E.C. No. 881

ESTIMATES COMMITTEE (1977-78)

(SIXTH LOK SABHA)

SIXTEENTH REPORT

MINISTRY OF ENERGY
(Department of Power)

POWER

Presented in Lok Sabha on 19 APR 1978

LOK SABHA SECRETARIAT
NEW DELHI
April, 1978/Chaitra, 1900 (Saka)
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Page	Para	Line	For	Read
10.	2.15	4	the first in	in the first
13.	2.23	6	chronic/under-utilisation	chronic under-utilisation.
16.	2.38	4	CW&DC(PW)	CW&PC(PW)
17.	-do-	-	In last col: of the statement for figures 886.7 shown against Tamil Nadu read figures 826.7	
18.	2.40	6	After word 'have' add the words 'a pipeline of projects which'	
19.	2.42	11	After words 'Andhra Pradesh' add word 'in'	
22.	2.48	Table last line	27.9	27.9%
25.	2.53	13	mico	icro
31.	2.63	12	133FW	133MW
34.	2.70	3	there 15MW	three 15 MW
48.	2.101	6	appriased	appraised
48.	2.104	4	460 MW	640 MW
49.	2.107	last line	enercy	energy
55	2.114	5	Add the word 'is' before the word 'about'	
55	2.119	2	Fifty	Fifth
58	2.130	3	follKowing	following
63	2.141	9	assential	essential
63	2.142	18	aide	wide
70	2.157	2	1975-65	1975-76
73	2.165	1	Minister	Ministry
74	2.168	6	After the words 'in the' Add the word 'country'	

Page	Para	Line	For	Read
80	2.185	8	versions	various
"	"	11	agencies	age
"	"	12	person	personal
81	2.188	5	Central	Centre
84	sub-para (viii) of 2.197	2	After the word 'form' add the word 'from'	
104	2.244	9	After word 'should' Add 'be'	
	"	10	the	at
129	3.16	3&4	Delete the words 'The Committee note that Central Electricity Authority, and data collection'	
129	3.17	11	in	is
140	3.49	7	possible	impossible
142	3.56	3	are	were
153	4.29	1	new	now
"	"	2	obstrve	observe
203	6.24	12	show	shown
213	6.49	16	outlaying	outlying
214	6.52	20	Add 'in' after 'complaints'	
215	6.55	8	feel	feed
222	7.23	4&5	Add 'of' fter 'estimate'	
240	7.78	11	tampo	tempo
328	-	17-18	Delete words 'the above observations'	
335	-	2nd col. last para Nos.	'2.97 to'	'2.97 to 2.103'
356	-	1	piferage	pilferage
"		13	concern	concert
363		2nd col.	'5.50'	'5.51'
369		21	appoint	point.

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ESTIMATES COMMITTEE
(1977-78)

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Shri Satyendra Narayan Sinha

MEMBERS

2. Shri V. Arunachalam
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6. Shri K. Gopal
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10. Shri Vasant Singh Khalsa
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21. Shri K. Vijaya Bhaskara Reddy
22. Dr. Saradish Roy
23. Shri N. K. Shejwalkar
24 Shri Annasaheb P. Shinde
25. Shri Ganga Bhakt Singh

*Elected w.e.f. 30-11-1977 *vice* Shri Samar Guha resigned and Shrimati Renuka Devi Barakataki Sarvashri S. Kundu, Janeswar Mishra, Fazlur Rehman and Sher Singh ceased to be members on their appointment as Ministers of State.

26 *Shri Ugrasen

27. Shri K. P. Unnikrishnan

28 Shri Shankersinhji Vaghela

29. *Shri Vinayak Prasad Yadav

30. *Shri Roop Nath Singh Yadav

SECRETARIAT

Shri B. K. Mukherjee—*Joint Secretary*

Shri K. S. Bhalla—*Chief Financial Committee Officer*

Shri A. N. Bhatla—*Senior Financial Committee Officer.*

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*Elected w.e.f. 30-11-1977 *vice* Shri Samar Guha resigned and Shrimati Renuka Devi Barkataki, Sarvashri S. Kundu, Janeswar Mishra, Fazlur Rehman and Sher Singh ceased to be members on their appointment as Ministers of State.

SUB-COMMITTEE OF ESTIMATES COMMITTEE ON POWER

CHAIRMAN

Shri Satyendra Narayan Sinha

MEMBERS

2. Shri Annasaheb P. Shinde—*Convener*
3. Shri Yashwant Borole
4. Shri M. N. Govindan Nair
5. Shri U. S. Patil
6. Dr. Saradish Roy

(i) MW	=	Megawatt	=	1000 Kilowatts.
(ii) MW (e)*	=	Megawatt	=	1000 Kilowatts.
(iii) KW	=	1 Kilowatt	=	1000 watts.
(iv) MKW	=	Million Kilowatts	=	1000 MW.
(v) Kwh.	=	1000 Watthours		
(vi) Gwh. (Gigawatt hours)	=	One million Kilowatt hours.		
(vii) MU	=	Million units.		
(viii) KV	=	Kilovolts	=	1000 volts.

*Letter (e) indicates power generated at Nuclear Power Plants.

INTRODUCTION

I, the Chairman of Estimates Committee, having been authorised by the Committee to submit the report on their behalf present this 16th Report on the Ministry of Energy (Department of Power)—Power.

2. The subject was taken up for examination by the Estimates Committee (1976-77). Necessary information was obtained and evidence of the representatives of the Ministry of Energy (Department of Power), Department of Atomic Energy, Ministry of Shipping & Transport and the Ministry of Science and Technology was taken by them. The Committee, however, could not finalise their report due to the dissolution of the Lok Sabha on 18 January, 1977.

3. The Estimates Committee (1977-78) appointed a Sub-Committee to finalise the report on the subject. On the basis of the evidence tendered before the previous Committee (1976-77) and on the basis of additional information obtained by the Sub-Committee, the Sub-Committee considered and approved the report at their sittings held on 26 August, 25 October, 26 October, 1 December and 2 December, 1977 and 18 March, 1978. The report as approved by the Sub-Committee was considered and adopted by the Estimates Committee at their sitting held on 22 March, 1978.

4. The Committee place on record their appreciation of commendable work done by the Chairman and members of the Estimates Committee (1976-77) in taking evidence and obtaining information for this report.

5. The Committee wish to express their thanks to the Officers of the Ministry of Energy and other concerned Ministries and Departments for placing before them material and information which they desired in connection with the examination of the subject and for giving evidence before the Committee.

6. For facility of reference the observations|recommendations of the Committee have been printed in thick type in the body of the report. A summary of the observations|recommendations is appended to the Report (Appendix XXI).

SATYENDRA NARAYAN SINHA,
Chairman,
Estimates Committee.

NEW DELHI;
April 18, 1978.
Chaitra 28, 1900 (*S*).

CHAPTER I

INTRODUCTORY

1.1. There had been acute power shortage in the country which had been responsible for retarding the development of the country's economy both in the industrial and agricultural sectors. Taking note of the situation, the Estimates Committee (1972-73) examined the various aspects of the Power Industry in the country and presented their 39th Report (Fifth Lok Sabha) on the erstwhile Ministry of Irrigation and Power—'Power', to Lok Sabha on the 30th April, 1973. This Report contained 191 recommendations in all.

1.2. Government's replies to these recommendations indicating action taken to implement them were examined and commented upon in the Fifty-sixth Report (1973-74)—(Fifth Lok Sabha) on the 'Action Taken' by Government on the recommendation contained in the Thirty-ninth Report' which was presented to Lok Sabha on the 30th April, 1974. According to this Report, out of 191 recommendations, 172 recommendations had been accepted by Government, and the Committee did not desire to pursue 15 recommendations in view of Government's replies. Reply of the Government in respect of one recommendation had not been accepted by the Committee. Replies of Government in respect of three recommendations had not been received till the time of presentation of the Action Taken Report.

1.3. The Estimates Committee (1976-77) at their sitting held on the 7th May, 1976, decided to pursue with the Government, *inter alia*, the action taken by Government to implement the recommendations contained in the 39th and 56th Reports of the Estimates Committee (Fifth Lok Sabha) on the erstwhile Ministry of Irrigation and Power—'Power'.

1.4. The Committee took the evidence of the representatives of the Ministry of Energy (Department of Power), and other Ministries and Departments, concerned with the subject, on the 27th and 28th December, 1976.

1.5. The various matters taken up by the Committee and their recommendations in this regard are dealt with in the subsequent chapters.

CHAPTER II

PLANS FOR POWER DEVELOPMENT

A. Plans for Power Development

2.1. The Estimates Committee in paragraph 3.45 of their 39th Report (1972-73) were distressed to note that none of the power plans achieved the targets envisaged. The First Plan was designed to add 1.40 MKW of power, the second 3.48 MKW, the third 7.04 MKW, the three annual plans (1966—69) 6.88 MKW, and the first three years (1969—72) of the Fourth Plan 4.13 MKW. The actual achievement during the plan periods was 1.12 MKW, 2.73 MKW, 4.52 MKW, 4.12 MKW, and 2.60 MKW, which worked out a shortfall percentage of 20, 36, 35, 88 and 37 respectively.

2.2. The Committee in paragraph 3.46 of their 39th Report noted that the shortfall in the plan had been mainly attributed to delay in the supply of equipment by indigenous manufacturers, non-availability of essential raw materials like steel, coal, cement etc. to the required extent and delay in the receipt of replacement parts from abroad. Delay in delivery of main equipment by HEIL/BHEL as well as civil works alone had resulted in shortfall to the extent of 3.25 MKW during the Fourth Plan period.

In reply Government in November, 1973 stated:—

> "It is regretted that there would be a shortfall to the tune of about 3.5 million KW during the Fourth Plan Period, which is mainly due to delay in delivery of plant and equipment by manufacturers, and delay in construction work at site which is due to shortage of essential materials like steel/and cement, paucity of funds, labour troubles and other causes. Every effort is being made to bring the gap narrower."

2.3. The Committee in paragraph 3.49 of their 39th Report noted that power was a basic infra-structure for building up the country's economic growth and development, and that shortfall in power impeded growth in the industrial and agricultural sectors.

2.4. The Committee, therefore, felt that there was need of a well-coordinated programme for power development correlated with the growth of industry, agriculture and other sectors which consume it.

2.5. In reply, Government in December, 1973 stated:—

> "The Committee's observations, have been noted. It is agreed that the power Development Programmes have to be based on an integrated and internally consistent inter-sectional development plan. This is being attempted in the formulation of the Fifth Plan also. The energy requirements of the industries, agriculture and other consuming sectors are assessed and the power plan provides for generating and supplying the same within the constraints of resources."

2.6. The Committee in paragraph 3.53 of their 39th Report expressed the view that for the successful planning and implementation of power development, it was necessary that a long-range plan extending over a period of 10 to 15 years based upon realistic estimates of demand, optimal mix of hydro, steam and nuclear generation with adequate transmission system, taking into account the regional power system condition, from time to time should be formulated.

2.7. Government in their reply furnished in December, 1973, also stated:—

> "Power planning is being undertaken on a long-term basis covering a span of about 10 to 15 years. The Fifth Five Year Plan is being worked out in detail at present and greater attention is also being paid to some hydro electric schemes which would yield benefits during the early part of the Sixth Plan. Advance action for Sixth Plan Projects is also contemplated so that new capacity is added on a continuous basis. While it may not be possible to have a detailed plan covering a period of 15 to 20 years ready in the context of inadequate information on certain important issues in a developing economy, the estimated demands for power for the period upto the end of the century have been projected. The Ministry of Irrigation and Power have prepared a decade plan (1971—81) in

which various hydro, thermal and nuclear power generation schemes to be taken up immediately for implementation have been identified."

2.8. Asked to indicate the power demands in the country for a period of 15 years as projected in the Ninth Annual Survey conducted during 1974-75, the Ministry of Energy in their written replies furnished in November, 1976 have stated that the power demand for the country as a whole has been projected as under in the Ninth Annual Electric Power Survey of India 1974:—

Year	Utilities	
	Peak load	Energy requirements
	(MW)	(MU)
1974-75	14685	80255
1975-76	16898	91014
1976-77	18922	102327
1977-78	21231	114115
1978-79	23535	126997
1979-80	25065	139847
1980-81	27488	153965
1981-82	30341	169340
1982-83	33385	186399
1983-84	36749	205082
1990-91	69535	388052

2.9. The Ministry also stated that a programme for meeting the requirements of peak load and energy till the end of the Fifth Five Year Plan (1978-79) has been drawn up. The projections made in the Ninth Annual Power Survey Report are expected to be on the high side since the basis of load forecasts made earlier have changed due to financial constraints faced by the country in the later years of the Fourth Plan and the first two years of the Fifth Plan.

2.10. The Fifth Plan power programme is expected to be of the order of 12.42 million KW. The projects which are likely to afford benefits of 12.42 million KW during the Fifth Five Year Plan are as follows:—

Region/Schemes	Benefits during Plan (MW)	Latest estimated cost, as per Planning Commission May '76 Review document (Rs. in lakhs)	Present position as in December, 1976
1	2	3	4
Northern Region			
1. Faridabad Thermal (Haryana)	120	3250	Commissioned.
2. Panipat Thermal (Haryana) .	220	7800	Under Construction.
3. Bhatinda Thermal (Punjab) . . .	440	12250	220 MW Commissioned, Balance under const.
4. Beas I (Haryana, Punjab & Rajasthan).	660	29999	Under Construction.
5. Beas II (Haryana, Punjab & Rajasthan)	240	5588	Do.
6. Sumbal HE (J & K) . .	11	1610	Commissioned.
7. Chenani HE (J & K) .	9	1265	Do.
8. Lower Jhelam HE (HP)	105	6301	Under Construction.
9. Giri H. E. (HP) . .	60	2521	Do.
10. Bassi Extn. HE (HP) . . .	15	444	Do.
11. Yamuna St. II (Chibro) (UP) .	240	11300	Commissioned (include the cost of Khodri).
12. Yamuna St. IV (Kulhal) (U.P.)	30	1388	Commissioned.
13. Ramgana HE (UP) . . .	180	4141	60 MW Commissioned Balance under construction.
14. Rishikesh-Hardwar (UP) . . .	36	6815	Under Construction.
15. Obra Thermal Extn. I (UP) .	200	6735	Commissioned.
16. Obra Thermal Extn. II (UP)	600	18653	Under Construction.
17. Obra Thermal Extn. III (UP) .	200	9718	Do.

1	2	3	4
18. Harduaganj St. V (UP) . .	110	3437	Under Construction.
19. Harduaganj St. VI (UP)	110	3965	Do.
20. Panki Thermal (UP) . .	220	5918	Do.
21. Badarpur Thermal Extn. I (Central) .	200	5987	Commissioned.
22. Badarpur Thermal Extn. II (Central) .	200	6606	Under Construction.
23. Baira Siul HE (Central) . .	180	9212	Under Construction.
24. Rajasthan Atomic Station (Central) .	220	7334	Do.
Sub Total N.R. .	4606	172337	
Western Region			
1. Ukai HE Scheme (Gujarat) . .	300	1798	Commissioned.
2. Gandhi Nagar Th. (Gujarat)	240	6050	Under Construction.
3. Ukai Thermal (Gujarat) . .	240	5350	Commissioned.
4. Ukai Thermal Extn. (Gujarat) .	400	9330	Under Construction.
5. Korba Thermal Extn. (M.P.)	120	3012	Commissioned.
6. Amarkantak Thermal I (MP)	240	7104	Under Construction.
7. Satpura Thermal Stn. (MP) .	400	12737	Do.
8. Vir. H.E. (Maharashtra) . .	9		Commissioned.
9. Bhatgar HE (Maharashtra) . .	16	530	Under Construction.
10. Koyna HE St. III (Maharashtra) .	320	6186	240 MW commissioned 80 MW under const.
11. Vaitarna HE (Maharashtra) .	60	1952	Commissioned.
12. Koradi Th. Stn. (Maharashtra)	480	11506	Do.
13. Koradi Th. Extn. (Maharashtra) . .	200	18513	Under const.
14. Nasik Th. Stn. Extn. (Maharashtra)	200	7677	Do.
Sub Total W.R. . .	3225	91745	
Southern Region			
1. Kothagudam Th. St. III (A.P.) .	220	5050	Commissioned.
2. Kothagudam Th. St. IV (A.P.)	220	8154	Under Construction.
3. Vijayawada Th. (A.P.) . . .	200	12577	Do.
4. Lower Sileru HE (A.P.) .	400	9550	100 MW commissioned balance under construction.

1	2	3	4
5. Nagarjunasagar HE (A.P.) . . .	110	1560	Under const.
6. Srisailam HE (A.P.) . .	110	17500	Do.
7. Idikki St. I (Kerala) .	390	11025	260 MW commissioned and balance under construction.
8. Sharavathi HE St. III (Karna.) .	1 78·2	1071	891 MW commissioned and balance under construction.
9. Lingarmakki HE (Karna.) . .	55	926	Under construction.
10. Kalinadi HE (Karna.) . . .	270	2000	Do.
11. Kundah HE St. IV (TN)	110	1134	Do.
12. Surulier HE (T.N.) .	35	1458	Do.
13. Ennore Thermal Extn. (T.N.) . .	110	2210	Commissioned.
14. Tuticorin Thermal Stn. (T.N.) .	200	12929	Under Construction.
15. Madras Atomic Stn. (Central) .	235	8534	Do.
SUB-TOTAL S.R.	2845·2	113678	
Eastern region			
1. Kosi HE (Bihar) . .	5	767	Under construction.
2. Subernrekha HE (Bihar) . . .	130	2502	Do.
3. Pathratu Extn. VII & VIII . . .	220	6068	Do.
4. Balimela HE (Orissa) .	240	3778	180 MW commissioned and balance is under construction.
5. Talchar Thermal (Orissa) . .	110	7518	Under Construction.
6. Santaldih Thermal (W.B.) . .	360	10000	120 MW commissioned and balance is under const.
7. Jaldhaka HE St. II (W.B.) . .	8	609	Under Construction.
8. Kursoong HE (W.B.) . . .	2	173	Do.
9. Lower Lagyap HE (Sikkim) . .	12	1499	Do.
10. Chandrapura Thermal (DVC) . .	360	8390	240 MW commissioned and balance is under construction.
11. Durgapur Thermal Extn. (D.V.C.) .	200	6600	Under Construction.
SUB-TOTAL S.R. .	1647	47904	

1	2	3	4
Northeastern region			
1. Narup Thermal Extn. (Assam)	30	638	Commissioned.
2. Kyrdam Kulai HE (Meghalaya)	60	1800	Under construction.
3. Dsuza HE (Nagaland)	1·5	N.A.	Do.
4. Gumti HE (Tripura)	10	1482	5 MW commissioned and balance under construction.
SUB-TOTAL NER	101·5	3920	
TOTAL—ALL INDIA Hydro	4597 7		
Thermal	7370		
Nuclear	455		
GRAND TOTAL	12,422,7 (MW)		Rs. 4,29,584 lakhs.

2.11. The break-up of this capacity category-wise, *viz.* hydro, thermal and nuclear, together with additions during the Fifth Plan are indicated below:—

	(MW)			
	Hydro	Thermal	Nuclear	Total
Capacity at the end of IV Plan	6964	9060	640	16664
Additions during V Plan	4654	7390	455	12499
Capcity at the end of V Plan	11618	16450	1095	29163

2.12. The Ministry in their written replies further stated that preliminary work on the power development programme for the Sixth Plan period, ending 1983-84, has been taken in hand and studies for generation-load balance during different years of the Sixth Plan are being carried out. These studies are mainly for the identification of both hydro and thermal projects considered feasible for commissioning during the Sixth Plan. Reliable projections of requirements of energy and capacity in various region States upto the end of the Sixth Plan and beyond are necessary for determining the priorities of projects to be taken up for benefits in the

Sixth Plan. The demand picture as projected by the Ninth Annual Power Survey is under review and fresh exercises for the Tenth Annual Power Survey are presently in hand. However, preliminary studies for the Sixth Plan power programme have already been made with a view to identify suitable hydro and thermal schemes so that their implementation can be taken up to maintain continuity of power development to meet the expected growth in demand. The preliminary studies indicate that an additional capacity of about 18 MKW may be required by the end of the Sixth Plan period.

2.13. The methodology proposed for the formulation of the Sixth Plan is first to identify hydro projects in respect of which project reports have already been prepared|cleared or are under preparation|examination. The investigation of such projects would have been taken up on a rational basis on techno-economic considerations in each Region|State and after ascertaining feasibility of implementation in the required time and the relative economics of several projects available. The hydro projects selected in each Region|State for implementation during the Sixth Plan would be on considerations such as the state of readiness, simplicity of civil engineering features, feasibility to complete the projects wthin the plan periods and magnitude of their benefits as well as economic considerations. Thermal projects which can be implemented in a relatively shorter period compared to the hydro projects which have a longer gestation period would be taken up to ensure that the expected load demand is met. New thermal plants would be considered mostly at sites already developed or under development so that the infra-structural facilities created at such sites could be taken advantage of. A regional approach to planning for power projects has also been kept in view to the extent feasible on the presumption that the various state systems would be capable of operating in an integrated manner and the grid systems being planned would be capable of handling inter-state and inter-regional transfers of power.

2.14. The Ministry in their written note added that long-term planning for power generation beyond the Sixth Plan is not being done at present. It is proposed to take up this work after the Sixth Plan is finalised, based on the Tenth Annual Power Survey.

2.15. Asked to state the criteria adopted for deciding the development programme for power generation and also the long-term

planning done in this regard, the Secretary, Ministry of Energy during evidence, stated:—

"The starting point for planning the development of power is, the first in place, a study of the projections in regard to consumption or the demand for power in the years to come. This is being done and there is a systematic exercise known as the Annual Power Survey which was started about ten years ago. We are, at the moment, in a very advanced stage of completing the tenth annual Power Survey which is a rolling exercise. Each year we take up a review of the demand projections for the next seven to ten years and sometimes the review goes even beyond that period. Basically, this tenth Survey is concentrated around what the picture would be in 1983-84. We have got to think sufficiently ahead and allow for the gestation period in creating additional capacity and we must also know about the deficit sufficiently in advance so that we can take action for creating the necessary new capacity.

....Having arrived at what is the demand pattern a certain number of years hence we also allow for better output from the present installed capacity. But still there is a net deficit which is to be made good by creating additional capacity. Having come to that, we also look at the regional planning aspects and the integrated operations. Having come to this stage, the important point is what should be the priority as among different choices available—thermal or hydro or nuclear to some extent. The first preference always stands for hydro. Hydro is not so cheap in terms of initial cost; it can be higher than thermal; but its advantage is that the operating costs are exceedingly low. There is hardly any fuel to be burn. It is cheap especially in actual generation. It is also a very clean energy compared to coal and it is replenishable. Therefore, having established the deficit, we go maximum for hydro coverage."

2.16. Asked to state the revised targets of production in various sectors of power, as finalised by the Planning Commission, and how far they are different from the original targets the Secretary, Ministry of Energy, during evidence stated that the target for additional installed capacity in the Fifth Plan would be 11,900 MW,

the original target was 16,500 MW and it had been lowered to this figure.

2.17. Explaining the reasons for the short-fall, the representative of the Ministry of Energy stated:—

> "The original target of 16,500 MW was on the basis of power demand arising in certain progression according to the 9th Annual Power Survey. Then, there was a revision in industrial production targets and there has been a lowering of the growth rate in these sectors. Similarly, rural electrification could not go on as fast as it should and it had repurcussions on the growth trend to some extent. As a result the power demand has not been of the order envisaged in the 9th Annual Power Survey. At the end of the Fifth Plan it was expected to be 120 billion units, it is now likely to be 111 billon units. To that extent the demand for power for the major consumers has also slackened. There has also been a certain revision of priorities in taking up certain projects, mainly hydel projects; they were envisaged to come up in the beginning of the Fifth Plan but they had not come up by that time because investigations were not complete or detailed project reports were not of the order in which could we have launched investment decisions or similar other factors. So, about a year ago, the target of 16.5 had been lowered to the present figure."

2.18. The Ministry of Energy have stated the following position of the installed capacities region-wise at the end of the Fourth Plan capacity added during the first two years of the Fifth Plan, and the installed capacity envisaged at the end of the Fifth Plan:—

Region	Installed capacity at the end of IV Plan (as on 31-3-1974)	Installed capacity additions during the first two years of the Fifth Plan		Total installed capacity envisaged at the end of Fifth Plan	Remarks
		1974-75 (actual)	1975-76 (actual)		
1	2	3	4	5	6
	(MW)	(MW)	(MW)	(MW)	
1. Northern	4179·04	671	425·2	8785·04*	*Includes Rajasthan Atomic Unit II.

1	2	3	4	5	6
					(220 MW) Unit II to be commissioned in Fifth Plan
2. Western	4070·11	474	735	7295·11	
3. Southern . .	4516·34	220	429·1	7359·54	@Includes Madras Atomic Unit I (230 MW) to be commissioned in Fifth Plan.
4. Eastern . .	3686·08	360	180	5333·08	
5. North-Eastern . . .	211·99	..	35	313 49	
UTILITIES TOTAL	16,663·56	1725	1804·3	29,086·26	
NON-UTILITIES TOTAL .	1,792·51	236·06	15·43	2,044·00	
UTILITY AND NON-UTILITY GRAND TOTAL .	18,466·07	1961·06	1819·73	31,130·26	

2.19. With regard to the likely additions in the installed capacity during the Sixth Plan, the Ministry stated that the tentative computations for the requirements of additional capacity region-wise during the Sixth Plan period made by the Central Electricity Authority indicate that total additional installed capacity between 18 to 21.5 million KW may be required to be installed during the Sixth Plan. The break-up region-wise on the basis of 21.5 million KW is as under:—

	(Million KW
Northern Region . . .	6·48
Western Regionan	7·16
Southern Region . . .	3·92
Eastern Region	3·29
North Eastern Region	0·65
TOTAL	21·50

2.20. The details of power projections as assessed by the 10th Annual Power Survey have been dealt with in the subsequent section of this Chapter.

2.21. The Committee have already noted in their 39th Report (1972-73) the shortfalls in the Plan targets during the four Plan periods. As against the additional power to be created to the tune of 1.40 MKW, 3.48 MKW, 7.04 MKW, 6.88 MKW and 4.13 MKW; during the First Plan, Second Plan, Third Plan, and the three Annual Plans (1966—69) and the first three years of the Fourth Plan respectively, the actual achievements amounted to 1.12 MKW, 2.73 MKW, 4.52 MKW, 4.12 MKW and 2.60 MKW in each of these Plan periods, resulting in a shortfall to the tune of 20, 36, 35, 38 and 37 per cent respectively. These shortfalls the Committee have already noted, resulted mainly from the delay in delivery of plant and equipment by manufacturers and delay in construction work at site which was due to delayed supply of essential materials like steel, cement and paucity of funds etc.

2.22. The Committee, however, find that the situation during the Fifth Plan is still more distressing, though on different account. The Committee note that in accordance with the Ninth Annual survey, the Fifth Plan had envisaged an additional capacity of 16.5 MKW. The Committtee are, however, concerned to find that the target was first lowered to 12.42 MKW and reduced further to 11.90 MKW. According to the Ministry this is stated to be due to the overall slackening of the economy of the country during the last few years resulting in lowering of growth rate in industrial sector. The Committee are concerned to note that the progress in rural electrification was also slow which in turn had its repurcussions on the growth trends to some extent. All these factors are stated to have contributed towards slackening of demand for power from the major consuming sectors, and consequently the targets for creation of power generation capacity laid down for the Fifth Plan had to be lowered.

2.23. The Committee are not convinced that the lowering of the target for additional capacity for power generation to be added in the Fifth Plan was at all justified. If previous experience is any guide, the demand for power both for industry and agriculture has been significantly in excess of availability with the result that the industry had to suffer long-term shut-downs/chronic/under-utilisation of capacity and agriculture also suffered for want of availabilty of electrical energy for tube-wells, pumpsets etc.

2.24. The Committee would like to recall the observations made by them in paragraph 22 of their Thirtieth Report (Third Lok Sabha,

March 1963):

> "Since the cost of installing 1 KW of electric power is but a fraction of the capital investment required to utilise it, it is obvious that if in any eventuality power generating capacity was under-utilised it would entail less overall loss to national economy than would be the case if productive machinery was to be rendered idle on account of power deficit. Past experience, in India and other countries, clearly shows that in a developing economy the demand for power nearly always outruns the available supply. Planning for surplus power is, therefore, essential for achieving an optimum rate of growth in the country. The Committee strongly recommend that power being a primary source of energy should be one step ahead of industrial and other requirements."

2.25. The Committee reiterate the above observations which are as pertinent today as they were in 1963 and regret to have to point out that Government do not appear to have learnt the requisite lesson from the persistent power shortages which have plagued the industrial and the agricultural sectors in successive plans and retarded the pace of development.

2.26. The Committee are inclined to think that the reduction in two stages of the target for addition of electric power from 16.5 MKW to 11.90 MKW has been done with a view to cover up the shortfall that is likely to occur during the Fifth Plan as compared to the original targets envisaged.

2.27. The Committee find that the reasons now adduced for the delay in the execution of hydel projects and other projects are largely the same as have been repeated from one Plan period to the other. This is also indicative of the fact that hardly any perceptible improvement has been effected in the institutional arrangements for survey, investigation, preparation of project reports, communication of sanction execution etc. with the result that the projects drag on for year rendering the entire planning for power unrealistic. The Committee cannot too strongly emphasise that at least now Government should improve the institutional arrangements to see that large power projects which have a vital role and contribution to make towards power development are selected and implemented in the field in accordance with the Plan programme and no slippage

on any account is allowed to take place. The Committee have dealt with this matter in greater detail in separate sections dealing with hydel, thermal, nuclear power projects.

2.28. The Committee are distressed to note that there has been a revision of priorities in taking up certain projects, mainly hydel projects, during this period. These projects which were envisaged to come up by the beginning of the Fifth Plan, failed to come up because investigations were not completed in respect of these projects or detailed project reports in respect of these were not upto the mark.

2.29. The Committee have dealt with the question of future power projections for the years 1978-79 to 1982-83 elsewhere in this Chapter.

Power Potential

Development of Hydro-electric potential

2.30. The Estimates Committee in paragraph 4.60 of their 39th Report (1972-73) expressed their unhappiness that out of 41.15 MKW (at 60 per cent load factor) of hydro-electric potential in the country, only 16 per cent had been developed and it was expected to rise to 18 per cent only at the end of the Fourth Plan.

2.31. The Committee in paragraph 4.61 of their 39th Report noted that the hydel potential in the country was the cheapest source of power and the present extent of utilisation would only be of the order of about 18 per cent by the end of the Fourth Plan period. The Committee felt that there was great scope for hydro-power development in the various regions of the country, and therefore, recommended that high priority should be given for hydel development in the subsequent plans.

2.32. The Committee suggested that a timebound programme should be drawn up for harnessing in full the hydel power resources in the country.

2.33. The Committee also desired that schemes pending due to inter-State agreements should also be finalised without delay.

2.34. In reply, Government in December, 1973 stated:—

"The observation of the Committee is noted.

Every effort is being made to ensure rapid development of hydro resources. However, it is submitted that a number of factors notably inter-State disputes, need for detailed field investigations, generally long gestation periods, large requirements of funds, and lack of access to hydro-electric sites, stand in the way of more rapid pace of development being achieved. Appropriate steps to get over these difficulties are being taken."

2.35. Government also stated that advance action for investigation etc. was being initiated for ensuring more rapid development in subsequent Plans.

2.36. Government further stated that all efforts were being made to see that inter-state agreements were reached to enable hydro-electric development to take place.

2.37. The Committee in their 56th Report (1973-74) showing action taken by Government on the recommendations contained in the 39th Report of Estimates Committee (Fifth Lok Sabha) observed that they would like the Government to take vigorous and effective steps to overcome the difficulties like inter-State disputes and lack of access to hydro-electric potential in the larger interests of the nation.

Percentage increase achieved at the end of Fourth Plan

2.38. Asked to indicate the percentage increase achieved at the end of the Fourth Plan the Government in their written note furnished in November, 1976 informed that as per the assessment by the erstwhile CW&DC (PW) in the Fifties, the hydro-electric potential of the country was estimated at about 42 million KW at 60 per cent load factor (including the hydro-electric potential of Sikkim). This assessment is based on the firm power contributions of the schemes identified during the Hydro-Electric Survey and does not include the seasonal energy potential. Further, at that time the necessary topographical and hydrological data for some of the river basins were not available and the assessment of potentialities in such areas could not be carried out. If these are taken into account, the hydro-electric potential would be substantially higher. Further, in view of the increasing cost of fuel and the changing economic pattern, as also the technological advances, many possibilities of hydro-electric development which were not considered earlier would have come into the realm of economic feasibility. In view of these factors, the hydro-electric potential would be higher than what has been assessed earlier. The hydro-electric potential developed till the end of the

Fourth Five Year Plan (March, 1974) is about 13.1 per cent of the assessed potential. The State-wise details are given below:—

Hydro electric potential developed as on 31-3-1974

Region/State	Total potential (MW at 60% L.F.)	Potential developed (MW at 60% LF.)
Northern Region		
Jammu & Kashmir	9590.5	57.5
Punjab, Haryana, Himachal Pradesh & Rajasthan	3377	995.8
Uttar Pradesh	3764	451.7
TOTAL	10731.5	1505.0
Western Region		
Gujarat	677	
Madhya Pradesh	4582.3	112.5
Maharashtra	1909.6	785.3
TOTAL	7168.9	897.8
Southern Region		
Andhra Pradesh	2476.5	207.7
Karnataka	3372.8	988.7
Kerala	1539.5	545.3
Tamil Nadu	708.2	886.7
TOTAL	8097.0	2568.4
Eastern Region		
Bihar/West Bengal	631.7	76.6
Orissa	2062.0	412.5
Sikkim	940.0	10.00
TOTAL	3623.7	501.10
North Eastern Region		
TOTAL	12464.4	37.5
Total (All Indial)	42095.5	5509.8

Hydro potential developed 13.1 per cent.

Percentage increase of hydro development at the end of the Fifth Plan (1978-79)

2.39. As regards the percentage increase proposed to be achieved at the end of the Fifth Plan out of the available potential of 41.15 MKW of hydro electric in the country, the Ministry of Energy in their written note stated that as per the present anticipation, an installed capacity of 2807 MW in hydro is expected to be added during the period 1974-75 to 1978-79. The total potential developed at the end of the 1978-79 would be 19.8 per cent.

2.40. Asked to state whether the assessment of hydro-electric potential was proposed to be reviewed, the Secretary, Ministry of Energy during evidence stated:—

> "The Ministry and the Central Electricity Authority will step up the tempo of investigations required topographical, hydrological, geological etc.—so that we have we will examine and keep ready for sanction from time to time."

2.41. Against the hydel potential available, the potential developed by the end of the Fourth Plan (as on 31st March, 1974) in the following States was very low:—

Region /State	Total potential (MW at 60% Load Factor)	Potential developed (MW at 60% Load Factor)	Percentage
Northern Region			
Jammu & Kashmir .	3590·5	57·5	1·6%
Western Region			
Madhya Pradesh . .	4582·3	112·5	2·4%
Southern Region			
Andhra Pradesh ..	2476·5	207·7	8·3%
Eastern Region			
Bihar/West Bengal .	631·7	78·6	12·4%
Orissa,.	2062·0	412·5	20·0%
Sikkim . . .	940·0	10·0	1·1%

2.42. Asked to state the potential that would be developed by the end of the Fifth Plan in States of Jammu & Kashmir, Madhya Pradesh, Andhra Pradesh, Bihar, West Bengal, Orissa and Sikkim, the Secretary, Ministry of Energy, during evidence stated:—

"So far as the northern region *viz.*, Jammu & Kashmir is concerned, the percentage is 1.6. We expect this to be 2.9 at the end of the 5th Plan and 8.5 at the end of the 6th Plan, taking into account the schemes already sanctioned. For the Western region, say Madhya Pradesh it will be 2.4 and 3.2 for these two Plans.....

For Andhra Pradesh the Southern region from the present 8.3 per cent it will go up to 25.5 per cent at the end of the Fifth Plan and further to 55 per cent at the end of the Sixth Plan. In the Eastern Region, in the segment of Bihar and Bengal the present percentage is 12.1 per cent. It will rise to 16 per cent at the end of the Fifth Plan and will go up to 49.8 per cent at the end of the Sixth Plan In Orissa the present percentage is 20 per cent. It will rise to 22.7 at the end of the Flfth Plan and further to 34.8 per cent at the end of the Sixth Plan. In Sikkim at present it is 1.1 per cent. It will rise to 1.6 at the end of the Fifth Plan and 2.1 per cent at the end of the Sixth Plan.

2.43. Asked to explain whether as against the availability of 42 MKW of hydro potential, the 19.8 per cent potential that would be developed at the end of the Fifth Plan was not considered low and what steps were taken to speed up development, the Secretary, Ministry of Energy during evidence stated:—

"The position stated therein is correct. We shall have attained only one-fifth by the end of the Fifth Plan. One step we have taken is that we have sanctioned a large number of schemes. We have sanctioned a few schemes which are under implementation. Hydel takes a little more time. I have ventured to work out a forecast as it would be at the end of the Sixth Plan—1983-84. If all the schemes now sanctioned are commissioned by that time-there is enough time, that is, 8 years from now—then in the all-India picture it accounts for 27.6 per cent out of 42 million killowatts potential."

In the Northern region we have consumed about 35 per cent of the total potential. In Western region, 17 per cent of

the total has been availed of. There is Narmada Water Dispute and that is why we could not move fast. In the Southern region, it is 65 per cent and in the Eastern region, it is 29 per cent. In the North-Eastern region, out of 42 million killowatts, 12 million killowatts are to be exploited by Assam and Brahmputra area. Their exploitation is going to be only 1.9 per cent even at the end of 1984. The point is that there is not enough population and the demand is not there.

2.44. Asked further to state as to when was the survey completed, the Secretary, Ministry of Energy stated that it was completed about 10 years ago and it was out of date and it was decided to take it up more systematically. The Secretary further stated:—

"If I may submit another reason, what was thought to be inaccessible is now more accessible and what was thought to be less potential is now more potential. We think that we shall be able to augment the potential by further survey and tests."

2.45. With regard to the schemes, if any, drawn up for surveying the inaccessible areas, the Ministry through their written note informed that the present knowledge about the hydro-electric potentials of the country is based on the survey conducted by the CW&PC (PW) during the Fifties. This survey was carried out on the basis of the topographical and hydrological data available at that time. The economically utilisable power potential of the country was estimated at about 42 million KW at 60 per cent load factor. Necessary topographical and hydrological data for some of the river basins were not available at that time and as such assessment of hydro-electric potential of such areas could not be carried out. There is, therefore, need for review of hydro-electric survey on the basis of up-dated topographical, hydrological and geological data and taking into account prevailing techno-economic conditions. It is proposed to carry out this work now.

2.46. After identifying the potential hydro electric sites, investigations of specific projects are taken up to formulate proposals for hydro-electric projects keeping in view the power requirement and *prima-facie* economic feasibility of taking up projects. In certain areas, such investigations are conducted by the concerned State authorities in their respective States and also by the Central Water Commission. The Central Water Commission is conducting investigations of the schemes in the Chenab basin in Jammu & Kashmir, Ladakh, Sikkim, Andaman & Nicobar and Arunachal Pradesh.

2.47. The Ministry of Energy later through a written note have furnished a Statement (Appendix—I) showing the Hydro potential developed in various Regions|States during the Fourth Plan, potential to be developed in the Fifth Plan & Sixth Plan. From the Statement it is seen that the percentage potential developed in the following States at the end of the Fourth Plan potential to be developed at the end of 1978-79 and 1983-84 would be as follows:—

	Fourth Plan	1978-79	1983-84
Northern Region	%	%	%
Jammu & Kashmir	1·60	2·87	11·55
Uttar Pradesh	12·00	19·82	28·54
Western Region.			
Madhya Pradesh	2·45	2·45	3·14
Southern Region.			
Andhra Pradesh	8·39	25·50	58·59
Eastern Region.			
Bihar /Bengal	12·44	18·32	55·04
Orissa	20·00	22·67	34·84
Sikkim	1·06	2·13	2·13

2.48. In October, 1977 the Sub-Committee of the Estimates Committee (1977-78) asked the Ministry to state the latest position regarding the development of hydro-electric potential, with a view to installing hydro-electric units of smaller capacities. The Ministry of Energy in their note (December, 1977) stated as follows:—

Hydro Electric Potential

Region/State	Total Potential (MW at 60% L.F.)	Potential developed under development with sanctioned scheme (MW at 60% L.F.)
1	2	3
Northern Region		(Position in October, 1977)
Jammu & Kashmir	3590·5	304·7
Punjab, Haryana, Himachal Pradesh & Rajasthan	3377	1967·1
Uttar Pradesh	3764	1663·7
TOTAL	10731·5	3935·5

1	2	3
Western Region		
Gujarat	677	131·7
Madhya Pradesh	4582·3	144·0
Maharashtra	1900·6	934·2
TOTAL	7168·9	1209·9
Southern Region		
Andhra Pradesh	2476·5	1442·1
Karnataka	3372·8	1826·0
Kerala	1539·5	1133·7
Tamilnadu	708·2	877·8
TOTAL :	8097·0	5279.6
Eastern Region		
Bihar/Western Bengal	631·7	348·0
Orissa	2062·0	718·5
Sikkim	940·0	20·0
TOTAL:	3633·7	1086·5
North Eastern Region	1246·4	242·0
TOTAL (All India)	42095·5	11753·5
Hydro potential developed/under-development.		27·9

2.49. It may be mentioned, in this connection, that the studies and surveys for assessment of the hydro-electric potential of the country were last conducted during 1953—59. This assessment did not include seasonal energy generation, particularly from the schemes located in the Himalayan region which are largely run-of-the-river type developments. It also did not include the potential of small-scale schemes. Besides, more hydrological, topographical and geological data have become available since the last survey was carried out during the fifties. For the purpose of perspective planning and identification of possible new Hydro-electric sites for investigation and exploitation, a fresh systematic survey of the hydro-electric potential is considered necessary. Accordingly, a scheme has recently been drawn up for setting up a Specialised Cell in CEA for up-dating the hydro-electric potential of the country through a comprehensive National survey.

2.50. While hydro-electric power constitutes the most economic source of power development and schemes, including small and microhydel developments, are taken up wherever attractive sites are available and their feasibilities have been established through site investigations, it is necessary to take note of the fact that, particularly for the larger projects, long gestation periods are involved and time is taken in the preparation of project reports and in investigations. Attention is being given to investigations in Hilly and relatively less developed areas with a view to identifying projects for the utilisation of the hydro potential in such areas on the basis of the best techno-economic options available.

2.51. The Sub-Committee of the Estimates Committee also asked the Ministry to state when was the last survey for development of hydro-electric potential undertaken, particularly of the Himalayan region, and whether in the context of the present oil crisis, Government had any fresh proposal to conduct another survey to assess the hydro-electric potential in the country. The Ministry of Energy in their reply (December, 1977) have stated thus:—

"The present knowledge of availability of hydro-electric resources in the country is based on the Systematic Survey carried out by the erstwhile CW&PC(PW) during the period 1953—60. The assessment of hydro-electric potential was carried out on the basis of topographic and hydrological data then available. Detailed studies of each river basin in the country were carried out to identify the schemes capable of development on techno-economic considerations. On the basis of these schemes, the economically utilisable power potential of the various river basins covered under the survey, was estimated at 24.69 million KW continuous. For the purpose of the above survey, the rivers of the country were divided into six groups *viz.* West flowing rivers of Southern India, East flowing rivers of Southern India, Central Indian rivers, Ganga basin, Brahmputra basin and Indus basin. The hydro-electric potential, as assessed, is indicated below:—

Group/Basin	Power Potential in India (Million KW Continuous)
West flowing rivers of Southern India	2·61
East flowing rivers of Southern India	5·18
Central Indian rivers	2·57
Ganga Basin	2·89
Brahmaputra Basin	7·49
Indus Basin	3·95
TOTAL	24·69

NOTE : The above potential did not include the hydropotential of Sikkim State, which was assessed as 564 MW continuous.

The above potential did not include the seasonal energy generation and also did not take into account the potential of small schemes which could be covered only by extensive site investigations. Adequate topographic details of some of the areas were also not available at the time of original hydro-electric survey. Subsequent investigations carried out by some of the States like Himachal Pradesh and Uttar Pradesh have revealed that the hydro-electric potential may be much higher than originally assessed.

It has been proposed to reassess the hydro-electric potential of the country by up-dating the original assessment made in 1953—60 based on further hydrological, topographical and geological data which became available since earlier survey was carried out and the valuable information collected during these investigations would also be useful in the reassessment of hydro-electric potential. The Ministry of Energy, Department of Power has conveyed the sanction of the scheme regarding reassessment of hydro-electric potential in the country, during October, 1977 at an estimated cost of Rs. 30 lakhs. The proposal involves reassessment of hydro-electric potential up-dating the original assessment made in 1953—60. While doing this:—

(a) Annual energy contribution both for dependable and average conditions would be computed;

(b) Possible pumped storage schemes would be identified;

(c) Gross theoretical potential as well as economic potential would be determined.

The work is scheduled to be completed in 5 years."

2.52. The Committee note that the hydro-electric potential of the country was estimated at 42 million KW at 60 per cent load factor. This assessment is based on the Survey conducted in the fifties. The Committee were further informed that if the latest topographical and hydrological data for all the river basins and the latest technological advances on the possibilities of hydro-electric development are taken into account, the hydro-electric potential of the country would be much higher.

2.53. Though two decades had elapsed since the last assessment, it is only now that Government had felt the need for up-dating the old survey. The Committee understand that a scheme has been drawn up for setting up of a specialised cell in the Central Electricity Authority for up-dating the hydro-electric potential of the country

through a comprehensive national survey and that the Ministry of Energy has conveyed the sanction of the scheme during October, 1977 at an estimated cost of Rs. 30 lakhs. This work of re-assessment is scheduled to be completed in five years. The Committee feel that considering the fact that the reassessment of hydro-electric potential has already been delayed for long, at least the period of completing the assessment now being undertaken should be as short as possible so that a long term perspective plan for development of power could be drawn up earlier in the light of the reassessment. They would therefore urge the Government to examine the feasibility of completing the work in shorter time. The Committee would also like to stress that while making the assessment of the potential, the possibility of development of small and mico level projects should not be lost sight of. The Committee would urge that this aspect should be specifically included as one of the items to be looked into while assessing the potential.

2.54. It is an admitted fact that the hydro-electric power is ultimately cheaper as its operating and generation costs are exceedingly low, apart from the other benefits accruing from the fact that the hydro-electric projects are in the nature of multi-purpose projects. Besides, it is a very clean energy compared to coal and is replenishable. In view of these obvious advantages of developing the hydro-electric potential the Committee had expected that there should have been speedier development of this potential. The Committee however, find to their regret that hardly 13 per cent of the potential as assessed in the fifties had been utilised till the end of the Fourth Plan and only about 27.9 per cent of the potential is now either developed or under development.

2.55. The Committee note that there have been wide disparities in developing the hydro-electric potential in the various regions and States in the country. The percentage of hydro-electric potential development at the end of the Fourth Plan was 31.72 in the Southern Region, 14.02 in the Northern Region, 13.79 in the Eastern Region, 12.52 in the Western Region and 0.30 in the North Eastern Region. The disparities in the development of the potential in the various States are also very wide. While the percentage developed was 116.73 in Tamil Nadu, 41.12 in Maharashtra, 35.42 in Kerala, 29.49 in Punjab, Haryana etc., it was only 12 in U.P., 8.49 in Andhra Pradesh, 2.45 in Madhya Pradesh and 1.60 in Jammu and Kashmir at the end of the Fourth Plan. The development of the potential at the end of 1978-79 region-wise, would be 45.98 per cent in the Southern region, 26.02 per cent in the Northern Region, 16.60 per cent in

the Eastern Region, 15.78 per cent in the Western Region and 0.54 per cent in the North Eastern Region. Even at the end of the 1983-84 according to the present indications, the development region-wise would be 70.99 per cent in the Southern region, 33.71 per cent in the Northern region, 29.90 per cent in the Eastern region, 17.84 per cent in the Western region and 1.94 per cent in the North Eastern region. The development of the potential in the various States at the end of 1978-79 would range from 2.13 per cent in Sikkim to 142.32 per cent in Tamil Nadu. The Committee are greatly concerned at this imbalance in the development of hydro-electric power as compared to the known potential in the various regions/States in the country.

2.56. The Committee need hardly point out that the availability of power is one of the key factors in the development of a region or a State. It is, therefore, no wonder that the States with less availability of power are comparatively backward. The Committee would like Government to pay serious attention to this aspect and take necessary remedial measures to correct the imbalance in the development of hydro-electric potential in the various States. They would like that priority in the development of hydro-electric potential should be given to those States which are lagging far behind in such development in spite of having promising potential and wide gap between requirements and availability of power.

2.57. The Committee are neither impressed with these figures nor the progress made. Apart from the fact that the present utilisation is even less than 30 per cent of the potential, it has to be remembered that the potential itself is based on survey carried out nearly two decades earlier. The Committee cannot but express their deep disappointment that the progress in harnessing the hydro-electric potential in the country should have been so slow. The Committee hope that in the new perspective plan for development of power hydro-electric power development would find its due place and Government would take concerted measures to step up the development of hydro-electric potential in the various States of the country.

Inter-state Disputes

2.58. The Ministry of Energy in their written replies stated that Inter-State disputes constitute a bottleneck in the clearance of hydro electric projects. All efforts are being made to resolve the inter-State aspects involved and accord techno-economic approval of the hydro-electric schemes. With the gazette notification of the award of Krishna Water Disputes Tribunal in May, 1976, it has become possible to accord approval to some of the hydro-electric pro-

jects in the Krishna basin. The proposals submitted by Andhra Pradesh authorities in regard to the Nagarjunsagar hydro-electric project envisaging installation of one 110 MW conventional generating unit and 4 reversible pump turbines units at the dam site power house have been accorded techno-economic clearance by the Central Electricity Authority, at its meeting held on 13th and 19th August, 1976. These have since been sanctioned by the Planning Commission. The recent agreement reached on the sharing of waters of the Godavari basin would enable processing of the Uppar Indravati Multipurpose project and other projects in this basin that may be put up by the concerned State authorities.

2.59. An agreement has been reached between Punjab and Himachal Pradesh authorities for carrying out extension works at the existing Shaman and Bassi Power Stations. These schemes have now been sanctioned by the Planning Commission. The Mukerian Anandpur-Sahib and U.B.D.C. (Upper Bari Doab Canal) Stage II Projects in Punjab could not be accorded techno-economic approval on account of inter-State aspects involved. Meetings have been convened with State Chief Ministers with a view to resolve the Inter-State disputes.

2.60. The Sub-Committee of Estimates Committee (1977-78) enquired about the progress made in the settlement of Narmada Water Dispute and the details of the hydel projects that were likely to be taken up after the settlement of the dispute. The Ministry of Energy in their note (December, 1977) have stated thus:

> "The sharing of waters of the Narmada basin is currently under adjudication of the Narmada Water Disputes Tribunal and their Award is awiated.
>
> The Narmada river passes through hilly terrain and debouches into plains at Navgam in Gujarat. Features of the other projects located upstream would ultimately depend on the FRL of Navgam dam which is to be decided by the Tribunal. The Khosla Committee in its report of the Narmada Water Resources Development (1965) had suggested an FRL of 500 ft. for Navgam dam which was based on its extensive studies to ascertain the benefits available on various levels and combinations of dams. The development of the Navgam and upstream projects in Narmada Valley would depend upon the decision by the Tribunal about the height of the Navgam Dam and allocation of waters.
>
> ..

In view of the above, it would not be possible to indicate the details of hydel projects that are likely to be taken up after the settlement of the dispute. However, during the course of hydro electric survey of India conducted by the then CW&PC(PW) during 1953—60, the power potential of the river was estimated at 1.3 million KW continues. The potential sites were located at Rosra, Burhner, Basania, Pandaria, Bargi, Jhiri, Sagra, Chinki, Sitarewa, Hoshangabad, Tawa, Punasa, Barwaha, Harinphal and Navgam. The features of the project as outlined in the Hydro Electric Survey are as follows—

Salient Features of the Schemes of Narmada Basin

Sl. No.	Scheme	River	Name of the dam	Catchment area (Sq. Km.)	Height of dam. above river-head (M)	Power potential at 60% L.F.(MW)
1	Rosra:	Narmada	Rosra	4662	85·3	43
2	Burhner	Burhner	Burhner	3294·5	61·0	21
3	Pandharia	Narmada	Bassania	—	21·3	49
4	Bargi	Narmada	Bargi	16032	33·5	33
5	Jhiri	Narmada	—	—	—	15
6	Sagra.	Narmada	—	—	—	33
7	Chinki	Narmada	Chinki	23699	32·0	54·5
8	Sitarewa	Sitarewa	Sitarewa	200	30·5	11·0
9	Hoshangabad	Narmada	Hoshanga-bad	376634	30·5	48·5
10	Tawa P.H. I	Tawa	Tawa	5083	51·8	20·0
11	Tawa PH. II	Tawa	Tawa	—	—	
12	Punasa	Narmada	Punasa	61642	76·2	442
13	Barwaha	Narmada	Barwaha	—	32·0	224
14	Harinphal	Narmada	Harinphal	82900	—	446
15	Navgam	Narmada	Navgam	—	80·0	587
					TOTAL :	2027

The feasibility report in respect of the following projects have been prepared by the concerned State authorities. Brief features of the projects as outlined in these reports are given below:—

Narmada Sagar (Punasa) Multipurpose Project Madhya Pradesh

The Narmada Sagar (Punasa) located in Madhya Pradesh, being a major storage type development constitutes key to the develop-

ment of the potentialities of the Narmada Basin. As per the project report of Narmada Sugar Multipurpose Project prepared by the Madhya Pradesh Government in 1969, the scheme involves construction of 92.56 m. high masonry dam across the Narmada river and a power house at the foot of the dam with an installation of 10 units of 100 MW each. The project also provided for construction of a net work of canals to provide irrigation in Madhya Pradesh. The final features of the project could be decided after the award by the Narmada Water Disputes Tribunal is made. The annual energy potentials of the scheme has been assessed as 2,170 GWh initially and 786 GWh on full development of irrigation upstream as envisaged by Madhya Pradesh. The project was estimated to cost Rs. 111.33 crores is 1969.

Bargi Multipurpose Project—Madhya Pradesh

The Madhya Pradesh State Government had prepared a project report in 1968 for utilisation of upstream waters for irrigation purposes. The State Government revised the project report in 1974, in corporating power development at the foot of the dam. The scheme envisages construction of a 61 m. high masonry dam and 5.68 Km. long earth dam across the river Narmada and a dam site power station with an initial installation of conventional generating unit of 50 MW operating under an average head of 48.74 m. Provisions for installation of 2 additional units of reversible type each of 60 MW capacity had been assessed as 359 GWh in the initial years which would reduce to 53 GWh when upstream irrigation would materialise. The Project was estimated to cost Rs. 9.15 crores during 1974 for power portion. Total capital outlay was estimated at Rs. 68.43 crores.

Omkareshwar Multipurpose Project—Madhya Pradesh

The project report for the above was prepared by the Madhya Pradesh State Government in 1972, which envisaged construction of a lifting dam across the Narmada river for power generation and irrigation. It provided for construction of a 50m. high masonry dam, 755 m. long with earthern flanks across the Narmada, and a power house at the foot of the dam with an installed capacity of 3 units of 75 MW each, operating under a head of 34 m. The project was estimated to cost Rs. 77|30 crores as per 1972 estimates. The annual energy potential of the scheme had been assessed as 821 GWh initiallly and 271 GWh ultimately on full development of irrigation.

Maheshwar Hydro Electric Project—Madhya Pradesh

As per project report prepared by the Madhya Pradesh State Government in 1972 the project envisages construction of a lifting dam across the Narmada river. It comprises of a masonry dam 34.8 m. high and 789 m. long with earthen flanks 147 m. in length and a power house at the foot of the dam with installed capacity of 3 units of 40 MW operating under a head of 22 m. The annual energy potential of the scheme has been assessed as 718 GWh initially and 202 GWh ultimately when the upstream irrigation develops. The estimated cost of the project in 1972 has been indicated as Rs. 13.3 crores.

Harinphal Hydro Electric Project—Madhya Pradesh

As per project report submitted by Madhya Pradesh State Government in 1975, the project envisages utilisation of the drop available between the tailrace of Maheshwar dam and FRL of the Jalsindhi dam on the Narmada river for power generation. The project envisages construction of a 45.1 m. high and 640 m. long dam across the Narmada with a power station at the toe of the dam with an installation of 3 units of 400 MW each, operating under an average head of 19.5 m. The annual energy generation afforded by the project has been estimated as 718 GWh initially and 20 GWh ultimately when the upstream irrigation develops. It was estimated to cost Rs. 30.36 crores in 1975.

Jalsindhi Hydro Electric Project—Maharashtra

This project has been proposed in the stretch of the Narmada river where it forms the boundary between Maharashtra and Madhya Pradesh. As per project report submitted by the Maharashtra authorities in 1970, the project envisages construction of 52 m. high dam across the Narmada river and a dam site power station with an installation of 6 units of 75 MW each operating under a design head of 38.75 m. The annual energy generation afforded by the project has been assessed as 1,340 GWh in the initial stages and 526 GWh in the final stage, when the upstream irrigation develops. The total cost of the project has been estimated at Rs. 47.13 crores in 1970.

2.61. Asked to state the details of the hydro-electric projects which were pending due to inter-State disputes and the steps taken to resolve such disputes, the Secretary, Ministry of Energy, during evidence stated:—

"There are some projects in the North which are also held up. There is Upper Bari Doab Canal project in Punjab. The Thien Dam on the river Ravi is also located there. That

involves Himacal Pradesh, Punjab and J. & K. Once we put up the dam there, the submergence is going to take place in all three states. It has become a point of discussion amongst these three States. The lower riparian States of Haryana and Rajasthan are also interested in that. The Minister of Energy held some some meetings with individual Chief Ministers. I also had the privilege to be present there to have a feel of what is happening. We are quite colse to an amicable solution. Luckily, it is not before any tribunal."

2.62. Asked to state the outcome of the meetings convened with the State Chief Ministers with a view to resolving the inter-State disputes in regard to Mukeria-Anandpur Sahib and UBDC Stage II, the Secretary, Ministry of Energy, during evidence stated:

"The present position is that it is in-determinate. One Minister from the State met our Minister first; then 2 or 3 of them have done so. The dialogue is going on. The officials have given some proposals".

2.63. Asked to state the present position regarding settlement of disputes between the States of Himachal Pradesh, Punjab and Jammu and Kishmir, and how the States of Haryana and Rajasthan became interested in the matter, the Ministry have explaned the position through a written note as follows:

"The Thien Dam Project was proposed by the Government of Punjab to harness the remaining waters of the Ravi river and to generate power therefrom. The project envisages the construction of a 422 ft. high dam, with a live capacity of 1.90 Maft. The installed power capacity has been raised to 40 MW in the revised project report. The Energy generation in the Thein Dam would be 133FW continuous, while 56 MW of continuous energy would be available as a result of the UBDC Stage II and the regulation of waters to the Stage I Project. The cost of the project was last revised on the basis of December, 1975 prices by the Government of Punjab and comes to 223.60 crores. These revised costs are being examined by the Central Electricity Authority and it is envisaged that the costs would be high."

The water harnessed in the Thien Dam would be utilised to meet the shares of the concerned States in terms of the decision of the Government of India regarding sharing of the Ravi-Beas waters.

The reservoir created by the Thein Dam would submerge areas in Punjab, J & K and Himachal Pradesh. These States,

therefore, are concerned in matters like acquisition of land, rehabilitation of oustees, concurrence to the submergence of territory etc. Himachal Pradesh has sought consideration for being forced to give up some upstream projects on the Ravi if the Thein Dam is constructed. The waters of the Ravi river are likely to be used by both Punjab and Rajasthan and they are, therefore, parties concerned with this project. Haryana has also made a claim that, being a successor State to the erstwhile Punjab it is entitled to a share of the benefits in the water and power from the integrated development of the Ravi-Beas and Sutlej rivers.

Since all these States have made a claim to the benefits of water and power from this project, and since the resolution of these State matters is necessary before the project could be sanctioned, the then Minister of Irrigation & Power had convened a meeting of the Chief Ministers of Punjab, Haryana, J & K, Himachal Pradesh and Rajasthan in December, 1972. In this meeting, the interest of all these five States in the project was recognised and it had been recommended that the project should be implemented as a Central Scheme with sharing of benefits by all these States. Subsequently, it was found that the Centre could not take up the project during the Vth Plan. At that stage, the shares of the benefits proposed by the then Minister of Irrigation & Power, were not accepted by the concerned States. The present Minister of Energy has held several discussions with the concerned States in a bid to resolve differences between them. In 1974, it was found that there were differences of a factual nature relating to the project data between Punjab and J & K. It was, therefore, accordingly decided that the two States would resolve these differences. This has subsequently been done. J & K has agreed to make available land on long term lease for the construction of the dam subject to its being given its due share in the power generated. It has, however, not been possible for all the States to agree on the sharing of power by each of them. Further discussions in this respect are to be held.

The UBDC Stage II Project is an extension of the Stage I Project and envisages installation of three 15 MW machines. This project was originally envisaged as a part

of the Thein Dam Project but is now intended to take it up, after sanction, independently of that project (*See Footnote*).

2.64. The Committee are glad to note that an award of Krishna Water Disputes Tribunal has been given in May, 1976, and it has become possible to accord approval to some of the projects in the Krishna basin. The proposals submitted by the Andhra Pradesh authorities in regard to Nagarjunasagar Project which envisaged installation of one 110 MW conventional generating unit and 4 reversible turbine units at the dam site power house have been accorded techno-economic clearance by the Central Electricity Authority in August, 1976 and have since been sanctioned by the Planning Commission. Similarly, agreement has also been reached on sharing the waters of Godavari basin, and this would enable processing of Upper Indravathi multi-purpose project and other projects in this basin. The Committee hope that no time should now be lost in clearing all the remaining projects which were held up due to Krishna and Godavari Water dispute.

2.65. The Committee also note that sharing of waters of the Narmada basin is still under adjudication of the Narmada Water Disputes Tribunal, whose award is awaited, and that the development of the Navgam and upstream projects in Narmada valley would depend upon the decision of the Tribunal about the height of the Navgam dam and allocation of waters. The Committee hope that the Tribunal award would be available soon and thereafter no time would be lost in finalising the various hydel projects in the Narmada valley.

2.66. The Committee further note that an agreement has also been reached between the Punjab and Himachal Pradesh authorities for carrying out extensive works at the existing Shaman and Bassi Power Stations. These schemes have now been sanctioned by the Planning Commission.

*2.67. The Committee are, however, distressed to note that some hydro-electric projects have been held up in the Northern region on account of inter-State disputes. The Committee note that no solution is in sight as regards the Mukerian Anandpur Sahib and UBDC Stage II projects in spite of the repeated efforts made by the former Ministers of Energy. The Committee also note that the Thien Dam located on river Ravi is held up due to similar disputes between Himachal Pradesh, Punjab and Jammu and Kashmir and also the States of Haryana and Rajasthan. The Committee view this state of affairs as extremely unfortunate as the power potential

available in the region would remain untapped for long periods for want of suitable solutions to the disputes.

*2.68. The Committee are dismayed over the help lessness exhibited by the Central Government so far in the whole affair of inter-state River Water Disputes and the indifference shown by the State authorities concerned in a matter which has a vital bearing on the economic well-being of the people of the area. The Committee would like Government to give this matter their most serious consideration. The Committee at the same time would appreciate if Government would evolve very early a framework of a broad policy in regard to these disputes, based on justice and keeping in view the economic interests of the people so that amicable solutions could be found to these problems without delay and a major bottleneck standing in the way of development of hydel projects and economic prosperity of the regions and welfare of the people could be removed.

*2.69. The Committee would like the Central Government and all other authorities concerned to redouble their efforts to see that an amicable and workable solution is found about the sharing of power from the proposed Thien Dam Hydel project so that it could be taken up for implementation without any further delay.

*2.70. The Committee note that Government have already taken a decision that UBDC Stage II project which envisages installation of there 15 MW Turbo generators would be taken up independently of the Thien Dam project. The Committee expect the Government to take the necessary follow-up action so that at least UBDC Stage II project is taken up for speedy implementation to meet the gap between the known requirements and availability of power in the region.

Projects sanctioned after 1973-74.

2.71. Asked to Furnish a note giving details of the projects investigated and sanctioned after 1973-74, uptil now, which would yield benefits during the Fifth Plan and Sixth Plan, and also the position with regard to their execution, the Ministry of Energy

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*At the time of factual verification of the draft Report the Ministry of Energy vide their O.M. dated 6th April, 1978, have indicated the latest position regarding Mukerian Hydel Project, and Anandpur Sahib Hydel Project and Thien Dam as under:—

"At the meeting of the Chief Ministers held in July, 1976 it was decied in principle that the issues concerning the cost and benefits

among the States of Haryana, Punjab and Rajasthan in respect of Anandpur Sahib Hydel Project and Mukerian Hydel Project and UBDC—Stage II Hydel Project should be referred to a Referee. While the Governments of Himachal Pradesh, Rajasthan and Haryana have accepted that the Referee's findings would be acceptable to their Governments, the Government of Punjab, while accepting the appointment of a Referee, has mentioned that the Referee's findings should be subject to a review by the Government of Punjab. The Government of Punjab was requested and has also been reminded to convey their unconditional acceptance to the appointment of a Referee whose findings would be final and binding for them also. They have not communicated their acceptance so far. The last reminder was sent in December, 1977. A telegraphic reminder is also being sent.

With a view to resolving the Inter-State issues involved in the Thein Dam, the Prime Minister took a meeting of the Chief Ministers of the concerned States on 3rd October 1977. The decision taken in this meeting, as noted in the proceedings, is as follows:—

"After discussion it was decided that the construction work of the Thien Dam should start immediately and the Government of India would consider the claims of Rajasthan and Haryana regarding sharing the Thein Dam power. The Government of India will also consult Dr. Khosla, who had made the recommendation regarding sharing of costs for Irrigation and Power among the erstwhile State of Punjab and Rajasthan for the Beas Project Units I & II.

After discussion it was decided that there shall be Inter-State Control Board with the Union Minister of Agriculture and Irrigation as Chairman and Union Minister of Energy as Vice Chairman, and Chief Minister and I & P Ministers of the concerned States as Members. The Board will take policy decisions and will give directions to the Punjab Government during the construction stage as well as during operation. The Project, however, will be implemented by Punjab. All efforts shall be made to accommodate the staff rendered surplus from the Beas Construction Work. There shall also be a Standing Committee under the Control Board which will meet regularly and review progress and secure expeditious implementation of the Project."

have furnished written information which is summarised below.

State	Scheme	IC (MW)	Benefits expected during	Remarks
1	2	3	4	5
Himachal Pradesh	Andhra	15	VI Plan	The projects have been sanctioned by Planning Commission in September, 1976 and are to be taken up for implementation from 1977-78.
	Binwa	6	VI Plan	
	Rongtong	2	VI Plan	
	Bassi Extn.	15	VI Plan	The Project has been sanctioned by the Planning Commission in September, 1976 for implementation. This is an extension to the existing Bassi Hydro Electric Project with an installed capacity of 30 MW and involves only addition of one more unit of 15 MW at the existing power house. Order for the generating unit has already been placed with M/s BHEL. The unit is expected to be commissioned during early part of the Sixth Plan period.
Punjab . .	Shanan Extn.	50	VI Plan	The Project has been sanctioned by the Planning Commission in September, 1976 for implementation. The project is presently under construction and the order for the generating unit has already been placed with BHEL. The unit is expected to be commissioned during early part of the Sixth Plan period.
Andhra Pradesh .	Nagarjunasagar conventional unit	110	V Plan	The project is presently under construction and provides for installation of one conventional unit of 110 MW. The unit is expected to be commissioned during 1977-78.
	Nagarjuna-Sagar pumped storage	400	VI Plan	Tenders for the units have been invited and are currently under examination.
Kerala .	Kakkad	50	VI Plan	The project was sanctioned by Planning Commission in September, 1976. The project is to be taken up for implementation for benefits during 6th Plan.

1	2	3	4	5
	Idukki Stage III	..	VI Plan	The scheme involves diversion of additional waters into the Idukki reservoir to augment the energy generation at the Idukki Power Station. The project has been taken up for construction.
Tamil Nadu	. Upper Thambrapani	20	VI Plan	The project was sanctioned by Planning Commission in July 1976.
West Bengal	. Ramman Stage II	50	VI Plan	Authorization for taking up the infra-structural works has been given by the Planning Commission in October, 1976.
Bihar	. Koel Karo:	710	Partial benefits in VI Plan. Balance in VII Plan	The project has recently been sanctioned by the Planning Commission. BHEL have been asked to take up the design work for the generating equipment and some preliminary works at the project site has been taken up.
Orissa	. Upper Kolab .	240	VI Plan	The project has been taken up for construction.
Assam/Meghalaya	Kopili a	150	VI Plan	The project has been taken up for construction by the North Eastern Electric Power Corporation.

Approval of the National Committee on Environmental Planning and Coordination.

2.72. The Sub-Committee of Estimates Committee (1977-78) enquired whether there had been any cases where power projects had not been sanctioned or were held up on account of ecological consideration. The Sub-Committee also desired that the policy of the Government in this behalf be indicated. The Ministry of Energy in their note (January, 1978) have stated that under Section 30 of the Electricity (Supply) Act, 1948 and Amendment Act, 1976 clearance of a thermal power project from environmental consideration is obligatory. In accordance with this, the CEA refers all thermal power projects to the National Committee on Environmental Planning and Coordination before clearance. As regards the hydro-electric projects, although there is no specific provision in the Act, some projects have also been referred to the NCEPC as detailed below:

"The Silent Valley Hydro Electric Project located in Kerala was sanctioned by the Planning Commission in February, 1973 for an estimated cost of Rs. 2,488 lakhs for installation of 3 units of 40 MW each.

Subsequent to the sanction of the project the proposed installation has been changed to 2 units of 60 MW each. The preliminary works on the project were started in 1972-73 and upto the end of March, 1977 an amount of Rs. 52.21 lakhs is reported to have been spent. During 1977 the National Committee on Environmental Plannng & Co-ordination (NCEPC) have suggested dropping of the project on account of submergence of virgin forest and ecological disturbances. They have, however, stated that they will be able to reconcile themselves for execution of this project provided certain safeguards are taken in respect of environmental protection during the course of execution and subsequent operation and maintenance of the project. The Kerala State authorities have indicated that the various safeguards suggested by NCEPC have been examined by the State Committee on Environmental Planning & Co-ordination and they have decided to implement the suggestion of NCEPC so that the ecological balance of the area would be maintained. The Central Electricity Authority has already taken up the matter with the Department of Science & Technology.

Further during the 22nd meeting of the CEA held on 26th October, 1977 for according techno-economic approval to Power Schemes, Adviser (Energy), Planning Commission stated that clearance from environmental angle is obtained in respect of thermal projects and desired that hydro-electric projects also should be referred to NCEPC for similar clearance. The following hydro-electric projects were cleared from techno-economic angle in the above meeting subject to clearance by NCEPC from environmental angle.

1. Bhaba H.E. Project (Himachal Pradesh)—120 M.W.

2. Vishnu Prayag (Uttar Pradesh)—262 M.W.

3. Gangavali Stage I (Bedthi) H.E. Project (Karnataka)—210 M.W.

The Department of Science & Technology have nominated one expert for each of the above project for environmental appraisal. It is understood that the experts have visited the project sites. Their reports are awaited."

2.73. The Committee note that a number of hydel projects have been sanctioned after 1973-74 and in most of the cases, orders have also been placed for generating plants, to yield benefits during the Fifth and Sixth Plans. The Committee further note that a number of them have already been taken up for construction. The Committee would like to emphasise that investigations of the hydro projects which are likely to yield benefits, beyond the Sixth Plan may also be initiated and the projects kept ready in the pipeline so that

the same could be taken up without let or hinderance at the appropriate time.

2.74. The Committee find that most of these hydel projects which have been taken up would result in addition to power only in the Sixth Plan, the only exception being Nagarjunasagar Conventional Unit of 110 MW which is expected to be commissioned during 1977-78. This again underlines the need for longer perspective planning so that the selected hydel schemes are taken up for implementation well in time to contribute towards the augmentation of power generation to meet the requirements. The Committee have been stressing the need for perspective and detailed planning for the next ten to fifteen years and they desire that learning from experience Government should see that hydel projects in particular are got investigated and a shelf of schemes got ready for selection and implementation so as to achieve in time the Plan targets envisaged.

2.75. The Committee learn that there is no obligation under Sec. 30 of the Electricity (Supply) Act to refer the hydel projects to National Committee on Environmental Planning & Co-ordination for clearance while such a clearance in the case of thermal power project is obligatory. Even so, the Committee observe that the National Committee on Environmental Planning & Co-ordination had suggested the dropping of the Silent Valley Hydro Electric Project of Kerala on account of sub-mergence of virgin forest and ecological disturbances. The objection was raised by the NCEPC in 1977 at a time when an amount of Rs. 52.21 lakhs had been reportedly spent on preliminary works of the project and the project itself was sanctioned as early as February 1973. The Committee learn that the NCEPC (National Committee on Environmental Planning Co-ordination) had stated that they would be able to reconcile themselves for the execution of the project provided certain safeguards were taken in respect of environmental protection during the course of evecution, operation and maintenance of the project. Kerala Government have agreed to provide these safeguards and the matter has been taken up with the Department of Science and Technology.

2.76. The Committee have also been informed that there was a suggestion from the Adviser (Energy) of the Planning Commission in October, 1977 that the hydel projects should also be referred to the National Committee on Environmental Planning and Coordination for clearance in the same way as thermal projects, and that three such projects which have been cleared from the techno-economic angle by the CEA are awaiting clearance of the National Committee on Environmental Planning and Coordination.

2.77. The Committee appreciate the need to ensure that the execution of power projects does not lead to ecological disturbances. What the Committee would like to emphasise is that in order to expedite the entire process of approval, sanction and execution a hydel project should be taken up simultaneouly with the Central Electricity Authority for clearance from techno-economic angle and with the NCEPC for clearance from ecological angle so that once the project is cleared from techno-economic angle, there is no further hold-up in the process of sanction & execution. The Committee would like the procedure in this regard to be settled after due consultation with the State Governments, Planning Commission and the Department of Science & Technology and necessary guidelines isued to all concerned in the preparation and approval of future projects.

Guidelines for investigation

2.78. The Ministry in their written replies furnished in November 1976 have stated that guidelines have been issued by the Central Water Commission for investigation of river valley projects and circulated to State Governments. A manual for investigation and preparation of project reports for power generation projects has been prepared by the Central Electricity Authority and this also has been circulated to States for guidance. These guidelines are expected to enable the project authorities to investigate the projects in necessary details and formulate realistic project proposals. One of the reasons for over-runs in construction period for hydro-electric projects has been ascribed to inadequate construction planning. It has, therefore, been proposed to pay special attention to this aspect at the time of according techno-economic approval to the project. Wherever found necessary, the projects are being cleared in the first instance for taking up infra-structural works like providing access facilities to the project sites, temporary buildings, construction, power etc. and also taking up further confirmatory investigations and preparation of detailed project reports before a final investment decision is taken. This step is expected to reduce the gestation period as the projects would be in a state of readiness when active construction is taken up.

2.79. Asked to state as to when these guidelines were issued and indicate the broad details of the guidelines, the Secretary, Ministry of Energy, during evidence stated:

> "Guidelines went in December, 1972. As you know the gestation period is long enough. I have consulted the engineers. There are areas of improvement. There is a

Committee which has been appointed to find out what should be the parameter of the Detailed Project Report. Six months is the time-limit."

2.80. The Committee note that one of the reasons for over-runs in the construction and commissioning of power plants has been the inadequacy in investigations and preparation of detailed project reports. The Committee note that guidelines have been issued by the Central Water Power Commission for investigation for river valley projects. A manual for investigation and preparation of project report for power generation projects has also been prepared by the Central Electricity Authority. A Committee has also been appointed to lay down parameters for the preparation of detailed project report.

2.81 They desire that the Committee appointed by Government to revise the guidelines should complete their work with expedition so that the authorities can be provided firm guidance for investigating and preparing the schemes along the approved lines to faciliate selection of projects for the Sixth Plan.

2.82. The Committee need hardly point out that there should be a monitoring arrangement in the Central Water and Power Commission to continuously review the guidelines in the light of experience so as to supplement and modify them as necessary and notify them to the authorities concerned contemporaneously to bring about the necessary improvement. The Committee also suggest that these guidelines may be reviewed at least once during each Plan period so that these could provide firm and up to date basis for investigation and preparation of schemes along approved lines for the succeeding Plan period.

Thermal

Location of Thermal Power Stations near pitheads

2.83. The Estimates Committee in paragraph 3.106 of their 39th Report desired the Government to examine most carefully whether it would not be in the larger economic interest to locate the new thermal stations at the pit-heads The Committee also stressed that the decision should be taken in each case after most careful consideration so that power is generated and supplied at a most competitive rate to the public.

2.84. Government in their action taken replies furnished in November, 1973 stated that the Ministry of Irrigation and Power had set up a Committee to identify sites nearer to the pit-heads and study their suitability in detail from all techno-economic considerations for setting up of large thermal power stations of approximately

2000 MW capacity (ultimately) in different regions. The Committee had been asked to inspect sites in the following regions:

(i) One site in Maharashtra;

(ii) Two sites in Madhya Pradesh;

(iii) One site in Andhra Pradesh; and

(iv) Two sites in Eastern Region.

2.85. The Ministry also stated that the Projects were being cleared by the Technical Advisory Committee after a careful examination of all techno-economic feasibilities. Larger size units and other technical advances to be incorporated during the Fifth Plan will, it was expected, bring down the cost of generation.

2.86. In their written replies furnished in November, 1976, the Ministry of Energy stated that the Committee set up by the Government of India to identify sites near the coal pitheads for setting up large thermal power stations in the various Regions of the country submitted its report in April, 1976. The Committee considered the merits of various sites from the point of view of coal availability and other techno-economic considerations such as;

(i) Proximity to large deposits of suitable grades of coal and its mode of transport;

(ii) Proximity to the source of water for meeting the requirement of condenser cooling boiler feed make-up and the type of cooling to be adopted;

(iii) System of net-work with reference to existing and proposed transmission lines and exchange of power;

(iv) Availability of large areas of low lying land for each disposal;

(v) Soundness of site geologically with good sound conditions, freedom from flooding etc. and

(vi) Environmental factors like density of population and pollution problems.

2.87. The Committee suggested certain sites for consideration in the first instance. Keeping in view their suggestions, the anticipated requirements of the various regions as also the availability of resources, it was proposed to establish in a phased manner one large thermal station each in the Northern, Western, Eastern and Southern

Regions. Feasibility reports had been prepared for Singrauli (2000 MW), Korba (2000 MW), Farakka (1200 MW), Ramagundam (1000 MW) and Neyveli (1000 MW). Proposals had accordingly been sent to the World Bank for financial assistance. The Committee also *inter-alia* recommended that the size of a single station should not exceed 2000 MW. Initially the unit size may be kept at 200 MW and 500 MW sets may come only later when they are indigenously manufactured.

2.88. Asked to state the amount of assistance sought from the World Bank for setting up the super thermal project and whether orders for the project had been placed the Secretary, Ministry of Energy, during evidence stated:—

"We have posed to the World Bank five super thermal power stations of which Singrauli is one. The other four are Korba, Farakka, Ramagundam and Neyveli. Of the five, they took up Singrauli for more detailed appraisal. A team came in February-March, 1976. They made their studies. They sent some more people to go into the question of tariff, allocation, etc. Then they were busy with other countries. They invited our team in December. I just got a telex that negotiations have been completed. So far as Singrauli is concerned, it is of a total size of 2000 MW. What we have taken up for implementation is the Phase I which is 600 MW. For that, the loan negotiations were conducted. These have been just completed. From their side, it is to go to the Board and so on. It will take another two or three months. But we have been told that we will get 150 million dollars for the Phase I.

We have had a lot of discussions on what is known as the shopping list. We have taken care to indicate those items of equipment where the BHEL can be a very good competitor. Being a member of the World Bank, the Indian companies are fully eligible to compete in the global tenders. We will be inviting tenders for the generators, turbines etc. We are 99.9 per cent certain that they will get the contracts. The World Bank has promised up to give a price preference of 15 per cent in the case of indigenous equipment. The Ministry of Finance and the Ministry of Commerce have also agreed that any of their supplies for the World Bank tenders will be deemed to be exports. The phase I of 600 MW is going to cost

Rs. 225 crores. Rs. 50 crores for the other Phases of the Project".

2.89. Asked about the time to be taken for its completion, the witness stated:—

"As regards phase I, we have to complete it within 48 months of sanction. Outside aid is also involved. All the negotiations have been completed and the agreement will probably be signed in about 2-3 months' time from now. All the sets are to be commissioned around March-April, 1981, if not sooner. The later phases of the project will come up at the rate of every three months and six months."

2.90. With regard to the other projects, the witness added:—

"As regards Korba, it is likely to be the next station, which will come up for formal sanction and for proposing to the World Bank. They have already disclosed to us that they will take up the next station in the year 1977-78. At home, we have nearly completed all the negotiations for Korba and the Central Electricity Authority is a legally competent body to okay the scheme. It will be placed before them in the last week of January or latest February. So we shall have to get this techno-economic approval and then we will have to get the consent of the Planning Commission and the Public Investments Board. Our timetable is that we will complete all Government sanctions as soon as possible and then immediately approach the World Bank."

2.91. The Ministry of Energy in a written note furnished in May, 1977 have stated that the World Bank team has conducted a preliminary appraisal of the Korba Super Thermal Power Project in last February. Another team from the World Bank is expected in India on an appraised mission in June|July.

2.92. The Minister of Energy, while answering USQ No. 1198 on 1st March, 1978 in Lok Sabha, *inter alia* stated that Government have accorded approval for the setting up of thermal power stations at Korba & Ramagundam. It was further stated that Korba in Bilaspur District of Madhya Pradesh where the first stage installation of 1100 MW, which has been approved, will include three units of 200 MW and one Unit of 500 MW. Ramagundam in Karimnagar District of Andhra Pradesh with the first stage installation of 1100 MW includes three units of 200 MW and one unit of 500 MW".

2.93. With regard to Farrakka Super Thermal Project, the Minister of Energy in reply to USQ No. 1285 answered in Lok Sabha on 1st March, 1978 stated that "the feasibility project report for the Farrakka Super Thermal Project has been prepared by National Thermal Power corporation and submitted to the Central Electricity Authority for techno-economic approval. The project is being appraised in the Central Electricity Authority. After techno-economic clearance is recorded by Central Electricity Authority, the project will be processed for an investment decision."

2.94. That Ministry have also stated that proposals for taking up survey and detailed investigations at the sites of three possible super thermal power stations are presently under process of being sanctioned.

2.95. Asked the cost of generation, the Secretary, Ministry of Energy, during evidence stated:—

> "I would like to say that in Rajasthan thermal power stations have been put up very recently and they have proved to be quite expensive because the capital cost has gone up. Similarly, at Badarpur the cost of generation is 18 paise per unit. It depends on the source. It is a question of location as to how much away the station is from the coal pithead....At the pithead it is 9 paise. It is a question of location as to how much away the station is from the coal area."

Setting up of small thermal Power Plants

2.96. The Sub-Committee of Estimates Committee (1977-78) desired to know the economics, feasibility and desirability of setting up of small thermal power stations whether any small thermal stations had been set up in the past and the proposals for the future. The Ministry of Energy in their note (January 1978) have stated thus:—

> "In 1947, the total installed capacity in the country was about 2,000 MW only and the maximum unit rating was of 30 MW. Over a period of 30 years, the installed capacity has increased to about 24,000 MW. Out of this capacity, there are about 154 thermal units of various sizes (above 25 MW) totalling to 11450 MW in utilities alone. The units sizes of these sets range from 30 MW to 200 MW. The first 200 MW unit has recently been commissioned at Obra on 31st December, 1977.

In view of anticipated accelerated pace of growth of economy in the country, it is considered necessary to commission about 20,000—22,000 MW of additional genrating capacity during the next 5—7 years. Out of this about 17,000 MW would be in thermal generating sets of sizes ranging from 60 MW—500 MW. In the cases of the thermal power stations apart from the unit size, the supporting facilities like coal and ash handling facilities cooling water systems, etc. that are required also have an important bearing on the unit rating.

There are a number of advantages in going for higher size of units because of economics of scale in efficiency, lower initial capital cost lower cost of generation etc. The high ash content and abrasive nature of the ash of the Indian coal that is used for power generation also adds to the problems not only in the operation of the power station but also in the disposal of the ash. Roughly for a 2,000 MW power station will yield nearly 2.2 million tonnes of ash per year and would reuire about 28 kilometers of land for disposing of ash during the life time of the power station. This alone can pose a serious problems for locating large thermal power stations at the load centres. The new strategy for installing new thermal power station is to locate these large thermal power stations at coal pitcheads and transmit power at high voltages to the load centres. This also results in considerable economic in cost apart from locational problems indicated above. The installation of about 17,000 MW additiional generating capacity in thermal units is a collossal task and we have to go in for higher size units of achieve this target during the next 5—7 years. If we were to install a very large number of smaler units at a number of sites, it would not be physically possible to commission the additional capacity proposed during the next 5—7 years. The organisational resources would come under great strain. Moreover, the average cost per KW installed in the case of 50 MW, 200 MW and 500 MW power station comes to about Rs. 5,000 per KW, Rs. 3,500—4,000 per KW and Rs. 3000—3,500 per KW respectively. The installation of smaller sets, however, is not completely ruled out and proposal for installation of small sets at suitable locations where the transportation of higher sibe units becomes a problem or load conditions in isolated places so warrant etc. is being considered. Each such proposal is considered on the basis of its own merits.

In addition to the generation in the utilities power generation is also resorted to by the non-utilities through captive units as an insurance against breakdowns of power supply and voltage fluctuations in the power systems etc. The total installed capacity in such non-utilities is about 2100 MW i.e. about 8.5 per cent of the total installed capacity in the country. In the case of captive units, generating sets of smaller sizes are generally installed as the power requirements of such non-utilities are limited.

While as a policy, smaler stations are not being encouraged in view of the need for rapid growth of power in the country, the installation of small units by certain industries or at certain other locations on merits is not ruled out and such proposals are considered as and when received on their own merits".

2.97. The Committee in their 39th Report (1972-73) had recommended that Government should examine the feasibility of locating the new thermal stations at the pitheads in the larger economic interest.

2.98. The Committee have been informed during evidence that locating the new thermal stations at the pitheads would be economical from the point of view of cost of generation of power as the cost of generation per unit at the pit-head would be 9 paise as compared to 18 paise at other places.

2.99. The Committee are glad to note that in implementation of their recommendation, Government appointed a Committee to indentify sites nearer to the pit-heads and study their suitability from the point of view of techno-economic factors for setting up larger thermal power stations of 2000 MW capacity approximately in different regions. The Government Committee was also asked to inspect sites in the following regions:—

(i) One site in Maharashtra;

(ii) two sites in Madhya Pradesh;

(iii) one site in Andhra Pradesh; and

(iv) two sites in Eastern region.

2.100. Keeping in view the suggestions made by the aforesaid Committee and other considerations, Government, it is stated, propose to establish in a phased manner one large thermal station each in Northern, Western, Eastern and Southern regions. Feasibility reports have already been prepared for Singrauli (2000 MW), Korba.

(2000 MW), Farakka (2000 MW) Ramagundam (1000 MW), and Neyveli (1000 MW). Proposals have been forwarded to the World Bank for financial assistance, The Committee note that negotiations with the World Bank in respect of Phase I of the Project at Singrauli are in an advanced stage. The Committee during evidence have been informed that an assistance of 150 million dollars would be available for Phase I. The Committee would like to be apprised of the outcome of the negoitiations, and the progress made in the setting up of the Singrauli Project.

2.101. As regards the Projects at Korba, Ramagundam and Farraka, the Committee observe from the replies given in answer to Questions to Lok Sabha on 1-3-78 that Government have accorded approval for setting up super thermal power stations for the projects at Korba and Ramagundam and in respect of the super thermal project at Farakka, the project report has been prepared and is being appriased in the Central Electricity Authority for techno-economic clearance and thereafter the project will be processed for an investment decision. .. ..

2.102. The Committee would like to emphasise that implementation of all these projects may be taken up in accordance with the relative priorities fixed, keeping in view the need for development of the various regions and in accordance with a time-bound programme. ..

2.103. As regards the setting up of small thermal Power Plants, the Committee have been informed that as a policy, Smaller Stations are not being encouraged in view of the need for rapid growth of power in the country, but the installation of small units by certain industries or at certain other locations on merits is not ruled out and such proposals are considered as and when received on their own merits. The Committee hope that proposals for establishment of small Thermal Power Plants, will be considered only on merits.

Nuclear Energy

2.104. Nuclear power generation in India was started in 1969 with the commissioning of nuclear power station at Tarapore with an installed capacity of 420 MW. The present installed capacity in nuclear power stations in 460 MW. Centribution from nuclear generation is about 3 per cent of the country's total generation at present. The total installed capacity from the nuclear generation is expected to be 1330 MW at the end of the Fifth Five Year Plan (1978-79).

The Nuclear Power Development has been dealt with in a separate Chapter in this Report.

Development of Non-Conventional sources of Energy

2.105. The term 'Non-conventional' is used to cover sources of energy such as 'Solar energy', 'Geothermal Energy', 'Tid-al power', 'Wind power' and 'Chemical sources'. Some of the important non-conventional sources are dealt with below:

(a) *Solar Energy.*

2.106. There is considerable activity in the field of sloar energy in the country and about 25 institutions are involved. Priorities have been defined and institutions working in the priority areas have been identified. The main thrust of the research programme is towards the appliaction of solar energy in rural areas with a view to complement the other sources of energy. Development of solar pumps has been accorded very high priority. A laboratory model of a solar pump has been developed and tested successfully. Prototype models of this type of pump have been fabricated and they would be installed and tested in the field shortly. A project to develop a prototype 10 KW solar power unit has been taken up as a joint project with West Germany. A comprehensive programme to develop the technology of direct conversion of solar energy into electricity through solar electric cells has also been drawn up. The other areas in which R & D work is in progress are solar dryers for drying agricultural produce, solar heating, solar cooling and refrigeration and solar distillation and desalination.

2.107. With regard to the development of Solar energy, the Secretary, Ministry of Energy, during evidence stated:—

> "In the field of solar energy, we are engaged on two or three priority areas, priority in terms of what an agricultural country might need. For example, we are engaged in developing a system whereby water can be drawn from the underground wells with the help of solar energy. Since the standard motor now used is of 5 HP, the research is concentrated on development of solar energy for a 5 HP motor. Of course, we are not shutting out the question of larger dimensions, but our chief concentration is on that. The Pilani Institute has got a motor which is working on solar enercy on an experimental basis....."

Another area is to try out the generation of conventional electrical Energy through solar energy. Forthis, we have entered into collaboration with a German firm and a 10 KW station is being put up in Madras. There are two ways of doing it. Conventionally, solar energy is only used to heat a liquid or to create a gas or to create some source of heat which will then drive turbine.

The Madras plant will follow the normal conventional generation, except that the source will be solar energy. Because solar energy cannot heat water to that extent, some chemical mixture will be used which will become productive more easily.

The other type in which there is no break-through, what we call direct conversion of solar energy into electric energy, not passing through the intermediate stages. On that, research is going on in our country and many other countries. But there is as yet no break-through. Research is also in an advance stage in regard to solar cells for dry batteries of 100 watts capacity.

Sometimes it becomes very difficult in the monsoon period to dry agricultural products. Solar energy can be utilised for this purpose, some dryers are also being experimented upon.

So we are very much in the vanguard of countries in effective solar research."

(b) *Geo-thermal energy*

2.108. Geo-thermal manifestations in the form of hot springs are known to occur in several regions of the country. North-west Hamalya region which includes Puga in Ladakh District, J & K State, Manikaran in Himachal Pradesh, West coast geo-thermal belt running through Maharashtra and Gujarat, Narmada—Sone lineament in Bihar and Damodar Valley Region offer bright prospects in this field. Besides the above, small manifestation (hot springs) located in various parts of the country may also offer some power generation.

2.109. The Fuel Policy Committee in their Report (1974) have observed that even though quantatively geo-thermal energy is not very important in India, some of these sources like Puga in Ladakh have locational advantage which cannot be ignored. In June-September, 1973 the Geological Survey of India led a multi-purpose drilling exploration in Puga Valley with specialised assistance from National Geo-physical Research Institute, AMD, Indian Institute of Technology, Kanpur, IIT, Delhi and Roorkee University. This project consisted of shallow drilling operations at about 15 sites. Central heating by geo-thermal energy was also successfully demonstrated. The exploration experience from Puga multipurpose project indicates that the total power potential in geo-thermal energy may be several megawatts.

2.110. Explaining the development of Geo-thermal energy the Secretary, Ministry of Energy during evidence stated:

> "In regard to geo-thermal energy, research activities are going on at the moment in north-east Himalayas, especially in a place known as Puga and in another place near Manali, and in the west coast."

2.111. With regard to the progress made in the development of Geo-thermal energy at the research centres at Puga and Manali, the Ministry of Energy in their written note furnished in March, 1977 have stated:—

> "The Puga Valley is located in Ladakh, several organisations like the Geological Survey of India, the Oil and Natural Gas Commission, the Regional Research Laboratory, Jammu, the Central Electricity Authority and the National Geo-physical Research Institute have been associated in the investigations to prove the geo-thermal potential at Puga, and to find possible uses of the energy. After conducting the preliminary geological, geo-physical and geo-chemical studies shallow exploratory drillings were started in 1973. The drill holes have established a potential of a few MWs of energy at shallow depths. It has also been indicated that larger geo-thermal potential exists at greater depths. The proving of this potential would, however, require deep drilling and sizeable investments.
>
> If generation of electricity at Puga is not found justified for meeting the power demands at distant load centres, the justification for further investigations would rest upon the possibility of local use of geo-thermal energy. There

are deposits of sulphur, borax potassium and sodium nearby and work has been done in utilising the geo-thermal energy for the extraction of these chemicals|minerals. The commercial feasibility has, however, yet to be established.

Thus further activities at Puga would be dependent upon the possibilities of using the geo-thermal energy potential.

The exploration work in the Parbati valley in Himachal Pradesh and along the West Coast is being carried out with the assistance of UNDP. The main objective of these investigations is to carry out geo-logical, geo-chemical and geo-physical surveys in promising areas followed by exploratory and evaluation drilling in one of the areas for the purpose of geo-thermal reservoir evaluation. Geological, geo-physical and geo-chemical investigations are being carried out in Manikaran, Kasol and Jan Sectors in the Parbati valley and certain hot spring areas in the Thana, Kolaba Ratnagiri Districts in the West Coast.

In the West Coast also, regional and detailed geo-logical mapping work over certain areas have been done. Geo-chemical monitoring is being continued. Some shallow drilling has also been done. The explorations conducted so far have indicated only medium base temperature conditions, which will not be suitable for power generation directly.

The explorations under way would enable identification of areas where the most promising geo-thermal reservoirs are located. Deep drilling would have to be undertaken at these locations to prove the extent of the reservoirs exact flow and temperature conditions and other characteristics, potential etc. In view of the cost involved in undertaking such drilling, it is essential to establish the *prima facie* techno-economic feasibility of geo-thermal development in various promising locations, based on the inferred data from the investigations in progress. These studies will be undertaken as soon as the present phase of investigations are completed. Depending on the results of these studies, a decision on the further course of action will be taken.

(c) *Bio-Gas (Gobar Gas) Plants*

2.112. Our country with its large cattle population, has sizeable potential of bio-gas (gobar gas) production. The energy yield by

treatment of gobar and other organic matter in bio-gas plants is substantially higher than that obtained by using them directly. Treatment of organic matter in bio-gas plants yields, in addition to gas, manure which is richer than the ordinary compost. Thus, there is every reason to undertake intensive promotion of bio-gas plants. A programme of installing one lakh gobar gas plants has been undertaken in the Fifth Plan. This programme is mainly oriented to individual farmers establishing small-sized plants for their own use. In order to develop the vast bio-gas potential available in the country rapidly, it is considered essential to evolve a programme of establishing community type bio-gas plants.

2.113. In regard to establishing Bio-Gas (Gobar Gas) Plants, the Secretary, Ministry of Energy, during evidence stated:

> "In the field of bio-gas, we had only 6900 plants when the 4th Plan ended. The target for the Fifth Plan is one lakh additional plants, and already 30,000 have been installed in the first two years. We are very confident that all the one lakh plants will be installed during the plan period.
>
> We feel that the requirements of domestic cooking for which so much kerosene is being consumed to-day will be met by bio-gas one day because it requires on an average 1.5 head of cattle to look after one person's requirements of energy. We have a cattle population which is about half the human population, and most of it in the villages. Therefore, bio-gas is also economical and easy to operate.
>
> It will be easier if we have a community centre where the cattle are also kept and the collection of night soil becomes easy. But it will have one disadvantage that the bio-gas will have to be piped from the community centre to individual houses.....
>
> For giving a greater fillip to it, we want to have a Corporation which will do the turn-key job. We want to create adequate loan finance for it. The dividend will be there. We are making a major break-through in this field. We are so much known in other countries, in this field that we have become the preceptors for those countries."

2.114. The Ministry when asked to state the steps taken to set up Gobar Gas Plants, both in the private and co-operative sectors in their written note furnished in March, 1977 stated as follows:

> "The Ministry of Agriculture and Irrigation are primarily responsible for the development of bio-gas in the country.

The Khadi & Village Industries Commission has been mainly instrumental in popularising the installation of gobar gas plants. They have standardised the designs for various capacities of plants, and they have been actively assisting in their installation. The Agro-Industries Corporation in some States have also been taking keen interest in promoting development of bio-gas potential.

Financial support, in the form of loans is being given by the nationalised banks. The Ministry of Agriculture & Irrigation is also providing a subsidy to the beneficiaries of the plants. During 1974-75 and 1975-76, a subsidy of 25 per cent of capital cost was given to the beneficiaries. It has been decided to continue this subsidy throughout the plan period, but on a tapering basis (*i.e.* 20 per cent in 1976-77, 15 per cent in 1977-78, 10 per cent 1978-79).

The present bio-gas programme is mainly oriented to individual formers, establishing small sized family units (3 to 6 cum|day requiring dung from 4 to heads of cattle) for their own use. Rapid development of the vast bio-gas potential available in the country, for meeting the rual energy needs, would require establishment of large sized plants which can also be taken up on a co-operative basis for the community|village needs. However, there are a number of socio-administartive as well as technical problems associated with the establisment of such plants. Consideration is now being given to undertake a pilot project to study these problems and find appropriate solutions.

The cost of bio-gas plants varies according to size. As per estimates prepared by KVIC, cost of bio-gas plants of small size are as follows:

Size of Plant	Approximate number of animals required.	Estimated cost as on February, 1975
		Rs.
3 cum/day	3—4	3,016
4 cum/day	4—6	3,360
6 cum/day	6—10	4,175

The above costs are inclusive of piping and one set of burners. The cost of a gas burner to the consumer is indicated to be about Rs. 150|- for a single burner and Rs. 220|- for a double burner. The cost of a suitable gas light (for use of gobar gas for illumination purposes) about Rs. 120|-".

2.115. The Committee note that some of the non-conventional sources of energy are 'Solar energy' 'Geo-thermal' and 'Bio-gas.'

2.116. The Committee note that the thrust of research on the solar energy is towards its application to rural areas with a view to complement the other sources of energy. They have been informed that prototypes of solar pumps for drawing underground water have been developed and would be installed and tested in the field shortly. Research is stated to be under-way for direct conversion of this energy into electricity. R&D efforts are also directed at solar dryers for drying agricultural produce, Solar heating, solar cooling and refrigeration and Solar distillation and desalination. The Committee recommend that considering the special significance this source of energy has for a tropical and agricultural country such as ours, R&D efforts should be intensified to make a break-through in this field.

2.117. The Committee also note that some investigations are being conducted in the field of Geo-thermal energy to find its possible uses, but these are at a preliminary stage. They hope this source of energy will also receive due R&D attention.

2.118. The Committee also note that Bio-gasis yet another non-conventional source which appears to have great potential for development particularly in rural areas. Needless to say, the use of this source of energy, can be of great help in conserving large quantities of kerosene which is being burnt in rural areas for cooking and lighting purposes and easing pressure on the demand for power in rural areas.

2.119. The Committee are informed that at the beginning of the Fifty Plan the number of bio-gas plants was about 7,000. target of one lakh plants was set for the Fifth Plan. As against this target, the number of plants set up at the end of the second year of the Fifth Plan was only 30,000. The Committee urge Government to take vigorous steps to ensure that the target set for the Fifth Plan is fully achieved by 1978-79.

2.120. The Committee would, however, point out that the cost of setting up a small size bio-gas plant which is between Rs. 3016/-

and Rs. 4175/- appears to be beyond the reach of a common man in the rural parts of the country. They would therefore, urge Government to direct their efforts towards reducing the cost of setting up plants through economy in design and enable the villagers to benefit from this programme.

2.121. The Committee would like to point out that the rapid development of the vast bio-gas potential available in the country for meeting the rural energy needs, would require establishment of large sized community type bio-gas projects. They would like Government to encourage the setting up of such large sized community type bio-gas projects.

B. POWER GENERATION

(a) *Per capita consumption of electricity*

2.122. The Estimates Committee in paragraph 3.189 of their 39th Report expressed their unhappiness that although the *per capita* consumption of electricity rose from 17.8 Kwh in 1950 to 93 Kwh in 1971-72, it was dismally low as compared to the world average of 1200 Kwh.

2.123. The Committee in paragraph 3.190 of their Report were distressed to note that despite nine fold increase in the generating capacity, there still persisted considerable imbalance in *per capita* consumption between the various States in the country. The Committee noted that certain States|Areas *viz.* Uttar Pradesh (60 Kwh), Rajasthan (55 Kwh), (Himachal Pradesh (46 Kwh), Jammu & Kashmir (40 Kwh) in the Northern Region; Madhya Pradesh (58 Kwh) in the Western Region; Andhra Pradesh (58 Kwh) and Kerala (74 Kwh) in the Southern Region; North Bihar (18.3 Kwh) and North Bengal in the Eastern Region; and the entire North Eastern Region comprising Assam, Meghalaya, Mizoram, Manipur, Tripura, Nagaland and Arunachal Pradesh were far below the national average.

2.124. The Committee in paragraph 3.191 of their Report noted that the pre-requisite to reduce the disparities was providing increased availability of power in States|Areas which were below average in electricity consumption. They, therefore, suggested that effective steps should be taken to achieve the desired results by providing additional installed generating capacity and building extensive transmission and distribution systems in such areas.

2.125. The Committee in paragraph 3.192 of their Report also noted that the *per capita* consumption of electricity was anticipated to be only 200 Kwh even at the end of the Fifth Plan as against the

per capita consumtpion of 1000 Kwh in the United States and 2000—3000 Kwh in Europe. The Committee had accordingly recommended that in view of the fact that *per capita* consumption of electricity was a yard stick for measuring the economic development of the country highest priority should be given for meeting the power demands in all section of economy, and the poor revenue yielding areas which had hither to remained neglected should be given preference in regard to their economic up lift by providing the essential infra-structure of electricity at cheap rates.

2.126. In their action taken replies, the Government while noting the observations of the Committee accepted the recommendations for minimising disparities. The Government *inter alia* stated that speical efforts were made to attract industries to the relatively backward areas by providing the necessary infra-structure for industrial development and other necessary incentives. Government also stated that in the formulation of the Fifth Plan, speical attention was being given to creation of generation facilities or improving power availability in the backward areas.

2.127. Government further stated that the rate of growth of the power sector was however, influenced by a variety of factors. A Five year plan was an integrated development plan and takes into account the available material and financial resources and implementation capabilities, Consistent with the growth rate of 5.5 per cent, in 1978-79 had been assessed at about 1,40,000 million Kwh for meeting which an installed capacity of 33 million kw would be required. In the Fifth Plan, the additions being planned were of the order of 16.5 mkw. Considering the above, the target adopted was quite ambitious. The *per capita* power consumption would, therefore, depend upon the implementation capabilities developed over the Fifth Five Year Plan.

2.128. The Committee in their Fifty-sixth Report on action taken by Government on the recommendations contained in the Thirty-ninth Report observed as follows:—

> "The Committee hope that Government will make efforts to develop the implementation capabilities during the Fifth Plan period not only to achieve the Fifth Plan targets for power development but also to raise *per capita* electricity consumption by providing increased availability of power in States/areas which are below average in electricity consumption."

2.129. Later asked to furnish the *per capita* availability of electricity in different regions in the country, and the steps taken to

increase the *per capita* consumption by the end of the Fifth Year Plan, and how far did it compare with the developing countries, the Ministry of Energy in their written note, explained the region-wise position in the years 1970-71, 1973-74 (*i.e.* at the end of the Fourth Plan), and for the first two years of the Fifth Five Year Plan as follows:—

Year	*Per Capita* consumption (KWH)			*Per Capita* availability (KWH)		
	1970-71	1973-74	1974-75	1975-76	1974-75 (Prov.)	1975-76 (Prov.)
Region:						
Northern	74·4	83·9	82·3	99·6	110·5	130·7
Western	116·1	130·0	139·6	143·1	167·5	171·0
Southern	92·0	99·8	100·4	110·0	128·0	137·2
Eastern	89·6	91·1	90·1	98·1	106·6	114·3
North-Eastern	18·3	23·1	23·5	26·7	28·0	30·4
All-India	89·8	97·5	99·0	108·8	123·5	134·0

2.130. About the steps taken to raise the *per capita* consumption of electricity the Ministry of Energy in their written replies stated that follKowing steps have been taken to raise the *per capita* consumption of electricity:

(1) It has been possible to raise the installed capacity substantially during the last two years through close monitoring of the projects under construction. As compared to an addition to capacity of about 400 MW in 1973-74, the additions to capacity during 1974-75 and 1975-76 were 1720 MW and 1800 MW respectively.

(2) Generation from each power is being closely watched and steps taken to maximise it.

(3) Steps are being taken to reduce system losses by installation of capacitors and reinforcement of the existing transmission and distribution net work.

(4) Integrated operations on a regional basis are helping to mitigate regional imbalances in the availability of power as also in the most economic manner.

(5) Supply of power is being extended to rural areas so that facilities are created for greater consumption of electricity by a larger sector of the population.

2.131. About its comparison with the developing countries, the Ministry of Energy have furnished the following information:—

Statement showing Per Capita Electricity consumption in £ of some foreign countries during the years 1970-71 to 1974-75.

	Name of country	1970-71	1971-72	1972-73	1973-74	1974-75
	Developing Countries					
1.	Egypt	228	235	230	228	225*
2.	Algeria	138	144	152	190*	200*
3.	Libya	214	244	263	310	320*
4.	Morocco	128	136	147	159	164
5.	Ethopia	21	23	23*	25*	25*
6.	Ghana	338	332	368*	385*	379*
7.	Guinea	99	112	110*	107*	116*
8.	Kenya	68	73	78	86	86
9.	Mauritious	271	280*	302*	336*	361*
10.	Nigeria	28	32	37	44	46
11.	Zambia	957	1025	1062*	1080	1062
12.	Argentina	915	981	1038	1082	1117*
13.	Brazil	491	536	575	630	684
14.	Jamaica	825	877	1022	1079	1110
15.	Mexico	567	601	640	667	707
16.	Israel	2350	2535	2753	2717	2774
17.	Iran	246	269	298	386	389*
18.	Iraq	291*	287*	288*	298*	297*
19.	Kuwait	3510*	3962*	4379*	4617*	4764*
20.	Turkey	247	274	299	331	352
21.	Japan	3391	3622	3909	4324	4201
22.	Sri Lanka	65	71	76	78	77*
23.	Indonesia	20	21	22	25	27
24.	Nepal	6	7	9	9*	9*
25.	Pakistan	67	69*	131	130*	137*
26.	Thailand	124	139	165	188	194
27.	China	101*	118*	130*	141*	146*
28.	Mangolia	413	443	480	492	528

*Provisional.

£Per Capita consumation = $\frac{\text{Gross generation} + \text{Import export}}{\text{Population.}}$

2.132. With regard to achieving the anticipated 200 Kwh *per capita* consumption at the end of the Fifth Five Year Plan, as recommended by the Estimates Committee in their 39th Report, the Government in their written replies stated that with the *per capita* consumption for 1975-76 at about 109 Kwh and assuming a 10 per cent growth rate in power consumption and 2 per cent in population, the *per capita* consumption was likely to be in the region of 200 Kwh by 1983-84. The Ministry also stated that special efforts were being made to increase the *per capita* consumption in those State areas where the consumption was below average. The Rural Electrification Corporation was also offering loans on easy terms for electrification of those areas where the consumption levels were very low.

2.133. Asked to state what were the reasons for not being able to achieve the original target of 200 Kwh of *per capita* consumption at the end of the Fifth Five Year Plan (*i.e.* 1979), the Secretary, Ministry of Energy during evidence stated as follows:—

> "There are two aspects—one is that of the conceptual figure and the other is that of failure. The conceptual aspect is of larger dimensions. All over the world, when they work out the *per capita* energy, they take the total generation and divide it by the total number of people, which gives a certain figure. As if we take only the energy that is 10. When the Minister gave the figure of 20 he must have had in mind only the normal-procedure followed all over the world. Now the other thing is about failure. Here again, there are two things involved. To improve the
>
> *Per capita* availability, you must create more power and have less people—but we failed on both the fronts; we could not have as much powers as we wanted to add and we had more people added than we wanted. Both these factors contributed towards the failure.
>
> To answer the question as to when we will reach 200, our calculation is that we may do so by the end of the Sixth Plan."

2.134. Regarding comparison with the developing countries, the witness added:

> "But when we compare ourselves with the advanced nations, one point to be remembered is that we don't need as much as they."

2.135. The Sub-Committee of Estimates Committee (1977-78) sought information on the following points:—

(a) the basis on which the target of 200 Kwh of *per capita* consumption of electricity at the end of the Fifth Plan was arrived at;

(b) the reasons for not achieving the target; and

(c) the basis on which it was now anticipated to be achieved at the end of the Sixth Plan.

The Ministry of Energy in their note (December, 1977) have stated as follows:—

(i) As already explained, a higher target of installed generating capacity had earlier been envisaged for the end of the Fifth Plan. The target of *per capita* consumption of 200 Kwh at the end of the Fifth Plan indicated earlier was based on this higher target.

(ii) The target of installed generating capacity during the Fifth Plan was revised from 16,500 MW in the draft Fifth Plan to about 12,500 MW in the Fifth Plan as finalised. The *per capita* consumption corresponding to the revised target and based on ultimate consumption was estimated at about 148 Kwh.

(iii) According to projections of demand as indicated in the 10th Annual Power Survey, the *per capita* consumption is expected to reach about 200 Kwh by the end of the Sixth Plan (1983-84). It may be mentioned in this connection that the power programme for the next five-year period is presently under formulation by a Working Group set up by the Planning Commission. This Working Group is at present examining the demand for power taking into account the strategy being formulated for the overall development of the economy and the programme of power development required to meet the anticipated demand. The target of *per capita* consumption in the future would emerge from the power programme being formulated now by the Working Group.

2.136. Asked to furnish the information regarding the *per capita* consumption of electricity at the beginning of the Fourth Plan and Fifth Plan, the Ministry in their written note have informed that the *per capita* consumption of electricity at the beginning of the Fourth Plan (1968-69) was 78 and at the beginning of the Fifth Plan (1973-74) was 97.5. The Ministry have also furnished details of *per capita* consumption of electricity in Kwh for the various States and Union Territories of Delhi, Chandigarh and Pondicherry during the years 1968-69 and 1973-74, which are given at Appendix II.

2.137. The position regarding the per capita consumption of electricity during the years 1974-75 and 1975-76 in the States and the Union Territories as also is given at Appendix III.

2.138. It would be seen from the Appendix that while the *per capita* consumption of electricity in the year 1973-74 (*i.e.*, at the end of the Fourth Plan) in States like Punjab, Maharashtra, Gujarat, Haryana, Tamil Nadu, Karnataka was 197, 170, 154, 141, 133 and 121 Kwh respectively, in States like Tripura, Manipur, Assam, Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Rajasthan and Madhya Pradesh, the *per capita* consumption was as low as 6, 8, 21.2, 43, 57; 58, 61, 68 Kwh respectively during the year 1973-74.

2.139. With regard to the *per capita* consumption of electricity in backward areas of North Eastern Region, the Ministry have stated that the *per capita* consumption in the different States of the North Eastern Region for the years 1968-69, 1973-74 was as under:

Per capita consumption in Kwh as published

	1968-69	1973-74	
Assam (including Meghalaya & Mizoram): .	15	21·2	
Nagaland . . .	8	35 (21·2)	revised on receipt of detailed return.
Tripura: .	5	6	
Manipur . . .	3	8	
Arunachal Pradesh	NA	5·2	

2.140. The Committee in paragraph 3.189 of their 39th Report (1972-73) had expressed their unhappiness at the dismally low per capita consumption of electricity in the country which was 93 Kwh in 1971-72, compared to the world average of 1200 Kwh. They had noted that even at the end of 1978-78, the per capita consumption of electricity was anticipated to be only 200 Kwh as against the per capita consumption of 1000 Kwh in the USA and 2,000 to 3,000 Kwh in Europe. The Committee are very much perturbed to note that even the anticipated 200 Kwh per capita consumptoin of electricity by 1978-79 is now not likely to be achieved before the end of Sixth Plan i.e., 1983-84.

2.141. The Committee are not convinced by the reasons advanced by the Ministry that the target of 200 Kwh of per capita consump-

tion at the end of the Fifth Five Year Plan 1978-79 related to the total generation of electricity. Considering that per capita consumption of electricity in 17 countries out of the 28 developing countries, was above 200 Kwh in 1974-75 and in 6 of them, it was over 1,000 Kwh, it is evident that the target of 200 Kwh of per capita consumption by the end of 1978-79, was a very modest one. It is regretted that even this modest target is now proposed to be achieved by the end of the 1983-84. The Committee need hardly stress that power is an assential input for agricultural, industrial and economic development of the country. It is, therefore, imperative that there should be an acceleration in the programme for development of power. They would, therefore, like Government to prepare an accelerated programme for the development of power—hydel, thermal and nuclear—so as to achieve the target of 200 Kwh per capita consumption of electricity at the earliest. The Committee have no doubt that if the programme for development of power is accelerated the target of 200 Kwh would be achieved earlier than the end of 1983-84.

2.142. The Committee further note that there were wide disparities in the per capita consumption of electricity between the various State/areas at the end of the Fourth Plan. The per capita consumption in 1973-74 (i.e. at the end of the 4th Plan) ranged from 6 Kwh in Tripura, 8 Kwh in Manipur, 21.2 Kwh in Assam to 197 Kwh in Punjab, 170 Kwh in Maharashtra, 154 Kwh in Gujarat. The Committee had in their 39th Report expressed distress at this persistent imbalance in the per capita consumption between the various States/areas in the Country and had recommended effective steps to be taken to reduce the disparities by providing additional installed generation capacity and building extensive transmission and distribution system in such areas. The Committee regret to observe that determined efforts do not appear to have been made in this regard. They note that the additions to the per capita consumption of electricity during the Fourth Plan period were not made to the desired extent in the low per capita consumption States/areas. The Committee strongly urge that effective measures may be taken by Government to reduce these side disparities by according higher priority to the generation, transmission and distribution of power in such areas with potential consumption for industrial and agricultural development.

2.143. The Committee would further like to point out that lack of availability of power acts as a constraint on the growth and development of rural and semi-urban areas. It is well known that there is high consumption in metropolitan and big urban areas.

The per capita consumption of electricity at Delhi and Chandigarh was 316 and 425 respectively against the All India average of 108.8 Kwh in 1975-76. The easy availability of power in these big cities has been one of the main factors for concentration of industries and employment potential in these areas resulting in migration of population from rural areas to these centres. The Committee consider that in the interest of development of rural and semi-urban areas, it is imperative that power is made easily available in the rural areas. They would, therefore, like Government to give high priority to make power available to these areas in the interest of integrated rural development and creating employment potential there.

(b) *Utilisation of installed capacity*

2.144. The Ministry of Energy in their written replies sent in November, 1976 and up-dated in March, 1978, have indicated the following position regarding installed capacity, derated capacity and generation of power regionwise, during the periods 1974-75, 1975-76 and 1976-77: —

Type of Energy	1974—75			1975—76			1976—77		
	Installed	Derated	Generat-tion	Installed	Dereated	Genera-tion	Installed	Derated	Genera-tion
	(MW)		(Gwh)	(MW)		(Gwh)	(MW)		(Gwh)
Northern Region									
Thermal	1996.4	1893.0	8379	2276.4	2240.2	9992	2556.4	2501.2	11681
Nuclear	220.0	220.0	748	220.0	220.0	553	220.0	220.0	2095
Hydro	2468.8	2459.4	7607	2624.8	2624.8	10867	2756.8	2747.4	11772
Southern Region									
Thermal	162.5	1632.5	6265	1762.5	1742.5	6561	1872.5	1852.5	8639
Hydro	3114.6	3101.2	12087	3433.5	3420.3	13828	3882.6	3869.4	13296
Western Region									
Thermal	2976.5	2809.5	14336	3306.5	3167.0	15094	3786.5	3639.5	16921
Hydro	1207.5	1207.5	6199	1582.5	1582.5	6144	1598.5	1598.5	7306
Nuclear	420.0	420.0	1458	420.0	420.0	2094	420.0	420.0	2158
Eastern Region									
Thermal	3182.5	2974.5	11387	3302.5	3128.5	11957	3412.5	3238.5	13358
Hydro	666.0	660.0	1726	720.0	720.0	2723	845.0	845.0	2202
N.E. Region									
Thermal	111.5	111.5	329	141.5	141.5	439	141.5	141.5	582
Hydro	65.2	65.2	219	65.2	65.2	175	75.2	75.2	190
All India Total									
Thermal	9919.4	9421.0	40696	10789.4	10419.7	44043	11769.4	11337.2	51181
Hydro	7516.1	7493.3	27808	8426.0	8403.4	33237	9158.1	9135.5	34766
Nuclear	640.0	640.0	2206	640.0	640.0	2627	640.0	640.0	3253
TOTAL	18075.0	17554.3	70710	19855.4	19463.1	79907	21567.5	21148.7	89200

2.145. The Ministry also informed in their written replies that the total generating capacity of the country at the end of the Fourth Plan (1973-74) was 18455 MW which comprised 16633 MW in utilities and 1792 MW in non-utilities.

2.146. The Ministry were asked to state the reason for the power generation being less than the installed capacity and what steps had been taken or proposed to be taken by Government to attain the rated capacity. The Ministry of Energy in their written replies stated that the full capacity of a station was not and could not be continuously available for generation. A portion of the capacity goes towards statutory planned maintenance and unforeseen forced outages. The balance is called "availability". But this available capacity cannot be fully utilised because of partial losses comprising reduction in capability of the units due to outage of a single component of multiple auxiliaries, constraints in the main equipments, like Boiler, Turbine generator etc. due to temporary abnormalities in operating conditions, system, line or transformer capacity limitations etc. Loss of capacity on these factors is of the order of 27.5 per cent.

2.147. Over and above, there is the influence of load factor i.e. the variations in the pattern of consumption due to consumer behaviour. In a metropolitan area having industrial, traction commercial and residential loads met from a common utility system, the demand is minimum at night and early hours of the morning. Thereafter, it varies reaching peak either by 10-11 in the forenoon or in the evening when the incidence of different categories of load is simultaneous to a great extent. In other areas also, the variation in consumption will be there depending on the nature of load. Thermal stations have to backdown generation during period of low load at night which depresses the utilisation factor. It is sometimes necessary to back down thermal generation, in case of composite system of hydro, thermal mix, depending on Hydro availability.

2.148. The Ministry also informed that as per review conducted for the performance of Thermal stations during 1974-75, and 1975-76, it is found that the availability is above 75 per cent and plant load factor (ratio of units generated to the units possible at continuous utilisation of the full capacity) is nearly 52.2 per cent. The balance 23 per cent goes towards partial loss including load factor. The Ministry also pointed out that the plant load factor of 52.2 per cent

was a reasonable achievement compared to the same in other countries. In this connection, the Ministry stated that the plant load factor for some other countries was as follows:—

Japan	60—65%
USSR	53—55%
USA	50—54%
France	40—44%
U.K.	40—43%

2.149. The Ministry also stated that as compared to these figures, the national average plant load factor for India had been 49 per cent in 1973-74, 52.5 per cent in 1974-75 and 52.2 per cent in 1975-76.

2.150. Asked to state whether the loss of capacity of 27.5 per cent was not on the high side, and what should be the reasonable loss, the Secretary, Ministry of Energy during evidence stated:—

> "Our forced outage is high for two reasons—one is that we have recently gone in for new sets of 100 MW. The experience by way of teething troubles is something which we have to live with. The equipment has come from the manufacturing countries which is stabilising.
>
> The 200 MW set which has been made in our country is yet to be installed. Further, the quality of coal is not good. Again our auxiliary and anciliary services including pulverising of coal to required specification has not yet been achieved. In our country we do not have certain allied equipment of the standard required of full reliability."

2.151. The witness added that the loss of "27.5 per cent is not too much on the high side." To a querry by the Committee as to what was the international average, the witness stated:—

> "International average would have to be seen from another angle. They have an installed capacity for greater than the need for it and, as such, they do not have this problem. The main point which needs consideration is what one should provide for forced outage. Firstly, the point arises why should there by any forced outage. The experience shows that the element of forced outage cannot be

totally overcome and it gets worse because the quality of coal is not good."

2.152. Asked to state what steps have been taken or proposed to be taken to reduce this loss, the Ministry in their written note later stated that the unavailability due to planned maintenance, forced outage and equipment and auxiliary constraints can be reduced by the following:—

"(a) Reduction in down time of units on planned maintenance by following recommendations of Kulkarni Committee on modernisation of maintenance procedures in large thermal stations;

(b) Adequate preventive maintenance of units and auxiliaries to contain the risk of forced outage or reduction of output;

(c) Employing proper working procedure in case of forced outage to bring back the unit on outage to service at the earliest.

2.153. Asked to state as to whether the loss of 23 per cent between the availability of 75 per cent and generation load factor of 52.2 per cent was not unduly high, and what was the norm prevailing in other countries, the Ministry of Energy in their written replies have stated:

"The loss of 23 per cent consists of generation not possible due to system constraints such as low load, backing down of generation on account of excess hydro availability etc. and constraints in auxiliaries and main equipment for which full rated output is not possible. Equipment and auxiliary losses during the first quarter of 1976-77 is 14.99 per cent.

Loss of capacity and Planned maintenance

2.154. The Sub-Committee of Estimates Committee (1977-78) sought information on the following points:—

(a) Break up of the time lost due to planned maintenance, forced outages and partial unavailability as compared to the reasonable time (norm) required for the various tasks, the overall norm of loss of capacity on all these heads, the lower level of the loss.

(b) the time prescribed for statutory maintenance, and

(c) whether any study had been made regarding the atcual time taken and what steps had been taken to ensure that there was no unavoidable loss of time on this account.

2.155. The Ministry of Energy in their note (December 1977) have stated thus:

"The loss of capacity due to planned maintenance, forced outage and partial unavailability during 1975-76 and 1976-77 are shown below:—

Particulars	1975-76	1976-77
1. Planned maintenance (%)	11·70	9·60
2. Forced outage (%)	12·80	12·95
3. Partial unavailability (%)	19·00	16·03
4. Total	43·50	38·58

(a) The break-up is given above.

No norms can perhaps be set up for loss due to unscheduled outages, although it should be endeavour of each undertaking to reduce such outages to the minimum. The susceptibility of a generating plant to forced outage depends on the quality of the plant, type of fuel, quality of design as well as the quality of operation and maintenance. There is, therefore, a characteristic forced outages rate that can be associated with each plant. Obviously such a rate has to emerge from a study of actual operation of the plant in regular service.

From the world experience it is observed that forced outage rates have tended to be higher when new designs and ratings are introduced but decline when the designs are perfected.

It may be interest to compare the forced outage rates of some other countries of the world as given below:—

Country	Forced outage rate (%)
1. Union for the Coordination of the Production and Transport of Electric Power Countries like Belgium, France, Luxumbergs, Italy, Austria	7-8.6% (1974-75)
2. France	11.1-20.3% (1965-75)

The possibility of reducing the forced outage rate in our country may depend on the perfection of design as per operating conditions of the country, quality of coal supplied to power stations and the experience of the operating personnel to take charge of operation of the higher capacity units now being installed.

(b) Norms recommended by the Kulkarni Committee are as under:—

(1) Boiler overhaul 4 weeks

(2) Capital maintenance of turbine—45 days

The above norms are subject to lead time for proper planning, documentation for procedures and methodology of maintenance/ repairs, Manpower at various levels of working quality-quantity-wise, availability at work site of tools, tackles, spares consumables, facilities to create congenial working atmosphere, as recommended by the Committee.

(c) As per analysis carried out by the Central Electricity Authority actual time taken are as under:—

Work	Average duration (days)	
	1975-76	1976-77
1. Annual overhaul of boiler . .	69	39
2. Capital maintenance of turbine .	119	67

2.156. The Central Electricity Authority periodically reviews the time taken for each of the above works and urges the State Electricity Boards to follow the recommendation of the Kulkarni Committee for such works. PERT Charts with suggested duration of each activity, sequence of work etc. have been made available to the Boards based on the above recommendations. While there is marked improvement in this regard from 1975-76 to 1976-77 it is expected that there may be further betterment with complete implementation of the recommendations.

2.157. The Committee note that the installed capacity of power generation was 18075 MW in 1974-75, 19855.4 MW in 1975-65, and 21567.5 MW in 1976-77. The actual power generation in these three years was 70710 Gwh, 79907 Gwh, and 89200 Gwh respectively. The Ministry of Energy have stated that a portion of the capacity goes towards statutory planned maintenance and unforeseen outages and the balance is called availability. But this available capacity could not be fully utilised because of partial losses comprising reduction in capability of the units due to outage of a single component

of multiple auxiliaries, constraints in the main equipments, like Boiler, Turbine generator etc. due to temporary abnormalities in operating conditions, system, line for transformer capacity, limitations etc. Loss of capacity on these factors is of the order of 27.5 per cent. There is also the influence of the load factor i.e. the variations in the pattern of consumption due to consumer behaviour which depresses the utilisation factor. The Committee note that the national load factor for India had been 49 per cent in 1973-74, 52.3 per cent in 1974-75, and 52.2 per cent in 1975-76 which compares well with USSR (53-55 per cent), USA (50-54 per cent), France (40-44 per cent) and U.K. (40-43 per cent). The loss of about 23 per cent between the availability and generation load factor of 52.3 per cent consists of generation not possible due to system constraints such as low load, backing down of generation on account of hydro availability etc., and constraints in auxiliaries etc., and main equipment. Equipment and auxiliary losses during the first quarter of 1976-77 was almost 14.99 per cent.

2.158. The Committee have been informed that the loss of capacity due to planned maintenance, forced outage and partial unavailability during 1975-76 and 1976-77 was as follows:—

Particulars	1975-76	1976-77
1. Planned maintenance (%)	11.70	9.60
2. Forced outage (%)	12.80	12.95
3. Partial unavailability (%)	19.00	16.03
TOTAL	48.50	38.58

As regards statutory planned maintenance, the Committee were also informed that the Kulkarni Committee had recommended the norms of (i) 4 weeks for boiler overhaul and (ii) 45 days for capital maintenance of turbine as against these norms the actual average time taken in 1975-76 and 1976-77 for (i) boiler overhaul was 69 and 39 days respectively, and (ii) capital maintenance of turbine was 119 and 67 days respectively.

2.159. The Committee would like the Government to keep a careful watch on the losses arising out of forced outages, equipment and auxiliary constraints and bring them down through vigorous implementation of the measures which are stated to have been take..

such as reduction in down-time, modernisation of maintenance procedures adequate preventive maintenance of units and auxiliaries and employing proper working procedures in case of forced outage to bring back the unit on outage to service at the earliest.

2.160. The Committee are glad to note from the speech of the Minister of Energy in reply to discussion on Demands for Grants of his Ministry on 14 July, 1977 in Lok Sabha that he has directed that "plant by plant review be undertaken of the forced outages, partial outages, and constraints on output of the plant by the technical experts to diagnose the problems and find urgent technical solutions." The Committee hope that the above review would be completed at an early date and the quality and performance of power stations would be improved so as to ensure maximum output from the existing capacity.

(c) *Augmentation of Installed Capacity*

Fourth Plan—Targets and Achievements

2.161. The Committee in paragraph 3.44 of their 39th Report noted that the Fourth Five Year Plan envisaged augmentation of installed power generating capacity from 14.3 million KW to 23.1 million KW. There were, however, deeply concerned to find that there was likely to be a short-fall to the tune of about 3.5 million KW during the Fourth Plan period.

2.162. In reply Government stated:—

> "It is regretted that there would be a shortfall to the tune of about 3.5 million MW during the Fourth Plan Period, which is mainly due to delay in delivery of plant and equipment by manufacturers, and delay in construction work at site which is due to shartage of essential materials like steel and cement, paucity of funds, labour troubles and other causes. Effort is being made to bring the gap narrower."

2.163. The Ministry in their further written replies stated that during 1973 when the information was supplied to the Estimates Committee, it was expected that the shortfall in the power programme of Fourth Plan would be of the order of 3.5 million KW. The actual shortfall was higher. An additional installed capacity of 9.26 million KW was planned to be installed during the Fourth Plan. However, 4.16 million KW capacity was added during this period, resulting in a shortfall of 5.10 million KW.

1.164. Asked to state the precise reasons leading to higher shortfall in the Fourth Plan, than was expected, and lessons that have been learnt from the serious shortfalls and difficulties experienced in the Fourth Plan, the Ministry of Energy in their written replies furnished in April, 1977 stated that the main reasons for shortfalls in the achievement of physical targets have been:—

(i) increase in the costs of projects due to escalation of prices of materials, plants and equipments;

(ii) increase in labour costs;

(iii) inadequate investigation and deficiencies in project preparation especially in respect of hydro-electric projects;

(iv) delays in availability of essential construction materials and funds;

(v) delays in obtaining plant and equipment;

(vi) labour troubles; and

(vii) organisational|management deficiencies.

Fifth Plan

2.165. The Minister in their written replies stated that the installed capacity at the end of the Fifth Plan as originally proposed in the draft Fifth Plan document would be as under:—

(Million KW)

	Utilities	No-utilities	Total
Actual installed capacity at the end of IV Plan . .	16.66	1.79	18.45
Addition in IC as per draft V Plan	16.33	0.22	16.55
TOTAL expected at the end of V Plan . . .	32.99	2.01	35.00

2.166. It has also been stated that the Power Programme for the Fifth Plan has been revised. It is now expected that an installed capacity of 12.5 million KW will be added in utilities sector during

the Fifth Plan period. 3.52 million KW has been commissioned in the first two years of the Fifth Plan. An additional 2.0 million KW has been targetted for addition during the year 1976-77 and the balance of about 6.97 million KW is scheduled for commissioning during the last two years of the Fifth Plan. The total all India—capacity at the end of the Fifth Plan would, therefore, be expected to be as under:—

(million KW)

	Utilities	Non-utilities	Total
Actual installed capacity at the end of the IV Plan .	16.66	1.79	18.45
Addition in IC during V Plan as now anticipated .	12.50		12.50
TOTAL now expected at the end of the V Plan . .	29.16	1.79	30.95

2.167. The Ministry further stated that all the schemes covered in the target of 12.5 million KW have already been cleared. The schemes have also been taken in hand and the orders for the main generating plant have been placed.

2.168. Explaining the position further the Ministry in their written replies have stated that the Draft Fifth Five Year Plan prepared in 1973 provided for an additional installed capacity of 16.55 million KW in the country. The provision for power development in the Draft Plan was based on the 1972-73 price levels and in the context of the economic situation in the obtaining in the first half of the year 1973-74. Thereafter major developments took place due to steep rise in the prices of imported oil and other materials resulting in steep inflationary pressures and worsening of the balance of payment position which distorted the financial and physical magnitudes of the Plan. Escalation in costs, higher outlays on the public consumption and non-development expenditure led to the erosion of resources for the Plan resulting in staggering of programmes owing to dimunition in the size of investment in real terms. Steps have been taken to arrest inflationary tendencies and with the stability of prices and growth in economy, the Fifth Five Year Plan has been finalised in 1976. A total of about 12500 MW of additional generating capacity (including Atomic) is proposed to be added during the Fifth Plan, out of which 3529 MW have so far been added in the first two years of the Plan. As at present no shortfall is expected.

2.169. The Ministry of Energy in their written replies informed that a number of steps such as the following have been taken to expedite implementation of power projects:

(i) Restructuring of the electricity supply industry with a view to improving the capabilities for achieving targets.

(ii) Changing procedures and priorities with a view to improving the availability of the required inputs.

(iii) Assessments being made continuously through systematic monitoring of the projects and their capability to incur expenditure by sending teams of senior engineers to various projects and reassessment of projects costs due to price escalation so as to recommend release of adequate funds.

(iv) Indigenous manufacturers of power generating plants being asked to make supplies according to the fixed schedules in proper sequential order and according to the progress of works.

(v) A coal Linkage Committee being set up with representatives of the Ministry of Energy, Railways and Steel and Mines for identifying the sources of coal and expeditious clearance of thermal projects.

(vi) High priority being given to the procurement of scarce materials.

2.170. Asked to state how far the various steps taken have contributed to the expeditious implementation of the power projects and whether the results have been evaluated, the Secretary, Ministry of Energy, during evidence stated:—

"At the moment the installed capacity being added from year to year is sub-stantially higher than what it used to be. In the first year of the Fifth Plan it was 1760 MW. in the second year 1800 MW. in the third year 2000 MW. in the fourth year 2900 MW. and in the fifth year 3500 MW. This is an indication of the improvement."

2.171. The Ministry in their written replies furnished in April, 1977, stated that action being taken to ensure achievement of targets in the Fifth Plan included the following:—

(i) In the Fifth Plan, power is being treated as a core sector, for investment allocations and availability of funds has considerably improved. The allocation for the power sector in the first three years of the Fifth Plan has been as follows:—

1974-75—Rs. 766.65 crores (16 per cent of the total Plan outlay).

1975-76—Rs. 1101.58 crores (44 per cent more than in 1974-75).

the Fifth Plan period. 3.52 million KW has been commissioned in the first two years of the Fifth Plan. An additional 2.0 million KW has been targetted for addition during the year 1976-77 and the balance of about 6.97 million KW is scheduled for commissioning during the last two years of the Fifth Plan. The total all India—capacity at the end of the Fifth Plan would, therefore, be expected to be as under:—

(million KW)

	Utilities	Non-utilities	Total
Actual installed capacity at the end of the IV Plan .	16.66	1.79	18.45
Addition in IC during V Plan as now anticipated .	12.50	....	12.50
TOTAL now expected at the end of the V Plan . .	29.16	1.79	30.95

2.167. The Ministry further stated that all the schemes covered in the target of 12.5 million KW have already been cleared. The schemes have also been taken in hand and the orders for the main generating plant have been placed.

2.168. Explaining the position further the Ministry in their written replies have stated that the Draft Fifth Five Year Plan prepared in 1973 provided for an additional installed capacity of 16.55 million KW in the country. The provision for power development in the Draft Plan was based on the 1972-73 price levels and in the context of the economic situation in the obtaining in the first half of the year 1973-74. Thereafter major developments took place due to steep rise in the prices of imported oil and other materials resulting in steep inflationary pressures and worsening of the balance of payment position which distorted the financial and physical magnitudes of the Plan. Escalation in costs, higher outlays on the public consumption and non-development expenditure led to the erosion of resources for the Plan resulting in staggering of programmes owing to dimunition in the size of investment in real terms. Steps have been taken to arrest inflationary tendencies and with the stability of prices and growth in economy, the Fifth Five Year Plan has been finalised in 1976. A total of about 12500 MW of additional generating capacity (including Atomic) is proposed to be added during the Fifth Plan, out of which 3529 MW have so far been added in the first two years of the Plan. As at present no shortfall is expected.

2.169. The Ministry of Energy in their written replies informed that a number of steps such as the following have been taken to expedite implementation of power projects:

(i) Restructuring of the electricity supply industry with a view to improving the capabilities for achieving targets.

(ii) Changing procedures and priorities with a view to improving the availability of the required inputs.

(iii) Assessments being made continuously through systematic monitoring of the projects and their capability to incur expenditure by sending teams of senior engineers to various projects and reassessment of projects costs due to price escalation so as to recommend release of adequate funds.

(iv) Indigenous manufacturers of power generating plants being asked to make supplies according to the fixed schedules in proper sequential order and according to the progress of works.

(v) A coal Linkage Committee being set up with representatives of the Ministry of Energy, Railways and Steel and Mines for identifying the sources of coal and expeditious clearance of thermal projects.

(vi) High priority being given to the procurement of scarce materials.

2.170. Asked to state how far the various steps taken have contributed to the expeditious implementation of the power projects and whether the results have been evaluated, the Secretary, Ministry of Energy, during evidence stated:—

"At the moment the installed capacity being added from year to year is sub-stantially higher than what it used to be. In the first year of the Fifth Plan it was 1760 MW. in the second year 1800 MW. in the third year 2000 MW. in the fourth year 2900 MW. and in the fifth year 3500 MW. This is an indication of the improvement."

2.171. The Ministry in their written replies furnished in April, 1977, stated that action being taken to ensure achievement of targets in the Fifth Plan included the following:—

(i) In the Fifth Plan, power is being treated as a core sector, for investment allocations and availability of funds has considerably improved. The allocation for the power sector in the first three years of the Fifth Plan has been as follows:—

1974-75—Rs. 766.65 crores (16 per cent of the total Plan outlay).

1975-76—Rs. 1101.58 crores (44 per cent more than in 1974-75).

1976-77—Rs. 1453 crores. (32 per cent higher than in 1975-76).

(ii) Coordinated effort to ensure timely supply of key materials has been made and the delivery schedules of most critical items is being maintained.

(iii) There is greater indigenous availability of plant and equipment which has removed the uncertainties associated with large-scale imports. The availability of steel, cement and aluminium has improved greatly.

(iv) An effective monitoring is being done by the States as well as through C E A in order to ensure that commissioning targets are, by and large, adhered to.

(v) Improved construction techniques and better project management has been introduced and action to re-structure the electricity industry to improve the capability in the States for execution of power projects is under way. State Electricity Boards are introducing more and more professionalisation and specialisation and ensuring that better management techniques are adopted by project Chiefs to ensure the commissioning of projects on time.

(vi) Labour situation has greatly improved.

2.172. The Sub-Committee of Estimates Committee (1977-78) desired that the position regarding adequacy of funds *vis-a-vis* the power targets for each year and their actual utilisation during the each year of the Fifth Five Year Plan, might be solicited. The Ministry of Energy in their note (December, 1977) have stated that the position regarding the targets and physical achievements in respect of addition to generating capacity and the actual expenditure during 1974-75 to 1976-77 is given below:—

Year	1974-75	1975-76	1976-77
1. Target (MW)	2218.3	2663.2	2005.5
2. Physical achievement (MW)	1725	1804.3	1712.1
3. Planned Outlay (Rs. crores)			
(a) Total Power Sector	766.55	1101.58	1453.40
(b) On generation	417.17	670.21	886.44
4. *Plan Expenditure (Rs. Crores)*			
(a) On Power Sector	909.51	1207.27	1492.93*
(b) On Generation	552.36	769.27	928.42*

Anticipated as reported.

2.173. The Committee note that as against the targetted additional installed capacity of 9.26 million KW during the fourth Plan period, the actual addition was only 4.16 million KW, resulting in a shortfall of 5.10 million KW and in percentage terms, the achievement had been about 45 per cent. The Committee observe that apart from increase in the cost of projects due to escalation in prices and increase in labour costs the other main reasons for the shortfall were inadequate investigation and deficiencies in project preparation, delays in availability of essential construction materials and funds, delays in obtaining plant and equipment and organisational/management deficiencies. The Committee need hardly point out that with greater care in planning, greater determination to implement the schemes and necessary coordination with concerned authorities these difficulties could have been easily overcome. The Committee hope that Government have learnt the lessons from their past experience and would ensure that at least in future such short-comings do not hold up commissioning of power plants according to the stipulated schedules and the country is not denied the availability of power which provides vital sinews for industrial and agricultural advancement.

2.174. The Committee find that in so far as Fifth Plan is concerned, the target for additional installed capacity of 16.55 million KW as originally envisaged in the draft plan document has been steeply scaled down to 12.5 million KW. The Committee have already commented on this reduced target for Fifth Plan earlier in this Chapter.

2.175. The Committee note that during the first two years of the Fifth Plan, the capacity added was only 3.52 million KW and during the third year viz., 1976-77, the target was 2 million KW. The Committee observe from the Annual Report of the Ministry of Energy (Paragraphs 3.35 to 3.37) for 1976-77, that out of this targetted additional capacity of 2 million KW, only a capacity of 0.64 million KW till 30th November, 1976 has been achieved, and the construction works of some of the projects scheduled for commissioning during that year with capacity totalling 1.276 million KW were still at various stages of completion. The Committee would like to point out that even if the target of 2 million KW were achieved during 1976-77, the balance additional capacity left to be built up during the last two years of the Fifth Plan would be about 7 million KW.

2.176. The Committee have been assured by the Ministry of Energy that no shortfall is expected in the achievement of the revised physical target during the original Fifth Plan period i.e. 1974-75 to 1978-79. The Committee have no doubt that Government are fully aware of the stupendous nature of the task before them, namely,

of adding a capacity of more than 7 million KW in the last two years of the original Fifth Plan i.e. 1977-78 and 1978-79 against a likely achievement of 5.2 million KW during the first three years of the Plan. Needless to say, that if the target is to be fully achieved, Government will have to redouble their efforts and ensure that there is no complacency or slippage at any level and bottlenecks, if any, are immediately, identified and removed through a system of strict monitoring of the projects under construction.

(d) *Monitoring Arrangements*

2.177. The Ministry of Energy were asked to state the present position with regard to setting up of a Monitoring and Information system for the construction of power projects at the State, regional as well as the Central level which was proposed to be set up immediately as a Fifth Plan scheme, and for which necessary provision for the purpose was made in the Annual Plan for 1974-75, and also the follow-up action taken as a result of monitoring and the improvements effected. The Ministry in their written replies furnished in November, 1976, have stated that the Central Electricity Authority have, with the existing organisation arrangements, been monitoring the progress of power projects under construction in the Central and State Sectors. Recently, the proposals for setting up a full fledged Construction Monitoring Organisation in the CEA has been approved. There would be three wings in this Organisation viz., Thermal Projects Monitoring Cell, Hydel Projects Monitoring Cell, each under the charge of Chief Engineer. In addition, there will be a separate Central Data Processing Cell headed by a Systems Supervisor.

2.178. It has also been stated by the Ministry that some of the States have set up Monitoring arrangements both at the Project and at the State levels, but the majority have arrangements only at the State Board level. The arrangements are not yet uniform. The matter is being persued with the States with a view to having monitoring arrangements established both at the Project and at the State levels in all the States. The matter was also discussed at the Conferences of the States Power Ministers and the Chairmen of the Electricity Boards and was fully endorsed.

2.179. The Ministry has stated that one of the factors on which the success of monitoring depends is follow-up action and this is invariably done. There are a number of cases in which due to timely intervention many apparently involved problems could be solved thereby helping expeditious progress of works. In some of the difficult cases, matters have been brought to the notice of the

concerned Chief Ministers. Defects noticed in design and manufacture of equipment resulted in avoidable delays have been brought to the notice at the highest levels of the concerned manufacturers.

2.180. The Ministry further stated that the thermal generation schemes are being executed by the following States during the Fifth Plan period:

Andhra Pradesh,
Assam,
Bihar,
Gujarat,
Haryana,
Madhya Pradesh,
Maharashtra,
Orissa,
Punjab,
Tamil Nadu
Uttar Pradesh and
West Bengal.

2.181. Of the above, 6 States, namely, Bihar, Punjab, Tamil Nadu, West Bengal U.P. and Orissa have already set up monitoring organisation at Project/Board level. Other State Electricity Boards are being persuaded to set up the monitoring organisations.

2.182. As a result of close monitoring of some selected Projects and arranging timely inputs to the projects it has been possible to commission 1720 MW of new additional generating capacity in 1974-75 and 1800 MW in 1975-76, which was substantially higher achievement as compared to about 409 MW during 1973-74.

2.183. Asked to state the recommendation made by the State Power Ministers in regard to monitoring of projects and what follow-up action has been taken to establish monitoring arrangements both at the Project and the State levels in all the States, the Ministry of Eenergy in their written replies furnished in March, 1977, have stated that the conference of Power Ministers of the States held in July, 1976 had, *inter alia* stressed the need to achieve targets for commissioning new generation capacity during 1976-77 and had decided that all our efforts would be made to adequately monitor construction programmes to ensure that slippages do not take place. A set of proformae has been devised by the Department of Power after detailed examination and the working involved in various projects and discussions with the concerned autho-

rities on the subject, and these have been circulated to the Electricity Boards. A nucleus monitoring organisation has been sanctioned for the Central Electricity Authority with three Chief Engineers from three disciplines: Hydro, Thermal and Power Systems. So far, three Directors of the three disciplines have taken up position and the other posts are to be filled up.

2.184. Asked to state the position with regard to the arrangements made for monitoring and how is coordination being achieved between the CEA and the various Monitoring Organisations set up by various States, the Secretary, Ministry of Energy, during evidence on 28th December, 1976 stated:

> "We have got information of what is the arrangement at the moment in each State. Some of them have no full time people, while others have exclusive organisations which are not adequate in strength and therefore need further augmenting. Lastly, collectively in the matter of certain instruments which are in vogue for the last few years for effective monitoring, they are not effective monitoring, they are not fully up to date. So far as the Centre is concerned. we have now gone in for additional set up to make this effective. On the professional side, we have a management consultant in the Ministry who has gone to 7 of the projects for locating what goes wrong with monitoring. He has now devised a complete set of documentation, proforma of returns which would be required to be submitted on a monthly basis to enable effective monitoring to be done, we expect that by not later than the 1st April all units above 50 MW would be monitoring."

2.185. Asked to state when was the monitoring system started, and when was the last team of senior engineers sent to various projects, to assess about the progress of work, the Secretary, Ministry of Energy, during evidence on 27-12-1976 stated:

> "In the first few months of this year, we did not have anyone exclusively on the job. The Chief Engineer (Thermal), Deputy Chief Engineer (Hydro) and two members themselves would go out frequently visiting the versions sites. More recently, we have got exclusive staff for this purpose at the level of Directors and some Chief Engineers Chairman CEA joined about 3 months agencies and he has taken upon himself person responsibility for this until I am

able to support him more fully. Suppose, a project is to be commissioned in February, 1977, the equipment from BHEL must have arrived at the site by October (1976). We check whether it has come or not. Sometimes Instrumentation Ltd. poses a serious problem. They say, "our sub-suppliers are lagging behind." So, we have to put pressure through DGTD on the private sector to supply these things to the Instrumentation Ltd."

2.186. The Ministry through a written note furnished later in March, 1977 have stated that several States have set up monitoring organisations generally at the headquarters and in some cases, at project sites. The necessity of setting up monitoring organisations for each project has been emphasised in the Conference of the Chairmen of State Electricity Boards held in July, 1976. The importance of the construction monitoring as also the need for setting up of appropriate organisation at the project and at the State levels was appreciated.

2.187. The Committee note that at the Centre, the monitoring of the power projects under construction in the Central and State sectors is being done by the CEA. The Committee have been informed that a proposal for setting up a full fledged construction Monitoring Organisation in the CEA has been approved. There would be three wings in this organisation viz, Thermal Projects Monitoring Cell, Hydel Projects Monitoring Cell, each under the charge of Chief Engineer. In addition, there will be a separate central data Processing cell headed by a systems Superviser.

2.188. **The Committeee need hardly emphasise the importance of construction monitoring, particularly in the context of the shortfall in achieving the power generation target in the Fourth Plan. The Committee trust that with the strengthening of the monitoring organisation at the Central, all avoidable delays in the construction and commissioning of power projects will be eliminated.**

2.189. The Committee are, however, distressed to find that the arrangements for monitoring at State Electricity Board level leave much to be desired. According to the representative of the Ministry of Energy, "some of them have no full time people, while others have exclusive organisations which are not adequate in strength", and "collectively in the matter of certain instruments which are in vogue for the last few years for effective monitoring they are not fully upto date." Also, the Committee, observe that several States have set

up monitoring organisations at the headquarters and only in some cases at project sites.

2.190. The Committee need hardly point out that a majority of the bottlenecks that arise in the implementation of projects could be to a very large extent avoided or remedied by timely action through effective monitoring at project level and upwards and through close coordination with the Central Electricity Authoity. The Committee urge the Central Government to pursue this matter vigorously with the States and ensure that proper monitoring arrangements exist for all individual projects so that no avoidable delay occurs in their commissioning.

(e) *Avoidance of delays in issuing formal sanctions/approval*

2.191. The Estimates Committee in paragraph 2.33 of their 39th Report desired that Government at the highest level should review the existing procedure which is being followed in processing the formal references which are received from the project authorities in implementation of decisions taken by the Board of Control with a view to streamline the procedure and cut out all delays. The Committee need hardly point out that where a matter needs further elucidation, this can best be done by either seeking comprehensive written information in order to dispose of the matter finally or by convening a meeting at a sufficiently high level to resolve and finalise the matter.

2.192. Government in their reply stated that "suitable instructions have been issued for avoidance of delays in the matter of issue of formal sanctions/approvals by the Ministry for implementation of the decisions taken by the Board of Control. Proposals streamlining the existing procedure for issue of formal sanctions in implementation of the decisions taken by the board of Control are under consideration.

2.193. The Committee in their 56th Report (1973-74) desired whether a final decision had been taken to streamline the existing procedure for issue of formal sanctions in implementation of the decision taken by the Board of Control. Government replied in January, 1974 that the proposal for streamlining the existing procedure was still under consideration.

2.194. The Ministry of Energy later in their written replies furnished in November, 1976 have informed that so far as the Central Hydro Electric Projects are concerned, the procedure for issue of formal sanctions to implement the decisions of the Control Board

has been streamlined. The Control Board for Central Hydro-Electric Projects is a high level body with the Secretary, Ministry of Energy (Department of Power) as Chairman, Chief Secretaries of the concerned State Governments and representatives of CEA, CWC, Ministry of Finance and Chief Engineers of the Projects, as members. The Board has been vested with the necessary powers for scrutinising project estimates, deciding proposals for preparation of designs, obtaining expert advice, framing rules for delegation of powers, deciding programme of construction of different parts of the projects, receiving and reviewing the progress reports and laying down steps to expedite the work. All matters relating to the Central Projects are examined in depth in the meetings of the Control Board or its attached bodies/committees. Thereafter, processing of Government sanctions for implementation of the decisions taken by the Control Board is done expeditiously. The Secretary of the Control Board processes the decisions of the Control Board with the concerned Ministries for issue of Government sanctions.

2.195. The Ministry also stated that the Central Hydro-Electric Projects Control Board have constituted Standing Committees one each for the each of the projects namely, Salal, Loktak and Bairasiul Hydro-Electric Projects and have conferred certain functions to the Committees which meet periodically to expedite decisions. To expedite the solution of day-to-day difficulties and urgent matters of a local nature on the projects, the project officers have been delegated necessary powers by the Control Board.

2.96. Asked to state the powers and functions and how far the constitution of the Control Board for Central Hydro-Electric Projects has contributed to the avoidance of delays for issuing of formal sanctions, the Secretary, Ministry of Energy, during evidence sated:

> "This Board consists of myself in my capacity as Secretary of the Ministry as the Chairman, we have the Chief Secretaries of all the States concerned where the projects are located—Himachal Pradesh, Jammu & Kashmir, Manipur and now Sikkim also. We have four projects now. So much is required from the State Governments even for a Central project and so it is good to have them on the Board. We have also our own officers of the CEA, Finance Ministry. Because of the composite nature and also the high level composition of the Board, we are able to resolve quite a few issues and thereafter the assurance of Government sanction takes much less time than it might have taken otherwise.

The life of this Control Board is kept as counted number of months because the National Hydro Corporation is supposed to take over; we are about to transfer one in Manipur very soon; the others will follow. We are going to have some kind of overseeing body also. The State Governments would like to see what is happening. Many of the details of functioning including references to the Ministry of Energy, Ministry of Finance, etc. will cease once they become projects of the Corporation....."

2.197. Later the Ministry of Energy in their written replies furnished in April, 1977, stated the functions of the Control Board included:

(i) to scrutinise the estimates of the project, advise necessary modifications and recommend the estimate for administrative approval of the Government of India;

(ii) to examine and decide all proposals for preparation of designs and for obtaining expert advice;

(iii) to examine and approve from to time to time the delegation of such powers, both technical and financial as it may deem necessary for the efficient execution of the projects to the Chief Engineer and other Officers concerned with the execution of the Project;

(iv) Approve all sub-estimates and contracts, the cost of which exceeds the powers of sanction of the Chief Engineer;

(v) to approve all proposals for award of work or supplies on contract which are beyond the powers of the Chief Engineer of the projects;

(vi) to frame rules as to delegation of powers and procedure for the purpose of carrying out its business;

(vii) to decide the programme of construction of different parts of the project keeping in view the funds avilable, the economics of the project and the desirablity of obtaining quick results;

(viii) to receive such progress reports as it may prescribe both as to works and expenditure in the prescribed form the Chief Engineer and other officers, review the progress of different units of the Project and lay, down steps to be taken to expedite the work.

2.198. The representation of various Departments and organisations on the Control Board has been of considerable help in processing of proposals and in the issuing of formal santions after decisions are taken in the control Board. The Standing Committees which have been constituted by the Control Board have also been of assistance in the examination of financial, technical and other matters. It has become possible to promote close coordination with the State authorities who are provided representation on the Control Board in the overal interest of better execution of projects. The Secretary of the Control Board and the Financial Adviser together process the decisions of the Board with the concerned Ministries for issue of Government sanctions which has been facilitated as a result of the arrangement made.

2.199. On the question of issue of formal sanctions for the projects, the representative of the Ministry of Energy stated:

> "The situation is somewhat similar to what might be obtained for the projects of State Governments as a whole. Whether it is the Central Government or the State Government when they invest on a project, it is they who have to place that proposal before the Central Electricity Authority. It has some full-time Members and some part-time Members. This body is giving suggestion for the techno-economic appraisal. The proposals are placed before this body. Now in the case of Central projects, consultancy work is done by the CBA. In regard to consultancy, there is an advantage in this that any sort of obstruction is cleared. They will tell you how the difficulties could be sorted out. The sponsoring authority is in a position to ask the CEA to get it okayed and after that it goes to the Planning Commission for approval and then to the Public Investment Board for formal sanction.
>
> On the thermal side what happened is that State Government send a proposal saying that they wanted two sets of 200 MW each. At that time the State Governments said they had enough coal for running the two sets. Now we have to check up this. Sometimes we had discussed this situation informally. Now, when we had a series of meetings in the 10th Annual Survey, we came to the understanding of the core of the parameters...."

2.200. Asked to furnish a note giving specific instances where the normal time-schedule laid down had not been followed and the

impact of the delay in escalation of the prices etc. of the power projects, the Ministry of Energy in their written note furnished in March, 1977 informed that there was no normal time-schedule laid down for examination and clearance of power projects. The time taken depended on, among other factors, the quality of project preparation, the cross-checking of data collected, the complexities of project features and the extent of inter-disciplinery consultations and, therefore, the time taken would vary from project to project.

2.201. It was further stated that a project was deemed to be ready for implementation only when the techno-economic examination had been completed and the invesment decision taken. It was difficult to make any comment on the impact of time taken in project preparation and clearance on the cost of the project, which was finally determined only when it was completed as esclations would take place even during the construction period.

2.202. The Ministry has also furnished a list of some hydro-electric projects indicating the time taken for technical examination, which is appended at Appendix IV.

2.203. The Sub-Committee of Estimates Committee (1977-78) enquired the various stages of processing of a power project both in the Central and State sectors before it is finally cleared for sanction, and the role of the Planning Commission in clearing the projects for investment and also whether the projects are subject to further technical examination by the Planning Commission. The Ministry of Energy in their note (December 1977) have stated that as per the provisions of the Indian Electricity Supply Act, every scheme estimated to involve a capital expenditure exceeding Rs. one crore is required to be submitted to the Central Electricity Authority for its concurrence. The Authority is required to carry out detailed techno-economic examination of the project and make sure that they are justified on techno-economic considerations before giving their concurrence. The Planning Commission gives approval to the projects on the basis of recommendations of the Central Electricity Authority for their inclusion in the Plan. The Project reports formulated by the State Electricity Boards, State Governments. Power Corporations in the State and Central Sectors are submitted to the Central Electricity Authority. The aspects that are examined in respect of the various categories of project are indicated below:—

Hydro Electric Projects

—Water power potential.

—Pattern of load for regulation of Water flow.

—Water resources development under conception and proposed upstream and downstream of the site and their effect on the proposed scheme.

—Installed generating capacity, firm power, peaking capacity, continous power etc.

—Unit size and the cost of electrical equipment.

—Methodology in fixing the proposed scheme to fit into any other scheme of development, if any, contemplated under the same river basin.

—Operation of the project in the Power System to which it is connected.

—Method of evaluation of power.

—Inter-State aspects.

The aspects relating to hydrology and design and estimates of civil engineering works are got examined in the Central Water Commission.

Thermal Projects

—Availability of Coal and colliery to which the power station is proposed to be linked.

—feasibility for transportation of coal to the site of plant.

—availability of cooling water and mode of cooling systems proposed.

—availability of land for power house, ash disposal and colliery.

—mode of evacuation of power.

—impact of establishing the power house on the environment.

In examining the thermal power projects, clearances are obtained from the following organisations:—

—Deptt. of Coal—regarding coal availability and coal linkage.

—Ministry of Railways—regarding transportation of coal.

—National Committee on Environmental Planning and Co-ordination—regarding Pollution

Transmission & Distribution Projects

—System considerations.

—PLCC considerations.

—Financial aspects.

After techno-economic examination in the various specialised formations of the CEA, the schemes are discussed at the full meeting of the CEA and given techno-economic approval. The CEA then conveys their approval to the Ministry of Energy, Deptt. of Power who in turn approaches the Planning Commission for formal approval to inclusion of the projects in the Plan. The representative of the Planning Commission is co-opted as a part-time member of the CEA when the projects are discussed. In view of this, the projects are not subject to any further technical examination in the Planning Commission.

2.204. The Committee note that no time schedule has been laid down for examination and clearance of power projects. According to the Ministry, the time taken depended on, among other factors, the quality of project preparation cross checking of data collected, the complexities of the project features and the extent of inter-disciplinary consultations and therefore the time taken would vary from the project to project. It has also been stated by Ministry that a project was deemed to be ready for implementation only when the techno-economic examination had been completed and the investment decision taken. The Committee have been informed that it was difficult to make any comment on the impact of time taken in project preparation and clearance on the cost of the project.

2.205. The Committee observe that as per provisions of the Indian Electricity (Supply) Act every scheme estimated to involve a capital expenditure exceeding Rs. 1 crore is required to be submitted to the Cental Electricity Authority for is concurrence. This Authority carries out detailed techno-economic examination of the project to make sure that it is justified on techno-economic considerations before giving concurrence. After techno-economic examination in the various specialised formations of the C.E.A., the scheme is discussed at the full meeting of the C.E.A. and the representatives of the Planning Commission is co-opted as a part-time Member of the C.E.A. when the project is discussed. The C.E.A. then conveys its approval to the Ministry of Energy who then approach the Planning Commission for formal approval to the inclusion of the project in the Plan.

2.206. The Committee find from a list furnished by the Ministry of some hydro-electric projects indicating the time taken for technical examination that in the case of 7 projects technical examination was completed within a year, in the case of 13 projects, it took between one and two years; and in the case of 18 projects, the time taken exceeded 2 years and in a few cases it took 6 years and more. While the Committee realise that the process of technical examination of projects takes time they do not see any justification for taking more than a year in this process as preparation of project reports may have already taken its own time. The Committee feel that the Ministry should streamline the procedure for technical examination and issue guidelines indicating in detail about the kind of technical and other relevant data which should be submitted by the State Governments, so that all avoidable delays in obtaining clarifications are obviated and the projects are cleared for investment decisions expeditiously. The Committee would like to be apprised of the steps taken in this regard. The Committee need hardly emphasise that delays in the preparation of project reports and their sanction result in escalation of costs, apart from belated supply of power. The Committee would also like to emphasize that when a project is once cleared by the Central Electricity Authority from techno-economic angle after a full and detailed examination with which representative of Planning Commission is also associated there should be no case for reconsideration of the Project from techno-economic angle by either the Ministry of Energy or the Planning Commission and the clearance given by the Central Electricity Authority should be treated as final.

2.207. The Committee note that so far as Central Hydro-electric Projects are concerned, the constitution of the Control Board for Central Hydro-electric Projects and the procedures adopted by it have helped in processing of the proposals and in issuing of formal sanctions after decisions are taken by the Control Board. The Committee hope that the work relating to the projects in the Central Sector would be processed smoothly and the plans commissioned within the target dates.

(f) *Delays in deliveries of Equipment etc.*

2.208. The Estimates Committee in para 3.151 of their 39th Report (1972-73) brought pointedly to the notice of Government that there continued to be heavy delays in delivery of machinery and equipment to the State Electricity Boards by the Heavy Electrical Industries with the result that the power generation programme in the Fourth Plan had greatly suffered. The Committee

urged the Government to ensure that advance orders for generating sets and other machinery were placed on these Undertakings and that every effort was made to adhere to the time-schedule for delivery.

2.209. Government in their action taken replies furnished in November, 1973 stated that action was being taken to sanction all the Power Schemes, which would give benefits during the Fifth Five Year Plan. State Electricity Boards had been addressed to place firm orders on indigenous manufacturers for the supply of Plant and Equipment. It was being ensured that State Electricity Boards provided necessary funds in their annual plans in order to make advance payments, as necessary, to M/s. BHEL/HEIL. Member, (Thermal) CW&PC (PW) was on the Board of Directors of these Undertakings and was keeping a close watch on the manufacturing programme of the plants to ensure the timely supply of equipment for the Fifth Plan Projects.

2.210. The Committee enquired about the measures taken to procure equipment to speed up the completion and commissioning of the power projects of 8.53 MKW capacity during the Fifth Plan, the Secretary, Ministry of Energy, during evidence stated:—

> "Orders have been placed on suppliers for equipments. Past-experience shows that it does not mean that they will be delivered at the right time. A special set-up at Central Electricity Authority monitors these schemes above 50MW of installed capacity. We have Chief Engineers separately for thermal, hydro and power systems. The Chairman himself devotes a lot of attention personally. Bharat Heavy Electricals and Instrumentation Limited are the main parties."

2.211. Explaining the position regarding procurement of equipment for power projects further, the Chairman, Central Electricity Authority stated during evidence as follows:—

> "By and large, the position has improved for the equipment both from the B.H.E.L. as well as from Instrumentation Limited, Kotah. We were indentifying the gaps and we then held meetings of all the State Electricity Boards including the I. L. Kotah's Managing Director and they gave the priority, in accordance with the commissioning plan. Even with the constraints they have had, they should be able to match with the demands of the projects as and when they come in for commissioning. Similarly,

we have held very large number of meetings with the B.H.E.L. both at sites as well as at the headquarters to identify what are the items which can cause delay and how and in which sequence the items should be sent so that the items are there at least for rolling of the machines and then commissioning of the same. This has improved the position in this year's programme, the number of bottlenecks which were there, had been identified and corrective steps taken to remove them. And above all, what we are trying to do is that after removing the external constraints, we try to create that will in the people at the project level so that they all give the moral support. Even the Chairmen of the State Electricity Boards have taken personal interest to talk to them at the sites and making them feel the importance of their work and to complete it in time."

2.212. Asked to state the specific bottlenecks that have been identified and the steps taken to remove them so as to avoid delay in commissioning schedules, the Ministry of Energy, in their written note have informed that a few of the specific bottlenecks arising either out of delayed deliveries made by M/s. BHEL or due to defects in equipment supplied by M/s. BHEL observed during pre-commissioning tests are indicated below:—

(Thermal)

Gandhinagar (2 x 120 MW).

Supply of following items was delayed:

1. Boiler feed discharge line pipings and fittings.
2. Boiler feed pumps re-circulation systems.
3. Bled steam piping.
4. L.P. feed heating systems.
5. Drain and vents from heaters.
6. Cold reheat emergency line, small bone piping of heater etc.
7. Pressure reducing and desuperheating station.
8. AOP pumps with motors, turbo-oil pumps and other miscellaneous pumps for lub oil system, CICS & Governor valves, H.P. & L.P. steam chest.
9. Screened cables.

10. C.W. strainer.

11. Level controllers, pressure controller, head switches, valves.

12. Transmitters, local detectors, valves etc.

Kothagudam stages IV (2 x 110 MW).

BHEL bottlenecks:

1. Boiler and piping materials—mainly.

2. Furnace safe-guard supervisory systems.

Harduaganj—Stage VI.

BHEL bottlenecks:

1. Boiler feed pumps: Motor of one boiler feed pump has been sent to Hardwar for journal polishing as it had got pitted.

2. Main oil pump & AVR panel are still to be received from M/s. BHEL, Hyderabad. Exciter armature sent to BHEL (Hardwar) still awaited back. Also many other miscellaneous components are to be received.

3. Generator transformer got damaged and now has been repaired.

4. Refractory insulation and skin casing erection progress slow.

Patratu—III (2 x 110)

1. Energy absorbers giving trouble.

2. Ejector not working properly.

3. Leakage in the hydrogen oil seals.

4. Defects in the bearing oil seals of the feed pump motor.

5. BFP motors—leakage.

6. Generator rotor unit-II-repairs thereof.

7. Supply of 3 per cent safety valve discs—because of which floating of safety valves held up.

PANKI

I. T.G. erection-unit II delayed.

Ukai (2 x 120 MW).

BHEL bottlenecks:

1. Bearing problem on H.P. side of turbine & Generator on exciter side when run on full speed.

2. Damage to H.P. rotor & delay in rectifying.
3. Boiler feed pump supplies delayed.
4. Delay in supply of boiler feed pump motors.
5. Wrong fabrication of piping system and leakage in hydrogen seal etc.

Amarkantak

1. Despatch of Generator delayed from Bhopal.

It was due by June 1976 but could not be done till November, 1976.

2. Delay in T. G. erection.
3. Supply of Dearator delayed.

2.213. In so far as Hydro Power Stations are concerned, the Ministry further stated in their written replies that specific bottle-necks causing delays in the supply of component equipment and the commissioning schedules of the equipment which have come to light from time to time are as follows:—

(i) Inadequacy of fabricating capacity.

(ii) Difficulties in getting major castings and forgings of requisite quality indigenously.

(iii) Delayed deliveries of castings, forgings from abroad.

(iv) Difficulties/delays in getting imported components like AVR, governing equipment, generator stator and rotor winding material, stator and rotor core laminations, insulating material etc.

(v) Defects of mis-match, manufacturing error or design defects in some manufactured components requiring time for rectification to be done at site.

(vi) Difficulties relating to completion of supply of small components such as bolts dowel pins, insulating material etc., difficulties relating to packing, sequence of supply, identification of parts etc.

2.214. The Ministry stated that a result of the joint discussions with BHEL, continued improvement in all matters has been secured, particularly those which could be controlled by BHEL, for example increase in fabricating capacity. Progressively greater degree of manufacture is being undertaken in BHEL, thereby reducing the

difficulties associated with supply of imported fabrications and components. Joint discussions are held and difficulties noted relating to manufacturing errors etc., and greater emphasis is progressively being laid on more stringent quality control, shop inspection and assembly. Efforts are also directed towards having the packing and other methods improved and modernised.

2.215. Asked to state whether it had been possible to execute the orders that had been placed as per schedule, the Ministry in their replies informed that there were a large number of components which had to be delivered in a phased manner during construction. There had however, been occasions when some supplies got delayed either on account of false despatch or delays in transport.

2.216. The Ministry further explained that if there was delay in the timely delivery of any component in the sequence, it caused delay in erection. Sometimes such delays add up. Special efforts are now being made by project authorities to keep a watch on the delivery sequence and BHEL have also devised a method of documentation which helps in this directions. Immediately, when such delays are noticed action is taken to see that these deliveries are expedited by contacting top-level management in BHEL. CEA have also assisted in such cases by inter-ceding on behalf of the project authorities.

2.217. The details of the hydro-electric projects affected by delays in supply of equipment Hydro Projects are given below:—

Delays in Schedule of Deliveries by BHEL

1. Ramganga, U.P.—3×60 MW:

   Delivery of turbines and generators for all the three units was delayed by over two years. Unit Nos. 1 & 2 have now been commissioned in 4|75 and 11|76 respectively. However, the delayed delivery of equipment did not wholly effect the commissioning of the unit as these was some delays on account of floods and delay in receipt of penstock expansion joint.

2. Pong. Beas Project, 4×60 MW:

   Deliveries of some major components of turbines and generators were delayed by 7—11 months, thereby resulting in delay in the erection of the plant. Unit No. I is now scheduled for commissioning in October, 1977.

3. Chenani H.E. Project, J&K—2×4.6 MW:

Despatch of distributor casing for both the units was delayed by about two years. This was because of repeated failure of catings. The units were finally commissioned in April, 1975, and June, 1975.

4. Vaiterna H.E. Project, Maharashtra, 1×60 MW:

Despatch of draft tube one and stator bars was delayed by about three months because of which erection work at the project was held up.

5. Koyna State-III Project, Maharashtra—4×70 MW:

Despatch of speed ring for Unit-III was delayed for about two months for which erection work held up.

6. Ukai H.E. Project, Gujarat—4×75 MW:

The equipment for all the 4 units was delayed by BHEL by about 3 years. These units have since been commissioned in August, 1974, December, 1974, April, 1975 and March, 1976 respectively.

7. Subernrekha H.E. Project, Bihar—2×65 MW:

The generating equipment for both the units have been delayed by BHEL by about two years. The erection of Unit I is nearly complete and unit may be ready for rotation by 7th Feb., 1977. Work on Unit II is in Progress and the same is expected to be commissioned in March, 1978. On account of some delays the civil works the delayed deliveries did not effect wholly the commissioning of the units.

8. Loktak H.E. Project, 3×35 MW:

The generating equipment for 1st two units was delayed by BHEL by 1½ years. The erection work in respect of first two units is in progress. However, the delayed deliveries did not effect the commissioning of the Units as there is a delay in completion of civil works.

9. Sharavathy H.E. Project-Karnataka Unit No. 9 (89.1 MW):

The total delay in deliveries of the order of 2 years. Inordinate delay was experienced in the delivery of distributor pipes. These pipes took almost one year for reaching the site from Bombay. During erection, it was notic-

ed that many small components of the equipment were not supplied in time. The unit has since been commissioned.

10. Unit No. 10 (89.1 MW):

In this case also, total delay in deliveries from the first promised dates was of the order of 2 1|2 years and, as in unit No. 9, delays in delivery of the distributor pipes to the site, I resulted in delay in the erection of this unit. Subsequently during pre-commissioning tests of the unit in June, 1976, a fault in generator occurred. The generator is now in the process of repairs and the unit is likely to be commissioned by March, 1977.

11. Lower Sileru H.E. Project Unit 3&4: (2×100 MW):

There is a delay of about 3 months in the delivery of generating equipment by BHEL. Efforts are now being made to prepone the commissioning of unit 3 by 3 months provided BHEL will supply the balance equipment immediately.

12. Gumti H.E. Project (2×5 MW):

There was a delay of about 3 years in the delivery of equipment by BHEL for both the units. These units have since been commissioned due to delayed deliveries as was delay in completion of civil works.

2.218. The Committee note that delay delivery schedules and supply of defective equipment by BHEL is stated to be partly responsible for delay in the commissioning of power plants. They observe from the information furnished to them that the commissioning of thermal stations at Gandhinagar Kothagudam (State IV), Harduaganj (Stage VI), Pathrathu-III, Panki and Amarkantak was adversely affected by defects in equipment supplied by BHEL or delayed deliveries of equipment. In the case of hydro-electric projects also the delays in the schedule of deliveries held up the commissioning of several hydro-electric projects. For instance commissioning of Ramganga Pong, Chenani, Vaiterna, Koyna (Stage III); Ukai; Subernrekha; Loktak; Sharavathy (Unit Nos. 9-10) Lower Sileru and Gumti Projects was delayed by over 2 years on this account alone.

2.219. The Committee are constrained to observe that the continued delays in the deliveries of equipment are a pointer to the fact

that there has not been the necessary coordination between the BHEL on the one hand and the Project authorities/State Electricity Boards and the C.E.A. on the other. The Committee are unable to appreciate why such a vital matter was not attended to in time. The Committee would like Government to take suitable remedial steps so as to ensure that the orders are placed on BHEL well in advance and delivery schedules worked out in a phased and realistic manner. The Committee have no doubt that through strict monitoring and effective coordination at various levels concerted measures would be taken to ensure that the supplies are made on scheduled by BHEL and arrangements are made to inspect the equipments before despatch and later before installation at the projects. The Committee would like to be apprised of the concrete steps taken in this regard.

(g) Problem of Silt

2.220. During the tour of the Study Group of the Estimates Committee to Eastern Zone in September, 1976, the Committee observed that the Lower Lagyap Project, Sikkim, involved laying water pipes and tunnelling to bring water of three streams for generating power. The Committee has also learnt that in the case of the Jolly Hydel Project situated about 30 Kms away generators were damaged because of silt coming along with water and cracks developed in the pen-stock which required costly repairs.

2.221. Asked to state what steps have been taken to ensure that silt will not come along with the water thereby causing damage to the generators in the Lower Lagyap Project, the Member (HE), Central Electricity Authority, during evidence stated:

> "In the Himalayan rivers, there is quite a lot of silt flow. In addition to the silt, there are a lot of boulders and if they enter the turbine, that will cause a very severe damage. So the Central Water Commission has designed a very special type of weir where the intake is at the same level as the bed of the river and the water flows down into a water-conducting system through an opening of the river-bed and it passes through the system of pipes on the turbine. This inherently excludes the boulders from passing on to the turbine. But at the top of this intake, there will be a fair amount of collection of boulders every year. So after the monsoon season, as a routine, the cleaning has to be done every year. This is an unavoidable process.

So far as the exclusion of silt is concerned, a special device called the desilting arrangement has also been designed by the Central Water Commission which will flush out through a separate by-pass arrangement all the silt into the river particularly during the monsoon season when the silt load is very heavy. Whatever possible precautions could be thought of, are being incorporated in the design itself."

2.222. Asked to clarify whether it required shutting down the machines every year for the purpose of cleaning, the witness replied in negative and added:

Since the intake is below the bed of the river, we can clean the load even when the machines are in operation."

2.223. Asked about the problem of silt, in Kosi Canal the Member (Hydro-Electric), Central Electricity Authority, in his evidence, stated that:

"One of the very major problems that this project is encountering is the very heavy amount of silt load that is being carried in the Kosi Canal. Because of this, the runners are getting worn out very frequently so much so we found that after every three or four months some parts had to be replaced. These are very small parts that have to be replaced, but they have to be put in a fresh, and these replacements have been quite frequent. Now indigenous sources have been located for this purpose. So, at the moment this aspect is not causing any major problem. But the very problem is the very heavy silt load in the canal itself, for which we have not been able to find a very satisfactory solution.

Another problem which this plant is encountering is, because of the very thick foliage carried during the monsoon, the inlet of the turbines got blocked, so they have to be cleaned up very frequently. Now a special boom has been designed for this purpose and it is presently under installation."

2.224. With regard to the problem of the boulders in the case of Kosi river, the witness stated:

"In the Kosi project also, some modifications are being incorporated to the turbines. These are, I understand, currently under execution by the Bihar Government. These

are as per recommendations of the Central Water Commission."

2.225. About the steps taken to check silt, and the remedial measures taken to avoid damage to the machinery, the Ministry later in their written note stated as follows:—

> The Kosi is known to be carrying very heavy silt load. The Y. K. Murthy Committee (1973) for checking silt in the Canals made the follows principal recommendations for silt control:
>
> (i) Closing canal from the head when the silt intensity in the river water exceeds 3000 ppm.
>
> (ii) The up-stream left guide bund of the Kosi Barrage may be provided with a flatter radius.
>
> (iii) A second silt ejector may be constructed at the down-stream of the first ejector.
>
> (iv) During Kharif when silt concentration is heavier the canal may not be run at less than 70 per cent of its design discharge.
>
> (v) The power house by-pass and the Bhengadhar escape may be made fully operative.

2.226. The Ministry stated that out of these, the first two principal recommendations have been implemented. The canal is closed from the head when the silt intensity is over 3000 ppm. This would mean closure of the power house for a cumulative period of the order of a month in a year, but allow better operating conditions in the remaining period. The flatter radius upstream guide bund has been constructed. The State Government has been working to make the Bhengadhar escape effective but it is estimated that it may be operative after monsoon of 1977. So far, the recommendation that the canal may not be run at less than 70 per cent capacity could not be implemented, because the excess water above the irrigation needs cannot be escaped. The State Government has also not yet taken up the matter of second silt ejector recommended by the Y. K. Murthy Committee.

2.227. But it may be stated that the silt problem of Kosi Canal itself which had become quite acute before 1973 has since been considerably moderated and there has been no desilting done in the Kosi Canal during 1975-76.

2.228. The operation of the power house was also being obstructed by the flow of Pater grass in the canal in the monsoon and post-monsoon period, which blocks the trash racks of the turbine. A special boom has been designed to intercept this special grass and is under construction.

2.229. The above remedial measures are the most important steps to check silt and in turn avoid damage to turbine seals. To avoid damage to turbine seals by silt contained in the water, special arrangements to supply clear water free from silt were made.

2.230. Further, the composition and arrangement of the seal packing was modified by the Project authorities, in consultation with Hitachi and CEA. Accordingly, the turbines, of unit Nos. 1 and 2 were fitted with seals comprising entirely of resin packings. This modified seal arrangement gave satisfactory performance in the last rainy season *viz.*, between June 1976 and October, 1976 as reported by the Project authorities.

2.231. The Ministry further stated that the imported resin packings were found to be costly and as the procurement of the same was also a tedious and cumbersome affair, the Project authorities made special efforts to locate indigenous manufacturers to manufacture resin packings of suitable specifications. The indigenous resin packings have also been tried along with imported ones, and the performance is reported to be satisfactory.

2.232. The Study Group of the Estimates Committee during their visit to Lower Lagyap Project in Sikkim were informed that the Jolly Hydel Project situated about 30 Kms. away was be set with the problem of silt which resulted in damage to generators and led to development of cracks in the pen-stock which required costly repairs.

2.233. The Committee were informed during evidence that there was quite a lot of silt flow in the Himalayan rivers and in addition there were a lot of boulders which caused severe damage to turbines. The Committee would like Government to ensure that suitable safeguards are taken to obviate damage from silt and boulders to the turbines and other equipment in Lower Lagyap Project.

2.234. The Committee further note that Kosi Project has also to contend with heavy siltage problem. The Committee were informed that in 1973, Y. K. Moorthy Committee went into this matter and made certain recommendations. The Committee understand

that silt problem of the Kosi canal which had become acute before 1973 has since been considerably moderated. The Committee would like to urge that the recommendations made by the Moorthy Committee should be implemented early so that the silt may not assume major proportions in this project.

2.235. The Committee feel that these phenomena should have been known at the investigation stage of the various projects in the Himalayan region. They regret that adequate steps were not taken in time to prevent boulders and silt causing damage to the turbines of these projects. The Committee would like Government to undertake an overall survey of all the projects which are prone to the problem of silt and provide necessary safeguards in time to mitigate it. The Committee hope that the new projects which are likely to face this problem would have in-built devices to prevent silt etc., causing damage to the power equipment.

C. Power Shortage

2.236. The Estimates Committee had in paragraph 1.3 of their 39th Report (Fifth Lok Sabha) observed that as ag inst the target of 23 million KW to be attained by the end of the Fourth Plan, the generating capacity would be only 20 million KW resulting in a shortfall of 3 to 3.5 million KW which would entail a loss of about 25 per cent in the production of industries and agriculture and utilities, amounting to a tremendous loss to the economy in the country. The Committee expressed great concern about the acute power shortage in the country which had been responsible for retarding the development of the country's economy both in the industrial and agricultural sectors. The Committee had also felt perturbed over the state of helplessness exhibited by the Ministry in regard to solving the problem of power shortage in the country. They had urged that the problem called for immediate attention and had recommended that a crash programme for meeting the power shortage should be devised at the highest level so that development of country's economy both in the industrial and agricultural fields might proceed unhampered and uninterrupted.

2.237. In reply, Government stated in December, 1973 that they shared the concern of the Estimates Committee about power shortage and added that the following steps were already being taken to overcome the shortage:—

(i) The utilisation of existing power installation is being maximised by monitoring and arranging for supply and transport of coal and fuel oil, spare parts etc.

(ii) The programme of inter-state lines and setting up of load-despatch stations is being expedited.

(iii) Efforts are being made to expedite the commissioning of the generating units which are in an advanced stage of construction.

(iv) Exchange of power between neighbouring States is encouraged so as to achieve optimum utilisation of generating capacity and minimise the requirements of reserves.

2.238. The Estimates Committee in their 56th Report on the action taken by Government on the recommendations contained in the 39th Report noted the steps taken by Government to overcome the shortage in power supply, and stressed that in view of the continuing power arises, concerted measures should be taken to overcome the power shortages and continuous watch kept to remedy the bottlenecks in power generation.

2.239. The Committee desired information from Government on the following points:—

(i) requirement of power in the country and the actual availability of power during each year of Fifth Plan; and

(ii) measures taken by Government to overcome the power shortages in the country.

2.240. The Ministry of Energy in their written replies furnished in November, 1976 indicated the position as follows:—

(a) The requirements of power in the country are estimated by Annual Power Surveys which are carried out from time to time and in which the demands of the various sectors/consumers are examined for making estimates. The last such assessment was made by the Ninth Annual Power Survey for the years 1972-73 to 1978-79. According to the Ninth Annual Power Survey, the yearwise requirements in the country for the Fifth Plan period were estimated as follows:

Years	*Million units*
1974-75	80,255
1975-76	91,014
1976-77	102,327
1977-78	114,115
1978-79	126,097

Actual experience so far in the Fifth Plan has shown that the estimates of the Ninth Annual Power Survey were somewhat on the high side.

(b) A number of measures such as the following have been taken to augment the availability of power in the country and ensure rational and equitable distribution with a view, *inter-alia*, to meeting the essential requirements of all the priority sectors of the economy:

(i) Maximising the generation from existing thermal stations through close monitoring, arranging spares and adequate quantity of coal of suitable quality, training of O&M personnel rostering and staggering of loads, modernising maintenance procedures etc.

(ii) Advising the States to follow a system of rational distribution of available energy on the basis of graded priorities and curbing the use of electricity for ostentatious purposes.

(iii) Arranging relief from adjoining State Systems where there are surpluses.

(iv) Expediting the commissioning of projects under construction through monitoring of projects, arranging of essential materials.

2.241. The Ministry of Energy in their note sent in August, 1977 have indicated the State-wise requirement and availability of power during each year of the Fifth Plan period in the Statements (Appendix V & VI). The information for the first three years of the Fifth Plan is based on the actual requirements and availability. It also gives the projections of requirements and availability of power for the last two years of the Fifth Plan period. The State-wise information on surplus/deficit on availability is also indicated in the statements.

2.242. The Ministry in their note sent in August, 1977 have stated that the total generating capacity to be added in the country during the last two years of the Fifth Plan period is anticipated at 6190 MW comprising of 4095 MW from thermal schemes and 2095 MW from hydro schemes. The above additions do not include the benefits from the 2nd Unit (220 MW) at Rajasthan Atomic Power Plant which is also expected to be commissioned during the above period. They have further stated that even with the implementation of the above generation schemes, there would still be

a shortfall in meeting the anticipated power requirements upto the end of the Fifth Plan period.

2.243. At the Conference of State Ministers of Power held at New Delhi on the 21 and 22 July, 1976 the Chief Minister of Maharashtra stated that right from the Third Plan period Maharashtra had been short of power and the deficit would continue even in the Sixth Plan. It was essential that projects suggested by the State are cleared without delay. At the end of the Fifth Plan there would be a shortfall of 650 MW which would be equivalent to the target set out in one plan period. Different projects were under consideration of the Planning Commission and they had asked for certain information.

2.244. The Chief Minister, Maharashtra, mentioned that many States were facing power shortage perpetually and he expected that the Central Government would come to their rescue. Besides Maharashtra, Gujarat and M.P. in the Western Region were short of power and surplus was being utilised by them in a cooperative manner. Sometime, off peak power, when available was received Maharashtra had imposed 30 per cent cut on non-essential and 10 per cent on essential services. He suggested that a super thermal power station should constructed in the Western Parts of Maharashtra and the least 600 MW could be added from the atomic sources and to that extent the power shortage could be reduced.

2.245. About Karnatka, the Minister for Power, Karnataka, stated at the Conference of State Ministers of Power held at New Delhi on 21 and 22 July, 1976, that Karnataka had 100 per cent hydro power system. Large generating stations in Karnataka being in the Western Ghats, the power generation was dependent entirely on monsoon. Whenever the monsoon was favourable the power position improved, otherwise power cuts had to be imposed. To make the power system more stable and balanced, thermal backing was necessary.

2.246. Asked to state the basic reasons for less power supply in the States of Maharashtra and Karnataka and in the North Eastern Region, and the steps taken to overcome the shortage experienced by these States/regions, the Secretary, Ministry of Energy, during evidence stated:—

> "In Maharashtra, it is over 20 per cent. It shou'd be judged on the basis of percentage and not of absolute figures because the industrial load is fantastic.
>
> So far as electrification is concerned, there are a large number of schemes, which have been sanctioned. We have

sanctioned Chandrapur for 210, Parli for 210 and Nasik for 210, apart from Tata which is in an advanced stage of consideration. Similarly, regard to Karnataka, the Kalinadi Project will put Karnataka in a confortable position. In the North Eastern sector also a large number of stations are under implementation."

2.247. To a point raised by the Committee about the percentage of requirements that would be met, the witness stated:—

"By 1983-84, there would be a deficit in Maharashtra of the order of 700 MW in picking capa ity but the position in regard to energy would be fairly confortable."

2.248. The Ministry of Energy who were requested to indicate the reasons for less power supply to Maharashtra, Karnataka and North Eastern Region, in their written note furnished in April, 1977 have explained the position as follows:—

"The main reason underlying the comparatively limited availability of power in Maharashtra and Karnataka in the rapid growth of demand for power which has not entirely been met by the installation of additional generating capacity. However, a number of projects as such as the Koradi Extension, Nasik Extension, Bhusaval TPS and Kalinadi H.E. project are in various stages. In recent months, in Maharashtra, the Chandrapur TPS (2×210 MW), Parli TPS (1×210 MW) have been sanctioned for execution. The phased commissioning of the Kalinadi Project (5×134 MW+2×50 MW) would go a long way in meeting the power deficit in Karnataka. The Xth unit of the Sharavathy H. E. Project has also been commissioned in the current year.

In the North Eastern Region also, a number of generating projects such as the following are in hand:

1.	Kyrdemkulai H. E. Project (Meghalaya)	60 MW
2.	Bongaigaon Thermal Project (Assam)	2x60 MW
3.	Kopili H. E. Project (Assam & Meghalaya)	150 MW
4.	Loktak H. E. Project (Manipur)	105 MW

2.249. The Ministry have also furnished a Statement indicating the generating capacity and the generation, State-wise for each year of the 5th Plan period viz. 1974-75 to 1978-79 (Appendix VII).

2.250. The Ministry have also furnished the power supply position in the months of April, 1977 to June, 1977 in the States of Punjab, Haryana, Rajasthan, U.P., Kerala, Tamil Nadu and Andhra Pradesh which is stated below:—

Punjab & Haryana

"The Punjab and Haryana power systems mainly depend for power supply from Bhakra Complex. The design annual potential of Bhakra-Nangal Power Stations is 4200 GWH. The actual energy generation at these power stations from July, 1976 to May, 1977 was 5004 GWH. Thus even excluding the energy generation in June, 1977, the actual energy generation at these power stations have already exceeded their design potential. From March onwards, this year, the inflows in Bhakra reservoir was low due to poor snow-fall and snow-melt in the Bhakra catchment. As such, the energy generation during these months was marginally lower than the designs energy potential. The critical power supply position in these States is largely attributed to below normal performance of thermal stations in the area. The power supply position during the months of April, May and June, 1977 in Punjab and Haryana is as under:—

Punjab — *GWH/day*

Month	*Requirement*	*Availability*
April '77	9.00	7.27
May '77	10.10	8.80
June '77 (anticipated)	10.00	8.81
Haryana :		
April '77	7.00	6.05
May '77	7.60	5.60
June '77 (anticipated)	7.00	6.00

Uttar Pradesh

The present installed generating capacity in the State is 2557 MW, out of which 1069 MW is from hydro and the balance 1488 MW from thermal. The shortage backed hydro stations in the State are Rihand-Obra (399 MW), Ramganga (198 MW) and Mata-tila (30 MW). The ba-

lance capacity in hydro in the State is constituted by run-of-river type developments. The design annual energy potential of Rihand-Obra power stations is estimated at 1170 GWh. The actual energy generation from July 1976 to May 1977 at these power stations was 1441 GWh. Thus, the energy generation at Rihand power station during the current hydrological year, even excluding the energy expected in June, 1977 is higher than the design expectations. Due to overdrawal in earlier months, the energy generation from Rihand reservoir has progressively reduced. In the months of April, 1977 the energy generation from Rihand was 58 GWh and in May, 1977 it was 23 GWh against the design average monthly generation of 74 GWh.

Below normal performance of some thermal units in the State, recent shut-down of generating units at Badarpur which could have provided some assistance to the State, closure of Ramganga Power Station due to low water level in the reservoir and low generation at some of the run-of-river type hydro electric plants due to poor inflows have also contributed to the current shortfall in energy availability in the State. Unit-II at Obra (Thermal) (50 MW) is presently out of service on account of stator earth fault. The spares for re-winding the stator and the rotor are to be imported from Russia. This unit is expected to be commissioned by the end of 1977. Unit II at Panki power station is out of service since 21st January, 1977 on account of generator earth fault and the rotor is to be repaired by M/s. BHEL. This units is expected to return to service by the end of the June, 1977.

The following projects in which the States have share are expected to be commissioned during 1977-78 and 1978-79:

1977-78	Dehar (Hydro)	1 & 2 Units	330 MW
	Pong (Hydro)	1 & 2 Units	120 MW
1978-79	Dehar (Hydro)	3 & 4 Units	330 MW
	Pong (Hydro)	3 & 4 Units	120 MW

Rajasthan:

The present installed generating capacity in the State is 318 MW out of which 193 MW is in hydro and 125 MW in in thermal. The hydro capacity indicated above is 50 per

cent share of the State in Chambal complex. In addition, the State has also share in the Bhakra-Nangal power stations. Rajasthan also gets power supply from R.A.P.P. (220 MW).

The annual design energy potential of Chambal Power Stations is 1180 GWh The actual energy generation from July 1976 to May 1977 was 1918 GWh from these power stations. Thus even excluding the possible generation from these power stations during June, 1977 the actual energy generated has already for exceeded the design resorting to overdrawal of the Gandhinagar reservoir, was frequent outages in the R.A.P.P. The power supply position in the State during the months of April, May and June, 1977 is as follows:—

Month	*Requirement*	*GWH/day Availability*
April '77	8.0	7.40
May '77	7.50	7.00
June '77 (anticipated)	7.50	7.50

The State has share from Dehar and Pong Power Plans which are expected to be commissioned during the last two years of the 5th Plan period as indicated earlier.

The power supply position in the State during the months of April, May and June, 1977 are as follows:—

Month	*Requirement*	*GWH/day Availability*
April '77	33.00	27.00
May '77	36.5	25.00
June '77 (anticipated)	36.5	24.7

Kerala

The power system in Kerala is purely dependent on hydro, with the present installed generating capacity of 1011.50 MW. During the month of April, gross energy generated amounted to 305 GWh out of which about 83 GWh was exported to the neighbouring States. The present daily requirement of the State is 7.54 GWh. The State is able to meet its requirements fully.

The design annual energy potential of the hydro schemes in the State is 4007 GWH of which the Sabarigir and Iddikki Hydro Electric Stations account for 3180 GWH. The actual energy generation during July, 1976 to May, 1977 was 3231 GWH. Poor monsoons and non-completion of some of monsoons of 1976 contributed to lower energy generation compared to the design expectations. With the commissioning of all the generation units at Iddikki (3×30 MWO) H.P. Project and normal monsoon during the current hydrological year, it should be possible for Kerala to provide relief to the adjoining States, besides meeting its own requirements during the coming year.

Power supply position in the State during the months of April, May and June, 1977 is as follows:—

GWH/day

Month	*Requirement*	*Availability*
April '77	7.67	7.26
May '77	7.54	7.60
June '77 (anticipated)	7.67	7.67

Tamilnadu:

Tamil Nadu has present installed generating capacity of 2364 MW, comprising of 1224 MW from Hydro stations and 1140 MW from thermal stations. Presently, there is a 20 to 40 per cent cut in demand and 25 to 30 per cent cut in energy in the State. Below normal monsoons in the catchment of hydro stations in the State, unsatisfactory performance of Ennore T.P.S. and limitations in the energy output in Neyveli T.P.S. due to constraints on lignite mining are some of the factors that have contributed to the shortfall in meeting the energy and capacity requirements of the State. Ennore unit of 110 MW is out of service and is expected to return by July, 1977. Power supply position in Tamil Nadu (including Pondicherry) during the months of April, May and June, 1977 is as follows:—

GWH/day

Month	*Requirement*	*Availability*
April '77	27.07	22.78
May '77	25.71	19.60
June '77 (anticipated)	25.71	20.30

If the monsoon happen to be normal in 1977, the availability from hydro stations in the State would improve. Additional generating capacity of 110 MW is expected to be commissioned under Kundah Stage-IV during 1977-78. This would provide additional peaking capacity in the system. In 1978-79, the first generating unit of 200 MW at Tuticorin T.P.S. and 35 MW at Suruliar H.F. scheme was expected to be commissioned.

Andhra Pradesh:

The present installed generating capacity of the State is 1200.50 MW comprising of 468 MW from hydro and 732.50 MW from thermal stations. The power supply position in the State during the months of April, May and June, 1977 is as follows:—

GWH/day

Month	*Requirement*	*Availability*
April '77	14.23	12.48
May '77 . .	13.16	11.40
June '77 (anticipated) .	13.06	11.40

In 1976 the monsoon in the catchment of Sileru basin have been below normal which resulted in reduced energy genration at Machkund (114 MW) and power stations in Sileru basin. With the addition of generating capacity during 1977-78 and with stabilisation of energy generation from recently commissioned Kothagudem unit and the normal monsoons in the catchment of Sileru basin, the power supply position in the State can be expected to be commissioned in the State during 1977-78:—

Lower Sileru (hydro) 3 &4 Units	200MW
Nagarjunasagar (hydro) Unit—I	110MW
Kothagudem Stage—IV (Thermal)	110MW

Due to limitations of transmission, there is some difficulty in evacuating power from Balimela Power Station into the Orissa system and as such some relief can be expected from this power station to Andhra Pradesh.

Installed Capacity

2.251. The Sub-Committee of Estimates Committee (1977-78) sought information on the following points:

(i) the present actual demand for power in the country;

(ii) the maximum demand that can be met with the existing installed capacity;

(iii) the anticipations of demand, year-wise till 1983-84; and

(iv) the proposals to meet the demand year-wise.

2.252. The Ministry in their note (January, 1978) have stated that according to estimates of the 10th Annual Power Survey, the actual total peak demand that was met in the power systems of the country during 1976-77 was 14,490 MW. This was a restricted demand in view of the fact that power cuts and restrictions were in force in some parts of the country. The total peak demand during 1977-78 has been estimated by the 10th Annual Power Survey at 18,219 MW. An installed capacity of 25,004 MW had been anticipated at the end of 1977-78 in the 10th Annual Power Survey and with this capacity it had been estimated that a peak demand of 16,064 MW could be met. Thus, a peak load deficit of 2,155 MW had been projected for 1977-78 in the 10th Annual Power Survey. According to present indications, the installed generating capacity at the end of March, 1978 is expected to be about 24,400 MW. With this capacity, the total peak load capability would be somewhat lower than what was estimated in the 10th Annual Power Survey and the deficits corresponding to demand projections of the 10th Anuual Power Survey would be slightly larger than what was estimated in the 10th Annual Power Survey.

2.253. According to 10th Annual Power Survey, the projections of demand for power upto 1983-84, are as follows:—

	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
Peak load—MW	20219	22433	24748	27580	30390	33299
Energy requirement MK WH	111796	124262	137252	182817	168392	185064

The above projections would have to be reviewed in the context of the new strategy for economic development under consideration of the Government.

2.254. The Ministry have added that a Working Group has been constituted by the Planning Commission to formulate the power programme for the 5-year period 1978-79 to 1983-84. This Group is presently engaged in considering various aspects like demand for power, performance and reliability of generating units, reserve required to ensure reliable power supply, transmission and distribution losses, system load factors, etc., which are relevant to assess the requirements of generating capacity realistically. The precise capacity addition required during the next 5 years will emerge from these considerations.

2.255. Central Electricity Authority have carried out a preliminary study of capacity requirements based on the projections of the 10th Annual Power Survey and the norms on system operating requirements as established by it for the consideration of the Working Group. According to this exercise, a capacity of 22,000 MW will have to be added in the next 5 years to meet the growing demands adequately. This programme would have to be reviewed in the light of the review of demand projections corresponding to the new strategy being evolved for economic development, the outcome of the deliberations in the Working Group regarding criteria to be adopted for determining the future capacity requirements, capability to implement the programme in the various States within the time-frame etc. All these aspects will be considered by the Working Group and a realistic year-wise programme of additions to generating capacity would be formulated.

Power Self-sufficiency in seven years

2.256. In October, 1977, the Sub-Committee of the Estimates Committee (1977-78) drew attention of the Ministry to the press reports that "the Government was formulating an ambitious power development programme which would enable the country achieve self-sufficiency in the next seven years", and asked to indicate the basis on which the Government has made this declaration. The Committee also asked the Ministry to furnish a comprehensive note indicating the present position of power availability, the projects in hand, the projects likely to be taken up and completed within seven years and the time schedule for their completion.

2.257. The Ministry of Energy in their note (December, 1977) have stated that the power plan for the period 1978-79 to 1982-83 is under formulation. The Government is presently engaged in the formulation of a power plan for the period 1978-79 to 1982-83 keeping in view the perspective for the subsequent 5-year period.

The basic objective of this programme is to achieve self-sufficiency in the next seven years.

2.258. The installed generating capacity in the country at the end of 1976-77 was 23,664 MW of which 21,494 MW was in utilities and 2,170 MW in non-utilities.—A capacity of 2,596 MW had been scheduled to be added during the current year. Of this 1,550 MW was to come from thermal stations and 1,046 MW was to come from hydel stations. So far a capacity of 445 MW has been commissioned as follows:

Amarkantak (Th rmal)	120 MW
Harduaganj (Thermal) .	60 MW
Dehar (Hydro) . . .	165 MW
Lower Sileru (Hydro)	100 MW

2.259. According to a review carried out recently, an additional capacity of 1,955 MW is likely to be added during the rest of the current year. The schemes expected to be commissioned are:

Thermal :	
Obra Extention II . .	200 MW
Badarpur Unit IV .	200 MW
Kordi Unit V	200 MW
Amarkantak	120 MW
Kothagudem Unit VIII	110 MW
Patratu Unit VIII	110 MW
Santaldih Unit III	120 MW
Bhatinda	110 MW
Harduaganj .	110 MW
Hydro :	
Giri I & II	60 MW
Lower Jhelum	35 MW
Dehar I	165 MW
Pong I & II	120 MW
Koyna St. III	80 MW
Kundah St. IV . .	110 MW
Nagarjunsagar	110 MW
D'Zuzanallah	1·5 MW

———With the additions as above, the installed generating capacity at the end of March, 1978 would be about 26,000 MW.

2.260. According to the preliminary studies carried out by the Central Electricity Authority, an installed generating capacity of about 22,000 MW will have to be added during the period 1978-79 to 1982-83 to meet the growing demands adequately. The projects for deriving these benefits have been identified. The status of sanction of these schemes are summarised below:—

1. On-going schemes as per details (Appendix VIII)	10304·5	MW
2. Sanctioned schemes as per details (Appendix IX) . .	6163	MW
3. Suggested new hydel schemes as per details in (Appendix X)	312	MW
4. New Thermal Schemes as per details (Appendix XI) .	5400	MW
	22179·5	MW

Out of the hydro schemes yet to be sanctioned, projects with a total capacity of 272 MW are involved in inter-state aspects. The other scheme with a capacity of 40 MW has been provisionally cleared by the SEA.—Out of the thermal schemes yet to be sanctioned schemes with a total capacity of 1800 MW have already been cleared. They are to be sanctioned by the Planning Commission. Projects with a total capacity of 1070 MW in UP were placed before the meeting of the CEA but their consideration was deferred. Project report in respect of Projects with a total installed capacity of 1690 MW are under examination in CEA. The examination involves clarification from project authorities in respect of certain technical aspects, linkage of coal and its transportation etc. CEA is pursuing them and hopes to have them cleared shortly. Project reports in respect of projects with a total capacity of 840 MW are still awaited from the Project authorities. These are also being pursued by CEA.

2.261. The schedule of commissioning of power generation schemes during the next five years is presently being prepared as a part of the studies relating to formulation of the power programme during the next five year period.

Allocation of Funds

2.262. The Sub-Committee of Estimates Committee (1977-78) sought information on the following points:—

(i) the salient features of the Power Plan to meet a demand of 21000 MW by 1983-74 with specific reference to augmentation of capacity every year;

(ii) the total funds that would be required for full implementation of the Plan as well as the year-wise allocation of funds required;

(iii) whether the Government had got the organisational capacity to achieve this, the difficulties experienced, if any; and

(iv) whether the Planning Commission had given the clearance to this Plan; and if not, the reasons thereof.

2.263. In their reply (January 1978) the Ministry have stated that the planning exercise for the formulation of the power programme during the 6th Plan (1979-80 to 1983-84) had been initiated last year and some preliminary studies have been carried out to determine the capacity requirements, their phasing, requirements of funds etc. However, with the decision of the Government to terminate the 5th Plan for the current year and formulate a 5-year plan for the period 1978-79 to 1982-83 under the Rolling Plan concept, the future power programme is being reviewed. Against Item 4, a Working Group has been constituted by the Planning Commission to formulate the power programme for the period 1978-79 to 1982-83 and this Working Group is presently deliberating the various aspects relating to future power development. The Working Group is looking into aspects of requirements of installed capacity to meet the load demands adequately at the end of the 5-year period, matching transmission, distribution and RE programmes, funds required for the power programme and the year-wise phasing of funds, organisational capabilities to implement the power programme, adequacy of manufacturing capability for heavy electrical and other equipment and key materials etc. A detailed report covering the above aspects would be prepared by the Working Group.

2.264. The Committee in their 39th Report (1972-73) had expressed great concern about the acute power shortage in the country which had been responsible for retarding the development of the country's economy both in the industrial and agricultural sectors. The Committee in their 56th Report on the action taken by Government on the recommendations contained in their 39th Report, noted the steps taken by Government to overcome the shortages in power supply and stressed that in view of the continuing power crisis

concerted measures should be taken to overcome the power shortages and continuous watch kept to remedy the bottlenecks in power generation.

2.265. The Committee note further that a number of measures have been taken to augment the availability of power in the country and ensure rational and equitable distribution with a view to meeting the essential requirements of all the priority sectors of economy. In spite of the steps stated to have been taken by Government, the Committee cannot help observing that the position is still far from satisfactory.

2.266. The Committee have been informed that the requirement of power in the years 1974-75, 1975-76 and 1976-77 was 77600, 83508 and 88489 Gwh respectively, and the availability during these years was 66647, 74909 and 83365 Gwh. So far as the remaining two years viz. 1977-78 and 1978-79 are concerned, the anticipated requirement during these years would be 100260 and 111891 Gwh. and the availability would be 93734 and 109040 Gwh. The Committee would also like to point out that there is not a single State or Union Territory in the country where the supply of power has kept pace with its reuirements and what causes more concern is that the shortage is likely to persist for the years to come.

2.267. The Committee note that particularly in the States of Haryana, Uttar Pradesh, Punjab, Madhya Pradesh; Maharashtra; Rajasthan; Karnataka; Tamil Nadu and West Bengal, the gap between the availability and the anticipated requirement at the end of 1978-79 will continue to be very wide. Thus the total power picture that emerges is one that cannot but causes great deal of anxiety.

2.268. The Committee find that according to present indications, the installed generating capacity at the end of March, 1978 is expected to be 24,000 MW, whereas the 10th Annual Power Survey had anticipated the installed capacity as 25004 MW at the end of 1977-78. According to the assessment made by the 10th Annual Power Survey, the energy reuirements for the years 1978-79 would be 111796 MKWH which is likely to go up to 185064 MKWH at the end of 1983-84. Based on these projections of requirements of energy made by the 10th Annual Power Survey, the Central Electricity Authority has made a study of the capacity requirements of power and according to their study a capacity of 22,000 MW will have to be added in the next five years (i.e. 1978-79 to 1982-83) to meet these requirements.

The projects for generating this additional capacity have been identified by the Central Electricity Authority and the status of the sanction of these projects is as follows:—

	MW
1. On going sehcmes . .	10304·5
2. Sanctioned schemes . .	6163
3. Suggested new hydel Schemes . . .	312
4. New Thermal Schemes	5400
TOTAL :	22179·5

2.269. According to the Ministry of Energy, a Working Group has been constituted to formulate the power programme for this period, and the power plan for 1978-79 to 1982-83 is still under formulation. This Group is considering various aspects like demand for power, performance and reliability of generating units, reserves required to ensure reliable power supply, transmission and distribution losses, system load factors, etc. which are relevant to assess the requirements of generating capacity realistically, besides other aspects of requirements of installed capacity to meet the load demands adequately at the end of the 5-year period, matching transmission, distribution and RE programmes, funds required for the power programme and the year-wise phasing of funds, organisational capabilities to implement the power programme, adequacy of manufacturing capability of heavy electrical and other equipment and key materials etc. The precise capacity addition required during the next 5-Years will emerge from these considerations.

2.270. The Committee observe from the study carried out by C.E.A. that the projected additional capacity of 22000 MW, the ongoing schemes and the sanctioned schemes would together provide 16467.5 MW and for the rest certain new hydel and thermal projects will have to be considered.

2.271. The Committee also note that the basic objective of the power plan for 1978-79 to 1982-83 is to achieve self-sufficiency in the next seven years. While the Committee welcome the objective of the Government to achieve self-sufficiency in power in the next seven years, they cannot help observing that in this field the past performance had not been inspiring or encouraging to lend optimism regarding achievement of this objective. There had been wide gaps

between targets fixed and the actual achievement in Plan after Plan. The Committee have dealt with this matter elsewhere in the Report. It would suffice here to point out that all impediments noticed in the past coming in the way of achieving the declared goals will have to be ruthlessly removed so as to ensure that the targets once fixed are achieved in full without fail. The Government will have to ensure that on-going schemes and the already sanctioned schemes are completed by the target schedules which would provide as much as 16467 MW of power. The Committee need hardly emphasise that the funds for the schemes will have to be provided on an assured basis and adequate organisational capacity created and developed well in time to sustain the tempo of progress and that there should be close and strict monitoring of the project schedules in close coordination between the concerned authorities and above all an unwavering determination to achieve the targets. As regards new schemes, they should be so selected that the benefits of these schemes do become available within the seven years period.

2.272. The Committee need hardly repeat that power being the basic infra-structure for the overall development of the economy, Government would give the highest priority to this core sector and thereby provide the necessary impetus for the rapid growth in industrial and agricultural fields.

D. National Energy Policy

2.273. The Estimates Committee in paragraph 9.42 of their 39th Report (1972-73) have observed that apart from effective coordination, it was also necessary to formulate at the Central level a National Power Policy and prepare long term plans for power development extending over a period of at least 15—20 years as power generation schemes and also schemes for mining coal, manufacture of equipment etc. had long gestation periods of over five years.

2.274. Government in their action taken replies furnished in December, 1973 had *inter alia* stated that the observations of the Committee had been noted. There was already general agreement as regards the need for preparation of long-term plan for power generation extending over a period of at least 15 to 20 years.

2.275. During the cours of the debate on the Electricity (Supply) Amendment Bill on the 4 November, 1976, in the Lok Sabha, Members made references to formulating the National Power Policy, and the Minister of Energy, while replying to the debate on the Bill, stated

that Government would be interested in evolving a national power policy.

2.276. Spelling out the details of the National Energy Policy, the Secretary, Ministry of Energy, during evidence, stated:

> "The Government have formulated the National Energy Policy and the Parliament has also been informed. The salient features of the policy are—
>
> 1. Policy envisaged, coal as the principal source of energy to the extent practicable and economic.
>
> 2. Achieving self-relience on oil to the extent possible by maximising indigenous production and reducing imports and consumption.
>
> 3. Conservation of energy and energy resources.
>
> 4. Priority for improving rural energy needs.
>
> 5. R&D activities to develop new sources of energy.

2.227. The Secretary, Ministry of Energy, stated during evidence that the Policy had come before Parliament in the context of a Question answered in the Rajya Sabha on 12 August, 1976.

2.278. To another point raised by the Committee that the National Energy Policy could not come in reply to a Question, the Secretary, Ministry of Energy stated:

> "There was some discussion whether the Minister would like to make a formal announcement or statement in the House but the view held was that since energy policy was based on Fuel Policy Committee Report and already laid on the table and copies made available, there would be no particular urgency or need to make any special announcement in the House.

2.279. Later, through a written reply furnished in March, 1977 the Ministry of Energy informed that the main components envisaged in the energy policy were indicated by Minister of Energy in his reply to a Question in Rajya Sabha on 19 August, 1976. The Policy as formulated by the Government was also laid on the table of the Rajya Sabha on 12 August, 1976 in fulfilment of assurance given in the Rajya Sabha in reply to questions answered on 27 February and 20

March, 1975. The Ministry have also furnished a note explaining the National Energy Policy, which is reproduced below:—

The Fuel Policy Committee was appointed by the Government of India in October, 1970 with the following terms of reference:

(a) Undertake a survey of fuel resources and the regional pattern of their distribution.

(b) Study the present trends in exploitation and use of fuels.

(c) Estimate perspective of demand by sectors and by regions; and

(d) Study the efficiency in the use of fuel and recommend;

(i) the outline of a National Fuel Policy for the next 15 years.

(ii) the pattern of consumption and, measures, fiscal and otherwise which would help the best use of available resources; and

(iii) the measures and agencies to promote the optimum efficiency in the use of fuel.

The Committee submitted an Interim Report in May, 1972 which covered the Fifth Plan period. Subsequent to the submission of the interim report, there were several changes in the economic situation within the country and in the international situation in regard to the supply and the price of oil. The Committee, therefore, re-examined its earlier conclusions and recommendations and also extended the period of their supply upto 1990-91. The final report of the Committee was submitted in August, 1974.

Discussions with the various Ministries/Departments were initiated immediately after submission of the final report of the Fuel Policy Committee to consider its conclusions/recommendations. In addition to the discussions relating to specific recommendations of the Committee, considerable thought was also devoted to the general problems of energy. The steep increase in the price of oil since October, 1973 and the consequent changes in the world energy situation had their impact on the energy economy of the country. In view of the fact that energy is one of the basic inputs for economic growth and well-being of the people, and well integrated energy programme is in dispensable for the rapid progress of economic development, it was considered opportune to use the occasion

to formulate a coherent and well thought-out energy which would guide the energy economy of the country on the desired lines, and ensure the availability of energy to all sectors of the economy in adequate quantities and at the least cost. Accordingly, a comprehensive policy for the energy sector, based on the recommendations of the Fuel Policy Committee, was formulated for the consideration of the Government. Government have now approved the broad components of the energy, and also taken decisions on the specific recommendations made by the Fuel Policy Committee.

The main components of the energy policy accepted by the Government are indicated below:

(a) To the extent practicable and economic, coal shall be the principal source of energy in the country, and therefore, its exploration, exploitation and utilisation should be programmed accordingly.

(b) The policy for oil shall be to reduce the quantity of imports and to maximise indigenous production.

(c) Use of oil shall be substituted wherever technically and economically possible, by other forms of energy.

(d) The rate of growth of electricity production should be adequate to meet future needs, including the additional demands arising from the use of electricity in place of, oil.

(e) Electricity production should be based on the use of hydro-power, coal and nuclear energy.

(f) The policy relating to commercial forms of energy should be reviewed every year in the first instance.

(g) A study of the transport system, in terms of energy needs, should be made so as to plant the future growth of this sector.

(h) Meeting rural energy needs shall be given high priority.

(i) A rapid increase shall be made in the use of bio-gas.

(j) The social forestry programme shall be implemented more effectively.

(k) Alternative fuels to kerosene should be provided and consumption of kerosene discouraged, particularly by the use of the price mechanism.

(l) Energy production and utilisation must be made as efficient as possible.

(m) The pricing for energy should be such that at a reasonable level of operating efficiency and adequate return to the industry is guaranteed, and it is able to generate large funds for development purposes. Prices should also promote the desired pattern of energy use and provide energy conservation.

(n) The non-conventional energy sources like solar and geo-thermal energy, bio-gas, tidal power etc., should be developed with the greatest priority to solar energy and bio-gas.

(o) The R&D programme relating to energy should be pursued vigorously.

(p) Implementation of the energy policy should be adequately monitored and frequently reviewed."

2.280. The Secretary, Ministry of Energy, further during evidence, stated:

"..... In the implementation of this policy, we are at the task of preparing 20 papers and already 4 or 5 papers are ready...."

2.281. The Ministry of Energy in their Annual Report (1976-77) have stated that the implementation of the various components of the energy policy requires inter-action between several Ministries/Organisations in the Centre. Discussions have been taken up with the concerned Ministries|Organisations to work out the detailed proposals in regard to implementing the major components of the above policy.

2.282. To a specific question drawing attention of the Secretary, Ministry of Energy to the statement of the Minister of Energy on 4 November, 1976, in Lok Sabha, regarding evolving a National Power Policy, the witness stated:—

".....A formal of it has been laid down and priority for coal is there. There this concept of National Power Plan comes in."

To a suggestion that a White Paper on Power Policy be prepared, the witness added:—

"It is a good idea, Sir. We should take about 3 to 6 months on this. One on coal is now ready for 10 years."

2.283. The Minister of Energy in reply to the discussion on Demands for Grants of his Ministry in Lok Sabha on 14 July, 1977 stated "we are preparing an action plan for adding to installed capacity with a view to achieving self-sufficiency in meeting the power demands at least by the end of the Sixth Plan."

2.284. The Committee would like to point out that there is a clear statement made by the then Minister of Energy in the Lok Sabha on 4 November, 1976 that the Government are interested in 'evolving a national power policy'. It appears to the Committee that there is some mixup between having a National Power Policy and a National Energy Policy. While admittedly power, being a source of energy it would be covered by National Energy Policy, the Committee have to point out that Government as such have not brought out any White paper or official document spelling out in detail even the National Energy Policy.

2.285. What is available, is a statement which has been laid on the Table of Rajya Sabha on 12 August, 1976 by Government in response to an Unstarred Question asking for details of decisions taken by Government on the report of the Fuel Policy Committee. A perusal of the detailed statement laid on the Table indicates that in the case of power the Fuel Committee had relied on whatever limited data was made available to them by the Central Power Commission, nuclear power authorities etc. They had clearly pointed out in several places the need for further investigation and survey with a view to update the data and prepare perspective plans in depth. This does not appear to have been done. Besides, the Committee consider that the National Power Policy should cover in detail the role allotted to hydel, thermal and nuclear power, having regard to the overall economics of their generation, transmission etc. The Power requirements particularly for industrial development of backward areas and rural areas for the next 20—25 years have also to be projected in some detail in the National Power Policy.

2.286. The Committee feel that it would have been more appropriate for Government to have brought out a White Paper on Energy so that there was a Nation-wide debate on this matter which has a direct and intimate bearing on the developmental requirements. The Committee in this connection note the statement of the Minister of Energy made in Lok Sabha on 14 July, 1977 in reply to the discussion on Demands for Grants of his Ministry that "we are preparing an action plan for adding to installed capacity with a view to achieving self-sufficiency in meeting power demands at least by the end of the Sixth Plan." The Committee would like Government

to bring forward a White Paper on National Power Policy at the earliest which would cover inter alia the projections of power requirements for the next 20—25 years and the extent to which these requirements would be met by hydel, thermal and nuclear power, etc. The White Paper may be placed in time before Parliament so that there is well informed discussion both inside and outside the House before the National Power Policy is crystallised on the basis of a national consensus, and the schemes for power for the Sixth Plan are at least formulated in that perspective.

CHAPTER III

TRANSMISSION/DISTRIBUTION SYSTEM AND LOSSES

A. Transmission/Distribution System

(a) *Transmission/Distribution Programmes.*

3.1. The Estimates Committee in Paragraph 5.55 of their 39th Report (1972-73) recommended that in order to fix physical targets and outlays for the transmission programme in the Fifth Plan, advance action should be taken to finalise the generation and load demand of various regions and extensive studies should be undertaken to decide the important trunk lines within the State as well as the inter-State/Regional lines.

3.2. In reply, Government stated in November 1973 that power flow studies corresponding to load and generation conditions envisaged in 1980-81 with a view to identifying important trunk transmission lines at 220 KV and 400 KV to be constructed in the State as well as in the inter-State/Regional lines had just been completed for all the regions.

3.3. A Task Force for Transmission and Distribution for Fifth Five Year Plan had been set up under the Chairmanship of the then Secretary, Ministry of Irrigation and Power for drawing up the T&D Programme for the Fifth Plan. This Task Force would take into account the programme and details of power generation and system loads in the Fifth Plan and beyond. The Task Force submitted its Report to Government in November, 1973.

3.4. Asked to state the salient features of the Report of the Task Force on Transmission and Distribution Programme for the Fifth Plan, and the action taken by Government to implement its recommendations, the Ministry in their written replies *inter alia* stated that number of recommendations related to building up planning and design capabilities in the CW&PC (now CEA) and the State Electricity Boards. The Central Electricity Authority is being re-organised and strengthened with a view to enabling it to effectively guide and promote the power development programme in the country of which transmission and distribution is an integral part. A separate organi-

sation has been created in the CEA for undertaking power system studies and framing guidelines for systems planning in respect of the transmission network. A separate post of Member (Power Systems) has been created in the Central Electricity Authority. This organisation would plan for the operation of the Regional Grid Systems and Regional Load Despatch Stations and would play an important role in guiding the working of the Regional Boards. The Power Systems Organisation is proposed to be further strengthened in a phased manner to undertake studies on high voltage transmission system and distribution planning.

3.5. As regards the distribution of Fifth Plan outlays between generation, transmission and distribution allocations have been made keeping in view the inter-dependent nature of these areas of power development and the progress of schemes in various parts of the country.

3.6. Referring to the following important recommendations of the Task Force, the Committee enquired, what specific action had been taken by Government to implement these recommendations:—

(i) To improve the reliability of power supply;

(ii) Collection and collation of data by CW&PC regarding operation and availability of transmission lines;

(iii) Creation of a suitable organisation at the Centre to coordinate the procurement and supply of key materials and equipment.

3.7. In reply, the Chairman, Bharat Heavy Electricals Ltd. during evidence stated:—

> "So far as transmission systems are concerned, the lines and associated sub-stations are all planned by the States and in the Central Electricity Authority, these proposals are examined and on that basis, all the lines are planned and executed."

3.8. With regard to (i) above, *viz.* improving the reliability of power supply, the witness added:—

> "The transmission reliability is, by and large, high enough but probably in regard to distribution, due to lack of another source of power, there may be some deficiency, but on the transmission side, it is quite satisfactory."

3.9. With regard to (ii) above *reg*: collection and collation of data by CW&PC concerning operation and availability of transmission lines, the witness stated:—

> "In regard to collection of data etc. the States are maintaining all the data and it is being systematically analysed. But as regards inter-State and inter-regional links, the regional Electricity Boards are now collecting the data very systematically and we propose to do it in a much better way, once the distribution facilities in the various regions come up to a satisfactory level."

3.10. In regard to (iii) above, *viz.* creation of suitable organisation at the Centre to coordinate the procurement and supply of key materials and equipment, the Secretary, Ministry of Energy, during evidence stated:—

> "We have a complete cell which deals with the timely availability of controlled and non-controlled items required for transmission and otherwise."

3.11. To a query made by the Committee regarding coordination to be doen in the light of demand, the witness added:—

> "We are doing for those items which are required to be imported on which foreign exchange is to be spent. Coordination is being done. If 11 States want steel, we make a bulk indent. Coordination in the sort of screening is not being done."

3.12. The Task Force in its Report also recommended that the Trunk Transmission lines at 220KV and above tentatively proposed to be taken up during the Fifth Plan may be finalised in consultation with the States' representatives. The construction and completion of Trunk Transmission lines at 220KW and above tentatively proposed commissioning dates of the connected generation schemes.

3.13. Asked to state what action has been taken in this regard, and whether the work on construction of the trunk transmission lines as recommended by the Task Force has been undertaken and what progress has been made, the Chairman, Bharat Heavy Electricals Ltd., during evidence, stated:—

> "Transmission lines at 220 KV and above have all been finalised in consultation with the State Electricity Boards and the

construction and completion of these lines have generally been planned in such a way that they are associating themselves with various generating units. They are well-coordinated and we are also making efforts to ensure that these lines are taken up in such a manner that they match with the commissioning of the generating units.

By March, 1974, 13932 KMs of 220 KV lines have been commissioned, in 1974-75, 2674 Kms and 1975-76 another 2600 Kms have been commissioned. Between the remaining three years of the Plan we have programmed 3200 Kms in 1976-77 and 3,000 Kms. in the following years. 400 KV lines will be commissioned during 1978-79."

3.14. The Sub-Committee of the Estimates Committee (1977-78) enquired whether there had been cases where the plant was ready for commissioning, but power was not made available to consumers for lack of proper transmission/distribution facility; and the remedial steps taken to avoid such cases. The Ministry of Energy in their note (December, 1977) have stated thus:—

"Generally, the transmission network is ready for evacuation of power by the time the generating stations are commissioned. There have been cases where the construction of the transmission lines had not progressed according to schedule. The construction of these lines is reviewed periodically, in great detail with a view to identifying bottlenecks and locating slippages. As a result of this close monitoring the construction of the transmission network is generally sought to completed in time for evacuating power."

3.15. The Committee note that in pursuance of the recommendation made in their 39th Report (1972-73), regarding advance action to be taken to finalise the generation and load demand of various regions and undertaking extensive studies to decide the important trunk lines within the States as well as the inter-State/Regional lines, Government are stated to have completed power flow studies corresponding to the load and generation conditions envisaged in 1980-81 and identified important trunk transmission lines at 220 KV and 400 KV to be constructed in the States as well as in the inter-State/Regional lines for all the regions.

3.16. The Committee further note that a Task Force for Transmission and Distribution Programme for the Fifth Plan had been set up to take into account the programme and details of power generation and system loads in the Fifth Plan and beyond. The Task

Force had made a number of recommendations relating to building up planning and design capabilities in the CW&PC (Now CEA) and the State Electricity Boards, and data collection. The Committee note that the Central Electricity Boards, and data collection. The Committee note that the Central Electricity Authority is being reorganised and strengthened with a view to enable it to effectively guide and promote the power development programme in the country of which transmission and distribution is an integral part. A separate organisation has been created in the Central Electricity Authority for undertaking power system studies and framing guidelines for system planning in respect of the transmission net work. A separate post of a Member (Power Systems) has been created in the Central Electricity Authority. . .

3.17. The Committee have been informed that though generally, the transmission network is ready for evacuation of power by the time the generating stations are commissioned, there have been cases where the construction of the transmission lines has not progressed according to schedule. The Committee are surprised that in a country which has been in continuous grip of power famine, leading to halting growth in the industrial and agricultural sectors, a situation should have been allowed to develop in which the tranmission net work did not progress according to schedule resulting in delayed evacuation of power from the generating stations. That such cases should have arisen at all in an ample proof to show that in the scheme of power development, transmission|distribution systems have not been properly integrated.

3.18. The Committee note that the power systems organisation is proposed to be strengthened to undertake studies on high voltage transmission system and distribution planning. They desire that these studies may be undertaken at an early date to facilitate efficient and economic execution of high voltage transmission and distribution schemes. . . . .

3.19. The Committee note that for creation of suitable organisation at the Centre to coordinate the procurement and supply of key material and equipment, Government have a cell dealing with the timely availability of controlled and non-controlled items required for transmission and otherwise. The Committee stress that the cell responsible for dealing with the supply of key materials should maintain greater coordination with the State Electricity Board and assist them in timely procurement of materials for transmission and distribution systems.

3.20. The Committee note that the Task Force for Transmission and Distribution Programme in their Report had also recommended that the Trunk Transmission lines at 220 KV and above proposed to be taken up during the period 1974-75 to 1978-79 might be finalised in consultation with the States' representatives and that the construction and completion of the various links should be planned so as to strictly match with the commissioning dates of the connected generation schemes. The Committee note that these transmission lines had been finalised in consultation with the State Electricity Boards and construction and completion of these lines and generally been planned in such a way that they matched with the commissioning of various generating units. The Committee would like a close watch to be kept on the actual execution of the programmes for the construction of the transmission lines and distribution net work so that there are no slippages and their completion is synchronised with if not completed well ahead of the commissioning of the concerned generation schemes. . . . .

(b) *Laying of transmission|distribution lines.*

3.21. During the tour of the Study Group III of Estimates Committee to Eastern Zone in September, 1976, the Study Group were informed by the Sikkim Government that the responsibility for laying the transmission lines for carrying the generated power has not been clearly spelt out. At one time, the Sikkim Government wanted to undertake this responsibility themselves but later on they had passed it on to CPWD. The transmission line should be ready a short while before the commissioning of the Hydel Project (Lagyap Hydel Project). . .

3.22. Asked to state what measures have been taken or are proposed to be taken to ensure that transmission system is got ready concurrently with the completion of power projects, the Ministry of Energy in their written note have stated that the works on the various transmission lines required for the transmission of the power from new power porjects under construction and for the strengthening of the existing transmission network are in progress. A power Systems Monitoring Directorate has very recently started functioning in the C.E.A. to monitor the progress of the trunk transmission lines and inter-State Regional lines under construction and to render assistance to the States in removing bottlenecks, if any, so as to ensure the timely completion of these lines.

2.23. In so far as the transmission programme for the Sixth Plan is concerned, the necessary power system planning studies have already been initiated. The States are being associated with these

studies at appropriate stages with a view to enable them to simultaneously formulate their Plan proposals within the overall framework of EHV network evolved. Such an arrangement would enable formulation and clearance of transmission projects within the limited time available.

3.24. The Committee are glad to note that a Power Systems Monitoring Directorate has recently started functioning in the Central Electricity Authority to monitor the progress of the trunk transmission lines and inter-State|Regional lines under construction and to render assistance to the States in removing bottlenecks, if any, so as to ensure the timely completion of these lines. The Committee would like to judge the working of the Monitoring Directorate by the results it achieves of ensuring that the transmission lines for the projects under construction are completed well before the commissioning of the projects.

3.25. The Committee note that necessary power system planning studies have already been initiated in so far as the transmission programme for the Sixth Plan is concerned and that the States are being associated with these studies at appropriate stages with a view to enable them to simultaneously formulate their Plan proposals within the overall framework of EHV network evolved. The Committee note that advance action has been taken for planning the transmission programme for the Sixth Plan in consultation with State Authorities. They have no doubt that such an arrangement should enable the formulation of well thought out transmission programmes and their clearance and implementation in time.

B. Transmission/Distribution Losses

Transmission/Distribution Losses

3.26. The Estimates Committee in their 39th Report (1972-73) dealt with the question of transmission/distribution losses in detail. In paragraph 5.72 of the Report the Committee expressed their distress that the Transmission/distribution losses in the country were of the order of 18 to 25 per cent (and in some States like Punjab as high as 34 per cent) while in other countries such losses were in the range of 5.7 to 12 per cent only.

3.27. In paragraph 5.73 and 5.74 the Committee expressed the view that there was imbalance in the planning of generation *vis-a-vis* transmission and distribution resulting in not only poor voltage conditions but heavy losses in transmission and distribution. The Committee pointed out that investment in transmission and distribution

facilities in the country had remained much lower than the desired level and this was one of the chief reasons contributing to higher percentage of losses.

3.28. In paragraph 5.76 the Committee also pointed out that to reduce transmission/distribution losses optimum performance of power system was necessary and recommended that there should be a continuous watch over efficiency of operation in the generation, distribution and transmission system. After observing that the question of making each Divisional Engineer responsible for this purpose had been taken up by the Centre with the State Governments, the Committee desired to be apprised of the final outcome in this regard.

3.29. The Committee also drew specific attention in paragraph 5.78 to the following points of action recommended by the Power Economy Committee regarding transmission and distribution losses:

(i) Improvement in the transmission and distribution system designs by—

(a) selection of transformers with reference to expected load cycle so as to obtain minimum total fixed and variable losses;

(b) use of low iron loss transformers, particularly for rural areas and areas of low load factor;

(c) reduction in the number of power transformation stages;

(d) improvement of power factor—installation of capacitors etc., at appropriate locations;

(e) selection of appropriate sizes of low tension feeders keeping in view their lengths and load required to be carried.

3.34. In their action taken replies on these recommendations the Government in November, 1973 informed the Committee that the question of reducing the transmission and distribution losses had been constantly engaging the attention of Government. According to the field studies then carried out, the main reasons for losses were—the inherently low power factor of agricultural pumping loads and lengths of sub-transmission and distribution lines in rural areas. Wherever there had been extensive rural electrification, the power losses were found to be high. It had been found from field experiments that by improving the power factor by installing shunt capacitors the losses were reduced by nearly 50 per cent in such cases. The Ministry (Ministry of Irrigation and Power) had urged the State Electricity Boards that the installation of capacitors should be made obligatory with all agricultural pumping sets. The Boards

had also been requested to undertake detailed studies in their systems and take urgent measures to bring down the losses to a figure below 14 per cent. Expert assistance in these studies was being given by the Central Power Research Institute where required.

3.31. The Government also stated that the Rural Electrification Corporation had instituted special Loan called 'System Improvement Loans' specifically for strengthening existing distribution systems so as to minimise the losses and improve system performance such as voltage conditions and reliability. These loans would enable the State Electricity Boards to implement the suggestions made by the Estimates Committee regarding Improvement by adoption of appropriate voltages, conductor sizes, operating methods etc.

3.32. The Committee were also informed that Regional Load Despatch Stations were being setup in all the regions for ensuring optimum performance of the power systems in the country. The Load Despatch Stations would also enable continuous watch being kept on the efficiency of operation in the generation and transmission systems.

3.33. They also stated in a written note furnished in November, 1976 that the following guidelines had been issued:

(i) setting up of special units in the State Electricity Boards to prepare schemes for reduction of losses and ensure timely implementation of various items of work;

(ii) Amendment of Board's conditions of supply to make it obligatory on the part of the inductive motive power consumers to install shunt capacitors at their terminals before new power connection are given;

(iii) Installation of metering equipment for identification of lines with higher losses and initiation of measures for their reduction.

(iv) Erection of new transmission lines and sub-stations to relieve over-loaded lines, changing of conductors of the existing lines, relocation of sub-stations and rearrangement of existing L.T. System.

(v) Installation of H.T. capacitors at various Grid sub-stations or improving voltage conditions to reduce loading of the transmission lines.

(vi) Setting up of Vigilence squads comprising Board's Engineers and Police Inspectors to conduct surprise inspection to check pilferage of energy.

(vii) Provision of double compartment meter boxes in the consumer's premises to prevent tempering with the meters. The compartment housing the meter is to be permanently locked and sealed and the lock is to be broken for access to the meter.

(viii) Provision of cut-outs after the meter to avoid direct tapping of power.

(ix) Use of zig zag and numbered seals on the body of the meters, terminal covers and for sealing the cut-outs to prevent pilferage and to keep an account of seals and to detect fake seals.

(x) Use of PVC multi-core cable as service mains instead of single core V.I.R. wires to make direct tapping very obvious.

(xi) Provision of potential links inside the body of the meter instead of under-terminal cover to prevent tempering with the meter.

(xii) Regular check readings by the engineers of the Board at different levels and sending reports of check to the Billing Unit for verification with the reading furnished by the field staff.

(xiii) Monthly reading of agricultural consumers with the readings of other similar consumers of that area and investigations carried out in respect of doubtful consumers.

3.34. As regards the recommendations of the Power Economy Committee, Government in their action taken replies stated in November, 1973 that the recommendations of that Committee were communicated to all State Electricity Boards for implementation. In respect of transmission and distribution losses most of the State Electricity Boards including Andhra Pradesh, Haryana; Kerala; Madhya Pradesh; Maharashtra; Orissa, Punjab, Tamil Nadu had Planned/are planning to take the following measures for improving the respective power systems:

(i) Installation of L.T. Capacitors with the induction motor of tubewells, industrial consumers etc. The Board had even indicated the rating of capacitors for different sizes of meters

(ii) Improvement in the existing layout of the systems.

(iii) Setting up the sub-stations at the Centre of gravity of loads.

(iv) Rigorous checking and caliberation of meters at consumers' end.

(v) Amendment to the provision of the I.E. Act 1910, so as to provide powers for the Board Engineers to deal with cases of theft of energy.

3.35. Asked to intimate the achievements as a result of measures taken to reduce the transmission losses in electricity, particularly in rural electrification system, the Ministry of Energy in their written replied furnished in November, 1976 have stated that power losses in the country as a whole have been increasing mainly due to massive work undertaken in the field of energisation of pumpsets, and rural electrification without corresponding reinforcement in the sub-transmission and distribution net works. The quantum of percentage increase of losses over the previous year was, however, decreasing rapidly inspite of implementing large scale rural electrification and pumpset energisation programme, as would be evident from the following table:

Year	Percentage losses	Percentage increase in losses over the previous year	Villages electrified during the year	Pump sets energised during the year
1971-72	18·75%	1·25%	17157	271377
1972-73	19·94%	1·10%	17478	284485
1973-74	20·46%	0·52%	17141	241859
1974-75 . .	20·48%	0·02%	15454	184898

Note : Percentage loss in 1970-71 was 17·5%

3.36. The Ministry also stated in their written replies that the measures taken to reduce the loss had definite impact in arresting substantial increase in losses.

3.37. Asked to state the specific reasons as to why the percentage of losses had increased over the percentage of 1970-71, viz., 17.5 per cent and what remedial measures had been taken or proposed to be taken to arrest the substantial increase in losses, the Secretary, Ministry of Energy, during evidence on 27th December 1976 stated:

"The following aspects led to increase in loss:—

1. Human element—pilferage is taking place.

2. Technical dissipation which takes place. If we had put sufficient inputs to strengthen the system and if we had put in enough investment then they would not have adverse trend which has started.

3. Rural electrification which is increasing. With rural electrification we had larger length of low voltage line with relatively low loads.

So far as human element is concerned, the number of States have taken vigorous steps by taking the help of DIG Police, like checking ticketless travellers. They go and raid and expose people. Now the burden of proof is on the party which has over-consumed power. All this has brought good results.

"Technological improvements have been made. With the new Annual Plan we are insisting that every State must make some special provision to tone up the system. About 700 crores of rupee are to be invested on this aspect alone to minimise which can be worked on a technical way.

In the case of rural electrification which is now being insisted upon, more and more motors, should have testors fitted into them and also that feeders of 11 KV and other similar levels are being installed.

There is a counter pull of increased electrification of villages. 13 lakh pumpsets have to be installed in the Fifth Plan and then there will be 35 lakh pumpsets in all.

In 1974-75, All-India figure has come down to 19.6 per cent. There is only a marginal increase over the figure of last year. But if we have to take into account that, perhaps 3 lakh pumps were energised, it has improved over 19.6 per cent."

3.38. To a query by the Committee as to which State was topping in transmission and distribution losses, the witness added:

"In 1974-75, it happens to be Tripura with 31 per cent and Rajasthan with 30 per cent. When we take this into account we have to see the nature of the load. Rajasthan is not so developed in the industrial load and therefore, its distribution lines are long spread."

3.39. In reply to a further query about Maharashtra's percentage, and that of Tamil Nadu, the witness stated:

"Maharashtra—20.22 per cent.

Tamil Nadu—21.06 per cent.

West Bengal—9.5 per cent—it is having much of industrial load compared to rural load. It is a compact state in size also.

3.40. As to what percentage was due to technical improvement, the witness stated:

"Technical assessment is that having regard to the characteristics of the load perhaps we can't go below 1 per cent in any case. Even in advanced countries 8 to 9 per cent is obtaining. Below 14 per cent it would be difficult. A stage may come when it is cheaper to have even below 14 per cent than to have to go in for corrective measures. It would become much more expensive."

3.41. On the specific question of vigilance against theft of energy, the Secretary, Ministry of Energy stated during evidence:

"In practically every State, they have very much intensified the entire vigilance machinery. Some have DIGs and some Superintendents of Police. Raids are being made. When we meet them, we get acquainted with these steps. A lot more is being done."

3.42. On a point raised by the Committee about the theft of transformers and the steps that were being taken to check this, the Secretary, Ministry of Energy, during evidence state:

"So far as the corrective action is concerned, vigilance side has been strengthened and the laws also are being made vigorous by the State Governments so that if anybody is found in possession of this equipment, the burden of proof is on the party. We have reports that things are now better than they used to be."

3.43. Explaining the position further, the Ministry of Energy in a subsequent written note furnished in April, 1977 stated:

"Certain guidelines have been issued by CEA and several States have constituted Vigilance Squads and special cells for detecting thefts of energy by the consumers. Verifications of inaccuracies in meters and their replacement by

caliberated meters, provision of double compartment meter boxes, provision of cut-outs after meters using zig-zag and numbered seals, use of PVC multi-core cable for service connections and providing of potential link inside the meter are the measures adopted to have correct meter readings.

Wherever malpractices have been detected by the Vigilance Squads the State Electricity Boards have instituted legal proceedings.

Though it is not possible to precisely quantify the reduction in losses achieved, yet through the above measures the States have reported significant increase in their revenues."

3.44. The Sub-Committee of Estimates Committee (1977-78) asked the Ministry of Energy to furnish a note on the incidence of theft of transformers and the remedial measures taken. The Ministry of Energy in their note (Jan. 1978) have sent the following statement for the year 1975-76, indicating thefts of material which includes theft of transformers in various State Electricity Boards.

Theft of Materials for the Year 1975-76

Sl. No.	Name of the State Electricity Board	Number of cases of theft	Total Value of materials stolen including Transformers	Value of Transformers stolen
			Rs.	Rs.
1	Gujarat SEB	185	4,71,300	15,495
2	Madhya Pradesh SEB	275	5,15,383	1,25,671
3	Karnataka SEB	119	69,438	6,490
4	Andhra Pradesh SEB	792	5,27,875·25	52,380
5	Haryana SEB	451	12,79,487·61	8,20,681
6	Maharashtra SEB	168	1,57,606·15	20,040
7	West Bengal SEB	921	19,46,196	7,12,097
8	Tamil Nadu SEB	2010	10,10,536·55	
9	Himachal Pradesh SEB	13	61,830	
10	Kerala SEB	54	18,301·79	..
11	Meghalaya SEB	18	42,429·04	Nil
12	Uttar Pradesh SEB	..	Not known	(1601 Nos.) Rs. 112 lakhs

3.45. In a subsequent note (February, 1978) the Ministry have sent the following statement for the year 1976-77 and from 1st April, 1977 to 30th September, 1977, indicating theft of transformer in various nine State Electricity Boards. Information regarding the other State Electricity Boards is being collected and will be furnished shortly.

Sl. No.	State	Year 1976-77		1-4-77 to 30-9-77		Remarks
		No. of thefts	Estimated cost (Rs.)	No.	Amount (Rs.)	
1	2	3	4	5	6	7
1	Punjab . .	178	681136	58	155280	
2	Goa	Nil	Nil	Nil	Nil	
3	Tamil Nadu .	Nil	Nil	Nil	Nil	
4	Delhi .	28	1·85	30£	2 lakhs	£upto 31st Dec.. 77.
5	Kerala .	Nil	Nil	Nil	Nil	
6	Gujarat .	25	107925	24	128660	
7	West Bengal .	76	N. A.	80	Nil	
8	Assam .	Nil	Nil	Nil	Nil	
9	Maharashtra .	Nil	Nil	Nil	Nil	Intimated though there is no loss of Unit as such, there have been theft of trans formers oil and coils.

3.46. The Ministry have also stated in their note (February, 1978) that the State Electricity Board extends transmission and distribution lines and erects sub-stations in remote areas of the State for taking power supply to villages and to agriculture pump sets. These extensive transmission and distribution systems are exposed and liable to depredation by anti-social elements. The copper used in the distribution system and inside the transformers are the main attraction for the miscreants.

3.47. Whereas the penalties have been stipulated under the I.E. Act for theft of energy, malicious use of energy, tampering of meter and interference with the works of the supplier, the theft of departmental materials are covered by the Indian Penal Code and the State Electricity Boards are required to follow the same procedure as appli-

cable to any other person whose property has been stolen. With a view to control pilferage of departmental materials, some State Electricity Boards have created Vigilance Squads which not only takes steps for detection of theft of energy but also in respect of theft of materials.

3.48. The question of providing special identification to the materials used by the Board either by stamping or restriction of certain sizes of conductors for the use of the Board was examined so that the possession of such materials could be made an offence. But in view of the practical difficulties in implementing such a measure the idea has not been perused.

3.49. Controlling of theft of materials belonging to the State Electricity Boards needs special attention by the law enforcing authorities within the State as, such thefts not only involve loss of material but also interruption of power supply to thousands of consumers which in turn affects food and industrial production. The State Electricity Boards by themselves cannot cope with this task as it is will nigh possible for them to provide watch over the thousands of Kms. of transmission and distribution lines and sub stations spread all over the State. It is only with the co-operation of the public, the police and other administrative authorities of the State that the theft of materials belonging to the Boards can be brought under control.

3.50. Remedial measures taken by few State Electricity Boards| Undertakings are as follows:—

1. The transformers are welded to the base for making it difficut to dismantle or dislodge the transformer.

2. The bolts used for fitting the leads to the transformer are rivetted and thread portion of the bolts are punched making it difficult to remove the leads.

3. Totally sealed and fully covered welded transformer having no drain cocks are adopted.

4. Intensive patrolling of the line during the off agricultural season. In this case help of police is being obtained.

3.51. Asked to state whether any study had been made regarding any optimum level to which the losses could be reduced and what action had been taken or proposed to be taken to reduce the losses,

wherever they were found to be above the optimum level, the Secretary, Ministry of Energy during evidence on 27-12-76 stated:

> "We are making studies, to identifying causes for the outages. This question is about loss in transmission. What has been suggested is ground level exercise in relation to each. The State Electricity Boards have now set up separate Chief Engineers in rural electrification—that is the starting point for this, there is a lot of consciousness and even the Prime Minister in NDC referred to this factor; there is now better consciousness than there was before and there is going to be an overall limit though we may not be able to go down to 14 per cent or so. Even to reach 14 per cent we would need a lot of funds for which we are in dialogue with the Planning Commission."

3.52. Later, the Ministry of Energy through their written note furnished in April, 1977 informed that so far no study had been carried out to determine the optimum level to which the losses could be reduced. The States had been advised to identify areas where the losses were heavy and where with minimal investment, losses could be reduced to maximum extent and formulate system improvement projects for these areas and implement them. For rural areas, loan assistance was being provided by REC for system improvement schemes.

System Improvement Loans by Rural Electrification Corporation

3.53. In regard to the system improvement loans given by the Rural Electrification Corporation, specifically for strengthening existing distribution so as to minimise the losses and improve system performance, the Ministry of Energy in their written replies furnshed in November, 1976 stated that the Rural Electrification Corporation upto 30th September, 1976 have sanctioned 55 system Improvement Schemes for a total loan assistance of Rs. 10.74 crores. An amount of Rs. 6.17 crores has already been released to the State Electricity Boards All the schemes sanctioned by the Corporation are in different stages of implementation. An assessment of the improvements achieved cannot, therefore, be made at this stage;

3.54. The Committee also drew attention of the Ministry of Energy to the recommendations of the Task Force on Transmission and Distribution Programme set up in April, 1972, which, after analysing the technical reasons for comparatively high energy losses in the country, *inter alia* called for detailed studies by those

State Electricity Boards which had not till then carried out such studies to reduce the losses. When asked to state the action taken by Government on this specific question of studies, the Chairman, BHEL during evidence on 27-12-76 stated:

> "That was the position sometime ago. Now a number of States have come forward for system improvement and have set apart a sizeable amount for the purpose."

3.55. Later, the Ministry informed the Committee in March, 1977 that the States which were yet to undertake detailed studies were as under:

(i) Meghalaya;

(ii) Nagaland;

(iii) Tripura;

(iv) Manipur.

3.56. The Committee in their earlier report in 1973 had expressed their distress at the high incidence of 18 to 25 % of transmission/distribution losses in the country, compared to 5.7 to 12 per cent in other countries. The Committee are of the view that inbalance in the planning of generation vis-a-vis transmission and distribution and investment in transmission|distribution facilities not being upto the desired level were some of the factors responsible for such high losses and recommended a continuous watch over efficiency of operation in generation, distribution and transmission system. They also drew attention to the points of action recommended by the Power Economy Committee in regard to improvements in the transmission and distribution designs to reduce such losses.

3.57. The Committee observe from the replies of the Government that the main reasons for losses were inherently low power factor of agricultural pumping loads and long lengths of sub-transmission and distribution lines in the rural areas, and that wherever there had been extensive rural electrification, the power losses were found to be high.

3.58. The guidelines issued by Government to the State Governments for reducing transmission distribution losses include (i) setting up of special units in the State Electricity Boards to prepare schemes, (ii) amendment to the conditions of supply to make it obligatory on the part of consumers to instal shunt capacitors (which would bring down the loss to 50) before new connections are given,

(iii) erection of new transmission lines and sub-stations to reduce over loaded lines etc., and (iv) measures to prevent pilferage of energy and tampering of metering equipment etc. ..

3.59. The Committee also note that the Rural Electrification Corporation has granted loan assistance to States to the tune of Rs. 10.74 crores for 55 system improvement schemes till November, 1976.

3.60. The Committee would have been happy if all these and other measures stated to have been taken by Government had brought about substantial reduction in the transmission|distribution losses, which the country can ill afford in the context of our critical energy situation. The Committee, however, find to their dismay that since 1970-71 the losses instead of coming down have been rising every year. In 1971-72, they were 18.75 per cent, compared to 17.5 per cent in 1970-71, then rose to 19.94 per cent in 1972-73, registered further increase in 1973-74 when it stood at 20.46 per cent and further rose to 20.48 per cent in 1975-76. ..

3.61. The Committee have noted the claim of Government that the percentage increases in losses during these years have shown a downward trend inspite of large scale rural electrification and pumpset energisation programme, indicating thereby that the measures taken had the definite impact in arresting substantial increase in losses. The Committee are not convinced by the claim made by Government they feel that the losses are very high and with effective measures could be brought down considerably. The Committee would, therefore, like Government to take determined measures to bring down the losses to 14 per cent which is the suggested limit to which losses could be reduced at the earliest so that more power is available for agriculture and industrial purposes from the existing systems.

3.62. The Committee are also surprised to note that so far, no study has been carried out to determine the optimum level to which the losses in transmission|distribution can be reduced. The Committee would suggest that Central Government should urge each State Government to determine, after a study in depth, the optimum level to which such losses could be reduced in the power systems and take concerted measures to reach this level.

3.63. The Committee note that aleardy the Central Government are extending loan assistance through the Rural Electrification Corporation for strengthening and improving the systems. The Committee feel that what is required now is the formulation of time-bound programme by each State urgently to bring down the losses

to the optimum level on the basis of the guidelines issued by Government and to take concrete and concerted measures to implement such programmes. The Committee would like to be apprised of the details of such schemes drawn up by each State Government/State Electricity Board and the steps taken to implement the schemes.

3.64. The Committee would also like to reiterate their earlier recommendation regarding making responsible an officer of the level of a Divisional Engineer for watching and reporting the performance of the system under his control in respect of losses, and would urge the Government to take up the matter with the State Governments/ State Electricity Boards in his behalf.

3.65. The Committee would also like the Central Government to review the steps taken by the States in preventing pilferage or theft of power and urge upon them to strengthen the vigilance machinery and provide for technical safeguards to prevent tampering with metres etc. .. ..

3.66. The Committee regret to observe that the thefts of transformers and other Departmental materials continue to occur on large scale in spite of the measures stated to have been taken. In terms of value of the materials stolen, the Committee find that it was as high as Rs. 19.46 lakhs in West Bengal, Rs. 12.79 lakhs in Haryana, Rs. 10.10 lakhs in Tamil Nadu and so on in the year 1975-76. The Committee feel that it is high time that concerted measures are taken in close concert with the State Police authorities to prevent such thefts. The Committee would also suggest that necessary technological innovations should be found by which removal of transformers or their parts is made difficult if not altogether impossible. .. ..

CHAPTER IV

SETTING UP OF NATIONAL/REGIONAL GRIDS

A. States/Systems Load Despatch Centres

(a) *State/Regional Load Despatch Stations*

4.1. The Estimates Committee in paragraph 5.51 of their 39th Report (1972-73) noted that State Regional Load Despatch Stations were planned to be established to control and operate the State/Regional Grids and that the proposals were at various stages.

4.2. In paragraph 5.52 of their Report, the Committee urged that necessary action should be taken to ensure that these schemes were speedily matching with the delivery of equipment and other raw material so that their implementation was taken in hand well in time.

4.3. In their action taken replies, Government stated that action for preparation of schemes at the State level was already on hand and necessary assistance was being rendered where required. Schemes relating to Regional Load Despatch Stations in the four regions, namely, Northern, Western, Southern and Eastern Regions had already been finalised and necessary action for procurement of equipment etc. was being initiated. IDA credit had been arranged for the Northern and Southern Regional Load Despatch Stations. It was anticipated that bulk of the work pertaining to the establishment of Regional Load Despatch Stations in the above four Regions would be completed during the Fifth Plan period.

4.4. The Committee in their Action Taken Report (56th Report—1973-74) desired that a time-bound programme for the establishment of State/Regional Load Despatch Stations during the Fifth Plan period might be drawn up and continuous efforts made for coordination at all level to ensure their completion according to schedule.

4.5. The Ministry of Energy were asked to intimate whether the time-bound programme for establishment of State/Regional Load Despatch Stations in the four regions had been drawn up as recommended by the Committee; and if so, whether the work was going according to schedule or any impediments were coming in its execu-

tion. The Ministry in their written replies have stated that at present most of the State Electricity Boards have either established State Load Despatch Centre within the States or are in the process of doing so. The State|System Load Despatch Centres have been set up at the following places:

BMB.	Ganguwal
Rajasthan	Jaipur
U.P.	Lucknow
Gujarat	Jambua
Madhya Pradesh	Jabalpur
Maharashtra	Kalwa
Tatas	Trombay
Andhra Pradesh	Kothagudam
Tamil Nadu	Erode
Karnataka	Bangalore
Kerala	Kalamassery
Bihar	Patna
DVC	Maithan
West Bengal	Bandel
Orissa	Taleher

4.6. The Ministry have further stated that they are at different stages of completion as regards introduction of equipment and staffing.

4.7. Asked to indicate the States in which the Load Despatch Centres were yet to be established, and what was being done to expedite establishment of such centres, the representative of Central Electricity Authority during evidence, stated:

> "The Load Despatch Centre is meant to supervise the system on unit to unit basis. In other words it gives us an idea of health of the system. All the important power stations, grid stations are connected with the central power point from where we can monitor the functions of the system.
>
> The States in which the load despatch centres are yet to be set up, are J&K, Himachal Pradesh, Haryana, Assam, Manipur, Meghalaya, Nagaland and Tripura. Others have done it."

4.8. Asked to state the reasons why these states have not been able to set up Load Despatch Centres so far, the Ministry in their written replies later have informed that Load Despatch Stations

are required for controlling a system comprising a number of generating stations, a grid net-work and load centres. Such a situation had not arisen in J & K, Himachal Pradesh, Haryana, Assam, Manipur, Meghalaya, Nagaland and Tripura systems and, therefore, the need for establishment of Load Despatch Centres in these systems has not been felt so far. The Ministry further stated that these systems, barring Assam and Haryana are small. Some of these systems have no generation of their own (Manipur, Nagaland) and others have only one or two generating stations, (J&K, Himachal Pradesh, Haryana, Assam, Meghalaya, Tripura). Even Haryana, which is relatively more developed compared to other systems mentioned above, is dependent on Bhakra and I. P. Station for receiving power supply as per contractual agreement.

4.9. With the development of the systems, in future, the need for establishment of despatching stations in these would be examined.

Interim and Permanent Regional Load Despatch Centres

4.10. In order to facilitate integrated operation of systems on a regional basis and to coordinate the activities of the State System Load Despatch Centres with a view to ensuring optimum utilisation of generation and transmission facilities in the region, Regional Load Despatch Centres are being established in each region.

4.11. The Ministry have stated that to begin with Interim Regional Load Despatch Centres have already been established in the following Regions:

Northern Region—New Delhi
Western Region—Bombay
Southern Region—Bangalore
Eastern Region—Calcutta

4.12. The Interim Regional Load Despatch Centre of North Eastern Region is expected to start functioning from Shillong in about six months time.

4.13. The establishment of permanent Regional Load Despatch Centres (RLDS) with the associated tele-communication net work, telemetering facilities, and other equipment for the operation and control of the Regional Grids is in progress. In the Southern Region all equipments required for the Regional Despatch Station have also been ordered and the first phase of permanent Station in this Region was expected to be commissioned by December, 1976 and

the second phase in 1978. The equipment required for the permanent Despatch Stations in Northern, Western and Eastern Regions have been covered under the IDA credit and procurement action is being initiated. It is expected that the permanent Despatch Stations in these Regions would be in operation by 1980-81.

4.14. With regard to the establishment of permanent Regional Load Despatch Centres, the representative of CEA was asked to state whether the first phase of permanent station in the Southern Region had since been commissioned, as scheduled, if not, the reasons therefor, and what specific action had been taken for procurement of equipment for the Northern, Western Regions. The withness stated during evidence:

> "The first phase of permanent despatch station has been completed more or less. In fact, the building is already ready in all respects. The equipment, under the first phase has been erected at the various State despatch centres, sub-stations and at the regional centre. Commissioning tests are in progress; and we expect that the station would be commissioned formally in about 2 months. Some difficulties we experience of course, because some items have to be obtained from Andhra Pradesh and Karnataka; and we are trying to do things and we expect to get over this problems soon."

4.15. Later through their written replies, the Ministry have informed that the specifications for equipment for the Regional Load Despatch Centres in Northern, Western Regions are under preparation. After the specifications are ready procurement action would be initiated by floating of tenders under the IDA Transmission Credit.

4.16. The Committee note that Load Despatch Centres which are required for "controlling a system comprising a number of generating stations, a grid net-work and load centres" have been set up in all States except Jammu and Kashmir, Himachal Pradesh, Haryana, Assam, Manipur, Meghalaya, Nagaland and Tripura. The Committee have been informed that in these States the need for such Load Despatch Centres has not been felt so far. The Committee hope that Government will periodically review the question of setting up such Centres in these States also in the light of the future developments, and take speedy measures to establish such centres if the situation so warrants.

4.17. The Committee further note that in order to facilitate integrated operation of systems on a Regional basis and to coordinate

the activities of the State/System Load Despatch Centres for ensuring optimum utilisation of generation and transmission facilities in the region, regional Load Despatch Centres are required. The Committee find that so far the Government have established only Interim Regional Load Despatch Centres in the Northern, Western, Southern and Eastern Regions and one such Centre in the North Eastern region would also be commissioned soon. As regards permanent Regional Load Despatch Centres are concerned, the Committee were earlier informed that the bulk of the work pertaining to the establishment of Regional Load Despatch Centres would be completed during the Fifth Plan period. The Committee were also informed that while the first phase of the Southern Regional Centre would be commissioned in December, 1976, and the second phase in 1978, the Centres in Northern, Western and Eastern Regions would be in operation by 1980-81. The Committee, however, find that while the first phase of the Southern Regional Centre was expected to be commissioned "in about two months" from December, 1976, specifications for equipment for the Regional Load Despatch Centres in Northern, Western Regions were still stated to be under preparation and procurement action for the equipment would be initiated by floating of tenders under the IDA Transmission Credit after the specifications were ready. The Committee need hardly stress the importance for setting up of Regional Load Despatch Centres at an early date. The Committee trust that Government would ensure that these permanent Centres would be in operation by the targetted time namely 1978 for the Southern Region and 1980-81 for the other three Regions.

(b) *Establishment of National Despatching Centre at New Delhi.*

4.18. The Ministry of Energy, in their written replies stated that it is proposed to establish a National Despatching Centre at New Delhi, which would be responsible for coordination of the activities of the Regional Despatching Centres and regulation of inter-Regional power exchanges.

4.19. Asked to state the progress made so far for setting up a National Despatch Centre at New Delhi, and when this Centre was likely to start functioning, the representative of Central Electricity Authority, during evidence stated:

> "In the annual plan for 1977-78 we have made a provision of about Rs. 12 lakhs for purchasing land, in the first instance. It has been agreed broadly that the national despatch centre will be located in Delhi, but it has to be approved by the Cabinet in principle. Our intention is

to have it as close to the Northern Regional Despatch Centre in Delhi where we have located the land near Haus Khas. It will be extremely advantages if we can have it so, because certain common facilities will be available."

4.20. Later the Ministry in their written replies stated that the Project report for the Permanent Despatch Centre will be prepared once the land for the Centre is allotted as the communication links building plan etc., are dependant on the exact location of the Centre at Delhi. The Ministry also added that the National Despatch Centre will function under the Central Electricity Authority.

4.21. The Sub-Committee of Estimates Committee (1977-78) asked the Ministry of Energy to indicate the Total estimated cost for establishing the National Despatching Centre at New Delhi and the source from which funds would be made available. The Ministry of Energy in their reply (December, 1977) have stated that Phase I of the National Despatch Centre at New Delhi is estimated to cost Rs. 67.47 lakhs as per the abstract given below:—

	(Rs. in lakhs)
(*i*) Building facilities	5·94
(*ii*) Communication Facilities	10·23
(*iii*) System Diagram Board	0·40
(*iv*) Furniture and office equipment	1·39
(*v*) Special T&P and instrument	4·27
(*vi*) Pay and allowance of staff	13·48
(*vii*) Inspection vehicle.	0·76
(*viii*) Misc. items	4·00
(*ix*) Consultancy	15·00
(x) Land for permanent NIDC	12·00
Total	67·47

Estimates for Phase II has not been prepared as yet. As per the present indications it is anticipated that the total cost estimate of the scheme under Phase II would be Rs. 6-7 crores at current prices. The funds for National Load Despatch Centre would be provided by Central Government.

4.22. The Committee note that a National Despatching Centre which would be responsible for coordination of the activities of the Regional Load Despatching Centres and regulation of inter-Regional Power Exchanges is proposed to be established in Delhi. Phase I of this Centre is estimated to cost Rs. 67.47 lakhs, which include a provision of Rs. 12 lakhs made in the annual plan for 1977-78 for purchase of land. According to anticipations, the total estimated cost of the scheme under Phase II would be Rs. 6-7 crores, though the estimates for Phase II have not been prepared as yet. The funds for this Centre would be provided by the Central Government. The Committee urge that all formalities necessary for the establishment of the National Despatch Centre should be cleared and suitable steps taken to initiate work on this Centre expeditiously.

(c) *Regional/National Grids*

4.23. The Committee in paragraph 5.56 of their 39th Report recommended that long range planning for the inter-State/Regional Grid should be devised keeping in view the fact that not only the State systems should completely integrate to form regional grids, but also that these grids get adequately inter-connected to form a National Grid, with attendant economic gains to the community at large.

4.24. Government in their action taken replies stated that as recommended by the Estimates Committee, all inter-State/regional links proposed so far for the Fourth Plan and Fifth Plan have been planned keeping in view the ultimate evolution of a National Grid.

4.25. Asked to state the progress made in setting up regional and national grids, the representative of the Central Electricity Authority during evidence stated:

> "I believe that the 4 regional grid systems have come to stay. We are operating them although on a manual basis. The northern region happens to be the biggest region today comprising about 40 per cent of the total area. We experience a number of problems but we have plans on hand to have sophistication; and all the equipment specifications are in hand. In about 4 years we expect to put them up in the northern, western and eastern regions. So far the southern region is concerned, the first phase would be completed very soon, and the second phase, which would comprise of more communication facilities, what we call load frequency control and other sophistication, would be completed in another 1.1/2 to 2 years

from now. In other words, four years from now there would be regional despatch stations and regional grids throughout the country."

4.26. Asked further to state whether this would be the minimum time required to complete the formation of grids, the witness stated:

"We are trying our best. The north-eastern and western region are lagging behind the southern region.

In the northern and western region we have to acquire land, which takes time."

4.27. To a query by the Committee whether there were any other reasons, the witness added:

"On tele-communication facilities, we had presumed in the past that we would have our micro-wave communication. But the P&T Department are not agreeable. They feel that the micro-wave which could integrate the requirements of other agencies, including the Electricity Boards, would be much cheaper. We are also now more or less agreeing with them. There are a few problems which we are sorting out. We are not waiting for land to be physically available. We are going ahead with other arrangements. These are covered by the World Bank Loan. They have asked for certain particulars which we will supply within the next few months. After that we will float a tender for equipments...."

The supply of equipment itself would take two years. Then there is the question of erection. Preparation of specifications will take one year."

4.28. The Committee had in para 5.56 of their 39th Report (1972-73) recommended that long range planning for the inter-State/Regional Grids should be devised keeping in view the fact that not only the State system should completely be integrated to form regional Grids, but also these grids get adequately inter-connected to form a National Grid, with attendent economic gains to the community at large.

4.29. The Committee note that in setting up the regional grids, the only tangible progress that has been made so far relates to the first phase of the Southern Region. Government expect that the second phase of the Southern Region would be completed in about

two years from new. In the case of other three regions, namely Northern, Western and Eastern regions, the Committee obstrve that Government is yet to acquire land in the Northern and Western Regions. The Committee have also been informed that the preparation of specifications of the equipment would take one year and the supply of equipment would take another two years. According to the Government, the four regional grids would come into operation within four years from now.

4.30. The Committee are distressed to note that in an important matter such as establishment of regional grids, Government should have allowed such a long time to elapse and even then the preliminaries for setting up such Grids have not been cleared so far. The Committee trust that Government would expedite matters and set up the Regional Grids within the shortest possible time and take necessary steps to inter-connect these Grids to form a National Grid ultimately, so that the periodic power famine in certain regions could be overcome.

B. Inter State Transmission Programme

Construction of Inter-State Transmission Lines

4.31. The Committee in paragraph 5.45 of their 39th Report (1972-73) noted that out of all the 38 inter-State links taken up, 24 lines would be completed during the Fourth Plan and the remaining lines within the next year or two. The Committee urged that effective steps should be taken to expedite the completion of all these lines.

4.32. The Committee in paragraph 5.49 of their 39th Report expressed their unhappiness that there was lack of enthusiasm on the part of the State authorities to pursue the inter-transmission programme vigorously even though the Centre decided to provide 100 per cent loan assistance to States under centrally sponsored schemes outside the State ceiling for the construction of various inter-State links during the Fourth Plan period resulting in delay in the commissioning of some of the transmission lines and sharing of surplus power with the States suffering from power shortage in the region.

4.33. Government in their action taken replies stated that the concerned State authorities were being urged to complete construction of these inter-State lines as early as possible. The requisite funds were being made available outside the State Plan. Assistance in supply of steel, conductors, etc. was also given. Where necessary, arrangements were being made for close monitoring of the progress through the Regional Electricity Boards and Central Water and Power Commission (Power Wing).

4.34. The Government in their action taken replies further stated that the State Governments were being urged to take steps for speedy completion of various inter-State links. The matter was also being brought up for consideration by the Regional Electricity Boards where the programme of power exchanges was drawn up and operated.

4.35. The Committee in their 56th Report (1973-74) desired to be apprised of the progress made with regard to the completion of the inter-State links by the State Governments concerned.

4.36. The Ministry were asked to indicate the progress made in this regard by State Governments and the steps taken to complete the remaining inter-State links and their target dates of completion. The Ministry of Energy in their written replies furnished in November, 1976 have stated that at the beginning of the Fourth Plan, 24 inter-State and 7 inter-Regional transmission lines at 110|132 KV and above were existing. From the beginning of the Fourth Plan, these lines were being taken up as centrally sponsored projects. The projects were executed by the State Electricity Boards|Systems with the loan assistance provided by the Centre to the respective State Governments. The details of the 4th Plan lines completed are given below:

Inter State|Inter Regional lines completed during Fourth Plan

Sl. No.	Line Section	Voltage and No. of circuits	Route length (kms)	Circuit length (kms)
1.	Mathura—Bharatpur	132 KV S/C	38	38
2.	Delhi—Muradnagar	220 KV: (Stringing of 2nd ckt)	32	32
3.	Chandni—Bhusawal	132 KV: (Stringing of 2nd ckt)	90	90
4.	Satpura—Ambazari	220 KV: (S/C on D/C towers)	38	138
5.	Munirabad—Hampi	220 KV S/C	26	26
6.	Belgaum—Kolhapur	220 KV: (S/C on D/C Towers)	99	99
7.	Upper Sileru—Balimela	220 K.V. S/C	25	25
8.	Rihand—Morwa—Amarkantak	132 KV: (Stringing of 2nd ckt)	210	210
		Total:		658

Inter State/Inter Regional lines completed during Fifth Plan upto March 1976

Sl. No.	Line Section	Voltage and No. of Circuits	Route length (kms)	Circuit length (kms)
1.	Badarpur—Jaipur	220 KV S/C	274	274
2.	Pamba—Kayathar	220 KV S/C	139	139
3.	Hampi—Gooty	220 KV S/C	126	126
4.	Chandil—Joda	220 KV S/C	135	135
5.	Purnea—Siliguri	132 KV S/C	176	176
6.	Mangalore—Kasargode	110 KV S/C	32	32
		Total		882

4.37. The Ministry further stated that the target dates for completion of the remaining Fourth Plan lines were as follows:

Anticipated Programme of Completion of Fourth Plan Inter State/Inter Regional lines

Sl. No.	Line Section	Voltage and No. of circuits	Target date for completion
1	Udhampur—Sarna	220 KV S/C	1976-77
2	Nasik—Navsari	220 KV S/C (on D/C towers)	Do.
3	Ennore—Nellore	220 KV S/C	Do.
4	Giri—Yamuna	132 KV S/C	Do.
5	Alipurduar—Bonoigaon	132 KV S/C	Do.
6	Kolhapur—Ponda	220 KV S/C on D/C towers	1977-78
7	Dehar—Simla	132 KV S/C	Do.
8	Loktak—Dimapur	132 KV S/C	Do.
9	Dimapur—Mariani	132 KV S/C	Do.
10	Dimapur—Bokajan	66 KV S/C	Do.
11	Chandrapura—Durgapur (DVC)	220 KV	1978-79
12	Chandrapura—Santaldih	220 KV S/C on D/C tower	Do.
13	Mysore—Iddiki	220 KV S/C	Do.
14	Badarpur Imphal	132 KV S/C	Do.
15	Dehri—*Mughal Sarai	220 KV S/C Line	Early Sixth Plan

*According to the information furnished by the Ministry in December, 1977, the survey in respect of this line has been completed. Target date for completion of Bihar portion line has not yet been finalised. However, U.P. portion of this line is likely to be complete by March, 1978.

4.38. During the Fifth Plan, 1974-75 to 1978-79, 11 lines have so far been proposed. The details of these lines and their target dates for completion are given below:—

New Inter State/Regional lines proposed for Construction during Fifth Plan

Sl. No.	Line Section	Voltage and No. of circuits	Target date of completion
1	Ujjain—Kota	220 KV S/C on DC towers	1979
2	Belgaum—Kolhapur	220 KV (stringing of 2nd circuit)	1979
3	Kelimpong—Gangtok	66 KV	1979
4	Birpara—Phuntsholing	66 KV	1979
5	Muradnagar—Panipat	440 KV S/C	During Sixth Plan
6	Iddiki—Udumalpet	220 KV S/C	Do.
7	Chandil—Santaldih	220 KV S/C	Do.
8	Nagjhari—Ponda	220 KV S/C	Do.
9	Bokaro—Patratu	220 KV S/C on DC tower	Do.
10.	Majri—Abdullapur	132 KV S/C	Do.
11	Raigarh—Jharasguda	132 KV S/C	Do.

4.39. The Ministry further informed that to pursue the further progress of inter-State lines and ensure their speedy completion special monitoring arrangements were being organised in Central Electricity Authority.

4.40. From the tables given above, it would be seen that 658 Kms. circuit length of Inter-State|Inter Regional lines were completed during the Fourth Plan and 882 Kms. circuit length completed upto March, 1976. Asked to state how many kilometres of the circuit length of Inter-State|Inter-Regional lines would be completed during the remaining years of the Fifth Plan, the Chairman, Bharat Heavy Electricals Ltd. during evidence stated:

> "We expect that about 2460 circuit Kms. of inter-State and inter-regional lines would be completed during the remaining years of the Fifth Plan."

4.41. From the two Tables showing anticipated programme of completion of Fourth Plan lines and proposals for construction during

Fifth Plan of the Inter-State|Regional Lines, it would be seen that fourteen lines are scheduled to be completed by 1978-79. Asked to state whether these would be completed according to schedule, the witness added:

> "Out of the 14 Fourth Plan lines, we expect that 13 would be completed by 1978-79. The Chandrapur line on double circuit towers is also expected to be completed by December, 1979. The last one will be completed a little after the Fifth Plan. Others will be completed by 1979, as scheduled."

4.42. The Ministry of Energy in their written replies also informed the Committee that the National Hydro Electric Power Corporation incorporated under the companies Act, 1956, can also undertake where necessary the construction of Inter State transmission lines, and ancillary works for timely and coordinated inter-State exchange of power.

4.43. Asked to state which agency had been constructing inter-State lines so far, and what would be their position *vis-a-vis* the National Hydro Electirc Power Corporation, whether construction of inter-State lines has actually been entrusted to the National Hydro Electric Power Corporation, if so which sectors and how long would it take to complete the work, the Secretary, Ministry of Energy, during evidence, stated:

> "The inter-State line is meant normally to be constructed by each State in its own portion. Recently, Bihar had requested UP to take up the portion lying in Bihar.....
>
> The only line that the national hydro has taken up is the Imphal one. It is also an inter-State one. It is an enabling facility. If the State board wants it, we do it. At present each State can do it by itself."

4.44. The Committee in paragraph 5.45 of their 39th Report (1972-73) noted that out of the 38 inter-State links taken up, 24 lines would be completed during the Fourth Plan period and the remaining lines within the next year or two. The Committee in paragraph 5.49 of their Report expressed their unhappiness at the lack of enthusiasm on the part of the State authorities to pursue the inter-transmission programme vigorously even though the Centre had decided to provide 100 per cent loan assistance to States under centrally sponsored schemes outside the State ceiling for construction of various inter-State links during the Fourth Plan period.

4.45. The Committee are informed that out of 24 lines targetted for completion during the Fourth Plan period, only 8 lines were actually completed during that period, and 6 lines have been completed upto March, 1976, i.e., during the first two years of the Fifth Five Year Plan. Fourteen lines are expected to be completed upto 1978-79 and one line (viz. Dehri-Mughalsarai) is likely to be completed in the early Sixth Plan period. The Committee cannot but view with great concern the tardy progress made in constructing these important inter-State links. Particularly when the Centre had decided to provide 100 per cent loan assistance to States for the inter-transmission programme under centrally sponsored schemes outside the State ceiling.

4.46. The Committee would urge that Government should take up the question of early construction of inter-State links with the State authorities concerned and impress upon them the necessity of giving adequate priority for their speedy completion. On their own part, the Government should strictly monitor the progress of these schemes and extend all necessary assistance that the States may require to ensure their speedy completion.

4.47. The Committee also find that one of the various objectives of the National Hydro Electric Power Corporation recently incorporated is to undertake wherever necessary the construction of inter-State transmission and ancillary works for timely and co-ordinated inter-State exchange of power. The only line taken up by this corporation is the Imphal line. The Committee trust that in order to speed up the projects Government would impress upon the State Govts./State Electricity Boards the need for entrusting construction of more inter-State lines to the National Hydro Electric Power Corporation, which is a Central Government Undertaking..

CHAPTER V

RURAL ELECTRIFICATION

(a) *Progress made in electrification of villages*

5.1. The Estimates Committee in paragraph 7.36 of their 39th Report noted that power played a vital role in development. The Committee stressed that for an all round development of rural areas and for bringing about far reaching changes in the methods of irrigation and farming it was very essential to accelerate the pace of rural electrification in the country. In the opinion of the Committee, rural electrification was necessary for:—

(i) increasing agricultural production by energising tube-wells as a regular and steady source of irrigation;

(ii) agro-based industries as well as small scale rural industries in the rural areas;

(iii) providing employment potential in villages themselves in agro-based and small scale rural industries thereby arresting the drift of population to bigger cities and creating of slums there;

(iv) providing electrification and lighting facilities etc., in the villages which would not only make the educated persons from the villages not to leave villages but would also attract doctors and other social and technical workers to the villages by providing the basic amenities like power and light in the villages;

(v) providing means of better standard of living to the rural inhabitants and farm workers by giving them the benefit of industrialisation etc.

5.2. The Committee in paragraph 7.37 of their Report regretted that although 80 per cent of the population of India lived in villages and provision of electricity was an essential pre-requisite for the development of rural areas and which could bring far-reaching changes in the economy of these areas, very little was done in the first Three Five Year Plans for rural electrification with the result that till the end of the Third Plan only 45,409 villages out of total

5,66,878 that is, about 8 per cent were electrified and only 3,20,096 tubewells|pump sets were energised throughout the country. It was only in the three Annual Plans of 1966—69 and the Fourth Five Year Plan that the programme of rural electrification had picked up. The Committee noted that till 1972-73 only 23.4 per cent of the villages had been electrified and only 18,76,188 tubewells/pump sets energised. The Committee recommended that a time-bound programme of rural electrification should be prepared by the Government which while fixing a long-term programme for providing power to every village of the country, should fix a target for providing electricity to each and every village having a specific number of residents. The Committee recommended that sufficient funds should be provided in the Five Year Plans and implementation machinery at the field level should be geared up to achieve targets.

5.3. The Government in their action taken replies furnished in November, 1973 stated that the advantages of introduction of electricity to the rural areas had been well-recognised by the States and this was evident from the acceleration in the programme from the Fourth Plan onwards. As the programme of rural electrification was formulated and executed by the State Governments/State Electricity Boards, the observations of the Committee had been brought to the notice of the State Governments/State Electricity Boards.

5.4. The Government in their action taken replies further stated that the progress of rural electrification was dependent on various factors, viz. availabilities of power, transmission and distribution net work in rural areas, terrain, resources, organisation set up, etc. and availability of funds. It was therefore, not considered practicable to prepare a time-bound programme fixing a target date for electrification of every village in the country. The total number of villages in India was 5,66,878. Out of these, 3,51,653 villages had a population of less than 500. At the beginning of the planned development of the country in 1951, only 3,061 villages had been electrified. Considerable progress had been made since then in rural electrification and the progress was being accelerated from Plan to Plan. At the end of the Third Plan the number of villages electrified was 45,144. During the three years period 1966-69, 28,578 villages were electrified bringing the total number to 73,722 at the beginning of the Fourth Plan. During the Fourth Plan this was being doubled and the number of villages electrified had already reached 1.4 lakhs. This tempo was proposed to be maintained during the Fifth Plan.

5.5. Government also stated in their action taken replies that priority was being given to electrification of villages with a higher population in order that maximum coverage was obtained. With this end in view a long term plan had already been drawn for the decade 1971—81 under which it was proposed to electrify 3.4 lakh villages by 1981. It was envisaged in this programme that villages with a population of 500 and above should be electrified by 1981. 55 per cent of the villages with a population less than 500 should also be electrified by that time. By doing so, it was estimated that 90 per cent of the rural population could be benefited by 1981. During the Fifth Plan a special programme called the Minimum Needs Programme covering rural electrification was also proposed to be taken up. This was to ensure that 30—40 per cent of rural population would be covered in each State by rural electrification.

5.6. Government also stated that considering the magnitude of the problem and the large size of the country the aim was to cover as much of the ground as possible in the minimum possible time but it was not practicable to plan for the electrification of all the villages in the country within the decade 1971—81. Nor was it possible at that stage to lay down a time bound programme by fixing target dates for electrification of every village in the country.

5.7. The Ministry of Energy were asked to intimate the action taken by State Governments/State Electricity Boards to implement the recommendation made in para 7.36 of the 39th Report of Estimates Committee (Fifth Lok Sabha), relating to programme of rural electrification; with specific reference to the energising of tube-wells, encouraging agro-based industries and providing employment to the technical workers in villages. The Ministry of Energy in their written replies furnished in November, 1976 stated that there were 5,75,936 villages in the country as per 1971 Census. According to the reports received from the State Electricity Boards, 1,88,169 villages were electrified in the country as on 31-7-1976. Also 28,41,972 irrigation pump sets/tubewells were energised upto that date. According to the latest information furnished by the Ministry of Energy, the number of villages electrified as on 31-8-1977 is 1,92,635, and the number of irrigation pumpsets/tubewells energised in the country as on 31-7-1977 is 31,09,194.

5.8. Specific steps were stated to have been taken by the State/State Electricity Boards to accelerate the pace of rural electrification in the country. These include setting up of additional power generation capacity, strengthening of transmission and distribution system leading to improvement in the general supply conditions in

the rural areas and establishment of separate organisations in the State Electricity Boards to deal more effectively with matters relating to rural electrification. Also increasingly more funds are being provided in the Annual Plans for rural electrification works.

5.9. The Ministry of Energy in their written replies furnished in November, 1976, have informed that while Haryana had achieved 100 per cent village electrification earlier, the State of Punjab has also achieved it in May, 1976. Tamil Nadu and Kerala are also very near to this goal.

5.10. Government in their action taken replies furnished in November, 1973 had stated that additive finance was also provided to State Electricity Boards for implementation of their rural electrification schemes by the Rural Electrification Corporation which had been set up in Central sector. As per directive given by the Government of India, the Corporation adopts the project approach in sanctioning schemes. The adoption of project approach involved an assessment of physical resources in the area and required a sound technical plan to ensure the maximum utilisation of the resources potential. The projects should not only be remunerative but also permit the rural users to earn incremental income to pay for the use of electricity. This was done by integrating the scheme as a part of total development efforts in the areas. The schemes of Rural Electrification Corporation were, therefore, stated to be comprehensive to cater to the requirement of agricultural loads, small scale industries, agro-industries, commercial and domestic connections. In areas where there was little scope for agricultural pumpsets, but where potential existed for other activities like horticulture fishery, forestry, animal husbandary etc. schemes were drawn up, taking into account such activities. Rural Electrification Corporation sought to coordinate its activities with other programmes in operation like Small Farmers Development Agencies, Marginal Farmers and Agricultural Labourers Development Agencies, Intensive Agricultural Development Programme and Rural Works Programmes. Rural Electrification Corporation had also been making intensive efforts with the State Electricity Boards/State Governments to have effective coordinating machinery set up at project level, District level and State level.

5.11. Asked to state the progress made in rural electrification with specific reference to encouraging agro-based industries and providing employment to the technical workers in villages, the Ministry of Energy in their written replies furnished in November, 1976, stated that statistical data in regard to the setting up of agro-

based industries and providing employment to technical workers as a result of electrification* of villages is not being obtained. However, under the schemes sanctioned by the Rural Electrification Corporation, electricity has been provided to 16,509 LT/Agro** industries and 430,440 domestic/commercial services upto June, 1976.

5.12. The Finance Minister in his Budget speech on 17th June, 1977 stated that under the programme of rural electrification for energising the pumpsets, "we have made a provision of Rs. 175 crores which will also be augmented to a significant extent by institutional finance."

5.13. The Ministry were asked to state the targets fixed for electrification of villages during the Fourth Plan period and the targets fixed for electrification of villages during Fifth Plan period Statewise and what achievements have been made so far, the Ministry have in their written replies informed that no target was fixed in the Fourth Five Year Plan for electrification of villages. However, it was generally expected that about 75,000 villages would be electrified during the plan period. The actual achievement was electrification of 82,399 villages.

5.14. The draft Fifth Plan envisages a target of electrification of 1,10,208 villages as under:

	Villages to be electrified.
Normal Development of the States	32,549
Minimum Needs Programme	36,551
REC Normal Programme	41,108
	1,10,208

5.15. The Committee in their 39th Report (1972-73) had pointed out the need to accelerate the pace of rural electrification in the country for a rapid all-round rural development and for bringing about far reaching changes in the methods of irrigation and farming. The Committee also took note of the fact that till 1972-73 hardly 23 per cent of the villages had been electrified and only 18,76,188 tubewells energised. The Committee, therefore, recommended that a

*A village is deemed to have been electrified if electricity is being used within its revenue area for any purpose whatsoever.

**The term LT/Agro-based industries refers to the decentralised sector in rural and semi-urban areas covering a population of 20,000 where electricity is supplied through low tension for running agro-based industries ascent contrasted with large-scale industries needing power in bulk through high tension supplies.

time-bound programme for rural electrification should be prepared which while fixing a long term programme for providing power to every village of the country should fix a target for providing electricity to each and every village having a specific number of residents.

5.16. The Committee note that out of a total number of about 5.76 lakh villages in the country, according to 1971 census, about 3.5 lakh villages have a population of less than 500. The progress made in rural electrification has been as follows:

	No. of villages electrified
At the beginning of the First Plan in 1951	3061
At the end of the First Plan	9047
At the end of the Second Plan	24891
At the end of Thrd Plan	43932
At the end of 1968-69	73722
At the end of Fourth Plan	172169
As on 31-7-1976	188169
As on 31-8-1977	192635

5.17. While the Committee appreciate that the pace of electrification of villages has picked up momentum in recent years, they cannot help pointing out that much leeway is yet to be covered. In percentage terms, the number of villages electrified upto July 1976 works out to about 33 per cent. The Committee would, therefore, urge that Government should redouble their efforts in the direction of covering most of the villages within the shortest possible time.

5.18. The Committee have been informed that the progress of rural electrification was dependent on various factors viz., availabilities of power, transmission and distribution net work in rural areas, terrain, resources, organisational set up, availability of funds etc. and it was not, therefore, considered practicable to prepare a time-bound programme fixing a target date for electrification of every village in the country. While the Committee realise the difficulties in fixing the target date of electrification for each village in the country, they would like to point out that the obejctive of total electrification of villages can be achieved only through realistic and perspective planning. The Committee also note in this connection, that Government have prepared a long term plan for the decade 1971—81 and this plan envisages electrification of 3.4 lakh village by 1981. This programme would cover all villages with a population of 500 and above and 50 per cent of villages with lower population. The

Committee find that if this programme is fully implemented it would cover only about 61 per cent villages in the country by 1981. The Committee, would, therefore, urge the Government to prepare a long term perspective plan, in close consultation with the States, to cover all the villages for electrification so that work relating to allocation of resources, generation of power, construction of transmission and distribution lines etc. can be taken up well in advance and the objective realised.

5.19. There should be well-coordinated programme for energising pumpsets, establishment of rural industries and wide-spread growth of infra-structure such as transport, agro-based industries, forestry etc. The Committee note that as on 31 July, 1977, 31,09,194 pumpsets have been energised. Considering the need for attaining a rapid and sustained development of agriculture, it is imperative that greater and determined efforts are made to energise pumpsets in larger number.

5.20. The Committee note from the Budget speech of the Finance Minister in June, 1977 that under the programme of rural electrification for energising pumpsets, a provision of Rs. 175 crores, which will also be augmented to a significant extent by institutional finance, has been made in the budget for 1977-78. The Committee hope that in the years to come, the programme of energising pumpsets will be given a high priority leading to a sustained and abiding green revolution.

5.21. The Committee are surprised that Government do not have statistical data in regard to the setting up of agro-based industries and the employment generated as a result of rural electrification. All that the Committee have been informed is that under the scheme sanctioned by the Rural Electrification Corporation, electricity has been provided to 16,509 LT/Agro-Industries and 4,30,440 domestic/commercial services upto June, 1976. The Committee feel that it is high time that a systematic and scientific assessment of the impact of electrificaton on rural economy is made so that it may facilitate preparaion of integrated schemes for future rural development through electrification. The Committee hope that Govenment would address themselves urgently to this task and inform the Committee of the results of such an assessment in due course.

(b) *Disparities in provision of electricity in State*

5.22. The Estimates Committee in paragraph 7.38 of their 39th Report noted that although 23.4 per cent of the villages in the country had been electrified and about 19 lakh pump-sets had been pro-

vided in the country, there were wide disparities in the provision of electricity and installation of pumpsets in the various States. While there were States like Haryana and Tamil Nadu where practically every village had been electrified there were States like Assam where only 3.3 per cent of the villages had been electrified and only 105 tubewells and pumpsets energised. Similarly, percentage of villages electrified in Orissa was 7.7 per cent, in West Bengal 12.7 per cent and in 9 other States, the percentage was less than all India average of 23.4 per cent.

5.23. Government is their action taken replies furnished in November, 1973, stated that the all India average of electrification was 25 per cent as on 30-6-1973. The States of Assam, Bihar, Jammu & Kashmir, Madhya Pradesh, Manipur, Meghalaya, Nagaland, Orissa, Rajasthan, Tripura, Uttar Pradesh and West Bengal were below the All India average level of electrification. The Comparatively slow progress in these States was due to (i) lack of power development; (ii) lack of necessary transmission and distribution net work, and (iii) lower allocation made in the past by the States for rural electrification. It was not, therefore, possibe to ensure uniform development in all the States within a short period. During the Fourth Plan the outlays on rural electrification within the State Plan ceilings had been substantially enhanced to provide for acceleration of rural electrification schemes in the backward States. Good progress had been achieved in the Fourth Plan particularly in the States of Bihar, Orissa, West Bengal, Rajasthan, Madhya Pradesh and Uttar Pradesh.

5.24. Government also *inter alia* stated that observations of the Committee had been brought to the notice of the State Governments/ State Electricity Boards requesting them to take measures in order to accelerate the pace of rural electrification in their respective States.

5.25. The Committee in their Fifty sixth Report (1973-74) desired that a close watch should be kept to ensure that there was no slackness on the part of the State Governments concerned regarding the progress of rural electrifiaction programme for want of Central assistance.

5.26. A statement showing the number of villages electrified State-wise as on 31-7-1976 is at Appendix XII.

5.27. The Ministry of Energy have in a written note furnished in November, 1976, stated that of the 22 States in the country the level of village electrification in 13 States was below the All-India average (viz. 32.7 per cent as on 31-7-1976). These States were

Assam, Bihar, J & K, Madhya Pradesh, Manipur, Meghalaya, Nagaland, Orissa, Rajasthan, Sikkim, Tripura, Uttar Pradesh, and West Bengal. It was later stated that as on 30-11-1976, out of 5,75,936 villages in the country, 1,94,157 villages (i.e. 33.7 per cent) had been electrified. At that time in 12 States, the level of village electrification was below 33.7 per cent.

5.28. The position in regard to the number of villages electrified in these 12 backward States is indicated below:

States	Total No. of villages	No. of villages electrified as on 30-11-1976	Percentage villages electrified
1. Assam	21,995	1,850	8·4
2. Bihar	67,566	17,020 (p)	25·1
3. Madhya Pradesh	70,883	12,509 (b)	17·7
4. Manipur	1,949	235 (c)	12·1
5 Meghalaya	4,583	261 (b)	5·7
6. Nagaland	960	194 (a)	20·2
7. Orissa	46,992	11,843	25·2
8. Rajasthan	33,305	7,705	23·1
9. Sikkim	215	11 (c)	5·1
10. Tripura	4,727	269 (a)	5·7
11. Uttar Pradesh	1,12,561	32,329	28·7
12. West Bengal	38,074	10,521	27·7
TOTAL	4,03,810	94,747	

Provisional figure

(a) As on 31-10-1976

(b) As on 30-9-1976

(c) As on 30-6-1976

5.29. It would be seen from the statement that percentages of villages electrified vary from 28.7 per cent in Uttar Pradesh, 27.7 per cent in West Bengal, 25.2 per cent in Orissa, 25.1 per cent in Bihar

to 12 per cent in Manipur, 8.4 per cent in Assam, 5.7 per cent in Tripura and 5.1 per cent in Sikkim.

5.30. The Committee wanted to know the measures taken to step up the progress of rural electrification in States which were lagging behind. It has been stated by the Ministry that with a view to reduce this regional imbalance, rural electrification has been taken up as a part of the Minimum Needs Programme—(MNP) in the Fifth Plan. The resources for this programme-as allocated are also being routed through the Rural Electrification Corporation. Only such States which have not reached the coverage of 40 per cent population with electricity by the end of the Fourth Plan, are normally eligible for allocation under this programme. In exceptional cases, however, some provision has been made to enable the States to provide adequately for the tribal and backward pockets which have been left behind in this respect, even when their average coverage has reached the level of 30-40 per cent. The broad details of the areas to be covered under this programme have been worked out by the Planning Commission. Priority has been given to areas and districts which are more backward. The terms and viability criteria evolved for loans for schemes of such areas have been liberalised.

5.31. A statement showing the target for villages to be electrified (as given in the Draft Fifth Plan) under the Normal Development Programme of the States, Minimum Needs Programme and the Rural Electrification Corporation Programme, as also the achievement in the electrification of village during the period 1-4-74 to 31-7-76 is at Appendix XIII.

5.32. The Ministry further stated that the Rural Electrification Corporation has been given special consideration and high priority to projects for electrification in under-developed and backward areas. A special category of loan has been evolved for this purpose. The terms, conditions and viability criteria are comparatively softer for these schemes. Also the Corporation has opened regional offices in Calcutta, Patna, Gauhati, Lucknow, Jabalpur, Hyderabad, Chandigarh and Jaipur. This will enable them to have a closer association with the State Electricity Boards and render necessary assistance and guidance to them in the formulation of rural electrification programme. This will enable the Boards to formulate more viable rural electrification projects expeditiously for consideration by the Corporation and will also help in the accelerated implementation of the sanctioned schemes.

5.33. The Committee of Members of Parliament on Rural Electrification in their Report submitted in April, 1972 had *inter alia* recommended that Rural Electrification Corporation should continue

to sanction more schemes of backward states till these States reached the All India average of village electrification.

5.34. It was stated by Government that the above recommendation had been communicated to the Rural Electrification Corporation Ltd., for implementation. Rural Electrification Corporation Ltd. had taken note of the special requirements of the States which were below the All India average in regard to rural electrification. Recognising the fact that schemes in backward areas become viable in a longer period, loans on softer terms had been offered for such areas. More emphasis was being laid and would continue to be laid to advance loans to backward States. Out of 703 schemes sanctioned upto 5-9-1974, 403 schemes were for States which were below the All India average.

5.35. Asked to state how many more schemes have been sanctioned after September, 1974, for the backward States, and the number of villages that have been electrified in those States, the Ministry of Energy in their written replies have stated that the Corporation had sanctioned 703 rural electrification schemes upto 5-9-1974 for a total loan assistance of Rs. 327.36 crores. Since then it had sanctioned additional 691 schemes involving a total loan assistance of Rs. 277.64 crores. 3 Schemes for a loan amount of Rs. 0.74 crores have been withdrawn since 1-5-1974 on account of inability of the State Electricity Boards to produce the Ground water certificates. Thus the Corporation has upto 24-12-1976 sanctioned a total of 1391 schemes involving loan assistance of Rs. 604.26 crores.

5.36. Of the 691 schemes sanctioned by the Corporation after 5.9.1974, 402 schemes involving a total loan assistance of Rs. 202.62 crores are in respect of the States below the All India average of village electrification. However, these also include the schemes sanctioned for Jammu & Kashmir which has only recently exceeded the All India average of village electrification.

5.37. The Committee draw attention of the Secretary, Ministry of Energy to the observations of the Committee of Members of Parliament, which submitted its report as early as 1972, wherein that Committee had cautioned that even though good progress had been maintained in rural electrification during the Fourth Plan period, the level of achievement among the backward States would be less than that of the others. In this connection, the Committee on Public Undertaking in para 2.17 of their 62nd Report (1974-75) regretted to note that inspite of this observation, the backward States as

a whole still continued to remain as such. The Secretary, Ministry of Energy, during evidence stated:

> "Out of 1391 projects sanctioned by the REC so far since its inception, 804 pertain to States, which are below the all-India average. Also out of the total loan amount of Rs. 604 crores, that the REC has so far sanctioned, Rs. 388 crores pertain to these States."

5.38. Asked to state the amount utilised, the witness added:

> "Against the total sanction of Rs. 388 crores, they have so far drawn Rs. 189 crores. These are more recent sanctions. The whole of the gap between Rs. 388 and Rs. 189 crores may not be taken as shortfall, because by their very nature, they are phased programmes."

5.39. He, however, admitted that the slippage, or the difference between the promised and the actual performance was of course there which could be quantified.

5.40. The Ministry of Energy have in their written reply furnished in March, 1977, stated that the reasons for wide dispartiy in different States were:

(i) Lack of awareness of benefits of electricity.

(ii) General economic backwardness.

(iii) Lack of desired level of investment in the rural electrification programme and consequent inadequacy of transmission and sub-transmission lines.

(iv) Constraints on the availability of ground water, physical resources, geographical conditions, including difficult and hilly terrain; and

(v) Sparse population and long distances between the villages.

5.41. Asked to state the concrete steps taken or proposed to be taken for rural electrification in the States which are below 30 per cent level, and whether any time-bound programme has been drawn up by States in consultation with the Rural Electrification Corpora-

tion so as to create employment opportunities in rural areas, the Secretary, Ministry of Energy, during evidence on 28-12-76 stated:

> "Rural electrification requires a lot of outlay. In the total plan the States Government have to take into account how to deploy the funds. If some of the States want to go in for hundred per cent rural electrification they will need hundreds of crores of rupees, which they do not have. Now, they take up some areas, step by step. Now our coverage of villages is about 33 per cent but the coverage of population exceeds 80 per cent."

5.42. Explaining the position regarding availability of funds for rural electrification the representative stated:

> "Arrangements have been made by the Planning Commission and the Reserve Bank that all State Electricity Boards should be assisted through the Agricultural Rural Development Corporation. They are going to find money in a big way for providing the cost of the connection from the last point to the grid or the nearest village. In some of the States this is not being utilised. We have been pressing them to raise funds. I hope next year Rs. 50 crores would be available. About Rs. 20 crores to 30 crores are available this year. Kerala, West Bengal, Rajasthan and Haryana are making use of it. Now the approach is that the funds for rural electrification should be supplemented, by going to institutional finance. The share of the institutional finance is becoming a major part. If the farmers in the States and the banks are not going to work this scheme, then those States will lag behind while others will go forward.".

5.43. The Managing Director, Rural Electrification Corporation Ltd., explained the position thus:

> "In so far as the regional disparity is concerned, while fixing the annual allocation for different States, those States which are backward in the matter of electrification are able to get higher allocations. Before the annual plan discussion takes places, the REC discusses with the State electricity Boards what should be their requirement of funds in order to electrify more and more villages, and we jointly make submission to the Planning Commission for

augmentation of the plan resources for the State concerned. But once the plan allocation is fixed by and large, the REC has to operate within those plan allocations. While sanctioning a scheme in a particular State, we take into account the Plan allocation, we tell the States Electricity Board to give higher priority to backward areas.'"

5.44. The Secretary, Ministry of Energy, during evidence further stated:

"In the REC operations we have divided the States into those falling above or below national average. An analysis of the funds we have allocated shows a clear bias in favour of those States which are below the average. For those States which have above the average power in 1000sq. meter we have given Rs. 14 lakhs while for those States which have below the average we have given Rs. 20 lakhs. The total rural population covered is 18 crores in above the average and 25 crores in below the average. Lastly, the total amount sanctioned is Rs. 1.1 crores for the above average and Rs. 1.4 million (14 lakhs) for below the average per million of population. So there is bias of 25 to 30 per cent."

5.45. Asked to state his experience in the matter of implementation of REC schemes, and how it was proposed to improve the process of implementation, the Chairman, Rural Electrification Corporation stated during evidence:

"The main thing that we have been recommending to the State Electricity Boards is that there should be a separate organisation dealing with rural electrification programme of schemes and upto the point of implementation. Since the rural electrification programme as we look at it, is in area development programme, it requires the collaboration of various agencies. Therefore, we have suggested to all the State Electricity Boards that there should be at the district level committees consisting of officials and non-officials concerned with the development of that particular area to formulate the schemes and then to monitor the schemes from time to time, to see how the schemes are progressing. We have also suggested that at the State level there should be coordination committees which should meet from time to time to monitor the progress of different schemes.

5.46. In December, 1977 the Sub-Committee of Estimates Committee (1977-78) asked:—

(a) to state the number of rural electrification schemes and the total loan assistance sanctioned by the rural Electrification Corporation, and the total amount utilised;

(b) the number of schemes and the amount of loan assistance for States:—

(i) below All-India average of rural electrification;

(ii) above this average.

The Ministry of Energy have informed in December, 1977 thus:

(a) As on 2nd December, 1977 the Rural Electrification Corporation have sanctioned 1,702 rural electrification schemes involving a total loan assistance of Rs. 711.06 crores. These loans are released in instalments according to the phasing of construction schedule and financial expenditure of each project. Accordingly, the Rural Electrification Corporation have already disbursed an amount of Rs. 426.39 crores up to 30th November, 1977.

(b) The number of schemes and the amount of loan assistance sanctioned by the Rural Electrification Corporation as on 2nd December, 1977 in "Average and Below" States in point of village electrification (AB States) and "Above Average" States in point of village electrification (AA States) is given below:—

(Rs. in Crores)

	No. of schemes sanctioned	Loan assistance sanctioned
1. AB States .	989	456.24
2. AA States	713	254.82
	1702	711.06

5.47. The Ministry of Energy have further informed (March, 1978) that they have disbursed a sum of Rs. 254.64 crores for 'AB' (Average Above) States and Rs. 171.75 crores for 'AA' States (Above Average) States. The details of the State wise disbursement to 'AA'

& 'AB' States upto 30th November, 1977, by Rural Electrification Corporation, New Delhi, are as follows:—

	AA States	Rs. in Crores
1.	Andhra Pradesh	35.10
2.	Gujarat	15.79
3.	Haryana	10.76
4.	Himachal Pradesh	9.50
5.	Karnataka	16.80
6.	Kerala	7.59
7.	Maharashtra	37.82
8.	Punjab	21.91
9.	Tamil Nadu	16.48
	TOTAL	171.75
	AB States	
1.	Assam	9.67
2.	Bihar	44.37
3.	Jammu & Kashmir	12.26
4.	Madhya Pradesh	45.11
5.	Meghalaya	2.52
6.	Manipur	
7.	Nagaland	0.86
8.	Orissa	26.51
9.	Rajasthan	36.18
10.	Tripura	1.12
11.	Uttar Pradesh	43.49
12.	West Bengal	32.55
	TOTAL	254.64
	GRAND TOTAL	426.39

5.48. The Committee note that the national average for village electrification is 33.7 per cent. While some of the States such as Haryana, Tamil Nadu and Punjab and Kerala have attained 100 per cent coverage, in 12 States, the level of village electrification is below the national average of 33.7 per cent. Among these 12 States, Sikkim, Meghalaya, Tripura, Assam, and Manipur have percentages varying from 5.1 to 12, while Bihar, Orissa, Rajasthan, West Bengal and UP have percentages varying from 23.1 to 28.7. Madhya Pradesh has a percentage of 17.7 and Nagaland 20.2.

5.49. The Ministry of Energy have stated that the following are the main reasons for wide disparity in different States:

(i) lack of awareness of benefits of electricity;

(ii) General economic backwardness;

(iii) Lack of desired level of investment in the rural electrification programme and consequent inadequacy of transmission and sub-transmission lines;

(iv) Constraints on the availability of ground water, physical resources, geographical conditions, including difficult and hilly terrains; and

(v) Sparce population and long distances between the villages.

5.50. The Committee are distressed that as many as 12 States should be below the national average in the matter of rural electrification. The Committee would urge that the Central Government should take up this matter with these State Governments at the highest level and stress the need for accelerating the pace of rural electrification and come forward with positive assistance to these States both in the matter of providing resources and in formulation of schemes for rural electrification, so that the wide gap in the percentage of rural electrification among the various States is narrowed down at the earliest.

5.51. The Committee understand that with a view to reducing the regional imbalance, the rural electrification programme has been taken up as part of the Minimum Needs Programme in the Fifth Plan. For this programme only such States which have not reached the coverage of 40 per cent population with electricity by the end

of the Fourth Plan are eligible for allocation. In exceptional cases some provision has been made to enable the States to provide adequately for the tribal and backward pockets even when their coverage has reached the level of 30-40 per cent. Broad details of the areas to be covered under this programme have been worked out by the Planning Commission under which priority has been accorded to areas and districts which are more backward. The terms and viability criteria evolved for loans for schemes of such areas have been liberalised. The Committee have also been informed that the Rural Electrification Corporation has been giving special consideration and high priority for projects for electrification in under-developed and backward areas. The Committee would urge that Central Government and the REC should extend liberal assistance to the backward States so that the pace of rural electrification is accelerated and they come up to the level of more advanced States.

5.52. The Committee note that a total of 1702 schemes involving loan assistance of Rs. 711.06 crores have been sanctioned so far (upto 2nd December, 1977) by the REC. Out of these 1702 schemes, 989 schemes accounting for a loan assistance of Rs. 456.24 crores are for the States which are lagging behind the All India average of village electrification. The Committee, however, note that out of Rs. 456.24 crores sanctioned for the schemes pertaining to the States lagging behind the national average of village electrification, only Rs. 254.64 crores have been drawn so far. Although the whole of the gap (between Rs. 456.24 crores and Rs. 254.64 crores) may not be taken as a shortfall, it was stated by the representative of the Ministry of Energy during evidence in December, 1976 that the slippage between the promised and the actual programme was there. The Committee are surprised that these States which lag behind in rural electrification have not come forward to fully utilise the loan assistance sanctioned by the REC. The Committee would like Government to take up this question with the concerned State Governments and urge them to utilise the loan sanctioned by the REC by speedily implementing the schemes.

5.53. The Committee note that 713 schemes, involving loan assistance of Rs. 254.82 crores have also been sanctioned by the REC for States which are above the national average. The Committee would like that Central assistance for rural electrification may be mainly concentrated in the States which are lagging behind so as to enable them to come upto the level of the more advanced States at the earliest.

5.54. The Committee note that the REC had been suggesting to the States Electricity Boards to set up separate organisations dealing with rural electrification programme right from the point of formulation of schemes and upto the point of their implementation. They have, therefore, suggested to the State Electricity Boards that there should be at the district level, Committees consisting of officials and non-officials concerned with the development of that particular area to formulate the schemes and then to monitor the schemes from time to time. Further that there should be coordination committees to monitor the progress of different schemes. A recommendation for more efficient coordination at State and district level with other related Departments was also made by the Committee of Members of Parliament on Rural Electrification (1971).

5.55. The Committee feel that inadequacy of funds alone has not been a major factor for the slow progress in rural electrification in the States which are below the national average. The Committee are of the view that, as indicated by the REC these States do not have the necessary organisational structure for formulation of schemes and monitoring their progress, and for ensuring their speedy completion. The Committee would like the Central Government to give concrete assistance to these States in formulating their schemes and formulate necessary guidelines in this regard. It may also be impressed upon the State Governments that they strengthen their organisational structure so that the pace of rural electrification is accelerated in their areas.

(e) *Outlays for Rural Electrification*

5.56. The Committee in paragraph 7.48 of their 39th Report (1972-73) noted that a perspective plan for the decade commencing from April, 1971 to March, 1981 for rural electrification with emphasis on energisation of pumpsets, for increasing agricul- Rs. 405 crores in IV Plan as against provision of Rs. 290 crores. mended that in view of the urgent need for rural electrification for the development of rural areas the necessary allocation of funds might be made.

5.57. The Government in their action taken replies furnished in November, 1973 stated that the outlays for the programme of rural electrification had necessarily to depend upon the overall

resources position of the country. Increasing allocation were being made as could be seen from the outlays provided in successive plans:

	Rs. in Crores
First Plan	8·27
Second Plan	75·00
Third Plan	153·00
Annual Plans (1966—69)	227 00
Fourth Plan	444·69 (including Rs. 150 crores under REC).

5.58. Government further stated that the actual expenditure on rural electrification in the States Plans was expected to reach Rs. 405 crores in IV Plan as against provision of Rs. 290 crores. Besides financial assistance from banking institutions, assistance from LIC is estimated to be Rs. 150 crores against the original estimate of Rs. 75 crores. The loan assistance from REC is expected to be Rs. 170 crores. The total expenditure in IV Plan would thus be Rs. 725 crores as against the original expectation of Rs. 520 crores.

5.59. In the draft Fifth Plan document a provision of Rs. 1098.24 crores was made for rural elecrification schemes. However, in the final 5th Plan only Rs. 685.30 crores have been provided for rural electrification.

5.60. Asked to state the reasons for reducing the allocations on this important programme, and the impact of this reduction, the Secretary, Ministry of Energy, during evidence stated:

> "We had originally totalled up allocations of three different compartments, adding up to Rs. 1098 crores. We have now an allocation of Rs. 685 crores plus an unstated quantum of institutionalised advance. We had pressed Planning Commission for this amount also being quantified, but they said it depends on to what extent State Boards present schemes to the Banks and to the REC. But there is also an understanding that if the institutional advance, when asked for, is not forthcoming (which

situation, I think, will not occur), they will supplement the figure of Rs. 685 crores. There is also a linkage between this and the pumpsets to be energised in the Fifth Plan period."

5.61. Asked to state whether there would be no difficulty in regard to finances in the Fifth Plan, the Secretary, Ministry of Energy added:

"That would not be a correct impression. I would like to limit it by saying that a constraint has been faced by the REC in the area of some type of schemes they have sanctioned. In some States there has not been a problem but they do have cases where schemes cannot be sanctioned by the States because funds are not available. The funds position of the REC is not comfortable. In relation to other areas like ARDC, we have to see how far it is going to play a role."

5.62. Later the Ministry of Energy in March, 1977, stated that an outlay of Rs. 330.61 crores was provided for rural electrification during the first 3 years 1974—77 of the Fifth Plan. As against it an outlay of Rs. 354.69 crores is proposed in the Fifth Plan document for the last two years. With this increased outlay the pace of rural electrification in the country will be further accelerated.

5.63. In addition to the funds provided in the Plan, the State Electricity Boards will also be attracting institutional finance such as from ARDC, nationalised banks, etc. for rural electrification.

5.64. The Committee note that as against a provision of Rs. 1098 crores proposed in the draft Fifth Plan for rural electrification, only a sum of Rs. 685 crores has been provided for rural electrification in the final Fifth Plan document. In addition, an unstated quantum of institutionalised advance would be available. The Committee have also been informed that Planning Commission had given an assurance to the effect that if the institutionalised advance would not be forthcoming, the plan allocation of Rs. 685 crores would be supplemented.

5.65. The Committee trust that with the increasing realisation of the vital role of rural electrification in the rural economy and the development of rural areas, lack of resources would not be allowed to act as a constraint in the progress of rural electrification and on the contrary liberal allocation would be made to step up the pace of rural electrification in the country.

(d) *Electrification of Harijan Bastis*

5.66. The Committee in paragraph 7.42 of their 39th Report noted that in a number of villages where electricity had been provided, the 'Harijan Bastis' in those villages were not electrified because of unremunerative loads in those areas. The Committee further noted that the Government of India had introduced since December, 1971, a special scheme for electrification of such "Harijan Bastis" and for that purpose loan assistance at concessional terms was being provided through the agency of Rural Electrification Corporation to the State Electricity Boards. The Committee recommended that the provision of public lighting to the economically weaker sections of the society particularly in the Harijan and Adivasi areas and 'bastis' should be given special consideration by the Government and, if necessary, further incentives *viz.*, interest free loans etc. should also be given to the State authorities concerned for this purpose.

5.67. Government in their action taken replies recognised that the provision of street lighting to economically weaker sections of the Society particularly for Harijan and Adivasi areas and bastis should be given special consideration. Accordingly, a provision of Rs. 5 crores during the Fourth Plan had been made for giving loan assistance against specific schemes of provision of street lighting in Harijan Bastis adjacent to electrified villages with street lights but where the Harijan bastis were left out. In the Fifth Conference of the Chairman, State Electricity Boards held in May, 1971 a resolution was passed that in all future schemes of village electrification whenever a village is electrified for general purposes, the Harijan| Backward community basti(s) of the village should be automatically covered. As a special feature, as part of the programme of the Silver Jubilee Year of the country's Independence, instructions were issued to State Governments|State Electricity Boards to electrify one Harijan basti per day in every State of the country during the Silver Jubilee Year *i.e.* from 15-8-1972 to 14-8-1973. The Rural Electrification Corporation had instructed that while formulating schemes, provision should be included for street lights in Harijan Bastis adjacent to villages included for electrification in the scheme. In addition to the above, the Minimum Needs Programme would also have priority in backward areas. Many of the schemes for rural electrification under the Minimum Needs Programme in the Fifth Plan, therefore, are expected to cover the electrification of tribal areas too.

5.68. According to the scheme introduced by Government of India in December, 1971 for providing electricity to Harijan Bastis in villages already electrified mentioned above, loan assistance was being made available on concessional terms through the agency of Rural Electrification Corporation to the State Electricity Boards. The loan carried an interest of 5 per cent per annum and it to be repaid in 15 years. The other loans sanctioned by Rural Electrification Corporation carry higher rate of interest of 6¼ per cent per annum for first 10 years, 7½ per cent per annum for next 5 years and 8¼ per cent per annum for next 5 years. Besides, the funds given by Government for this purpose to Rural Electrification Corporation in the form of a loan carry an effective rate of interest of 4¼ per cent per annum only. Thus programme of extension of electricity to Harijan Bastis is already subsidised by Government of India.

5.69. The Ministry of Energy were asked to indicate the amount of loan assistance given by REC to the State Electricity Boards since December, 1971 *i.e.* from the time of the scheme for providing electricity to Harijan Bastis was introduced and the present position with regard to one provision of electricity in the Harijan Bastis. The Ministry in their written replies stated that the Rural Electrification Corporation has sanctioned 109 schemes of the various State Electricity Boards for a total loan amount of Rs. 4.5 crores envisaging extension of electricity to 10,460 Harijan Bastis adjoining already electrified villages. According to the reports received by Corporation 6,608 Harijan Bastis have been electrified under the programme upto 25-9-76.

5.70. It has also been estimated that there are about 8,500 villages where street light has been provided in the main villages but it has not yet been extended to the adjoining Harijan Bastis. After all the schemes sanctioned by the Rural Electrification Corporation for extension of electricity to the Harijan Bastis adjoining electrified villages have been fully implemented, about 4,500 more Harijan Bastis would remain to be provided with street light facility. The present decision of the Government is that power supply could be extended to such remaining Harijan Bastis from within the States' Annual Plan provisions made for Normal Development Works and/or Normal Rural Electrification Programme wherever these are provided. The various State Electricity Boards have been informed to take necessary action for electrification of the remaining Harijan Bastis accordingly.

5.71. Asked to state the exact number of Bastis which still remain to be electrified and the precise measures taken or being taken in providing electricity to Harijan Bastis, and the steps taken to collect data of Harijan Bastis still remaining to be electrified, the Secretary, Ministry of Energy, during evidence stated:

> "Now for those who were left out in the past, funds are created and after these schemes are implemented by REC these will still be about 4,000 Harijan Bastis which will not get covered through these arrangement which has been made and all the State Governments have been requested to take care of this as part of their normal efforts for effective rural electrification. 4000 bastis are not a large number."

5.72. To a query made by the Committee whether the Government's instructions that in every proposal submitted to REC the Harijan Bastis should be included, are being observed, the Secretary, Ministry of Energy during evidence stated:

> "In the REC no proposal would be entertained if in it the harijan bastis are left out. Those instructions are being fully honoured and implemented. Government also made a special provision of about Rs. 5 crores to cover those harijan bastis which in earlier proposals had been left out. There also very substantial progress had been made. The number of villages where bastis have been left out is very small and can be taken care of by the State Government with their own resources. REC never takes up a schemes where the Harijan bastis have been left out."

5.73. Later in their written note furnished in March, 1977 the Ministry informed that progress reports were being obtained monthly from States giving details of (i) number of villages electrified; (ii) number of electrified villages where street light has been provided; and (iii) number of electrified villages where street light has been provided in the main village and it has also been extended to the adjoining localities inhabited by Harijan and other backward communities. The data in regard to, (ii) and (iii) is not up-to-date for all the States. Acton is, however, being taken to obtain more updated information from the States with a view to have the exact number of Harijan Bastis which still remain to be electrified.

5.74. The Sub-Committee of Estimates Committee (1977-78) enquired about the latest position regarding the progress of electrification of Harijan Bastis adjoining the already electrified villages.

The Ministry of Energy in their note furnished in December, 1977 have stated that so far as the REC is concerned they have sanctioned 109 schemes for extension of electricity to 10,460 Harijan Bastis adjoining the already electrified villages. According to the information received, 8,673 Harijan Bastis have been provided with street lighting under the special scheme and 1,787 Harijan Bastis yet remain to be electrified.

5.75. The Committee had in their 39th Report recommended that the provision of public lighting to the economically weaker sections of the society particularly in the Harijan and Adivasis areas and 'bastis' should be given special consideration by the Government and, it necessary, further incentives viz. interest free loans etc. should be given to the State authorities concerned for this purpose. The Committee note that a provision of Rs. 5 crores during the Fourth Plan had been made for giving loan assistance against specific schemes for provision of street lighting in Harijan 'bastis' adjacent to electrified villages with street lights. The Committee also note that as part of the programme of the Silver Jubilee year of the country's Independence, instructions were issued to State Governments|State Electricity Boards to electrify one Harijan 'Basti' per day in every state of the country during the Silver Jubliee Year i.e., from 15-8-1972 to 14-8-1973.

5.76. The Committee note that according to the scheme introduced by Government of India in December, 1971, for providing electricity to Harijan Bastis in electrified villages loan assistance was being made available on concessional terms through the agency of REC to State Electricity Boards. Since then, the Rural Electrification Corporation has sanctioned 109 schemes of the various State electricity Boards for a total amount of Rs. 4.5 crores envisaging extension of electricity to 10,460 Harijan Bastis adjoining the already electrified villages. So far 8,673 Harijan Bastis have been electrified under this programme and 787 Harijan Bastis are yet to be electrified.

5.77. The Committee also note that it is estimated that there are still about 8500 villages where street light has been provided in the main village, but it has not been extended to the adjoining Harijan Bastis and that after all the schemes sanctioned by the Rural electrification Corporation for extension of electricity to the Harijan Bastis adjoining electrified villages have been fully implemented, about 4500 more Harijan Bastis would still remain to be provided with street light facility.

5.78. The committee have been informed that the power supply could be extended to these remaining 4500 Harijan 'bastis' from the States' Annual Plan provisions made for Normal Developmet Works and/or Normal Rural Electrification Programme, and that the State Electricity Boards have been informed to take necessary action accordingly.

5.79. The Committee would have liked if the remaining 4500 Harijan 'bastis' had also been covered by REC under the programme of extending loan assistance to States on concessional terms. The Committee hope that Central Government would urge the States to provide enough funds in their Annual Plans so that all the Harijan 'bastis' are electrified within a short period.

(e) Committee on Rural Consumers' complaints

5.80. The Committee on Rural Electrification *inter alia* recommended that efforts should be made to remove the complaints of farmers about the procedures, terms and conditions, quality of service etc. and also for improvement of power supply in rural areas. The Rural Electrification Committee suggested that the recommendations of the "Committee on Rural Consumers' Complaints" should be adopted by the Electricity Boards without delay.

5.81. Asked to state whether recommendations of the Committee on Rural Consumers' Complaints have been adopted by Electricity Boards, and what are the benefits that have accrued to farmers as a result of acceptance of the recommendations of the said Committee, the Secretary, Ministry of Energy, during evidence, stated:

> "This Committee was a very high powered Committee and the report has generally been accepted by all the State Electricity Boards. This Committee went into the difficulties faced by the consumers. The report is very exhaustive and it covers technical matters like design of transmission, sub-transmission system, and matters of system improvements upon which will depend elimination of voltage fluctuation and interruptions. It also covers administrative matters and procedural matters concerning connections and priorities of connections. The report also covers matter of simplification in tariff procedures.
>
> "As far as power supply is concerned, there is no cut for agricultural consumers and pumpsets. But the matter of voltage supply and interruption is receiving continuous attention from the Ministry and we are monitoring this."

5.82. To an enquiry made by the Committee whether any attempt has been made to know from the consumers their difficulties in getting Connections, payment of bills and many other things, and through what media, the Secretary, Ministry of Energy stated:

> "At the level of Central Government, I do not think we have taken this matter."

5.83. The Managing Direcor, Rural Electrification Corporation clarified thus:

> "We have recently commissioned a study through a research Institute to find out the consumer response and what their difficulties are. They will be study the consumers problems." ..

5.84. Later the Ministry informed through their written note that the Kureel Committee had gone into the difficulties faced by rural consumers in connection with the electricity supply in the rural areas and had recommended remedial action to ameliorate these difficulties. Some of the important recommendations were:—

(i) All States should prepare long-term plan for transmission/sub-transmission/distribution networks taking into account the entire load development, rural, urban and other categories. The extension of new lines should be done accordingly to these plans and not in a haphazard way

(ii) The rural consumers should be apprised of the procedures and the conditions for taking electric connections and related formalities and should be advised regarding the location of their pumpsets which will help in the formation of cluster schemes, wherever possible.

(iii) Standardisation of the irrigation installations with reference to horse power of motors, command area, water lifting capacity along with a standard list of other equipment required.

(iv) Organisations for load promotion and other activities should be created by the State Electricity Boards or by any other development Department of the State Government. This would help in removing difficulties in the matter of services connections.

(v) The Boards should de-centralise the power of sanctioning estimates, incurring expenditure in connection with normal repairs, maintenance and break-downs in supply, preparing bills and receiving payments etc. They should

organise their Planning and Procurement Organisation to have better materials quality and inventory control.

(vi) The boards should try to reduce the time of completing the formalities for agricultural and other connections in rural areas. It would be worthwhile if suitable time limits are fixed for completing each formality and these are properly displayed.

(vii) The Boards should arrange to deliver the consumers' copy of agreement to him immediately on signing.

(viii) The Board should investigate the reasons for heavy voltage fluctuations in rural feeders and take corrective measures such as adopting standard equipment and construction practices, restricting the lengths of feeders, improving the voltage regulation of lines and installation of shunt capacitors etc. The Boards should arrange for quick replacement of burnt transformers so that heavy transformers do not get over-loaded for long durations.

(ix) The boards should frame simple tariff structures which should be easily understood by farmers.

(x) The Boards should ensure that the meters are read as per their time-schedule which should be notified. Spot billing would eliminate many such difficulties.

(xi) The boards should not purchase non-standard meters as most complaints appear to result from defective meters.

(xii) Cash Collection Centres should be located at places convenient to the consumers and their location reviewed from time to time.

5.85. The recommendations of the Committee were communicated to the State Governments in September, 1974 through a D.O. letter of the Deputy Minister of Irrigation and Power to the Power Ministers of the States. The State Electricity Boards were also apprised of the recommendations. The matter was, thereafter, pursued from time to time. Action for the implementation of various recommendations has been taken in a number of States. The information in this connection is summarised in the succeeding paragraphs.

5.86. As regards the preparation of long term plans for transmission, sub-transmission and distribution networks, action is being taken, among other States, in Gujarat, Haryana, Karnataka, Madhya Pradesh, Punjab and Bihar. In Tamil Nadu, a Master Plan has been

evolved for the rationalisation of the existing distribution net work. The State Electricity Boards in Gujarat, Haryana, Karnataka, Madhya Pradesh and Bihar have intimated that load promotional activities designed to formulate viable schemes have already been taken up. The Kerala State Electricity Board is rendering assistance to consumers and giving guidance in connection with obtaining of Loans and selection of pumpsets etc. Similarly, the question of the procedure for service connections being made easy is receiving attention of the Andhra Pradesh, Haryana, Orissa, Punjab, Gujarat, Karnataka, Madhya Pradesh, Tamil Nadu, Bihar and Kerala State Electricity Boards.

5.87. In regard to de-centralisation of the powers of sanctioning estimates, incurring expenditure etc., implementational steps are in hand in Himachal Pradesh and Bihar apart from Gujarat, Haryana Karnataka, Madhya Pradesh, Orissa, Punjab and Kerala. The Gujarat, Haryana, Karnataka, Punjab, Tamil Nadu Orissa, Bihar and Kerala State Electricity Boards have taken steps to reduce the time taken in completing the formalities for agricultural and other connections in rural areas. It has been intimated by the Electricity Boards of Haryana, Gujarat, Karnataka, Madhya Pradesh, Orissa, Tamil Nadu and Bihar that consumers' copy of the agreement is being delivered immediately after signing.

5.88. A number of State Electricity Boards have responded to the recommendation regarding prompt corrective action for frequent interruptions of supply and voltage fluctuations. The States have separately been advised to formulate viable schemes of systems improvement with a view, *inter alia,* to improving the quality of supply.

5.89. The Haryana, Karnataka, Himachal Pradesh, Orissa, Punjab, Kerala and Bihar State Electricity Boards have intimated that their tariff structures are simple and are easily understood by agricultural consumers. The Spot Billing systems are being followed by the Gujarat State Electricity Board and is being tried out in Haryana, Himachal Pradesh, Karnataka and Orissa. Spot Billing has also been introduced at certain places by the Bihar State Electricity Board. Action has been taken for locating Cash Collection Centres at convenient places by the Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Orissa, Punjab, Tamil Nadu, Bihar and Kerala State Electricity Boards. The Haryana, Tamil Nadu, Madhya Pradesh and Kerala State Electricity Boards are giving attention to complaints regarding energy meters.

5.90. While the implementation of the recommendations is essentially in the area of State Governments and State Electricity Boards, the Ministry of Energy have from time to time, been following up this matter with the States so that remedial action to resolve the problems of rural consumers is accelerated and has maximum coverage.

5.91. The Committee note that a high powered Committee named the 'Committee on Rural Consumers' Complaints' had gone into the difficulties faced by the rural consumers of electricity and made a number of recommendations for remedial action to mitigate the difficulties.

5.92. The Committee note further that the Report has been generally accepted by all the State Electricity Boards and many States have already initiated a number of measures in implementation of recommendations of the Committee on Rural Consumers' Complaints.

5.93. The Committee hope that the progress of the implementation of the recommendations of the Committee on 'Rural Consumers' Complaints' made by the State Electricity Boards would be monitored through periodical reports so that the difficulties faced by the rural consumers are removed and necessary assistance rendered.

Electricity Tariff

5.94. The Sub-Committee of Estimates Committee (1977-78) asked the Ministry of Energy to state:—

(i) the criteria laid down regarding the rates to be charged from various categories of consumers in rural and urban areas;

(ii) the difference, if any, in the rates charged from various categories of consumers, the reasons therefor; and

(iii) whether the electricity charges for agriculturists are reasonable and the transmission/losses etc. are not passed on to these consumers.

5.95. The Ministry of Energy in their note (December, 1977) have stated that the State Electricity Boards are empowered under Section 49 of the Electricity (Supply) Act, 1948 to fix tariffs for supply of electricity for various categories of consumers from time to time keeping in view, *inter-alia* (a) the nature of supply and the

purpose for which it is required; (b) co-ordinated development of supply and distribution of electricity within the State in the most efficient and economic manner with particular reference to development in areas not adequately served with electricity; (c) the simplification and standardisation of methods and rates of charges for such supplies; and (d) the extension of supplies of electricity to sparsely developed areas. Under Section 59 of the Electricity (Supply) Act, 1948, the Boards are required to carry on their operations and adjust the tariffs in such a manner as not to incur loss. In fixing tariffs, considerations emanating out of general policy of the State Governments, such as speeding up of agricultural development and augmenting employment opportunities are generally kept in view.

5.96. In view of the position stated above, under the provisions of the Electricity (Supply) Act, 1948, the Boards are enabled to have different tariffs for different areas having regard to various factors. The Electricity Boards have, however, framed generally uniform tariffs for both rural and urban areas, though it is usually much costlier to deliver power to rural areas. Also, the tariffs for agricultural purposes and for small scale industries are generally kept below the cost of supply with a view to encouraging consumption of electricity for agricultural purposes and for running small scale industries.

5.97. Some element of loss is inherent whenever electricity passes through transmission and distribution systems and the cost thereof is to be recovered from the consumers in the interest of the commercial viability of the Boards. The costs of extending power supply for agricultural pump-sets and rural areas are comparatively high because of the extensive distribution systems to be erected and the low density. Even so, the tariffs for agricultural consumers as mentioned earlier, are generally lower than for other categories of consumption.

5.98. The Sub-Committee further enquired the aggregate rate at which electricity is supplied to farmers in various States and the industrial units; and whether these include all kinds of charges, service charges, fuel charges and other charges; or they are realised separately; and the nature of such charges. The Ministry of Energy in their note (December, 1977) have stated thus:

> "The details of tariffs for agriculture, small industries and large industries in various States are given in the attached Statements (Appendix XIV to XVI) indicating the nature of the charges, such as, fixed charges, energy

charges electricity duty, fuel charges, minimum charges and other charges, wherever applicable. Another statement (Appendix XVII) indicates the available information in regard to the meter rentals levied by different State Electricity Boards for these types of consumers. All these charges are realised from the consumers together and not separately.

It may be stated that electricity tariffs for different classes of consumers are determined from time to time by the State Electricity Boards after taking into account the variations in the cost of generation and the cost involved in the operation and maintenance of transmission and distribution systems. While evolving such tariffs, the Boards normally keep in mind the socio-economic policies of the State. The load densities in the rural areas are low and long transmissions and distribution lines are often required to be laid for energisation of agricultural pump-sets and for small industries. Nevertheless, the electricity tariffs for agricultural purposes and small industries are often kept below the cost of supply so as to encourage consumption of electricity for agricultural purposes and for running small industries.

The tariff structure can be broadly classified into three categories, namely, (a) tariff related to the energy consumption, (b) tariff related to the installation or connected load, and (c) a combination of these two. For smaller installations, it is usual to have a simple tariff related to the energy consumption. However, for practical and economical reasons, some Boards have resorted to a fixed charge which is related to the horse power of the motor. This type of tariff is in force in Uttar Pradesh and Punjab for agricultural pump-sets. The advantage of this system is that the meter reading expenses are avoided and the scope of pilferage reduced. The disadvantage, on the other hand, is that the average rate payable by a consumer per unit of energy varies depending upon the usage of the motor and the availability of water in the wells.

The consumer is required to pay a minimum charge even when he does not consume any power and this charge is levied to enable the State Electricity Board to collect a part of the fixed charges which are incurred by it for extending the connections to the consumer and maintain-

ing the same. In addition, the consumer has to pay meter rent charges varying from Rs. 0.50 to Rs. 200 depending upon the type and size of the installation.

Where power is produced from thermal stations, the State Electricity Boards levy a fuel adjustment charge to recover any additional cost incurred by them towards the fuel used in the thermal stations or give credit to the consumers in case the fuel costs go down. The fuel adjustment charges are normally levied only on large industrial units as the administrative costs of including the fuel adjustment charges in respect of smaller consumers would be too high.

Apart from the charges to be paid to the State Electricity Boards, the State Governments also levy electricity duty on the power consumer. The level of duty varies from consumer to consumer, the general policy being that the duty levied on agriculture and small industries is either zero or nominal."

5.99. The position with regard to the tariff for agriculturists, small industries and large industries, as indicated in Appendices XIV to XVI is as follows:—

State	Agriculture	Small Industry	Large Industry
	Average Rate 5HP 10% LFP/ kwh. including electricity duty excluding full surcharges	Average (including electricity duty excluding fuel surcharge) 10HP 15% LFP/Kwh.	Average (including electricity duty excluding fuel surcharge) 1000 Kw 50% LFP /Kwh
1	2	3	4
	Paise	Paise	Paise
1. Andhra Pradesh	19·68	32	25·77
2. Assam	18·00	23	21·78
3. Bihar .	21·23	24	23·91
4. Gujarat	24·77	28·64	22·45
5. Haryana	23·68	24·15	19·28
6. Himachal Pradesh . .	10·00	19·03	16·06

1	2	3	4
7. Jammu & Kashmir . .	11·50	Kashmir 10.22	4.36
		Jammu 12.52	6.08
8. Karnataka	19.68	23.15	12.85
9. Kerala .	13.02	16.50	16.77
10. Madhya Pradesh	16.00	23.50	18.12
11. Maharashtra .	22.00	26	17.16
12. Meghalaya	14.00	18	16.13
13. Orissa	17.50	20.79	19.32
14. Punjab	12.50	22.20	19.39
15. Rajasthan	21.00	24.00	21.00
16. Tamil Nadu .	17.84	31.00	29.14
17. Uttar Pradesh	22.06	25.00	17.98
18. West Bengal .	38.00	32.33	23.17
19. DESU (Delhi) . .	21.00	23.00	25.90

5.100. The Committee note that the State Electricity Boards are empowered under section 49 of the Electricity (Supply) Act, 1948 to fix tariffs for supply of electricity for various categories of consumers from time to time keeping in view, inter alia **(a) the nature of supply and the purpose for which it is required; (b) co-ordinated development of supply and distribution of electricity within the State in the most efficient and economic manner, with particular reference to development in areas not adequately served with electricity; (c) the simplification and standardisation of methods and rates of charges for such supplies; and (d) the extension of supplies of electricity to sparsely developed areas. It has also been stated that under section 59 of the Electricity (Supply) Act, 1948 the Boards are required to carry out operations and adjust the tariffs in such a manner as not to incur loss. In fixing tariffs considerations emanating out of general policy of the State Governments, such as speeding up of agricultural development and augmenting employment opportunities are generally kept in view. It has been further stated that the Electricity Boards have framed generally uniform tariffs for both rural and urban areas though it is usually much costlier to deliver power to rural areas. The Ministry have also stated that the tariffs for agricultural purposes and for small scale industries are generally kept below the cost of supply with a view to**

encouraging consumption of electricity for agricultural purposes and for running small scale industries.

5.101. The Committee also note that according to the Ministry of Energy some element of loss is inherent whenever electricity passes through transmission and distribution systems and the cost thereof is to be recovered from the consumers in the interest of the commercial viability of the Boards and that the costs of extending power supply for agricultural pump-sets and rural areas are comparatively high because of the extensive distribution systems to be erected and the low density. The Committee were further informed that "even so the tariffs for agricultural consumers are generally lower than for other categories of consumption".

5.102. The Committee, however, find from the statements (Appendix XIV to XVI) furnished by Government that except for Kerala and Delhi, large industrial consumers pay less tariff for electricity consumption than the small industrial consumers. In states like Karnataka, Maharashtra, Uttar Pradesh and West Bengal, the difference in tariff is in fact as much as 10.30, 8.84, 8.2 and 9.16 paise per unit. The Committee also find contrary to the claim of the Ministry of Energy, that the tariffs for agricultural consumers are generally lower than other categories of consumption, the agricultural consumers in States like Gujarat, Haryana, Jammu and Kashmir, Karnataka, Maharashtra, Uttar Pradesh and West Bengal pay more tariff than the large industrial consumers. The Committee need hardly point out that if any real break-through is to be made in encouraging agricultural consumers to utilise electric energy for agricultural purposes, the present tariff schedules would have to be made reasonably economical for them. The Committee feel that it is high time that a review of the tariff charged by different State Electricity Boards for different categories of consumers is made, keeping in view not only the viability of the Boards but also the paying capacity of different categories of consumers. The Committee would like that such a re-appraisal is done at the earliest and new norms and guidelines evolved in regard to the electricity tariffs to be charged from different categories of consumers.

5.103. While the Committee appreciate that certain quantum of loss of power is inherent in the transmission and distribution and the cost of extending power for agricultural pumpsets is comparatively high, they are unable to agree with the view that purely on consideration of commercial viability of the Boards, the cost arising out of these factors should be passed on to the economically non-too

strong agricultural consumers. The Committee had already suggested earlier a re-appraisal of the electricity tariff. Such a review should also take into account, in the context of the need for giving impetus to agricultural growth, the extent to which, if at all, the cost of transmission/distribution as also transmission losses should be passed on to the agricultural consumers.

5.104. The Committee would also like to point out in this connection that while agriculturists need assured supply of power so that agricultural operations can go on unhampered, the picture that obtain today is different. The agriculturists depending on pumpset has to contend with frequent breakdowns of power supply and damage to motors due to violent fluctuations in voltage etc. The Committee, therefore, feel that merely energising of pumpsets without guaranteed supply of electricity will not inspire the agriculturists to go in for more pumpsets. The Committee hope that this matter would also receive an urgent consideration from the Central and State Governments and the power supply would be so managed that the agriculturists are assured of their minimum needs of power.

CHAPTER VI

PLANT, EQUIPMENT AND RAW MATERIAL

A. Capability of Indigenous Manufacturers of Plant and Equipment.

Capability of Indigenous Manufacturers of Plant and Equipment.

6.1. The Estimates Committee in paragraph 3.55 of their 39th Report felt that an assessment of the indigenous machine building and design capacities and the time required for fabrication and delivery should be made with a view to planning imports wherever indigenous capacity was not sufficient to meet the requirements.

6.2. Government in their action taken replies furnished in November, 1973 stated that a Committee of Ministers was appointed by the erstwhile Ministry of Irrigation and Power in July, 1972, with a view to assess the capability of indigenous manufacture of plant and equipment to meet the requirements of power development programme envisaged in the Fifth Five Year Plan. This Committee submitted its report in 1973.

6.3. The Ministry of Energy were asked to state the findings of that Committee and the measures adopted by the Ministry to achieve optimum coordination with the indigenous manufacturers of plant and equipment for development of power in the country.

6.4. The Ministry in their written replies stated that this Committee was set up to determine:—

(i) The adequacy of indigenous capacity for supply of power equipment to meet the time-bound generation programme in the Fifth Plan.

(ii) To examine the capability of the manufacturers to engineer and deliver the associate substance in a coordinated manner along with the main equipment.

(iii) To examine the practicability of the generation programme and preparedness of the project organisations, by

way of capability of project preparation and execution in conformity with the programme to suggest measures for improvement and ensuring success of the power plants.

6.5. The aforesaid Committee made a total of 47 recommendations, out of which the following important recommendations related to manufacture of plant and equipment:—

(i) For meeting a target of addition of 13 million KW thermal capacity during the Fifth Five Year Plan, M|s. BHEL, Hardwar, would be able to supply only 18 sets of 200 MW each against the requirements of 33 sets during the Fifth Plan. Uttar Pradesh State Electricity Board has been permitted in principle by Government to import 2x 200 MW sets for installation at Obra. Arrangements will, therefore, have to be made to procure 13 sets more of this rating from sources other than indigenous for adhering to the stipulated commissioning schedule during Fifth Five Year Plan. Thus a total capacity of 3000 MW (including 2 x 200 MW at Obra) completed with boilers and other auxiliary equipment will have to be procured from other than indigenous sources to meet the proposed target of Fifth Plan.

(ii) In view of the difficulties of indigenous manufacturers, and urgency for overcoming the power shortage as early as possible, it is recommended that thermal generating plants aggregating to 5 million KW capacity should be imported in 500 MW size. This action should be taken immediately so as to provide enough capacity for meeting the power requirements in the early years of the Sixth Plan period.

(iii) It has been seen that there is a gap of 2628 MW capacity between requirements and the availability of indigenous manufacturing capacity of hydro sets. 900 MW of this capacity is already under import for installation at Balimela, Lower Sileru, Iddiki and Kunda. Action will have, therefore, to be taken to procure 1688 MW of capacity. Out of this 301 MW and 452 MW have already been recommended for imports. Therefore, action has to be taken to procure remaining 935 MW capacity.

(iv) It is necessary to ensure that adequate capacity in manufacturing power transformers is established well in

advance to meet the total requirements of the Fifth Plan.

Procurement of sets of 200 MW each from sources other than indigenous Manufacturers.

6.6. The Ministry were asked to state the latest position in regard to procurement of 15 sets of 200 MW rating from sources other than indigenous suppliers. The Ministry in their written replies stated that the Committee of Ministers on Indigenous Plant and Equipment in June 1973 had envisaged installation of 21.2 million KW of additional capacity during the Fifth Plan period, out of which 13 million KW was thermal and the balance Hydro and Atomic. However, the draft Fifth Plan prepared in early July 1974 envisaged an addition of only 16.5 million KW during the Fifth Five Year Plan. In the final plan document, recently approved by the National Development Council, keeping in view the availability of the resources, the installation of additional capacity in the Fifth Plan has further been scaled down to 12.5 million KW out of which 7.3 million KW is thermal and the balance is Hydro|Atomic. There has thus been a reduction of 8.7 million KW of capacity from the original additional capacity taken by the Committee of Ministers for commissioning during the Fifth Plan. The Ministry further stated that there was thus no necessity of importing any generating plant for commissioning during the Fifth Plan 1974-75 to 1978-79.

6.7. Asked to state whether they were in a position now to have the timely delivery of the orders that were placed on BHEL, the Secretary, Ministry of Energy stated during evidence:

> "All commissioning contracts when they are initially fixed, are fixed keeping in view the delivery schedule as the BHEL will give."

6.8. Asked to state what action had been initiated to import 500 MW unit size thermal generating sets referred to by the Committee of Ministers the Secretary, Ministry of Energy, during evidence stated:—

> "The imports were not necessary because programme itself was cut down compared to original one. Quantitatively, that much of import was not necessary.....The Government decided to set up 500 MW sets instead of importing them. So the urgency which was noticed at that time is

not there. We are meeting the requirements by installing more of 200 MW sets. In the meantime, with our concurrence, the BHEL has gone in collaboration with a German firm for manufacture of sets with larger capacity."

6.9. Enquired by the Committee as to when they would be able to manufacture and install the first 500 MW set, the Chairman, Bharat Heavy Electricals, during evidence stated:—

"If the decision is taken now for the installation of the first 500 MW set, I expect that sometime in the second half of 1981 that unit should be operating. Consistent with the general time schedule obtaining anywhere in the world, it will be a very attractive time schedule."

6.10. The Committee enquired the progress made by indigenous manufacturers for supply of plant and equipment. The Chairman, Bharat Heavy Electricals Ltd. during evidence stated:—

"In the last 10 years we have developed skills and manufacturing facilities at Bhopal, Hardwar and Hyderabad for heavy power equipment required for generating stations based on thermal hydro and nuclear energy.

When the skills are fully developed and factories manned, we should be able to provide equipment annually to the tune of 4500 MW. We have reached that stage now.

It is true that during the 4th Plan period, there were complaints of delays, but then the manufacture in these plants had just started. There was an attempt to fulfil the targets, but here and there we did fail to meet the delivery requirements, but that situation has now changed. We have now stabilised production in all these plants. We have developed skills and indigenous capability for not only designing the products but for manufacture and erection also. To-day we do not have any major complaint relating to delivery. There may be minor lapses here and there, but by and large we have been able to maintain whatever we have promised in the matter of delivery of equipment in the 5th Plan.

Out of this 4500 MW which is our capability to-day, we have been generally able to complete the supplies of turbine generators with matching boilers for all thermal stations. The maximum annual out put reached so far is 3400 MW.

That is strictly related to the orders that we have received. This year we are scaling down to less than 3000 MW as we expect that in the next three or four years the commissioning of the new power plants would be only around that level. We are, therefore, fully equipped to meet the requirements for sustaining a programme of this type.

The Committee, can take note of the fact that the indigenous manufacturing plants have come of age and will be in a position to meet the requirements anticipated in the next 5 or 10 years. We are continuously keeping in touch with the Ministry of Energy in the Department of Power. To the extent there are any changes in their requirements, we are re-adjusting our programme of production to suit the requirements of the various State Electricity Boards. To the extent, nuclear power development takes place, we are gearing ourselves to meet their requirements."

6.11. Enquired by the Committee if there were any items which had to be imported in regard to these power projects, or they could supply all items at present, the witness stated:—

"Qualitatively I would say we are in a position to totally supply all the equipment needed in the country. We have the means to do it, the facilities and the trained manpower necessary. Here and there, there are certain areas where imports cannot be totally avoided.

For example, Government is examining the installation of a gas turbine for meeting certain immediate problems in the Maharashtra and other places. We are not to-day equipped to manufacture them. However, with reference to the urgency, we are trying to get into the business to see that the requirements are imported and in the process acquire as much know-how as possible, so that at a later stage we can meet this demand. In the case of reversible pump-turbines, the demand is few and far between, and that is why we gave it a lower priority. Some imports were necessitated recently in the case of Nagarjnasagar. Except these rare cases, I would say we would be able to meet the total requirements of the power equipments needed by the country. I do not see any reason why even after 5 or 10 years we should run into difficulties."

6.12. The Committee enquired whether adequate manufacturing capacity of transformers has been built up in the country to meet

the total requirements of the Fifth Plan, as recommended by the Committee of Ministers on Indigenous Plant & Equipment, the Chairman, Bharat Heavy Electricals during evidence stated:—

> "As regards power transformers, particularly the large power transformers, they are manufactured not only by the BHEL —we cover only 40—50 per cent of the market but there are others also who manufacture these transformers. The TELK in Kerala, the NGEF in Bangalore, the Crompton Greeves in Bombay are some of the firms with whom we compete. Talking on behalf of the industry as a whole, I believe the capacity is available between the BHEL and other units which can take care of the total requirements of power transformers in the country. Anticipating that the Fifth Plan and the Sixth Plan requirements will be much higher, we have set up at Jhansi a new transformer factory which will take care of transformers upto 100 MVA capacity, leaving the Bhopal unit to take care of larger transformers. With the additional augmentation what we have made by installing a new plant at Jhansi and also by rationalising the product-mix, the capacity of the BHEL itself is going to be very high. In association with other companies which have all been licensed to go upto 400 KV transformers, I believe, there should be no apprehension about meeting the requirement of transformers in the country."

6.13. The Ministry also informed the Committee that there was sufficient manufacturing capacity indigenously for the manufacture of power transformers for the Fifth Plan requirements. M|s. BHEL has set up a manufacturing plant at Jhansi in UP. for the manufacture of power transformers to meet the future requirements.

6.14. The Sub-Committee of the Estimates Committee (1977-78) sought clarifications on the following points:—

(i) the indigenous capacity to manufacture power plants, and the highest capacity produced so far;

(ii) in case of Super Thermal Power Plants, whether the plants of the required capacity would be indigenously produced or would have to be imported;

(iii) if it is necessary to import, what would be the amount of foreign exchange involved, and the countries from which they are to be imported.

The Ministry of Energy in their note (December, 1977) have stated that Bharat Heavy Electricals Ltd. manufacture the complete range of power plant equipment *i.e.* hydro turbines and generators, steam turbines and generators, steam turbosets for nuclear power plants, and boilers along with boiler house auxiliaries. ACC-Vickers Babcock Ltd. at Durgapur also manufacture boilers for power generation.

6.15. With the present capacity, power plant equipment with total generating capacity varying from 4000 MW to 5000 MW (depending upon the mix of various unit ratings) can be produced within the country.

BHEL has so far manufactured thermal power plant equipment for unit ratings upto 210 MW capacity and is gearing up to manufacture 500 MW sets, the next higher unit ratings selected for India's power grid. Sets of 200 MW and 500 MW capacity are proposed to be installed in Super Thermal Power Plants.

6.16. National Thermal Power Corporation's current projects are partly financed by credits from the International Development Association. As such, the procurement of equipment will be by international competitive bidding and therefore, it is not possible to specify the actual source of supply. In case the lowest acceptable bid is of a foreign supplier, the foreign exchange component will be largely covered by the IDA credits.

6.17. It is therefore considered that the country is self-sufficient in production of generating equipment. However components will have to be imported by manufacturers. Small hydro sets, gas turbines and odd thermal sets may have to be imported. No firm estimate are available for these.

Steering Committee to review the performance of indigenous Power Plants and Equipments

6.18. The Committee were also informed by the Ministry of Energy that they ensure optimum co-ordination with indigenous manufacturers by having one of their Joint Secretaries in the Board of Directors of BHEL and Instrumentation Ltd. Kota and inter-acting with the Ministry of Heavy Industry through the Development Council set up by that Ministry for the purpose of technology development as well as standardisation and optimisation of plant and equipment etc. Also a high level meeting with the representatives of M/s. BHEL, Instrumentation Ltd. Kota and of power stations

with units of BHEL manufactures was taken by the Minister of Energy in December, 1974. It was decided that a Standing Committee be constituted consisting of representatives of the BHEL, CEA, Department of Coal and Instrumentations Limited, Kota. Accordingly a Standing Committee was constituted under the Chairmanship of the Member (Thermal), CEA to review the performance of the indigenous power plants.

6.19. The Ministry were asked to state whether the Standing Committee had undertaken the review of the performance of the indigenous power plants and equipment. It was stated that the Committee had been reviewing continuously the performance of indigenous power plants and equipment commissioned in the recent past. It had studied in depth, units commissioned upto December, 1974. The problem areas were identified and plans of action were drawn up identifying the role of BHEL, Instrumentation Ltd. and C.E.A. of improving the performance of those units. As a result of these studies, and efforts of the Standing Committee, the performance of stations like Badarpur, Kothagudam, Faridabad, Bhatinda etc. have shown considerable improvement.

6.20. The Estimates Committee had in their 30th Report expressed the view that an assessment of the indigenous machine building and design capacities and the time required for fabrication and delivery should be made with a view to planning imports, wherever indigenous capacity was not sufficient to meet the requirements of power development programme. The Committee were informed that Government had appointed a Committee of Ministers with a view to assessing the capability of indigenous manufacturers of plant and equipment to meet the requirements of power development programme envisaged in the Fifth Plan. The additional capacity for the Fifth Plan 1974-75 to 1978-79 then envisaged was 21.2 MKW.

6.21. The Committee observe that to meet the envisaged additional capacity of 21.2 MKW, the Committee of Ministers on Indigenous Plant and Equipment made a number of recommendations, which inter alia included import of equipment of various sizes viz. 200 MW unit sizes and 500 MW unit sizes. The Committee were informed during evidence that consequent on scaling down of the targets of additional capacity during the Fifth Plan period (1974-75 to 1978-79), from 21.2 MKW to 12.5 MKW, the indigenous manufacturers of plant and equipment were capable of meeting the requirements of the Fifth Plan (viz., 1973-74 to 1978-79) and there would be no necessity of importing any generating plant or equipment during this period.

6.22. The Committee also note that the capacity available with BHEL and others in private sector would take care of the total requirements of power transformers in the country during the Fifth Plan (1973-74 to 1978-79) period.

6.23. The Committee have been informed that with the present capacity, power plant equipment with total generating capacity varying from 4000 MW to 5000 MW (depending upon the mix of various unit ratings) can be produced within the country. The Committee hope that the equipment manufactured within the country incorporates the latest technology for the most efficient and economical generation, transmission/distribution of power. The Committee would also like the Governments to ensure that the manufacturers supply the required equipment according to the stipulated schedules so that there are no delays in erecting and commissioning of the power plants which, apart from delayed supply of power, result in avoidable escalation of costs. The Committee have also referred to this aspect elsewhere in the Report.

6.24. In order to review the performance of indigenous Power Plants, a Standing Committee has been constituted, consisting of the representatives of Central Electricity Authority, Bharat Heavy Electricals Ltd., Instrumentation Ltd., Kota, and others. This Committee has been reviewing continuously the performance of indigenous power plant and equipment commissioned in the recent past. It had studied in depth, units commissioned upto December, 1974. As a result problem areas have been identified and plans of action drawn up, identifying the role of BHEL, Instrumentation Ltd., Kota, and the CEA to improve the units. The Committee learn that as a result of such a review and the efforts of the Standing Committee, the performance of certain Power stations has show considerable improvement. The Committee would urge that this Standing Committee should cover all the power Stations within a time bound programme so that the optimum performance of all the existing power plants is ensured and break-downs in power supply are eliminated.

B. Supply of Coal/Fuel for Thermal Power Stations

Supply of Coal for Thermal Power Stations.

6.25. The Committee in paragraph 3.104 of their 39th Report observed that with large power stations, each requiring at least 2 to 5 full train loads of coal everyday, the methods of mining loading and unloading as well as transport would have to be revolutionised, introducing the latest modern techniques for efficiency and economy.

Unit trains, from specified mines for the power stations might become essential feature of the future set up. The Committee suggested that Government should carefully consider the administrative machinery and organisation for catering to these requirements and initiate advance action for these developments.

6.26. Government in their action taken replies stated that improvement in the methods and scale of operation of coal mining was already under careful consideration of the Department of Mines and the different agencies set up and exhaustive studies were being made for meeting the large coal requirements in the Fifth Plan. The question of improving the loading and unloading methods in regard to coal was under active consideration. A study team had gone into the problems of rationalisation of coal loading in the Bengal/Bihar fields, particularly in the Raniganj area, where the possibilities of grouping of the large number of small collieries into economic units for loading purposes had been gone into. Similar surveys for the Jharia field and the Karanpura field were also being finalised. With the nationalisation of the coal mines, the possibility of consolidation of loading arrangements would be gone into in great detail and suitable methods would be evolved for maximising output. The railways were keen on loading of coal in block trains at one single point and carrying the same to the one single unloading point leaving the distribution on therefrom to be arranged by the State Government or any other recognised agency. This block-rake movement would improve the wagon turnround and the availability of wagons for the movement of coal to industries, power houses, steel plants etc.

6.27. The Government also stated that all major power houses which were being set up in future would be having either tippler arrangements or underground hopper arrangements. This would enable the power house to release the BOX trains in the quickest possible time so that the same might be returned to the coal loading points without delay for further loading.

6.28. The Ministry of Energy were asked to state the results of the study undertaken by the Study Team which went into the problems of rationalisation of coal loading in the Bengal/Bihar Fields, particularly in the Raniganj area and the improvements made in the loading and unloading methods in regard to coal. The Ministry in their written replies stated that the Ministry of Railways had appointed three teams for studying the rail transport facilities required for the movement of coal during the Fifth Plan. The task allotted to each of these teams was as follows:—

(i) To prepare a short term plan for rationalisation of coal loading arrangements in the Bengal-Bihar coal fields;

(ii) To assess the Fifth Plan requirements of rail transport of coal and the facilities required in the Bengal-Bihar coalfields.

(iii) To assess the Fifth Plan requirements and facilities for rail transport of coal in the outlying coalfields.

6.29. The reports of these teams were made available to the Government during 1973-74. They were examined in detail in the Department of Coal in consultation with the coal producing organisations who had a series of meetings with the zonal railways to discuss various suggestion contained in the reports.

6.30. The most important recommendations contained in the rationalisation report was reduction in the number of loading points in the Raniganj and Mugma Coalfields from 379 to 86. After examination of this recommendation with reference to the actual conditions the Coal Mines Authority Limited (now Coal India Limited) came to the conclusion that reduction of 121 was possible. The view was accepted by the Railways and work has been proceeding accordingly. At some of the loading points, it involved remodelling of the sidings and the work has been in progress.

6.31. The other recommendations for rationalisation included the installation of weighbridges and bunkers and avoiding the splitting of rakes. It was felt that the recommendation for installation of bunkers needed further examination of the pilot and depot capacities and its success depended on assured supply of rakes at fixed interval of time. It was also not clearly established that the substantial expenditure on bunkers and mechanised loading would be justified by the resultant reduction in wagon turnround time. Hence, it was felt that mechanisation of loading arrangements may be confined to collieries producing over 25,000 tonnes per month. The number of splits* in a rake has also been drastically reduced from an average of 7 to an average of 5 in the Raniganj coalfields. As a result of various measures taken by the coal industry, it has been possible to load 88 per cent of coal in rakes in 1974-75 as against 70 per ment in 1972-73.

6.32. The action taken on some of the important recommendations is indicated below:—

(i) Proposals regarding expected distribution of coal to

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* The train formed by a number of railway wagons used for movement of coal by rail is called a rake. A rake may consist of 50 to 75 wagons depending upon the facilities of coal loading, distance to be moved etc. As it is not always possible to load a full rake at the collieries at a time, it is generally split into a number of groups of wagons. For example if a rake consists of 55 wagons then it can be split into 5 groups of 11 wagons each to facilitate the placement and loading of these wagons at the rail sidings of these collieries. This is called "splitting of rake".

different destinations and the creation of additional facilities for such movement have been agreed to in general.

(ii) The suggestion to replace 60 ton weigh-bridge by 100 ton weigh-bridge in some collieries has been agreed to.

(iii) While in general it has been agreed that 100 ton weigh-bridge should be installed at the major coal loading points, it has been stipulated that this may be, given effect to in the case of loading points from which normally more than 10 rakes are despatched in a month.

(iv) As against a proposal made by the Railways to reduce prevailing 340 loading points in Raniganj area to 77 loading points, a reduction of loading points to 121 has been agreed to and implementation work is being carried out.

(v) The immediate change over from manual loading to mechanical loading of wagons may not be possible in most cases as it involves retrenchment of existing workmen. Mechanical loading is, however, being planned in nearly 1000 collieries which would result in considerable reduction in loading time.

(vi) The construction of bunkers and mechanical loading arrangements at the loading points can be undertaken where essential only in a phased manner due to huge capital investment, displacement of labour and high magnitude of work involved.

(vii) The details of siding layouts will have to be gone into depending upon the topographical conditions, position of under-ground workings, built up areas etc.

(viii) The proportionate cost to be borne by the Railways and Coal India Limited would be determined after the estimates are available.

(ix) The proposal to increase the tele-communication facilities has been fully agreed to.

Coal Linkage Committee

6.33. The Minstry of Energy in their written replies also inform that on a matter of supply of essential materials, the power industry has been assigned priority next to Defence. A coal Linkage Committee is functioning with a view to ensure supply of adequate quantity of suitable coal for the Thermal Stations.

6.34. Asked to state the constitution, functions and terms of reference of the Coal Linkage Committee and how it maintains coordination in its functioning with various Ministries of the Government of India and State Government in the matter of supply and movement of coal from pitheads to the Thermal Power Stations, and whether any difficulties have been experienced in this behalf, the Secretary, Ministry of Energy, during evidence stated:

> "The Chairmanship of the Committee is with the Department of Coal, and there are members from the CEA and Railway Board and from Coal India. The functions of this Committee are to review from time to time the coal requirements of the existing thermal stations and also to suggest new stations to be put up and the linkage to be established.
>
> It was set up in January, 1973. It is an executive body; it is not as though it makes its report and then disappears. It is a standing Committee which deals with all matters of the same type for all new stations.
>
> I have suggested to the Secretary (Coal) that we should review its functioning and he has also agreed. But since this is his department, he will do the first exercise and we will then join them."

6.35. Asked to state whether timely supply of coal of the specified quality is ensured to thermal power stations, the Secretary, Ministry of Energy, during evidence on 28-12-1976 stated:

> "The position is all right now. I was referring to the quantity side of it and not the quality side about consistency etc., which are under constant scrutiny by the Linkage Committee. But now the supply position is extremely satisfactory, though Coal India would like to stock a little more."

6.36. Asked by the Committee as to how it is ensured to supply a particular type of coal needed for a station, the witness stated:

> "At the moment an exercise is going on bilaterally between Coal India and the various power stations for entering into a formal agreement, preferably of a long term type so that there can be a commercial binding of the delivery dates and so that certain quality can be ensured. At the moment, there is scope for dispute; Coal India Limited says if you don't lift what we want you to lift, we will

penalise you, while the others are saying if you don't give us the quality we want, we will penalise you. So this is under discussion for the purpose of having a more established system of covering the requirements which will be better both in regard to quality and quantity."

6.37. Asked to state whether allotment of wagons for haulage of coal was creating any bottlenecks for efficient performance of coal based—Thermal plants, the Secretary, Ministry of Energy during evidence stated:

"It is not so now."

6.38. The Ministry of Energy were asked to state the steps taken or proposed to be taken to find out a solution to the bilateral dispute between the Coal India Limited and the Power Stations to ensure timely supply of coal qualitatively and quantitatively, so as to avoid any disruptions of power supply to the consumers, the Ministry in their written note later have stated that a Linkage Committee exists to link definite collieries to a power station. The linkages of coal to the various power stations are reviewed by the Coal Linkage Committee every three months, wherein the quantities and quality of coal linked are discussed and finalised. In addition to this, the Central Electricity Authority and the Railway Board keep a constant watch on the movement of coal from the collieries to the power stations to ensure that adequate quantities of coal are available at all the power stations to meet their requirements. Wherever, there are persistent reports of poor quality of coal being supplied to the power stations, the matter is taken up by the Central Electricity Authority and the Department of Power with the Department of Coal and Coal India Ltd. to sort out these problems. Contracts for supply of coal between the sellers and the buyers will also regulate the supply of coal.

System study to determine the economics of rail-cum-sea movement of coal.

6.39. In regard to the recommendation of the Estimates Committee contained in para 3.104 of their 39th Report, Government in their action taken replies *inter alia* stated stated that in view of the very large increase in the requirements of rail transport for coal, proposals were being worked out for supplementing rail transport by coastal shipping. This would make Bengal-Bihar coal available to coastal power stations readily.

6.40. The Ministry of Energy were asked to state the outcome of the proposals for supplementing rail transport by coastal shipping in order to make Bengal-Bihar coal readily available to coastal power stations. That Ministry through their written replies have informed that a System Study has been made to determine the economics of rail-cum-sea movement as against all-rail movement for the transportation of coal from the Bihar-Bengal coal fields through Haldia to Madras, Tuticorin and Trombay Thermal Stations. The study shows that rail sea route is likely to be more economical. Action has been initiated to imlement their recommendations of the study in respect of Madras and Tuticorin for the present, pending decision about the location of a 500 MW Thermal Station at Trombay.

6.41. Asked to state what freight structure has been devised for transportation of coal by rail-sea route from coal fields to Madras and Tuticorin, how does it compare with all rail movement of coal, and what steps have been taken to ensure regular transportation of coal through this route, to avoid any difficulties in the generation of power by Madras and Tuticorin Thermal Power Stations, the representative of the Ministry of Shipping and Transport during evidence stated:

> "A system study has been carried out for the movement of coal to the three thermal stations at Tuticorin, Madras and Bombay. This study on movement of coal from the coal fields to the consumer points includes rail movement, loading at the ports, sea transport, unloading at the recipient ports and movement from the recipient ports to the thermal stations. This study has shown that if a proper system is adopted—that is, if a suitable type of ship is used and a proper system of loading and unloading is adopted and a proper system of movement of coal to the thermal stations is also adopted, the average cost of transportation of coal to these three stations can compare very well with rail movement and will, in fact, be cheaper. The study has shown that we will need approximately 35000 DWT vessels which can be loaded at Haldia. These vessels will be a self-unloading type—that is, they can unload with their own cranes and derricks. From the unloading points, with the help of a conveyor system or with the help of road transport, coal can be moved to thermal stations. A complete rail system from Raniganj to Haldia has been built already and its capacity is 3.5 million tons per annum. At the Haldia port, a fast coal loading system of 3000 tons per hour has been developed.

It can deal with ships of the standard size. The ships can then be unloaded at Madras and Tuticorin. In Madras, the berth is already available; only some mechanical unloading facility has to be provided. In Tuticorin, a berth has to be installed. A total view has been taken of the whole system, available in accordance with the schedules which are set for these thermal stations."

6.42. Asked by the Committee as to when these provisions would be available for a regular sea-rail movement, the witness stated:—

"At the loading point at Haldia, plant has been erected already. As soon as the port is opened, which is expected to be by 15th February, 1977, the loading systems can start. Acquisition of these ships is not a difficult proposition. These are available. Standard sizeships are available and can be procured as second-hand vessels within six months or new vells in about 18 months time. At Madras the berth is already available; only certain mechanised facilities are to be provided. They can also be completed in one year to 18 months. The only longer duration involved is in the case of Tuticorin where a berth has also to be built. The case is now under consideration with the Government, and as soon as it is sanctioned, it can be taken up; the estimated time for completion of that is three years.

The Tuticorin Thermal Stations is expected to be commissioned by March, 1979. At that stage the self-unloading ships will be able to unload on the other berths which are already in existence, and provision for loading of the unloading coal into a road transport is also being made. That is an interim arrangement that is being made till the full system with conveyers which will directly take the coal to the thermal station comes into being three years from now."

6.43 Asked to explain about the comparative freight headness between the all-rail and rail-sea movement of coal, the witness stated:—

The exact freight is a function of supply and demand. Freights keep on fluctuating. Based upon the actual investment involved and allowing for suitable return on the investment of capital, and all other capital charges,

It has been assessed that the cost of transportation of coal from Bihar-Bengal coal fields, including rail, will be Rs. 75 for Madras when the quantity is less and it may go down to Rs. 68 when the quantity is increased to full capacity, as against the present all-rail cost of Rs. 88 per tonne.

For Tuticorin, the present all-rail cost is Rs. 125 - per tonne and the estimated cost on the total system will be Rs. 107 when the quantity is less and will come down to Rs. 86 when the quantity goes up. This is an estimate based upon the capital costs. The actual freight, will be governed by the market situation at that time."

6.44. The Ministry of Energy were asked to state the steps that have been taken to provide mechanised loading at Madras, and to provide berth as well as mechanised loading at Tuticorin; and the probable time-schedule by which these provisions would be fulfilled. The Ministry in their written note later have stated that it is planned to provide mechanised handling facilities on one of the existing berths at Madras and a separate coal berth with mechanised handling facilities at the port of New Tuticorin. It has been estimated that the facilities would cost Rs. 1.55 crores for Madras and Rs. 11.50 crores for the port of New Tuticorin. In case of Tuticorin Port the responsibility of the Port is to provide a jetty for berthing of vessels at an estimated cost of Rs 4 crores and the coal handling system is to be provided by Tamil Nadu Electricity Board.

6.45. The Ministry while furnishing the information in March, 1977, further stated that a note for acquisition of second hand bulk cargo vessels of 35000 DWT and to initiate action for setting up the shore facilities at Madras and Tuticorin at an estimated cost of Rs. 5.50 crores has been prepared and is under circulation prior to placing before Public Investment Board for approval. The detailed project report for the shore facilities at Madras would be prepared after the clearance of the proposal by Public Investment Board.

6.46. M|s. Tata Consulting Engineers have been engaged by Tamil Nadu Electricity Board as their Consultants for the design of coal handling system at Tuticorin. The consultants are finalising the design of handling system from the jetty right upto the coal bunkers.

6.47. Shore facilities at Madras is planned to be completed by 1980. In case of Tuticorin, the thermal station is expected to be

commissioned by 1979 where-as the coal jetty and handling system is programmed to be completed by 1980. During the intervening period, interim facilities for handling coal at Tuticorin in one of the existing berths have been sanctioned and are being implemented to meet the coal requirements. These are expected to be ready before the commissioning of Thermal Station.

6.48. The Sub-Committee of Estimates Committee (1977-78) enquired about the latest position regarding acquisition of second hand bulk cargo vessels at an estimated cost of Rs. 5.50 crores for movement of a coal for Madras, Tuticorin. The Ministry of Energy in consultation with the Ministry of Shipping and Transport (Transport Wing), have in a note (December 1977) indicated the position as under:—

(i) Subsequent decision taken in the Department of Coal has ruled out the possibility of coastal movement of coal through the Madras Port. Thus movement of coal by the coastal route is now required to be done only to the Port of New Tuticorin. The primary requirement at Tuticorin is for the thermal station being set-up by the State Electricity Board. While the Port is to provide berthing facilities for the coal vessels in the harbour, the facilities for conveying the discharged coal are to be made by the Tamil Nadu Electricity Board. The present indications are that the facility would become operational in early 1980. The requirement of coal as projected for the thermal plant shows it to increase from 0.10 million tonnes in 1978-79 to 1.10 million tonnes in 1982-83. In terim facilities have been provided at one of the existing berths in the port mechanised facility is completed.

(ii) Since in the present market conditions it is possible to acquire vessels, particularly secondhand vessels, at short notice and other alternatives such as conversion of existing vessels, were being considered for the carriage of coal, it was decided to prepare in EFC paper which has now been circulated for the construction of a coal jetty at the Port of New Tuticorin.

(iii) In the light of the position indicated regarding availability of vessels for the movement of coal at short notice, the Tamil Nadu Electricity Board have been advised to initiate a dialogue with the Shipping Corporation of India, regarding their requirement of coal in the interim

period as well as in the final stage when the mechanised facility at Tuticorin is completed for entering into a long term agreement. The Tamil Nadu Electricity Board has already started discussions with the Shipping Corporation of India in this regard.

6.49. The Committee in their earlier Report had recommended that keeping in view the requirement of coal for large power stations, the methods of mining, loading and unloading as well as transport would have to be revolutionised introducing the latest techniques for efficiency and economy. The Committee were informed that for studying the rail transport facilities required for movement of coal during the Fifth Plan (1974-75 to 1978-79), the Ministry of Railways appointed three teams and the task allotted to each of them was as follows:—

(i) To prepare a short term plan for rationalisation of Coal loading arrangements in Bengal-Bihar coal fields;

(ii) To assess the Fifth Plan requirements of rail transport of coal and the facilities required in Bengal-Bihar coal fields;

(iii) To assess the Fifth Plan requirements and facilities for rail transport of coal in the outlaying coal fields.

6.50. The Committee note that the following important measures have been initiated as a result of the recommendations of the study teams:—

(a) The number of loading points in the Raniganj and Mugma coal fields is being reduced from 379 to 121 and the work is in progress.

(b) Mechnisation of loading arrangements is to be confined to collieries producing over 25,000 tonnes per month, and is being planned in nearly 1000 collieries.

(c) The number of splits in a rake is to be reduced from average of seven to an average of five in the Raniganj coalfields.

(d) Weighbridges of 60 tonnes is to be replaced by 100 tonnes at major coal loading points where loading was more than 10 rakes a month.

6.51. The Committee have also been informed that in the allotment of wagons for haulage of coal to thermal stations at present there are no bottlenecks and that the supply position is 'extremely satisfactory'.

6.52. The Committee, however, find that in the matter of supply of coal of a particular type to a particular thermal power station, there is still scope for improvement and that an exercise is going on bilaterally between Coal India and the various Power Stations for evolving final agreement, preferably on a long term basis, so that there can be a commercial binding on the delivery dates and a certain quality is ensured. The Committee also note that the coal Linkage Committee reviews the linkages of coal to various Power Stations every three months wherein the quantities and qualities of coal are discussed and finalised. In addition the Central Electricity Authority and the Department of Power also take up the matter wherever there are persistent reports of poor quality of coal being supplied to the power stations. The Committee need hardly emphasise that for efficient and economical generation of power in the coal based thermal stations and to avoid shut-downs, it is necessary that the requisite quality of coal is supplied. Now that there are no bottlenecks in adequate supply of coal to the power stations, the Committee trust that the Coal Linkage Committee would give greater attention to this aspect while reviewing the linkages of collieries to the power stations and ensure that no complaints regard to the quality of coal arise. The Committee also hope that the exercise undertaken for entering into formal agreement for a commercial binding in regard to delivery dates and for ensuring supply of coal of a certain quality would be completed expeditiously so that there are no difficulties in regard to the timely supply of coal in adequate quantity and of requisite quality.

6.53. The Committee note that a system study had been made to determine the economics of rail-cum-sea movement of coal as against all rail-movement of coal for the transportation of coal from the Bihar-Bengal coalfields through Haldia to Madras, Tuticorin and Trombay Thermal Stations. According to this study, the Committee note that if suitable type of ship is used and proper system of loading and unloading is adopted, the average cost of transportation of coal to these stations would not only compare very well with rail movement but would in fact be cheaper. The cost of transportation of coal by rail-cum-sea route from Bihar-Bengal coalfields to Madras has been estimated as Rs. 68 per tonne as against Rs. 88 by all rail route. Similarly as against the present all rail cost of Rs. 125/- per tonne

for Tuticorin, the rail-cum-sea transportation charges are estimated to come down to Rs. 86 per tonne.

6.54. The Committee were earlier informed that necessary action for acquisition of second hand bulk cargo vessels of 35000 DWT and for providing shore facilities at Madras and Tuticorin by 1980 at an estimated cost of Rs. 5.50 crores had been initiated and was awaiting approval of the Public Investment Board. In a later note (December, 1977), the Committee have been informed that subsequent decisions taken in the Department of Coal has ruled out the possibility of coastal movement of coal through the Madras Port. Thus movement of coal by the coastal route is now required to be done only to the Port of New Tuticorin. Interim facilities have been provided at one of the existing berths in the port till mechanised facility is completed. As regards acquisition of large vessels the Ministry have informed (December, 1977) that since in the present market conditions it is possible to acquire vessels, particularly second-hand vessels, at short notice and other alternatives such as conversion of existing vessels, were being considered for carriage of coal, it was decided to prepare an EFC paper which has now been circulated for the construction of a coal jetty at the Port of New Tuticorin.

6.55. The Committee are unable to appreciate in the absence of detailed statement of reasons, the decision taken in the Department of Coal, ruling out the possibility of coastal movement of coal to Madras Port, though it would appear that advance action for such movement of coal was initiated and proposals were awaiting approval of the Public Investment Board. The Committee would like to be apprised of the difficulties leading to the giving up of movement of coal to Madras Port to feel the thermal stations. As regards the movement of coal to the Port of New Tuticorin, the Committee would like Government to make concerted efforts in close coordination with State Government of Tamil Nadu to ensure that the necessary facilities are available at the New Port of Tuticorin in time so that there is no bottleneck in the coastal movement of coal to that Port affecting the commissioning schedule of the Thermal Power Station being set up at Tuticorin.

CHAPTER VII

NUCLEAR POWER DEVELOPMENT

Role of Nuclear Power and its development

7.1. Nuclear power generation in India was started in 1969 with the commissioning of nuclear power station at Tarapur with an installed capacity of 420 MW. The present installed capacity in nuclear power stations is 640 MW. Contribution from nuclear generation is about 3 per cent of the country's total generation at present. The total installed capacity from the nuclear generation was expected to be *1330 MW at the end of the Fifth Five Year Plan (1978-79), as stated in the Annual Report of the Ministry of Energy for 1975-76.

7.2. Asked to state the role envisaged for atomic power stations in the Fifth Five Year Plan, the Secretary, Ministry of Energy, during evidence on 28 December, 1976 stated:

> "There was a Fuel Policy Committee which went into the question of various options for electricity—hydro, thermal and nuclear. They have given a kind of perspective going upto 1985 or 1990-91, the capacity envisaged for different segments of the power industry. For nuclear the target is **8,000 MW. So far as the Fifth Plan is concerned, we have two units at Tarapur. There is one in Kotah and if the second unit comes into being by March, 1979, it will also become part of the Fifth Plan."

7.3. The following nuclear power stations are at present under construction:

Rajasthan Atomic Power Station (Near Kotah)	2x220 MW
Madras Atomic Power Station (Near Kalpakkam)	2x235 MW
Narora Atomic Power Station (U.P.)	2x235 MW

—Of this, the first Unit of 220 MW at Rajasthan Atomic Power Station was commissioned in December, 1973. The benefits from the second unit at Rajasthan Atomic Power Station and the first unit at Madras Atomic Power Station are included in the Fifth Plan. The second Unit at Rajasthan Atomic Power Station is in an advanced stage of erection.

*At the time of factual verification, the Deptt. of Atomic Energy in their communication dated 11.4.1978 have stated that "on the present indication the expected installed capacity of nuclear power by 1978-79 would be 860 MW only comprising two units of Tarapur Atomic Power Station (420 MW) and two Units of Rajasthan Atomic Power Sation (440 MW)."

**At the time of factual verification the Deptt. of Atomic Energy in their communication dated 11.4.1978 have stated that "the actual intention was to convey that "the indicated and inferred reserves of uranium would sustain about 8000 MW of nuclear power generating capacity."

Nuclear Power Programme

7.4. The Fuel Policy Committee (1974) in their Report has observed that in the first stage of India's Nuclear power programme, power stations based on thermal reactors have been planned. These reactors can either be light water reactors (like Tarapur Atomic Power Station) or heavy water reactor (as has been put up at Rana Pratap Sagar). The light water reactor uses enriched uranium as fuel whereas heavy water reactor uses natural uranium as fuel. Both these reactors produce plutonium as a by-product. The second stage of our nuclear power programme is based on Fast Breeder Reactor (FBR) which would enable us to fully utilise the uranium resources as well as exploit our vast thorium reserves. A FBR uses either plutonium or U-233 (both are fissile materials) as fuel. In addition either depleted uranium or thorium is put into it. A FBR produces in addition to power, more plutonium (if depleted uranium has been used) or U233 (if thorium is used) than what has been consumed. It is necessary to have sufficiently large capacity of thermal reactors which would produce large quantities of plutonium before we could go in for the breeder reactors. The breeder reactor system is a self-sustaining system as it produces more fuel than is consumed.

Long-term perspective

7.5. The Fuel Policy Committee in their Report (1974) in paragraph 9.62 have also observed that the Department of Atomic Energy has formulated the long-term strategy for development of nuclear energy taking into account the conditions prevailing in the country. This can be summarised as follows:

(a) Installation of 1680 MW capacity (upto Narora II) by early 1983.

(b) To start work on one more 2x220 MW power station by early 1977 and completion of its first and second units in 1983 and 1984 respectively.

(c) To take up construction of 500 MW Heavy Water reactor Unit in 1979 and to have 9 Heavy Water power reactors, of 500 MW each in operation by 1990-91.

(d) To start construction of first commercial Fast Breeder Power Reactor of 500 MW by 1978 so that it could be in operation by 1986.

(e) To add 3 more 500 MW Fast Breeder Reactors to the system by 1990-91.

7.6. In short, this strategy would yield the following nuclear capacities:—

	Installed Nuclear Capacity
By 1978-79	1,020 MW
By 1983-84	1,900 MW
By 1990-91	8,620 MW

7.7. That Committee in paragraphs 9.68 and 9.69 of their Report have also observed that considering the uranium availability and the industrial capability, it would be prudent to aim at adding about 4720 MW from CANDU reactors by 1990-91 in addition to nuclear power stations that are under operation or construction now. In addition to this, the CANDU power programme will generate adequate plutonium to instal about 2,000 MW from fast breeder reactors by 1990-91, thereby making the total installed nuclear capacity by 1990-91 to be about 8,620 MW.

7.8. In the absence of reliable data to determine the optimal level of nuclear power generation capacity that is to be established between 1983-84 and 1990-91 that Committee have felt that it would be prudent to assume a constructive estimate of 4000 MW. This is essentially a risk minimisation approach., as this assumption would lead to greater preparedness in the coal production and thermal generation. The Fuel Policy Committee, therefore, has recommended that if possible the nuclear capacity should be increased in the years beyond 1983-84. This should be based on a reappraisal of the nuclear power programme on the lines suggested above.

Plan for Nuclear Development

7.9. With regard to the future plans for development of nuclear power in the country, the Ministry of Energy in their written replies furnished in November, 1976 have stated that the Nuclear power programme in India envisages a three stage strategy. In the first stage of the programme, natural uranium fuelled, heavy water moderated and cooled reactors are being set up. At present 200—235 MW size units are being installed, but as soon as manufacturing capability, grid capacity and transport problems make them feasible, 500 MW size units will be installed.

7.10. At the same time, development work on sodium cooled fast breeder reactors has been initiated. A 40 MW fast breeder test reactor is being set up at Kalpakkam. In the second stage of the programme, it is proposed to build fast breeder reactors using plutonium as fuel, which is produced as a by-product in heavy water reactors. A certain minimum base programme of heavy water reactors is required to support the fast breeder reactor pro-

gramme. Construction of heavy water reactors may continue even after fast breeders have been commercially established but the relative capacities will depend on the extent of natural uranium resources located in the country.

7.11. Since India has vast resources of thorium, it is proposed to initiate development efforts on the thorium reactors which can be constructed in the third stage of the programme when there will be adequate quantities of plutonium and uranium—233 from the second stage reactors.

Long term plan

7.12. It has been stated that a Task Force set up by the Department of Atomic Energy has suggested a target of installed capacity of 4720 MW in heavy water moderated and cooled reactors and 1000 MW of fast breeder reactors by 1990. The recommendations are under the consideration of the Department.

7.13. With regard to the development of nuclear power, the Secretary, Ministry of Energy, during evidence has stated:—

> "By and large, nuclear stations come only in those areas where hydro stations are not possible and where, in any case, coal has to be brought from a very long distance. In the case of the station located on the western coast, you will find that the coal movement is very difficult, it is brought in small vessels at very heavy cost. In the case of Kapakkam also, the only deposits available are in Neyveli which are not of a very high order."

7.14. The witness has also stated:

> "The gestation period of an atomic power station is long. So even, if we make a start now, it will take a long time before the results are achieved. So, there is always scope to take into account new sites for atomic power stations, which can make their contribution when they start functioning. The gap which can not be filled up by thermal is the scope for atomic energy."

7.15. Asked to explain in brief the salient and essential features of the various recommendations contained in the report of the Task Force set up by the Department of Atomic Energy and the follow-up action, if any taken by Government on the reports the Ministry of Energy in their written replies furnished in March, 1977 have stated as follows:—

> "The following are the salient and essential features of the various recommenations contained in the report:—
>
> (i) The availability of uranium is recognised as the main constraint for a larger programme.

(ii) The Task Force has therefore recommended a programme based on two alternatives which are identical upto the end of sixth five year plan but there onwards are dependent on further discovery of uranium deposits and increasing uranium production capacity. The Task Force recommended commissioning of a total capacity of 4720 MW(e) based on natural uranium by March, 1989 and in case uranium availability permits take up another 3000 MW(e) at that time.

(iii) Depending upon the programme for natural uranium reactors, the task force recommended that fast reactors contribution should be 1000 MW(e) by 1988.

(iv) The task force identified the target for extension of facilities at the Nuclear Fuel Complex and for setting up additional plants for heavy water production.

(v) The task force also identified the capital and man-power required for implementing the programme.

The report is still under consideration by the Department of Atomic Energy."

7.16. Asked to state the installed capacity of nuclear power units and capacity proposed to be added during the Fifth and Sixth Plans, the Ministry of Energy through their note furnished in March, 1977 have given the following information:—

End Fourth Plan	Added in first two years of V Plan	End of the V Plan
	(i) *The installed capacity in nuclear power.*	
640 MW(e)	. .	1095 MW(e)
	(ii) *To be added during the Sixth Plan*	
705 MW(e)	(Second unit of MAPP and two units of Narora)	

7.17. In their Performance Budget (1977-78), the Department of Atomic Energy have stated that the total nuclear power generation capacity expected to be achieved would be as given below:—

	(Million KW)
1978-79	0.80 or 800 MW
1983-84 . .	1.68 or 1680 MW
1990-91	6.00 or 6000 MW

7.18. The contribution of nuclear power to the total generation capacity of 30.955 million KW expected to be achieved by the end of the Fifth Five Year Plan period would thus be about 2.5 per cent. which is expected to increase to about 4 per cent by the end of the Sixth Plan (1983-84) and 7 per cent by 1990-91.

7.19. In reply to an Unstarred Question No. 4124 answered in Lok Sabha on 20 July, 1977, the Prime Minister stated "a total nuclear power generation capacity of 1.08 million KW is expected to be achieved by 1983-84 and 6 million KW by 1990-91 according to current estimates."

"Funds for development of nuclear capacities"

7.20. With regard to funds for development of Nuclear Energy, the Sub-Committee of Estimates Committee (1977-78) asked the Government to:—

(a) indicate the allocation of funds during the Fourth and Fifth Plans and the actual provision in the Annual Budget documents and the funds required upto 1990-91 for development of the proposed Nuclear capacities; and

(b) Whether funds so allocated were|are adequate?

The Ministry of Energy in their note (February, 1978) have furnished a statement (Appendix XVIII) showing the allocation of Funds during the Fourth and Fifth Plans and the actual provision in the annual budget documents and the funds required upto 1990-91 for development of the proposed nuclear capacities. They have stated that the funds as allocated were/are adequate.

.. 7.21. The Committee note that at present the total nuclear power installed capacity in operation in the country is 640 MW, which forms about 3 per cent of the country's generation of power.

7.22. The Committee observe from the Report of the Fuel Policy Committee (1974) that the Department of Atomic Energy's long-term strategy for development of nuclear energy envisages the following nuclear capacities:

	Installed Nuclear capacity
By 1978-79	. 1,020 MW(e)
By 1983-84	. 1,900 MW (e)
By 1990-91	. 8,620 MW (e)

7.23. The Fuel Policy Committee have observed that in the absence of reliable data to determine the optimal level of nuclear power generation capacity that is to be established between 1983-84 and 1990-91, it would be prudent to assume a constructive estimate 4000 MW, and recommended that the nuclear capacity should be increased in the years beyond 1983-84 based on a re-appraisal of the nuclear power programme.

7.24. The Committee further note that the Task Force set up by the Department of Atomic Energy have recommended the commissioning of a total capacity of 4,720 MW(e) based on natural uranium by March, 1989 and in case uranium availability permits take up another 3000 MW(e) at that time.

7.25. The Committee were informed in March, 1977 that the installed capacity would rise to 1095 MW(e) by the end of 1978-79 from 640 MW(e) at the end of the Fourth Plan and an additional capacity of 705 MW(e) would be added during the next 5 years to make it 1800 MW(e) at the end of 1983-84.

7.26. The Committee, however, find from the Performance Budget document of the Department of Atomic Energy for the year 1977-78 and from the reply of the Prime Minister to an Unstarred Question in Lok Sabha on 20 July, 1977, that the nuclear power generating capacity expected to be achieved would be as under—

1978-79 .	800 MW (e)
1983-84 .	1680 MW (e)
1990-91 . .	. 6000 MW (e)

7.27. The Committee thus find that the target of capacity has now been reduced from 1095 MW(e) to 800 MW(e) at the end of the 1978-79, from 1800 MW(e) to 1680 MW(e) at the end of the 1983-84 and from 8620 MW(e) to 6000 MW(e) at the end of 1990-91. The contribution of nuclear power to the total power generation capacity will only be 2.5 per cent at the end of 1978-79 and 4 per cent by the end of the Sixth Plan (1983-84) and 7 per cent by 1990-91. The Committee thus observe that the pace of development of nuclear power in the country will be slower than was envisaged originally by the Department of Atomic Energy themselves and their Task Force and the Fuel Policy Committee.

7.28. The Committee need hardly emphasise that even if this modest capacity of 6000 MW is to be achieved by 1990-91, a long term perspective plan has to be drawn up right now taking into account:

the various constraints in the availability of fuel, and the long gestation period of nuclear plants etc. The Committee trust that in the light of the recommendations of the Task Force and the Fuel Policy Committee, Government would evolve such a long-term plan for further building up of nuclear power capacities in the country.

Uranium Fuel for Atomic Power Stations

Uranium

7.29. The Fuel Policy Committee (1974) in paragraphs 4.22 & 4.23 of their Report have observed that Uranium is the only primary fuel that can be directly used in nuclear reactors. Extensive prospecting and exploration efforts of the Department of Atomic Energy during the last two decades have led to the discovery of a number of occurrences of uranium in India. The most important region in India for uranium ore is the Singhbhum region in Bihar. The Jadugude mines and the Narwapahar mines situated in this area are the most important uranium mines so far. There are also other possible uranium deposits in the Singhbhum belt. The copper deposits of this region also contain small amounts of uranium. The tailings from the copper mines near Jadugude may yield uranium at economic prices.

7.30. The reasonably well assured uranium resources in India are about 22,000 TeU O_8 with an additional inferred reserves of 24,000 T U O . Uranium mined in India is slightly mere expensive than in many other countries, since the uranium concentration in the ore is relatively low in India. However, this is not of any great consequence as the fuel cost forms only a small component of the total unit energy cost from a nuclear power station. The Government have initiated a nuclear power programme based on natural uranium fuelled and heavy water moderated and cooled reactors.

7.31. The Fuel Policy Committee (1974) in paragraph 4.25 of their Report has observed that Thorium reserves in India are the largest in the world and are estimated at about 4,50,000 tonnes. Besides, the fast breeder reactors would be able to produce fissile Uranium—233 from thorium that is abundantly available in India. After the fast breeder reactors based on thorium are introduced, there will be virtually no limit to the capability to generate electricity from the resources point of view, as a total of about 24x106 billion Kwh of energy will be potentially available from the known thorium resources.

7.32. The Fuel Policy Committee in paragraph 9.63 of their Report has also observed that apart from the necessity of getting the projects sanctioned and executed in time, the realisation of the nuclear power programme depends on the adequate and timely mobilisation of resources and effort in specific related areas. One of the important requirements is that the uranium production should be significantly increased. At present uranium production is being done only at the Jaduguda mines. Production from this mine will be able to meet the requirements of the envisaged nuclear power programme only upto the year 1984. Hence, in order to achieve the target of 8,620 MW from the thermal reactor power stations by the year 1990-91, uranium mining from other uranium deposits will have to be taken up. At the same time exploration work to locate additional uranium deposits would also be essential to meet the long-term requirements of the nuclear programme.

7.33. Regarding Uranium deposits, the Chairman Atomic Energy Commission, during evidence has stated as follows:—

> "We have located certain fresh deposits in M.P. some in Himachal, and some in extreme eastern side, Meghalaya and so on, which are far richer than in Bihar and so on. The decision about this will take from 1 to 1.1½ years. The cost of a mill to produce 500 tonnes of uranium p.a. will, with the present inflation cost, cost 60-70 crores of rupees....."

Enriched Uranium

7.34. The Estimates Committee in paragraph 2.25 of their 129th Report (1969-70) on the Department of Atomic Energy—Atomic Power—had noted that enriched uranium had to be imported for the working of the Tarapur Project for the entire life time of the station. If for any unforeseen circumstances the supply of enriched uranium was cut off or denied due to world postures, the whole Project in that case would be jeopardised. They, therefore, suggested that Government should explore the possibility of building reserve of enriched uranium to meet such contingencies.

7.35. Regarding building reserves of enriched uranium and the terms and conditions on which India could expect enriched uranium from other countries, the Government in their action taken replies furnished in March, 1972, stated "while there is spare fuel in the country for 12 to 18 months operation without replenishment, stock-piling of reserves of enriched uranium would entail heavy interest charges on inventory. Also as per the bilateral agreements, between India and the USA, the Tarapur Atomic Power Station would be

operated on no other special nuclear material than that furnished by the Government of USA. The agreement also commits USA to supply fuel throughout the life of the station. As such, no steps are being taken to obtain enriched uranium from other sources."

7.36. Regarding the progress made in the development of technology for the enrichment of uranium in the country, the Government furnished the following information in March 1972:

> "Work on development of uranium enrichment technology has recently been initiated in Bhabha Atomic Research Centre. A group has been constituted to undertake preliminary studies on the three processes of uranium enrichment which are either in use or in various stages of development in other countries. These include the gas diffusion, the ultra-centrifuge and the separation nozzle processes. Studies on the production and handling of uranium hexafluoride which is the uranium compound used in all the three processes have also been started. Based on these studies a small-poale separation unit is expected to be installed in three to four years' time."

7.37. The Committee in their 29th Report (1972-73) had reiterated their earlier recommendation regarding the necessity of building reserves of enriched uranium to meet any stoppage in supply of enriched uranium for Tarapur due to unforeseen circumstances. They had urged that the development of technology for the enrichment of uranium in the country should be speeded up and research carried out taking into account its various technological and financial implications.

7.38. Asked to state the position regarding assured supply of enriched uranium for Tarapur Atomic Power Station, the Chairman, Atomic Energy Commission, during evidence on 28 December, 1976 has stated:—

> ".....The Tarapur Station seems to be all right for a year; after that we will have to see.
>
> The total amount of uranium which we need for Tarapur is 22 tonnes a year. This is too small a quantity to put up a plant. To give you an example, you take the Parala Plant; there the cost of production of enriched uranium is around four and a half times the cost of production of USA. It is of course a weapon plant, but still this is the cost. The other place from where we have received some cost figures is the British Plant; these are two to three times more than

the American Plant. We do not know the cost about Russians, but they sell at the same price, or 1/8th per cent less to capture the market. There is a new company called Uranco; a company jointly owned by Germany, the Netherlands and Britain; they have not announced any figures. Then the French are putting two Plants, Cordi and Eurodif. They think that they will be able to sell the enriched uranium at twice the price of the American plant. If America puts up a new plant, the uranium will be in the same price range.

When it becomes available, one will have to try. I can however assure you that we are exploring other sources also. We do not want to give up this source because it is in our signed agreement."

7.39. The Ministry of Energy later through their written replies sent in March, 1977 have stated as follows:—

"Only 3 to 4 other countries produce enriched uranium and only one other, USSR, supplies it in commercial quantities. In the recent past, we have experienced some delays in obtaining the required quantities of hexafluoride in time. These delays have been caused by the action of several intervenors in the US, who have filed petitions with the U.S. Nuclear Regulatory Commission (NRC) to block shipments of hexafluoride to India, and to force significant policy changes in US on export of nuclear fuel material. As per normal diplomatic practice in such matters, India's views are being presented to NRC who in this matter are acting in a quasi-judiciary capacity, by the US state Department. They are presenting our case on the basis of information furnished by DAE and in lose consultation with our Embassy in Washington.

It needs to be clarified that formerly entire fuel assemblies for Tarapur Atomic Power Station were being imported, and on these, there was a 30 per cent import duty. Presently, we import the enriched uranium hexafluoride and fabricate the fuel bundles completely at NFC, Hyderabad. Even though the import of hexafluoride attracts a 70 per cent import duty, the fabricated cost of fuel bundles now is lower than that of the bundles when they were being imported.

In respect of fuel for pressurised heavy water reactors, the basic raw material is natural uranium which is indigenously available and this is processed into finished fuel at the Nuclear Fuel Complex, Hyderabad."

7.40. The Committee pointed out that there was a long-term plan to switch over to Thorium instead of enriched uranium as the source of atomic power. Asked to state the latest position and what will be the critical material used in the power stations in the next two plan periods, the Chairman, Atomic Energy Commission, during evidence has stated:—

"This would depend on the development of fast breeder test reactor where you use fully enriched uranium, but in our case it is plutonium surrounded with Thorium. From the Thorium, you get Uranium 233; feed it again, put Thorium again and you get more U 233 and you put up another power station. This is the general idea. The process of making U 233 has already been designed. We have got a few kgs. of stuff also.

As far as enriched uranium is concerned, you have got one reactor. Tarapur consists of two reactors of 200 MW each. Our extra power system is going ahead all right with heavy water there is no question of enriched uranium in that system. That is natural uranium which is our own we can make use. For the fast reactor we take plutonium, from the heavy water reactor and dilute it with natural uranium to bring it to a strength of 28 per cent of the big size pure thorium and use that for further cycling. The advantage of the fast breeder is that it gives you the steam pressure of about 560 lbs. per sq. inch in Ranapratap Sagar project and 1000 lbs. in the Tarapur reactor."

7.41. In reply to a supplementary on Short Notice Question No. 17 in the Lok Sabha on 13 July, 1977 the Prime Minister stated that the supply of enriched uranium was held up by the United States for a year because of various objections raised. Those objections were now withdrawn and they have sent it already. In reply to another supplementary whether he had assured himself that this supply would now be regular and adequate, the Prime Minister stated "well, I hope it will be regular now, but who can say what will happen in the future."

7.42. The Committee note that according to the Task Force of the Department of Atomic Energy, one of the constraints for under-

taking a larger programme for nuclear power development would be the availability of uranium. According to the Fuel Policy Committee Report, the present level of uranium production would meet the requirements of the envisaged nuclear programme only upto the year 1984. If the nuclear power capacity is to be substantially increased during the period 1984 to 1990-91 as envisaged in the long-term strategy for nuclear power development, it would be necessary to discover uranium deposits on a large scale and increase the uranium production capacity. The Committee trust that concerted efforts would be made not only to step up the exploration work to locate additional deposits, but also to set up production units in a planned manner in the areas of M.P., H.P., and Meghalaya where fresh deposits of uranium richer than those in Bihar have been located so that non-availability of uranium does not act as a constraint in augmenting the nuclear power capacity in the country.

7.43. The Committee note that thorium reserves in India are the largest in the world and are estimated at about 4,50,000 tonnes. The Committee further understand from the Report of the Fuel Policy Committee that fast breeder reactor would be able to produce fissile U 233 from Thorium. The Committee have been informed during evidence that the process of making U 233 from thorium has already been designed and a few kgs. of the material produced. The Committee hope that while formulating the long-term plan for the development of nuclear power the indigenous availability of the minerals like uranium and thorium would be taken into consideration, so that the country would not have to depend on other countries for the nuclear fuel for the reactors.

7.44. The Committee note that the Tarapur Atomic Power Station reactors use enriched uranium as fuel, and under the bilateral agreement between Government of USA and Government of India, all requirements of enriched uranium for use as fuel in these reactors "shall be made available by the United States Atomic Energy Commission (USAEC) and that India shall not obtain these from other sources", and that the Tarapur station "would be operated on no other special nuclear material than that furnished by the Government of USA". This restriction, it is presumed, would not apply to the enriched uranium fabricated in our own country.

7.45. The Committee had earlier pointed out in their 129th Report (1969-70) and subsequently in the 29th Report (1972-73) that Government should explore the possibility of building reserves of enriched uranium to meet unforseen contingencies in which the supply of enriched uranium might be cut off or denied.

7.46. The Committee find that supply of enriched uranium by US was recently held up for a year because of various objections raised in that country. In this context they also take note of the observation made by the Prime Minister in Lok Sabha on 13th July, 1977 "I hope it (supply of enriched uranium) will be regular now, but who can say what will happen in the future". The Committee view with concern the total dependence of the Tarapur reactors on the supply of enriched uranium from the USA. The recent developments in regard to the supply of enriched uranium which was admittedly delayed for a year by the US authorities and the restrictions placed on India categorically forbidding her to get requirements of enriched uranium from any source other than USA abundantly go to show to what extent the Tarapur Atomic Power Station is dependent on supplies from USA and the developments in that country. This, the Committee feel, is not a very happy situation. Government should have a fresh look at the whole arrangement and take necessary steps to ensure uninterrupted working of the Tarapur Atomic Station.

7.47. The Committee would also urge that the development of technology for enrichment of uranium within the country itself for which preliminary studies are stated to have already been initiated in the Bhaba Atomic Research Centre should be accelerated and no efforts spared to develop this technology within the shortest possible time so as to rid the country of dependence on foreign countries in this vital field.

Heavy Water Projects

7.48. The Estimates Committee in paragraph 3.46 of their 129th Report (1969-70) had observed that in spite of the realisation of urgency by Government in regard to the production of heavy water indigenously to meet the requirements of the two units of Rajasthan Atomic Power Project as also that of Madras Atomic Power Project, nothing substantial had been done in the matter.

7.49. Government in their action taken replies furnished in January, 1971 *inter alia* stated that "all efforts are being made to complete the plants as quickly as possible and it is now expected that the Baroda Plant will be commissioned in 1972-73 and the Kota Plant in 1974".

7.50. Asked to state the position with regard to the production of Heavy Water for the country's atomic power projects and whether India would be able to have its own Heavy Water by the time the Atomic Power Plants were commissioned, the Government

in their action taken replies furnished in March, 1972, stated "the Heavy Water Plant under construction at Kota which is expected to be commissioned in 1974 will give an output of 100 tonnes of Heavy Water per year. The Heavy Water Plant under construction at Baroda will be commissioned in 1973 and is expected to give an output of 67.2 tonnes per year. A part of the output of the plant would be available for the second unit of the Rajasthan Power Station. The third plant designed on the same basis as the Baroda plant will be ready at Tuticorin during 1974-75 to give an output of 71.3 tonnes of Heavy Water per year. A fourth plant is under consideration for construction in conjunction with one of the Fertilizer Corporation of India's Fertilizer Plants. Over and above these sources, the Heavy Water Plant at Nangal gives an average output of 12 to 14 tonnes of Heavy Water per year."

7.51. The Committee in para 55 of their 29th Report (1972-73) expressed their concern that heavy water was in very short supply internationally and its non-supply might result in delayed commissioning of the projects. The Committee expected that problems connected with indigenous production of heavy water would be sorted out successfully and concerted efforts made to meet the targetted requirements of heavy water for the projects under construction indigenously at the earliest.

7.52. The Committee during evidence drew attention of the Chairman, Atomic Energy Commission to the shortage of heavy water, and asked him to state the requirement and the extent to which it was being met from internal production, and how soon the country would become self-reliant in this critical areas. The witness has stated:—

> "....There is the question of setting up enough heavy water capacity. It is one of the main constraints of power generation. We may have heavy water by two main routes, one is to make it part of the fertilizer plant. It should have minimum capacity of 900 tonnes of ammonia. At Kotah we use hydrogen sulphide and water exchanged. We had some problems. Some of the machinery being supplied were sequestered at the time of delivery that somewhat delayed the thing. But the programme is being actively pursued. I hope we will be able to take a decision on the setting up of heavy water plant."

7.53. Asked to furnish details regarding the present position of availability of heavy water and the perspective planning for setting

up of heavy water plant, the Ministry of Energy in their written note furnished in March, 1977 have stated that the Department of Atomic Energy is setting up Heavy Water Plants at Baroda, Kota, Tuticorin and Talcher. In addition it has also entered into a contract for the purchase of 200 tonnes of heavy water from USSR. With the heavy water which would be available from these plants and the arrangements thus made for its purchase from USSR, it is expected that the requirements of the Atomic Power Plants upto and including the two reactors of Narora will be met. The decision regarding the setting up of additional heavy water plants will depend upon the decision taken regarding the nuclear power programme.

7.54. According to the Ministry of Energy the position (March, 1977) in regard to the construction of the various heavy water projects is as under:—

"*Heavy Water Project (Tuticorin)* :—

Erection of equipment and welding of piping is almost complete. Radiography, hydro-testing, pneumatic testing and chemical cleaning of various piping circuits is in progress. Instrumentation and electrical works are progressing well. Pre-commissioning activities relating to the Ammonia Loop supplied by M|s. Toyo Engineering Corporation are in hand and this unit is expected to be commission by March|April, 1977. Testing and commissioning of the Heavy Water Plant of M/s. GELPRA is expected to begin in April|May, 1977. The main reason for the delay has been the delay in delivery of of indigenous equipment, which resulted in the delay of many of the erection jobs and in particular the finishing works like testing, insulation, instrumentation, painting etc.

Heavy Water Project (Talcher):—

The Heavy Water Plant being set up at Talcher in Orissa is designed to produce 62.7 tonnes of Heavy Water per annum. This plant is based on the bi-thermal NH2-H2 exchange process developed by M|s. Friedrich Uhde in West Germany and will be connected to the Ammonia Plant of the Fertilizer Corporation of India Ltd. at Talcher. All the synthesis gas produced by FCI Talcher will be routed through this plant to produce 62.7 tonnes of Heavy Water annually.

At present the Plant is in an advanced state of construction. Erection of 9 heavy towers was completed last year while the 2 re-ordered towers are scheduled to be erected during January-February, 1977. All the imported equipment and machinery which has reached site has been installed. With regard to the indigenous equipment many pressure vessels and all the heat-exchangers and power internals are still in the process of manufacture. The piping pre-fabrication and also installations in the field are in progress. The schedule for commissioning of the Plan is being seriously affected with the slippage in the delivery of indigenous equipment.

Common services like 132 KV Switch-yard, Cooling Tower, Cooling Water System instrument air system, analytical sub-station are in an advanced stage of completion. If all the indigenous equipment, which are likely to be delivered at site by September, 1977 arrive as per the revised schedule given by the fabrication, the plant will be ready for commissioning by early, 1978.

Heavy Water Project (Kota)

This Plant based on dual temperature exchange process between HO and HS for which the process know-how and engineering has been developed by BARC, is designed to produce 100 tonnes of heavy water per annum. The plant will utilise steam and power supplied by RAPP and need water from Rana Pratap Sagar Reservoir.

The civil works of the Plant are nearing completion except for No AIR Compressor building, Delay Tank and a few equipment foundations. As regards steel structural work 80 per cent fabrication and 60 per cent erection is completed. Both civil and structural works are scheduled to complete by middle of 1977.

All Distillation Unit Towers, 800 internals of Exchange Unit Powers, Product Stripper, HS Generator Storage Tanks, Purge Towers and 32 numbers of process Heat Exchangers have been erected. In addition, 12 numbers of process pumps have been placed in position. All the equipment of RAHTE unit have been erected. Erection of rest of tanks, pumps and Heat Exchangers is in progress and it is expected that 14 numbers of Heat Exchangers, 6 numbers of

Tanks and 30 numbers of Pumps will be erected by end of March, 1977. Erection of Distillation Unit Tower Internals will be commenced in January, 1977.

Electrical Works have started. Erection of 40 MVA Main Power transformer and 6.6 KV Switchgear is in progress. In addition, 7 Nos. of 2 MVA transformers and 10 Nos. motor control centres have been installed. Steam condensate and raw water piping between RAPS and HWP is complete. Pre-fabrication of piping, erection of piping and associated fittings and valves is in progress in various areas. As on today nearly 50 per cent of piping work is complete.

It is expected that supply of all equipment and materials imparted as well as indigenous will be complete by middle of 1977. Erection of equipment, piping, instrumentation, installation and painting is scheduled to be completed by end 1977 which will be followed by testing and commissioning.

Heavy Water Project (Baroda):

After completing of various maintenance jobs and balance modifications, commissioning of the Plant was restarted in November, 1976. Subsequently there have been leakages, especially from the covers of some high pressure vessels and fouling of heat exchanges. The plant is being re-started and if there are no fresh problems, it is expected that the production of heavy water will begin by February end 1977.

7.55. According to Plan Budget, 1977-78, the Kota Plant with a capacity of 100 tonnes per annum is expected to be commissioned by the end of 1978. The Baroda Plant with a capacity of 67.2 tonnes a year will be commissioned in the current year. Its ancillary facilities viz. Metallic Postassium Plant and Ammonia Synthesis gas Facility are already operational Tuticorin Plant with a capacity of 71.3 tonnes per year is expected to be commissioned by the end of 1977. The Talcher Plant with a capacity of 62.7 tonnes a year is likely to be commissioned by middle of 1978.

7.56. The Sub-Committee of the Estimates Committee (1977-78) enquired about the latest position regarding commissioning of Heavy Water Plants at Tuticorin, Talcher, Kotah and Baroda. The Minis-

try of Energy in their note (February, 1978) have stated that the latest position about the commissioning of the Heavy Water Plants is as follows:—

(i) *Heavy Water Plant (Tuticorin)* :—The plant is undergoing commissioning trials and is expected to be on stream by the end of March, 1978.

(ii) *Heavy Water Plant (Talcher)*:—Mechanical erection is expected to be completed by the end of July, 1978. It is, however, understood that the Synthesis gas from Fertilizer Corporation of India, Talcher will be available only in April, 1979. The plant could be commissioned within 4-5 months from the date of availability of Synthesis gas from Fertilizer Corporation of India, Talcher.

(iii) *Heavy Water Plant (Kota)*.—Subject to the receipt of boosters by April, 1978 and the employees' strike being called off in the near future, the erection of the plant will be completed by November/December, 1978. The plant is expected to be commissioned in 7-8 months after the erection work is over.

(iv) *Heavy Water Plant (Baroda)*:—This plant became operative on 4th July, 1977. The plant, however, met with a mishap on the 3rd December, 1977. It is expected that in case it does not involve the replacement of any major high pressure equipment, valves or piping, the revamping work can be completed and the plant put back in production by April, 1979. A clearer picture will, however, emerge after receipt of the report of the Committee looking into the mishap and after obtaining results of the various tests being carried out.

7.57. The Committee note that the Department of Atomic Energy is setting up heavy water plants at Kotah, Baroda, Tuticorin and Talcher. In addition, the Department have also entered into a contract for the purchase of 200 tonnes of heavy water from the USSR. The Committee have been informed that the heavy water which would be available from these plants and the supply from USSR would meet the requirements of the Atomic Power Plants upto and including the two reactors of Narora.

7.58. The Committee note that the Heavy Water Plant at Kotah which was expected to be commissioned in 1974, has not so far been

commissioned. According to the latest information (February, 1978) furnished to the Committee, the erection of the plant will be completed by November/December, 1978 subject to the receipt of boosters by April, 1978, and the employees' strike being called of in the near future. It was earlier stated that the plant was expected to be commissioned by the end of 1978, but it has now been stated that the plant is expected to be commissioned in 7-8 months after the erection work is over, which is scheduled to be completed by November/December, 1978.

7.59. The Committee further note that the Heavy Water Plant at Baroda was scheduled to be commissioned in 1973. However, the Committee find that after completion of various maintenance jobs and balance modifications, commissioning of the Plant was restarted in November, 1976. The Committee have now been informed that the plant met with a mishap on the 3rd December, 1977. It is expected that in case it does not involve the replacement of any major high pressure equipment, valves or piping, the revamping work can be completed and the plant put back on production by April, 1979. A clearer picture will, however emerge after receipt of the report of the Committee looking into the mishap and after obtaining results of the various tests being carried out.

7.60. With regard to the Tuticorin Plant, which was scheduled for commissioning during 1974-75, the Committee note from the information furnished to them in March, 1977, that the testing and commissioning of the Plant was expected to begin in April/May, 1977, and the plant commissioned by the end of 1977. The Committee have been informed in February, 1978 that the plant is undergoing commissioning trials and is expected to be on stream by the end of March, 1978.

7.61. As regards Talcher Plant, the Committee have been informed that the schedule for commissioning the plant has been adversely affected by the delays in the delivery of indigenous equipment and the Plant is likely to be commissioned in middle 1978. In a later note (February, 1978), the Committee have been informed that mechanical erection is expected to be completed by the end of July, 1978. It is, however, understood that the Synthesis gas from Fertilizer Corporation of India, Talcher will be available in April, 1979. The plant would be commissioned within 4-5 months from the date of availability of Synthesis gas from Fertilizer Corporation of India, Talcher.

7.62. The Committee had, as early as 1969-70, in their 129th Report on Atomic Power, observed with regret that nothing substantial had been done in regard to the production of heavy water indigenously and they had drawn pointed attention of the Government to the urgent need to produce heavy water within the country to meet the requirements of the atomic power projects.

7.63. The Committee are distressed to note that inspite of government assurance given in 1971 that "all efforts are being made to complete the plants as quickly as possible", none of the four heavy water plants has been commissioned on schedule and in certain cases like the plants at Kotah and Baroda, considerable slippage has been allowed to occur. The Committee are surprised that Government should have allowed slippage in commissioning schedules in a vital field like heavy water production on which the entire nuclear power programme depends, leaving no option to the Government but to enter into an agreement with another country for the supply of heavy water. The Committee hope that Government would at least now ensure by closer and effective monitoring that no further delays occur and the plants are commissioned within the shortest possible time.

7.64. As regards the future programme for setting up additional heavy water plants the Committee have been informed that it would depend upon the decisions taken regarding the nuclear power programme. Considering the long time taken in commissioning heavy water plants, the Committee trust that adequate advance planning will be made for setting up such plants as a part of the long-term plan for development of nuclear power.

Atomic Power Plants

Utilisation of capacity in Tarapur and Ranapratap Sagar Power Stations

7.65. During the course of evidence, the Chairman, Atomic Energy Commission has informed the Committee that "Tarapur, at the present moment, is working fairly well. We are getting 57 per cent capacity, which is quite good."

7.66. Asked to state whether 57 per cent was satisfactory, the witness has added:

> "The highest for the Tarapur type system in the world is about 64 per cent. One station did attain 83 per cent for about a year, but then next year went down to 20. You

do not want that type of thing here. In Trombay we ran for 1½ years and attained almost 95 per cent and then....you have to refuel Tarapur by shutting it down. You cannot refuel it while operating.

For 1½ years, we operated at 95 per cent. Also the fuel which we got in the initial stage was very poor, this was imported fuel, not what we are making. When it broke, you had radio-activity all over the place. This gives rise to more doses of radiation which are not acceptable according to ICRP standards. You go for 5 hours and then you are out. This refueling at Tarapur is worth seeing."

Rajasthan Atomic Power Project—Unit I

7.67. Rajasthan Atomic Power Project Unit I was recommissioned on April 12, 1976 after shut-down of nearly two months for replacing some blades in the low pressure rotor; it continued to operate at power levels from 175 MWe to 180 MWe generating 1150 million units upto end March, 1977 at an average availability of 85 per cent. It has been stated that the year has been considerable improvement in the operation of the unit; it achieved a continuous outage-free operation during October and November, 1976.

7.68. Explaining the position about Rana Pratapsagar the witness has stated:

"It has a sad history. We got that turbo set, we started operating it. But there was sand in it. We had to strip it out. Afterwards when we put it into operation, it was all right for some time. Then the blading broke. We lost 3 stages. At the moment we are running without 2 stages.

In August, we hope to have them replaced by Bhopal; they are our main contractors for these turbo jobs. After that we hope it runs better."

Rajasthan Atomic Power Project—Unit II

7.69. According to the Annual Report (1976-77) of Department of Atomic Energy, the position of RAPP Unit II is as follows:

"Erection of nuclear and conventional equipment is almost complete and commissioning of various systems is in

progress. All jobs on fuelling machines, reactivity mechanisms and feeder and header insulation cabinets have been completed. Installation of piping for new air-compressors, relocation of the chilled water plant and 2 per cent and 15 per cent Heavy water storage facility are in progress. Erection of motor generator sets has been completed and commissioning is in progress. Instrumentation work on various systems is almost complete. Erection and testing of steam line to Heavy Water Project Kota is nearing completion. 30 per cent of civil works on the solar Evaporation Facility has been completed."

7.70. According to Plan Budget, 1977-78, Unit II of the Rajasthan Atomic Power Station with a capacity of 200 MW is expected to go into criticality by end of 1977 and will start commercial operation a year later.

Kalpakkam Power Station

7.71. Asked to state the reasons for delay in the completion and commissioning of the Kalpakkam Power Station, the Chairman, Atomic Energy Commission, during evidence has stated:

"Valves and pumps are the biggest single bottleneck. The delivery time would be 3-4 years. After the 3rd or 4th year, they say 'sorry, no'. Then you have to go right through the whole thing again. This is the problem. They hit us at that very period. In fact, some of the stuff is lying in the dock."

7.72. Asked to state the steps taken to remedy the situation and ensure commissioning of the Kalpakkam Project, the Ministry of Energy, through their notes furnished in March, 1977 have informed the Committee that for the various pumps and valves for which supplies on earlier orders did not materialise, alternative orders have been placed on other sources. Most of the valves ordered on indigenous manufacturers have been delivered. It is expected that the first unit of Madras Atomic Power Project would be completed by September, 1978 and the second unit by March, 1980.

7.73. According to Plan Budget, 1977-78, the First Unit of the Madras Atomic Power Station with a capacity of 235 MW is expected to reach criticality by end of 1979. The second unit of the Station is also of 235 MW capacity and is in advanced stage of cons-

truction. The unit is scheduled to become critical by middle of 1981, and would start commercial operation a year late.

7.74. In reply to S.Q. 127 answered in Lok Sabha on 1st March, 1978, the Prime Minister stated "most of the equipments have now been delivered including those affected by the embargo. The erection work has been speeded up wherever feasible. Pre-commissioning activities have also been taken up in parallel to reduce the time required after erection for commissioning and full power operation. The first unit of the Project is likely to attain criticality by December, 1979 and the second unit in mid-1981. Full commissioning can be expected a few months thereafter."

Narora Atomic Power Project

7.75. The Committee enquired the progress in setting up the Narora Plant and how long it would take to commission it. The witness has stated:

> "Our targets are December, 1981 and 1982 for units 1 and 2 respectively. I must point out that we had some problems there. The first one was getting the land. The second one which has arisen is the question of cooling water. We had been assured something like 3,000 cusecs of cooling water. That has dwindled down to 800 or 1000 now. So, we had to do extensive re-designing and put up cooling towards."

7.76. Asked to state the specific steps taken to solve the problem relating to land and cooling water at Narora Power Plant, the Ministry of Energy in their written replies furnished in March, 1977 have stated that the problem of land acquisition arose mainly out of delayed payment of compensation to farmers who were affected by the acquisition. As a result, there were instances of impediments to the progress of site work by the farmers. As a result of the special efforts put in by the Department and the State Government with reference to the acquisition problems and special measures at project site, the situation has improved. Due to the problem of not having minimum assured supply of 3000 cusecs in the Ganga canal, the plant cooling water system has been re-design and cooling towers have been adopted to reduce the dependence of the plant on the cooling water availability in the Ganga canal. A closed loop recirculating system has been adopted as against earlier once through cooling system. The requirement of water is now restricted to the make-up quantities which is about 50 cusecs per unit. This method also eliminates thermal pollution of the canal water.

7.77. According to Plan Budget, 1977-78, the Narora Atomic Power Station will have two units each of 235 MW capacity which are expected to be critical by 1982 and 1983 respectively.

7.78. The Committee are informed that the Tarapur Atomic Power Station is "working fairly well" at 57 per cent capacity which is stated to be quite good. They are distressed to find that the Rajasthan Atomic Power Project Unit I had to face a number of problems. Earlier sand was found in the turbo set which had to be stripped out and later the blading broke and had to be replaced. The Committee observe from the Annual Report of the Department of Atomic Energy for 1976-77 that the year 1976-77 has seen considerable improvement in the operation of the unit and it has attained a continuous outage-free operation during October and November, 1976. The Committee hope that this tampo would not only be maintained but further improved upon.

7.79. The Committee note that the following power plants are under different stages of construction:—

(i) Rajasthan Atomic Power Project—Unit II.

(ii) Madras Atomic Power Project—Kalpakkam—Units I & II.

(iii) Narora.

7.80. The Committee observe that the benefits of the second unit at Rajasthan Atomic Power Project and first unit of Madras Atomic Power Project are included in the Fifth Plan. The targets are December, 1981 and 1982 for Units I & II at Narora. The Committee would urge Government to take concerted measures to eliminate all delays by strict monitoring of the progress of construction of these projects, and ensure that they are commissioned according to the schedules now laid down.

Spares for Atomic Power Plants

7.81. The Ministry of Energy in their written replies furnished in November, 1977 have informed the Committee that the import of spares is being reduced commensurate with the progress of indigenisation of plant equipment. Spare of the value of Rs. 46,88,000 have been imported on an average in the three years 1973—76 for the Tarapur Atomic Power Station. An amount of Rs. 25 lakhs is being spent annually on import of spares for operating RAPP-I. At present these are the only two operating stations.

7.82. Steps are being taken continuously to obtain spares from Indian sources. Special cells have been set up to review the spare requirements, prepare drawing for issuing enquiries to local suppliers and follow-up the manufacturers of spares. As far as RAPP-I is concerned, the cell has prepared about 200 drawings for taking up the question of possible manufacture by indigenous manufacturers. This cell has initiated indigenisation action for more than 100 items till now. Out of these 100 purchase orders have already been placed for 19 items whose dollar value is about 100,000. The value of spares indigenised in RAPP-I thus comes to about Rs. 9 lakhs.

7.83. Asked to state the progress made in preparing designs and manufacture of spares indigenously, the Chairman, Atomic Energy Commission during evidence on 28 December, 1976 has stated:

> "We are not independent yet for things like valves and big things like forgings. We are encouraging Indian suppliers like BHEL, HEC, private parties like Bombay Manufacturers, and they are gradually building that gap. We are also, in conjunction with the Ministry of Heavy Industries, getting people like Instrumentation, Kotah and BHEL to do things specially for us and it is making progress. But, necessarily, this is a very uphill task and it takes a long gestaion period."

7.84. The Committee are informed that the country is not independent yet for things like valves and forgings required for atomic power stations. The Committee also observe that this dependence has created bottlenecks coming in the way of completion of the Atomic Power Station at Kalpakkam near Madras.

7.85. The Committee have no doubt that with the large R & D facilities available with the Department of Atomic Energy, the necessary proto-type of all the items now being imported can be fabricated and the indigenous manufacturers such as BHEL, Instrumentation Ltd., Kotah and REC, Ranchi and other private sector manufacturers could be encouraged to produce these items. The Committee urge Government to take all necessary steps to ensure maximum indigenisation of the equipment and spares required so that the country does not remain dependent on foreign countries for these items.

CHAPTER VIII

RESEARCH AND TRAINING

Research and Development

8.1. The Estimates Committee in paragraph 2.24 of their Report (1972-73) observed that the importance of research and testing facilities in the growing field of power development in the country, could not be too strongly emphasised. Research was necessary for achieving economy, quality control and standardisation in construction, generation, transmission, distribution and superior performance of the power supply system. Collection of technical information and basic data for the efficient and economic design and construction of extra high voltage lines, after taking into account the conditions prevailing in our country was also necessary. There was thus much scope for research in power engineering in the country.

8.2. Government in their action taken replies furnished in November, 1973, stated that the recommendations of the Committee was very timely. The importance of stepping up research and development activities in the field of Power was fully recognised and provisions for important research and projects were being made in the Fifth Plan within the available resources.

8.3. The Ministry of Energy were asked to state the precise measures taken to step up research and development activities in the field of power; what provision has been made in the Fifth Plan for this purpose; and the measures taken to keep abreast with the latest technological development abroad in the field of power generation.

8.4. The Ministry of Energy in their written replies furnished in November, 1976 stated that in order to step up research and development activities in the field of power grants-in-aid were given to State Electricity Boards through Central Board of Irrigation and Power for conducting studies in generation, transmission and distribution problems. Funds were also given to the Central Power research Institute, Bangalore for augmenting research facilities in the various fields of power research. Central Power Research Institute was being registered as a society with a view to giving it autonomy and flexibility in management.

8.5. In regard to the proviso made in the Fifth Plan, the Ministry stated that under the Fifth Plan, a sum of Rs. 70.00 lakhs had been

provided for Central Board of Irrigation and Power Research Schemes, for the remaining two years 1977-78 and 1978-79. In addition, a sum of Rs. 33.00 lakhs had been released in the first two years of the Fifth Plan *viz.*, 1974-75 and 1975-76. For the year 1976-77, a sum of Rs. 25 lakhs had been provided. This works out to a total Fifth Plan outlay of Rs. 128 lakhs. As regards Central Power Research Institute a sum of Rs. 367.00 lakhs had been provided for the remaining two years of the Fifth Five Year Plan. This is in addition to Rs. 21.30 lakhs spent during 1974-75 and 1975-76 *viz.* the first two years of the Fifth Five Year Plan. A provision of Rs. 38.50 lakhs existed in the budget for the year 1976-77 for this purpose. The total Fifth, Plan outlay for CPRI would consequently be of the order of Rs. 436.80 lakhs.

8.6. In regard to the measures taken to keep abreast with the latest technological developments abroad in the field of power generation, the Ministry in their note further stated that SEA is a member of VGB, and association of power plant operators of West Germany, of ERA of UK and has collaboration arrangements with EDF of France. Latest journals and necessary documentation facilities are provided in the research institute so as to enable the engineers and scientists to keep abreast with the latest technological developments abroad. Opportunities are afforded to engineers and scientists to attend various International Seminars arranged by Institute of Engineers|Central Board of Irrigation and Power and other educational Institution so as to get the information on various developments in other countries. Engineers are also deputed to other countries to attend technical studies.

8.7. The Ministry were asked to state whether any programme for intensifying research in areas of great relevance and potentiality has been drawn up, if so the progress made in this behalf may be indicated.

8.8. The Ministry in their written replies furnished in March, 1977 have stated that the number of research schemes have been taken up both by Central Power Research Institute, Bangalore and Central Board of Irrigation and Power in areas of great relevance in generation, transmission and distribution systems in the country. With the increasing tempo of installation of thermal generating stations, some new problems relating to the thermal stations are also proposed to be taken up from next year. There is a proposal to erect an experimental ultra high voltage AC Transmission line for conducting research on the problems likely to be faced in 400 KV Transmission system and also to conduct research for higher voltage

transmission. This proposal, however, is still under the consideration of the Government.

8.9. About 200 organisations are taking advantage of the testing facilities available at CPRI Bangalore in getting their equipment tested. A Tower Testing Station has also been set up by CPRI Bangalore. The test bed can test 400 KV double circuit tower.

8.10. Progress made and the results achieved in respect of the schemes already in hand by CBIP and CPRI are indicated in Appendix XIX.

8.11. The research schemes which are in hand and the new research schemes proposed to be taken up in 1977-78 are given at Appendix XX.

8.12. The Committee note that in order to step up research and development activities in the field of power, grants-in-aid are given to State Electricity Boards through Central Board of Irrigation and Power for conducting studies in generation, transmission and distribution problems etc. The Fifth Plan outlay for CBIP schemes works out to Rs. 128 lakhs. The Central Power Research Institute at Bangalore has also been provided with a Fifth Plan outlay of Rs. 426.8 lakhs. The Committee have been informed that CPRI Bangalore and CBI&P have taken up research schemes in areas of great relevance in generation, transmission and distribution systems in the country.

8.13. The Committee need hardly stress that there should be close coordination among the various agencies that are engaged in research in power problems, so that overlapping and wasteful duplication of efforts is avoided.

8.14. The Committee would like that greater emphasis should be placed on problem oriented research and it is, therefore, necessary that priorities for research projects have to be laid down on the basis of needs and problems faced in the field. They desire that research in power-problems that lead to substantial reduction in losses in generation, transmission and distribution of power should be accorded higher priority.

8.15. The Committee would further emphasise the need for costing of research projects in terms of time and money likely to be required for their completion. They consider that this would encourage and promote cost consciousness in the staff engaged in research and would result in proper utilisation of time, energy and resources.

8.16. The Committee feel that if resources on rseearch projects are to be utilised effectively and to the best advantage it would be very necessary that their progress is reviewed from time to time. The Committee desire that an objective assessment of the quality and usefulness of the research done should be made at least once in five years.

8.17. The Committee would also like to lay particular emphasis that there should be widest dissemination of the results of research and the State Electricity Boards encouraged to utilise the same in the field expeditiously.

Development of Technical Manpower

Resources and Training of Personnel

8.18. The Estimates Committee in paragraphs 8.87 and 8.88 of their 39th Report (1972-73) expressed their concern about the inadequate capacity of the Thermal Power Station Personnel Training Institutes one at Neyveli and the other at Durgapur. The Committee observed that against a large requirement of trained personnel, the actual personnel train had been very much less and it would not be possible for Government to train more than 150—200 personnel in both institutions during 1972-73 and 1973-74, resulting in heavy shortage in the number of trained personnel for operation and maintenance of Thermal Power Stations. The Committee recommended that immediate steps should be taken by Government to assess realistically the requirement of trained engineers and technicians for the Fifth Plan when the generation of power was to be increased from about 20 million KW at the end of the Fourth Plan to about 32 million KW in 1978-79. The Committee also apprehended that in case adequate steps were not taken in time in this regard, the non-availability of trained manpower for efficient and economic operation and maintenance, might become a major bottleneck in the achievements of targets of power generation, transmission and distribution in the Fifth Plan.

8.19. Government in their action taken replies furnished in November, 1973 while sharing the anxiety expressed by the Committee in respect of paucity of technical manpower and training facilities/programmes, stated that vigorous steps were already being taken to ensure that the facilities for training of personnel at the Neyveli and Durgapur Thermal Power Institutes were utilised fully. The requirement of trained personnel for operation and maintenance of Thermal Plants was being assessed. Government was considering establishment of more Technical Institutes and expansion of the existing training facilities at Neyveli and Durgapur.

In order to accelerate the training programme for meeting the large needs in respect of operating personnel, introduction of simulators was also being considered.

8.20. Asked to state the latest position with regard to the requirement and availability of trained personnel and the steps taken for establishment of more technical Institutes, the Ministry of Energy in their written replies sent in November, 1976, stated that it was estimated that during the Fifth Plan, 1750 supervisory personnel and 4000 operators were required to man the additional units being commissioned. The qualified personnel were available for employment. These were given initial training by the State Electricity Boards/Undertakings etc. prior to their being put on regular duties. Presently the training Institutes established by CEA including the two new Institutes set up during 1974-75 have got the capacity to train 230 personnel annually in both the categories. Some of the State Electricity Boards/Undertakings etc. have got their own training facilities. The Ministry further stated that arrangements were there to train 155 personnel annually in the O&M of Thermal Power Stations.

8.21. Two more training Institutes had been established one at Delhi and the other at Nagpur in the Fifth Plan. These Institutes would when fully developed impart training to 50 Supervisors and 100 operators. i.e., 150 personnel at each of these places. The training capacity at Neyveli and Durgapur was being increased to 50 Supervisory personnel and 100 operators respectively, from the initial capacity to train 32 supervisors and 40 operators respectively in March, 1972. These four Institutes when fully developed, are intended to train about 200 engineers and 400 operators per year. Some of the Electricity Boards have set up their own training Institutes to train their operators and technicians in their training institutes. State of Bihar, Madhya Pradesh, Andhra Pradesh, have already set up Training Institutes. Uttar Pradesh and West Bengal are intending to set up these Institutes very shortly.

8.22. On power system side, a Power System Training Institute has been established at Bangalore with a view to train engineers of State Electricity Boards, Regional Electricity Boards etc. in power system Operation and Load Despatch Techniques, Relaying and protection etc.

8.23. It is proposed to avail the help of UNDP for training power system Engineers. The Project envisages training of about 1000 engineers, partly by deputing them to other advanced countries and partly by importing experts from UN member countries.

8.24. State Electricity Boards are being persuaded to arrange training of linemen, electricians, pump mechanics, fitters etc. They have the resources and the manpower for this kind of work. With greater inter-action between the reorganised CEA and the Boards, it is expected that the Boards will be able to meet this obligation.

8.25. Tata Electric Company have a good training organisation. They have recently commissioned a simulator in their training Institute at Trombay. CEA and the Boards are availing of the facility. CEA are now proposing to instal a simulator at Badarpur in their Delhi Training Institute.

8.26. In addition to the above, engineers are also being sent to the Central Electricity Generation Board in UK, VGB in West Germany, USSR and USA for receiving advanced training in operation and Maintenance of the Thermal and Hydro Power Stations. It is also intended to obtain the services of 4 experts of the CEGB to advise on the Organisation of Maintenance training and running of the Training Institutes in the country and to train the trainers in the country.

8.27. Every State Electricity Board is availing the courses being conducted by the various management Institutions, in the country covering several areas of training including the project management, Financial Management, Personnel Management, etc.

8.28. The Department of Personnel, under the advice of the Planning Commission, have been arranging "Organisation Based Programmes" for power sector and the State Electricity Boards and the Central Electricity Authority have been availing of this opportunity to train their managers/executives for implementation of the power programmes on a scientific basis.

Development of Technical Manpower Resources and Training of Personnel

8.29. The Committee of Ministers appointed in 1972 had also made the following recommendation:

> There is an urgent need for developing the technical manpower resources. In this connection, it is recommended that training course should be drawn for all the technical staff in a phased manner so that each person has to go through a course at the interval of 5—7 years. Training of personnel for erection, testing, repair, operation and maintenance of power stations should be arranged by the project authorities.

8.30. Asked to state what follow-up action has been taken by Government for development of Technical Manpower resources and training of personnel for erection, testing, repair etc. in the country, the Secretary, Ministry of Energy, during evidence on 28-12-76 stated:

> "We have four Institutes which we are augmenting further. These are not going to be enough by way of implementation of what was intended by the Ministers. We are also in touch with the State Governments and Electricity Boards to try and augment their capacity. Unlike the Railways, the P&T and the Defence, in the power industry the question of training has not been adequately tackled having regard to the magnitude of the problem involved. Setting up a Commiteee is no solution. We are really going into it in depth with a view to creating adequate facilities for the very large tasks."

8.31. Asked to state the steps taken or proposed to be taken to create adequate facilities for development of manpower resources and training of personnel, the Ministry of Engery in their written replies furnished in March, 1977 have informed that the trained manpower requirement for the nuclear power programme is being met from the training school established at BARC and from the Nuclear Training Centre at Kota, Rajasthan which provide training for Engineers, Scientists and Technicians. The Nuclear Training Centre provides the training in the operation and maintenance of the Nuclear Power Stations. A nuclear power plant simulator for retraining of operating personnel is proposed to be installed in the near future. In addition to the in-house training facilities, the operational staff are also provided training at the Neyveli Thermal Power Station on operation and maintenance of turbo-generator systems. In addition, for specialised design analysis and development, the services of various technological institutions like IITs are also utilised.

Training facilities.

8.32. The Ministry of Energy in their written replies furnished in November, 1976 had informed that the State Governments had been addressed on matters relating to State Electricity Boards such as specialisation of cadres and provision of adequate training facilities for various types of personnel engaged in the Power development Programmes. These matters were being pursued with the States.

8.33. The Ministry were asked to state the areas/fields in which training was proposed to be given to the personnel from State Electricity Boards, and what had been their reaction in his behalf, the

Ministry, in their written replies furnished in March, 1977 stated that the need for separation of cadres of generation and transmission engineers to improve their operational efficiency was taken up with the State Electricity Boards. The State Electricity Boards were also asked to identify their requirements of training facilities for engineers, operators and other personnel for the next 7—10 years. The Ministry further stated that the States of Karnataka, Madhya Pradesh, Himachal Pradesh, Maharashtra, Bihar, Uttar Pradesh, Gujarat have already agreed to be separation of these cadres. The matter was being pursued with other State Electricity Boards.

8.34. The Ministry of Energy in one of their written replies furnished in November 1976 stated that the Committee on Rural Electrification in Eastern States constituted in January, 1974 under the Chairmanship of Union Deputy Minister for Energy to review the progress achieved in the matter of rural electrification in Eastern States had inter alia recommended that the States in the North Eastern Region should be provided help in training their personnel in design, construction, and maintenance of rural electrification works. The staff posted in difficult and remote areas should be properly compensated.

8.35. Asked to state what action had been taken to implement the recommendation of the Rural Electrification Committee in this regard and the results achieved, and whether Government have any plans to establish some institute in the North Eastern Region, the Ministry of Energy in their written replies furnished in March, 1977 have stated that with a view to train suitable trainers of the rank of Assistant/Engineers/Junior Engineers/Supervisors to impart training to the technicians engaged in rural electrification works in the North Eastern region, the Corporation has so far arranged to get 14 such officers from the North Eastern Region trained at the training courses conducted by it. Further 3 more such trainees are undergoing training at the Third Training Course now under progress at Hyderabad.

8.36. The Corporation has commissioned the Institute of Applied Manpower Research, New Delhi to suggest suitable measures for staff development and training of field staff for rural electrification in the North-Eastern Region. It will also review the training needs of the staff and the existing facility available as well as recommend the creation of additional training facility.

8.37. The Corporation has decided to provide financial assistance of Rs. 12.00 lakhs from out of its special development funds for setting up 2 training centres in the North-Eastern Region. A sum of Rs. 2.00 lakhs has already been released to the Meghalaya State Electricity Board for setting up a Linemen Training Centre at Barapani which has since commenced its operation with effect from 5-1-1977. The second training Institute is to be set up at Jorhat in Assam for which the project report is awaited from the Assam State Electricity Board.

8.38. The Committee in their 39th Report expressed their apprehension that non-availability of trained manpower for efficient and economic operation and maintenance of power project might become a major bottleneck if adequate steps were not taken in time in this regard. The Committee of Ministers appointed in 1972 had also pointed out the urgent need for developing technical manpower resources and recommended that training course should be drawn for all technical staff in a phased manner so that each person has to go through a course at the interval of 5-7 years.

8.39. The Committee note from the replies of Government that for the efficient operation of thermal stations, Government had set up two training Institutes in the Third Plan, one at Neyveli and the other at Durgapur. Two more institutes, one at Nagpur and the other at Delhi have also been established during the Fifth Plan period. These four institutes when fully developed can train 200 engineers and 400 operators every year. Apart from these, the States of Bihar, Madhya Pradesh and Andhra Pradesh have set up their own training institutes and West Bengal and Uttar Pradesh intend to do so shortly.

8.40 The Committee note that for the Fifth Plan period, 1750 supervisory personnel and 4000 operators are required to man additional units being commissioned. With the facilities available in the four institutes set up by the Central Government, viz., training of 600 personnel annually, the Committee wonder whether the entire 5750 additional personnel required to man additional units during the Fifth Plan period would be imparted the requisite training. The Committee also feel that as suggested by the Committee of Ministers in 1972 each person should go through re-orientation courses at an interval of 5-7 years. The Committee need hardly point out that with the increasing accent on power expansion, the country would need more and more trained technical personnel to man the power stations. The Committee would; therefore, urge that a study may be undertaken to assess the requirements of technical personnel of various categories on a short term and long term

basis and urgent steps taken by Government to augment the existing training facilities.

8.41. The Committee note that only three States viz., Bihar, Madhya Pradesh and Andhra Pradesh have set up training institutes. It is surprising that while power development has been taken up in a big way and rural electrification has been given greater emphasis, many States have not come forward to set up Institutes for training more personnel in operation and maintenance of power stations. The Committee consider that the training requirements can be adequately met only if the States join in the endeavour with the Centre. The Committee would urge the Central Government to take up this matter with the concerned State Governments to augment the training facilities.

8.42. The Committee also note that the question of separation of cadres of generation and transmission engineers to improve their operational efficiency was taken up with the States. Seven States have agreed so far to the separation of cadres. The Committee would like the Government to impress upon the other States the need to separate the cadres as early as possible.

8.43. The Committee observe that the Committee on rural electrification in the Eastern States constituted in January, 1974, recommended that the States in the North-Eastern region should be provided help in training their personnel in design, construction, and maintenance of rural electrification works. The Committee learn that with a view to train suitable trainers of the rank of Assistant Engineers/Junior Engineers/Supervisors to impart training to the technicians engaged in rural electrification works in the North Eastern region, the Rural Electrification Corporation has so far arranged to get 14 such officers from the N.E. region trained at the training courses conducted by it. Further 3 more such trainers are undergoing training at the Third Training course now under progress at Hyderabad. The Rural Electrification Corporation has also commissioned the Institute of Applied Manpower Research, New Delhi to suggest suitable measures for staff development and training of the field staff for rural electrification in the North Eastern Region, as also to review the training needs of the staff. The Committee also observe that the Corporation has decided to provide financial assistance of Rs. 12.00 lakhs from out of its special development fund for setting up 2 training centres in the North Eastern Region, and that a sum of Rs. 2.00 lakhs has already been released to the Meghalaya State Electricity Board for setting up a Linemen Training Centre at Barapani which has started functioning since January, 1977, and that project report for setting up the second

training Institute at Jorhat was awaited. The Committee would urge that the training facilities in the North Eastern Region need greater and special attention as these States are lagging far behind the national average in rural electrification. The Committee would also like to be informed of the recommendations of the Institute of Applied Manpower Research, New Delhi in this behalf and the steps taken to implement them.

8.44. In the matter of training on power system side, the Committee note that there is only one training institute at Bangalore. The inadequacy of the institute in meeting the training requirements is obvious from the fact that Government are proposing to avail the help of UNDP, for training 1000 power system engineers, partly by deputing them to other advanced countries and partly by importing experts from UN-member countries. The Committee would like Government to assesss the requirements of power system engineers and to prepare a short-term programme for immediate implementation and a long-term perspective plan to train power system engineers to meet the demand.

Hot Line Training Centres

8.45. The Estimates Committee in paragraph 8.89 of their 39th Report (1972-73) noted that in foreign countries 'Hot Line Maintenance Techniques' were being used for a long time which enabled maintenance of lines and related equipment without de-energising and disrupting the power supply. They further noted that two Hot Line Crew Centres—one at Bangalore and another at Ganguwal—were set up by the Government after entering into an agreement with USAID. These centres which started functioning in 1958, were closed in 1962 and 1965 respectively. The Committee noted that there was a great demand from the State Electricity Boards for the trained personnel in the Hot Line Maintenance Techniques and that a proposal was under consideration for training employees on the new techniques called 'Bare Hand Method' which was in vogue in Russia and to conduct refresher courses on the 'Hot Stick Method' which was in vogue in USA.

8.46. The Committee had emphasised the usefulness of Hot Line Maintenance Techniques being adopted in the country on a large scale in view of the large expansion in the power system in the country and the advantages of the technique in carrying out maintenance without interrupting power supply. The Committee were unable to appreciate why the two centres were closed down after a brief period of 5 to 8 years. They urged that Government should set up

training centre|centres for imparting training in this new technique as early as possible so as to meet the needs of the State Electricity Boards and other bodies engaged in the operation and maintenance of power supply in the country.

8.47. Government in their action taken replies stated in December, 1973 that the two Centres were closed down mainly for the reason that, after training of a sufficiently large number of personnel from the State Electricity Boards, the State Electricity Boards did not sponsor adequate number of candidates for training at the Hot Line Crew Centres. The then Ministry of Irrigation and Power in their action taken reply further stated that they shared the view of the Estimates Committee and felt that it was necessary to revive the centres for proper maintenance and transmission lines and related equipment without de-energising and disrupting the power supply. They further stated that Government were already considering early revival of the Hot Line Crew Training Centres.

8.48. The Minister of Energy were asked to state whether the two Hot Line Crew Centres at Bangalore and Ganguwal have been re-opened and what is the number of personnel which have been sponsored for training at these centres by various State Electricity Boards, and whether any new centres have been opened. The Ministry in their written replies have stated in November, 1976, that the Hot Line Crew Training Centre at Ganguwal which was closed down in 1965 has not since been re-opened. The training centre at Bangalore which was closed down in 1962 was re-opened and has started functioning from August, 1975.

8.49. The Ministry stated that two training courses each of 4 months duration were arranged at the Bangalore Centre since its inception. The first training course was conducted from 1st August, 1975 to 30th November, 1975 in which thirteen trainees—five from Karnataka Electricity Board, three from Gujarat Electricity Board and five from Delhi Electric Supply Undertaking successfully underwent training for working on energised lines upto 220 KV. The second training Course was conducted from 15 March, 1976 to 15 July, 1976, with nineteen trainees—five from Andhra Pradesh Electricity Board, seven from Madhya Pradesh State Electricity Board, five from Tamil Nadu Electricity Board and two from Tarapur Atomic Power Project. Out of these, eighteen trainees successfully completed that training and one trainee from Tamil Nadu could not complete the training. The Ministry further stated that the third training course (4 months) is scheduled to commence from

10 October, 1976, and about sixteen trainees are expected to participate.

8.50. The Ministry also informed that no new centres had been opened.

8.51. The Ministry were asked to state whether the feasibility of adopting the 'Bare Hand Method' in vogue in Russia and 'Hot Stick Method' in vogue in USA had been examined with a view to training employees on the new techniques, the Ministry of Energy had informed in November, 1976 that the training being imparted at the Bangalore Centre was on the use of 'Hot Stick Method'. However, it was proposed to adopt the 'Bare Hand Method' which was in vogue in Russia, USA and other Western Countries, with a view to training the employees in this technique as well.

8.52. Asked to state whether there was no demand from the State Electricity Boards for trained personnel in the Hot Line Maintenance Techniques in the northern region catered for earlier by Ganguwal Centre, the Secretary, Ministry of Energy, during evidence in December, 1976 stated:

> "The Hot Line Training Centre at Bangalore has started working for the past one year and we have trained about 35 people now. The third course is in progress at the moment. It is not certainly enough and we have realised the need for starting one more centre in the North. The Hot Line Training Centre at Bangalore is on the conventional method and the new centre in the northern region is on bare-hand technique which is a modern method."

8.53. The witness also added:

> "The intake of the technicians from various Electricity Boards went on decreasing to a level which was really not satisfactory from the operation of the training centre, and therefore, we had to close it down, but after 4-5 years the demand came and we had to start the school."

8.54. Later the Ministry through their written replies furnished in April, 1977 informed that presently the personnel from State Electricity Boards from the Northern Region were also being trained in the Bangalore centre. However, it was proposed to establish a Hot Line Training Centre in the Northern Region itself as early as may be possible.

8.55. The Ministry of Energy have further stated that it is proposed to introduce 'Bare Hand Technique' for maintenance of live lines, which eliminates the use of live line tools and increases the degree of safety. Both these centres would adopt this method and would gradually replace the 'Hot Stick Method' in a phased manner.

8.56. The Committee had in their 39th Report (1972-73) emphasised the usefulness of 'Hot Line Maintenance Techniques' being adopted in the country on a large scale and expressed their concern at the closing down of the two centres—one at Bangalore and another at Ganguwal—which were set up by the Government after entering into an agreement with USAID. The Committee had urged that Government should set up training Centre|Centres for imparting training in this technique as early as possible so as to meet the needs of the State Electricity Boards and other bodies engaged in the operation and maintenance of power supply in the country.

8.57. The Committee note that out of the two Hot Line Training Centres only the training centre at Bangalore has been reopened and it has started functioning from August, 1975. The Committee also note that Government propose to establish a Hot Line Training Centre in the Northern region itself as early as possible, and that this Centre would impart training in 'Bare Hand Method' which is stated to be a modern method and has the advantage of eliminating the use of live line tools and increasing the degree of safety. The Committee would urge the Government to expedite the opening of this Centre. They would further like that training in the 'Bare Hand Technique' may also be started at the Bangalore Centre at the earliest.

Building of Design and Engineering Capability in the country and standardisation of equipment

8.58. The Estimates Committee in paragraph 3.55 of their 39th Report (1972-73) observed that an assessment of the indigenous machine building and design capacities for fabrication and delivery should be made with a view to planning imports wherever indigenous capacity was not sufficient to meet the requirements.

8.59. With a view to assessing the capability of indigenous manufacturers of plant and equipment to meet the requirements of power development programme, the Government (erstwhile Ministry of Irrigation and Power) appointed a Committee of Ministers in July, 1972. This Committee submitted its report in 1973, and made a

number of recommendations, which inter alia included the following:

> "The need for design and engineering services for power projects will arise in a big way partly on account of ever large programme of new projects and partly due to the need for greater design and engineering support for better project execution. The design units in the electricity Boards, Electricity Departments the specialised Engineering Organisation of CW&PC and consulting engineering firms presently available will have to develop and expand suitably."

8.60. Asked to state what precise steps have been taken to ensure that the design and the engineering capability as well as the expertise for specific areas of complexity is built up in the Central Water and Power Commission (Now CEA), the representative of the Ministry of Energy during evidence on 28th December, 1976 stated:

> "The Central Electricity Authority are designing the thermal power stations, hydro electric power stations and the transmission systems. They have arrangement for regular feedback of operational and maintenance data collected with problems, to the Design Groups, based on these, they continuously provide the improvements in the new station designs and system designs. They have also embarked upon schemes for standardising equipment and lay-out. They are also inter-acting with the Ministry of Industrial Development in standardisation of equipment. With these measures, particularly on standardisation, we hope to overcome the complexities of particular problems."

Standardisation of equipment for transmission/distribution system

8.61. In his address to the Conference of the State Ministers of Power held at New Delhi on the 21st and 22nd July, 1976 the Union Minister of Industry and Civil Supplies stated as follows:

> "Proper and adequate attention was needed to be paid not only for generation of power but also for its transmission and distribution. He suggested that equipment required for transmission and distribution should be standardised which was not the case now and each Board had its own specifications different from the other. Standardisation would ensure speed and stability."

8.62. Asked to state the steps taken by Government to standardise the equipment for transmission and distribution system, the Secretary, Ministry of Energy, during evidence stated:

"There are two aspects: one relates to low voltage transmission and distribution. This work is being done by REC, for the reason that they are actively in touch with the State Boards in any case, for their own schemes. What applies by way of standardisation and specification for BEC's own schemes, holds equally good for the other efforts of the States in the same voltage and distribution levels. They have made a very systematic standardisation, by setting up special committees consisting of themselves and the State Boards. There are project engineers on the job. In terms of quantum of standardisation, 90 per cent of the value of all the equipment required have been covered. I have been assured not only by the managing director of the REC but also by the State boards, that they have fallen in line. It has been worked out jointly by the REC and the State representatives for the lower ones. For the higher ones, we have gone to the World Bank 4 or 5 times for IDA loans. In that context we have to make the standardisation in such a manner as to satisfy not only CEA but also the World Bank and the IDA."

8.63. Later in their written note, the Minister of Energy, explained the position thus:

(a) As far as the equipment for transmission distribution system pertaining to the rural electrification is concerned, the REC has set up a cell for standardisation of these equipments. This cell is being looked after by two Chief Project Engineers under the overall charge of a Chief Engineer. The standardisation of the equipment is being done in consultation with various State Electricity Boards, Indian Standard Institution, Central Electricity Authority, Manufacturers and other connected Agencies through the forum of Helping and Technical Committees and by organising standardisation conferences.

(b) The progress achieved so far is as under:

The REC has already standardised specifications on the following equipments and issued to State Electricity Boards.

11 *KV and Low-tension*

(i) Overhead line conductors of following sizes:

(a) All Aluminium conductors—16 and 30 mm^2 (CE).

(b) ACSR conductors—13, 20 & 30 mm^2 (CE).

(ii) Distribution transformers—16, 25, 63 and 100 KVA.

(iii) PCC poles.

(iv) Porcelain Insulators and fittings.

(v) Single phase and three phase current AC metres.

(vi) 415 V three phase shunt capacitors.

(vii) 11 KV circuit brakers.

(viii) 11 KV Lighting arresters.

(ix) 11 KV sealed distribution transformers—16, 25, 63 and 100 KVA.

(x) L.T. cables for Distribution—transformers—16, 70 and 150 mm.

(xi) Rubber Hand Gloves.

33 *KV System*

(i) ACSR Conductors—30, 48 and 65 mm^2 (CE).

(ii) 33/11 KV Power Transformer—630, 1600, 3150 and 5000 KVA. Work for standardising other equipments required for 33 KV transmission system is being done.

8.64. The above equipments, as standardised by the REC, cover approximately 90 per cent of the cost of materials used for 11 KV and Low-tension distribution system in REC schemes. In addition to these, the Corporation has also finalised and issued 87 construction standards which will affect better construction practices, stability in supply, overall economy in the RE system etc.

8.65. The Committee note that a Committee of Ministers appointed in 1972 in their Report had recommended that the design units in the State Electricity Boards, Electricity Departments, the specialised engineering organisation of CW&PC (now CEA) and consulting engineering firms will have to develop and expand suitably in view of the ever large programme of new projects and the

need for greater design and engineering support for better project execution. The Committee were informed during evidence that the CEA are designing the thermal power stations, hydro electric power stations and transmission systems and on the basis of regular feedback of operational and maintenance data, improvements in the new station design and system design are made.

8.66. The Committee need hardly point out that the designs of power stations will have to incorporate the latest and the most appropriate technology so that generation, transmission and distribution of power are most efficient and entail minimum of losses. The Committee attach great importance to feedback of information on operation and maintenance from the project levels so that necessary correctives could be applied and lessons learnt leading to new improved station and system design etc. The Committee would also like Government to take concrete steps to strengthen and augment the design units at various levels.

8.67. The Committee note that the Minister of Industry and Civil Supplies at the Conference of State Power Ministers held in July, 1976 had remarked that equipment required for transmission and distribution of power should be standardised, so as to ensure speed and stability. The Committee note that as far as the equipment for low voltage transmission/distribution system pertaining to the rural electrification was concerned, REC had set up a cell for standardisation of these equipments, under the overall charge of a Chief Engineer. The standardisation was being done in consultation with the various State Electricity. Boards, Indian Standards Institution, Central Electricity Authority, manufacturers and other connected agencies through the forum of Helping and Technical Committees and by organising standardisation conferences. The Committee are glad to be informed that in terms of quantum of standardisation 90 per cent of the value of all equipment required had been covered. They would like that effective steps should be taken to standardize the remaining equipment expeditiously.

8.68. The Committee also note that for the higher voltage transmission/distribution equipment, Government have approached the World Bank for IDA loans, as the standardisation has to be made in such a manner as to satisfy not only the CEA but also the World Bank and the IDA. The Committee would urge Government to expedite the matter and take necessary action for a standardisation of higher voltage transmission/distribution equipments at the earliest.

Research and Development of Cheaper and better material/equipment.

8.69. The Conference of the State Ministers of Power held on 21st and 22nd July, 1976 *inter alia* stated that as a long term measure,

it was necessary to develop cheaper and better substitutes of materials and equipment for distribution. Steps should be taken to identify Research and Development areas in distribution which could yield immediately results with a view to developing cheaper and better equipment.

8.70. The Ministry of Energy were asked to state the precise steps taken to identify the R&D areas to develop cheaper and better equipment. The Ministry in their written note furnished in March, 1973 have stated that the Rural Electrification Corporation has already identified some of the important materials and equipments which will yield immediate results in the development of cheaper and better equipments. For the support of 11 KV and LT lines, design of cheaper pre-stressed cement concrete poles have been evolved and standardised. REC has introduced a soft term loan for assisting State Electricity Boards in setting up of departmental manufacturing units for PCC poles based on the design, which will give cheaper and better quality poles R&D work is in progress for the evolving of:

.(i) economical PCC cross arms.

(ii) jointed wood poles—to utilise short poles and for easy transportation in hilly areas.

(iii) Mini-circuit breakers for LT net work

(iv) Sealed type distribution transformers.

8.71. The Ministry has also stated that the standardisation of sealed distribution transformers for use in rural areas would considerably reduce the maintenance cost as well as check the theft of transformers coil, oil etc. A number of manual on operation and maintenance aspects of equipments have also been issued by REC. It was found that huge capital remains idle for considerable length of time in the shape of damaged transformers because of the lack of know-how and workshop facilities for repairing of transformers. REC with view to assist in retrieving this capital which is of continuous nature, has finalised and issued a Manual for the 'Repair of Damaged Distribution transformers' covering technical, financial and organisation aspects. In addition to this Manual REC has also recently introduced a soft term loan to encourage repair workshops. The setting up of departmental workshop will provide for quick and cheaper repairs of damaged transformers.

8.72. REC has further identified some areas of R&D to develop cheaper materials|equipments for rural electrification. Special alloy

of aluminium has been developed for the manufacturing of conductors for use in the coastal areas to prevent the fast rate of corrosion. Embedded bearer wires for service connection are also being used in selected coastal areas an experimental basis for the same reasons. Substitute for clorinated Diphenyl which is being imported for use in the manufacturing of capacitors is also being developed. Considerable saving in foreign exchange is expected when the substitute is developed. Single wire Earth Return system is being tried on two pilot schemes. The introduction of this system would enable to electrify the hilly and Tribal areas economically because the load development in such areas is very meagre.

8.73. Indicating the progress made and the results achieved in the introduction of single wire Earth Return system, the Ministry of Energy in their written note have informed that it is considered economical to extend power supply to villages by utilising single wire earth return system as this will result in a saving of 30 to 40 per cent. To achieve this object, phase converters for using 3 phase motors in single phase have been developed and employed by Karnataka State Electricity Board on an experimental basis. These are working satisfactorily. Also, solid state earth fault relay suitable for the SWER system has been developed and is being used in Karnataka State Electricity Board. In addition, pilot schemes of SWER have been undertaken by MP and West Bengal State Electricity Boards.

8.74. The Committee note that the Rural Electrification Corporation has identified a few R&D areas for developing cheaper and better equipment and materials and has achieved results in some of these areas. The Committee need hardly stress that greater attention should be paid to identify more and more areas for developing cheaper and better equipments which would result in considerable economy in expenditure. The Committee would like the REC to step up their R&D activities and go in for large scale development of cheaper equipment and materials.

CHAPTER-IX

MAGNETOHYDRO DYNAMICS POWER GENERATION

Principle of MHD

9.1. The Ministry of Energy in their written note stated that Magnetohydro dynamics (MHD) is the process by which heat energy is converted directly into electricity through the interaction between all electrically conducting fluid and a magnetic field. The principle behind this process is not new and is based on the theory of electromagnetic induction enunciated by Michael Faraday in the early nineteenth century. The conventional generators at present use solid metal conductors to interact with the magnetic field to produce electricity. The MHD generator is based on the concept of using flowing ionized gases or liquid metals as the moving conductor, which has been heated by chemical or nuclear fuel, for interaction with a magnetic field to convert part of the energy directly into electricity. Thus, the MHD generator does not have the intermediate step of the prime mover. It has no moving parts and utilises working fluids at higher temperatures. In view of this, efficiencies obtained through MHD conversion process are much higher than the conventional conversion process.

Relevance of application of MHD in power generation system:

9.2. The Ministry of Energy in their written note have stated that the MHD process enables energy extraction of the order of 20—30 per cent of the total energy input to the hot gases, depending on the strength of magnetic fields. A conventional power generating system, added at the tail end of the MHD system would enable further energy extraction. A combination of the MHD and conventional power cycles makes it possible to achieve higher overall thermal efficiencies of 50 to 60 per cent as compared to 37 to 38 per cent possible from a conventional system.

9.3. The MHD has, thus the potential of raising the overall thermal efficiency of power generation considerably. Its adoption would lead to saving of sizeable quantum of fuel, which is important in the present context of the world energy situation.

MHD cycle under Indian context

9.4. India has large reserves of coal and in this context, it is considered advntageous to develop coal based MHD technology in the country. Further, the development of open cycle coal fired technology has made greater progress and it offers the best possibility of earlier commercial exploitation. MHD cycle based on coal as fuel in combination with conventional gas|steam turbine cycles are considered relevant in the present Indian context.

9.5. The Indian coal contains a high percentage of ash. Use of such high-ash-content coal leads to several technological problems in both the MHD and the conventional cycle. Hence, it would be desirable to develop MHD technology through the coal gasification route.

R&D Programme in advanced countries and progress made so far

9.6. The Ministry of Energy have stated in their written note that there have been sustained efforts and interest to develop the MHD technology among physicists and engineers. The efforts have recently been increased and intensified in several countries. The leading countries in the field are USSR, Japan and USA.

9.7. USSR has a 25 MW(e) demonstration plant in operation since 1971. Often this plant has been operated as a commercial unit for study purposes and the results have been encouraging. Based on this experience, the construction of a 1000 MW(e) commercial MED Power station has been sanctioned. Work on this has already been started and the station is expected to be ready by 1981.

9.8. In USA, several experimental generators are in operation at AVCO, UTSI, Westin house Research Laboratory and the US Bureau of Mines, Pittsburg. In addition, they are in the process of setting up a National MHD facility. This plant will be located in Montana and is expected to be in operation by 1980. The facility will be a fore-runner of a full scale commercial plant to be commissioned in 1989.

9.9. The Japanese programme started in 1966 with the basic objective of developing oil fired MHD power plants. This has anabled testing of many sophisticated sub-systems. The work of 10 MW(e) Demonstration Plant near Tokyo is in progress.

9.10. Poland and Romania have Government sponsored MHD programmes with operational experimental plants of several MWs

of thermal input. According to recent reports from IAEA Conference, 1975, West Germany and UK, who had de-emphasised MHD programme in favour of nuclear power, are now considering to reactivate the programme due to the reasons of new developments of MHD and the energy crisis.

9.11. Asked to state whether an evaluation of the technology of the MHD system of power generation available in various other countries has been made with a view to select the best technology in this field to suit conditions in India and which could be economical and efficient, the Chairman, Atomic Energy Commission, during evidence stated:—

> "The only country in the world which is ahead in the MD facilities is the USSR. The U.S. did start on it some years ago. Now the USA and the USSR are entering into the collaboration around the world. The USSR and the USA are leading countries in this technology at present."

Economics and advantages of MHD process.

9.12. The MHD technology is still in the R&D stage and no realistic cost data based on actual experience is, therefore, available. The cost projections available at present are based on assumptions regarding the availability and cost of suitable technology and materials. While the total installed cost of a coal gasification based MHD steam cycle plant is expected to be higher than that of conventional plant, the unit cost of generate power is expected to be lower due to higher efficiencies of the cycle.

9.13. The combined MHD-steam-gas cycles have the potential to increase the power generation efficiency to around 50 to 60 per cent which will mean an annual saving in coal consumption of about 0.5 to 1 million tonnes for a 1000 MW plant depending of the efficiency achieved and utilisation factors.

9.14. The power cycle based on MHD has the added attraction from the point of view of nitrogen fixation occurring at high temperature which can lead to the development of an integrated technology for power generation as well as fertiliser production. MHD technology will enable to minimise air pollution at no cost to the consumers. It will enable to minimise in the long run, the thermal pollution of rivers and lakes.

9.15. Asked to state what specific steps were being taken to develop the MHD power generation speedily so as to solve the problem of air pollution and water pollution as envisaged, the Chairman, Atomic Energy Commission, during evidence stated:

> "To prevent thermal pollution, you put up a cooling tower before you let off your water to a lake. That is the accepted standard practice in USA and USSR. As far as air pollution is concerned, in the MHD system since you are running at a high temperature with complete combustion, the air pollution is reduced to that extent. One has to be careful to see that excess of air is not introduced because in that case your MHD system would not work as it would give rise to oxides of nitrogen. So, one can say as a working proposition that there will be some pollution but in this way it will be very much less than what you have in a conventional thermal power plant. To determine to what extent it would be there, we have to run our Indian coal with its problem of high ash etc., then we can come to the conclusion that there will be some pollution but in the case of MHD there will be less pollution per KV of electricity sent out.

MHD programme in India

9.16. Preliminary work in the field of MHD was initiated by Bhabha Atomic Research Centre and Bharat Heavy Electricals Ltd. in 1973. A project for setting up a MHD R&D facility was completed in September, 1975.

9.17. The Indian MHD programme for the period 1976 to 1981 will consist of the following objectives:—

Creation of a suitable base for R&D work in the field of MHD power generation.

Initiating and coordinating research activities in this technology at various organisations and laboratories in the country.

Setting up of an MHD experimental plant at a level of 5 MW (Thermal) and conducting experiments thereon.

Developing scientific data and design capabilities for large size plants.

9.18. In the period 1981-1986, the experimental plant will be used in generating the technical expertise in MHD power generation.

9.19. The project is being executed jointly by BHEL and BARC and funded by DST. In addition, technical consultations will be provided by the Institute for High Temperature, Moscow.

Indo-Soviet Collaboration and Present status

9.20. The Ministry in their written note have stated that in accordance with the Agreement between the Government of India and the Government of USSR on setting up a joint programme in the fields of applied science and technology signed on October 2, 1972, in Moscow, co-operation between. India and USSR for the development of MHD power started in 1973, and will continue for 5 years in the first phase. Under this agreement, USSR will provide assistance in the MHD field by way of—

—Professional consultancy of Soviet specialists in setting up the MHD R&D facility in India.,

—Exchange of information by way of visits of engineers and scientists, discussions, lectures etc.,

—Visit to MHD installations in USSR by Indian scientists and engineers.

Technical consultations will also be provided by the Institute of High Temperature, Moscow. Number of visits have taken place both by Indian delegations and Soviet counterparts.

9.21. The R&D programme has already been initiated from October, 1976 and is programmed to be completed by March, 1981. The R&D facility is being set up at Tiruchy around the BHEL complex, so that the infrastructure coming up in connection with other Coal R&D programmes could be utilised for this project as well. The PERT net-work as well as the detailed work programme have been already completed indicating the responsibilities of various Working Groups specifically constituted, pooling the man power resources from BHEL and BARC to start with. A High Level Steering Committee has been constituted with the responsibility of co-ordinating and implementation of the project.

9.22. During the execution of the programme, the progress of the investigations and the programme of future work will be periodically reviewed jointly between Soviet and Indian Scientists and by the Steering Committee of the MHD Project.

9.23. Asked to state whether any survey has been carried out to identify the thermal power stations which could be combined with the MHD power generation successfully to achieve higher efficiency, the representative of the Ministry of Science and Technology during evidence stated:—

> "We have just gone to the recent technology. It might be a little too early to project any possible comparison."

9.24. The Secretary, Ministry of Energy, elaborating the position stated:—

> "The question is if our 5 megawat based on Indian coal is a success then do we have sufficient use for consumption. Now the answer is very clearly in affirmative. Well, there are no features in this experiment unlike uranium like that because there is no bottleneck in this once it has been successful. Once it is successful, as has already been indicated, the savings that you anticipated in the utilisation make this an attractive proposition."

9.25. Asked to state whether a suitable base for R&D work in the field of MHD power generation has been established, representative of the Ministry of Science and Technology during evidence stated:

> "This is a research programme which has just been approved by the Cabinet, sometime last month. This has been sponsored by the Department of Science and Technology which is doing the funding and coordinating role: the two implementing agencies are RARC and BHEL and it would be appropriate if I read a para of the cabinet note which really sets out the entire programme. It says—MHD Power generation is a process of direct conversion of heat into electricity. It has been well-established that coal fired thermal power plant using combined MHD process as conversion has an efficiency of 50 to 60 per cent as compared to 37-38 in conventional system. Fortunately coal is abundant in India and is a very important source of fuel. It is obvious in national interest this raw material should be exploited to the best advantage and it is anticipated the MHD process would result in a saving of approximately a million tonnes of coal annually for a thousand MW generation. This is the promise on which we have suggested the research project."

9.26. Asked to state why an experimental plant of a higher capacity, i.e. 25 MW as against the proposed 5 MW, was not being planned, when the USSR already had a 25 MW demonstration plant, and whether any special difficulties were envisaged in this regard, the representative of the Ministry of Science and Technology, during evidence stated:—

> "The point is that the Indian experiment is based on a five MW plant. We are getting technical assistance and collaboration from the Institute of High Temperature and Physics in Moscow where they have tried a 25 MW plant capacity. Being an experiment we thought we will start with 5 MW and see how it works out and step it up to 15 MW in course of time."

9.27. Asked to state the constitution, terms of reference of the High Level Steering Committee which has been constituted with the responsibility of coordination and implementation of the project at Tiruchy and the progress made, the representative of the Ministry of Science and Technology, during evidence stated:—

> "The Secretary, Science and Technology is the Chairman. The Chairman and the Managing Director, BEHL , the Director of BARC and the Member (Thermal), Centre Electricity Authority are the Members of this Committee, the Financial Advisor, DST and the Project Co-ordinator looking after this work in DST is the convener.
>
> We have done preliminary civil work in Tiruchy. As Dr. Sethna briefly mentioned, preparatory work has been done in anticipation of the Cabinet approval."

9.28. Asked when the work will be completed, the witness stated:—

> "We have the PERT Chart and the work is going on according to schedule."

The Chairman, Atomic Energy Commission added that by 1981 it would be completed.

9.29. The Committee note that a new process called 'Magnet-hydrodynamics' which converts heat energy directly into electricity through the inter-action between all electrically conducting fluid and magnetic field is being tried in various countries. The efficiencies obtained through MHD conversion process are stated to be higher than the conventional process. The Committee further note that the MHD process enables energy extraction of the order of 20—30 per

cent of the total energy input to the hot gases, depending on the strength of magnetic fields. It has also been stated that a combination of the MHD and conventional power cycles makes it possible to achieve higher over-all thermal efficiencies of 50—60 per cent as compared to 37-38 per cent possible from a conventional system. As the MHD has the potential of raising the overall thermal efficiency of power generation considerably, its adoption would lead to saving of sizeable quantity of fuel, which is important in the present context of world energy situation. The other advantages of the MHD technology will be to minimise air pollution at no cost to the consumer, and it will enable to minimise in the long run, the thermal pollution of rivers and lakes.

9.30. The Committee note that leading countries like USSR, USA and Japan are making sustained efforts to develop MHD technology and have increased their efforts in this field. It is noted that USSR has a 25 MW(e) demonstration plant in operation since 1971, and often this plant had been operated as a commercial unit for study purposes and the results had been encouraging. Based on this experience construction of a 1000 MW(e) commercial MHD Power Station has been started in USSR which is expected to be ready by 1981. Even West Germany and U.K. which had de-emphasised MHD programme in favour of nuclear power, are now considering to reactivate the programme due to the new developments of MHD and the energy crisis.

9.31. The Committee note that initiative has already been taken to establish an experimental plant of 5 MW based on the principle of Magnetohydro-dynamics at Tiruchi under an agreement with the USSR. The Committee would like the Government to keep in touch with the progress made in the field all over the world so as to see that the experimental plant being set up in our country incorporates the latest technology. Careful evaluation of its suitability and economics may be undertaken to ensure conclusive follow up action.

NEW DELHI;
April, 18, 1978.
Chaitra 28, 1900 (*Saka*).

SATYENDRA NARAYAN SINHA,
Chairman,
Estimates Committee.

APPENDICES.

APPENDIX I

(*Vide* para 2.47)

Statement showing the Development of Hydro Electric potential during Fourth Plan potential to be developed in the Fifth plan and Sixth plan.

Region/State	*Total potential as per Hydro-Electric Survey (MW at 60% L.F.)	Potential developed end of IV Plan		Anticipated Development of Potential					
				End of 1976-77		End of V Plan		End of VI Plan	
		MW at 60% L.F.	%age of estimated potential	MW at 60% L.F.	%age of estimated potential	MW at 60% L.F.	%age of estimated potential	MW at 60% L.F.	%age of estimated potential
1	2	3	4	5	6	7	8	9	10
Northern Region									
Jammu & Kashmir	3590·5	57·5	1·60	57·5	1·60	103·0	2·87	414·7	11·55
Punjab, Haryana, Himachal Pradesh and Rajasthan	3377·0	995·8	29·49	995·8	29·49	1943·8	57·56	2128·8	63·03
Uttar Pradesh	3764·0	451·7	12·00	710·0	18·86	746·0	19·82	1074·2	28·54
TOTAL	10731·5	1505·0	14·02	1763·3	16·43	2792·8	26·02	3617·7	33·71
Western Region									
Gujarat	677·0	..	0·00	115·0	16·98	115·0	16·98	131·7	19·45
Madhya Pradesh	4582·3	112·5	2·45	112·5	2·45	112·5	2·45	144·0	3·14
Maharashtra	1909·6	785·3	41·12	903·4	47·31	903·4	47·31	1003·5	52·55
TOTAL	7168·9	897·8	12·52	1130·9	15·78	1130·9	15·78	1279·2	17·84

1	2	3	4	5	6	7	8	9	10
Southern Region									
Andhra Pradesh	2476·5	207·7	8·39	411·0	16·60	631·6	25·50	1451·1	58·59
Karnataka	3372·8	988·7	29·31	988·7	29·31	1313·7	38·95	2155·2	63·00
Kerala	1539·5	545·9	35·42	929·6	60·38	920·6	60·38	133·7	73·90
Tamil Nadu	708·2	826·7	116·73	826·7	116·73	848·4	119·80	1007·9	142·432
TOTAL	8097·0	2568·4	31·72	3156·0	38·98	3723·3	45·98	5747·9	70·99
Eastern Region									
Bihar & West Bengal	631·7	78·6	12·44	92·8	14·69	115·7	18·32	348·0	55·09
Orissa	2062·0	412·5	20·00	467·5	22·67	467·5	22·67	718·5	34·84
Sikkim	940·0	10·0	1·06	10·0	1·06	20·0	2·13	20·0	2·13
TOTAL	3633·7	501·1	13·79	570·3	15·69	603·2	16·60	1086·5	29·90
North Eastern Region									
TOTAL	12464·4	37·5	0·30	45·0	0·36	67·0	0·54	242·0	1·94
ALL INDIA TOTAL	42095·5	5509·8	13·1	6665·5	15·83	8317·2	19·76	11973·3	28·44

*The above survey was carried out in the 50's.

The potential may be much higher on the basis of uptodate topographical and hydrological data.

APPENDIX II

(*Vide* Para 2.136)

Details of per Capita-consumption of Electricity for the Year 1968-69 & 1973-74.

(In Kwh)

States/UTs	1968-69	1973-74	Netincrease
1. Andhra Pradesh	43	61	18
2. Assam	15	21·2	6·2
3. Bihar	61	71	10
4. Gujarat	116	154	38
5. Haryana	75	141	66
6. Himachal Pradesh	16	57	41
7. Jammu & Kashmir	33	43	10
8. Karnataka	70	121	51
9. Kerala	68	85	17
10. Madhya Pradesh	49	68	19
11. Maharashtra	137	170	33
12. Manipur	3	8	5
13. Meghalaya	@	@	—
14. Orissa	88	93	5
15. Punjab	165	197	32
16. Rajasthan	33	61	28
17. Tamil Nadu	115	133	18
18. Tripura	5	6	1
19. Uttar Pradesh	50	58	8
20. West Bengal	106	116	10
Union Territories			
(a) Delhi	241	316	75
(b) Chandigarh	254	329	75
(c) Pondicherry	163	187	24
ALL INDIA	78	97·5	19·5

@ Figures for 1968-69 and 1973-74 are included in Assam.

APPENDIX III

(*Vide* Para 2.137)

Details of per capita consumption of Electricity (KWH) during 1974-75 & 1975-76.

	State	1974-75	1975-76*
1.	Andhra Pradesh.	62·00	66·2
2.	Assam	26·59	28·3
3.	Bihar	70·31	77·3
4.	Gujarat	177·30	180·0
5.	Haryana	124·88	146·6
6.	Himachal Pradesh	58·79	61·1
7.	Jammu & Kashmir	52·73	56·7
8.	Karnataka	122·35	141·3
9.	Kerala	83·12	88·7
10.	Madhya Pradesh	70·51	82·2
11.	Maharashtra	177·18	174·1
12.	Manipur	7·73	9·4
13.	Meghalaya	@	55·7
14.	Nagaland	27·22	27·5
15.	Orissa	91·30	112·0
16.	Punjab	155·22	231·3
17.	Rajasthan	64·98	72·6
18.	Tamil Nadu	133·14	144·3
19.	Tripura	5·99	8·2
20.	Uttar Pradesh	60·88	72·7
21.	West Bengal	113·87	116·7
	Union Territories		
(a)	A & N Islands	27·78	39·4
(b)	Arunachal Pradesh	3·40	4·1
(c)	Chandigarh	363·80	425·1

State	1974-75	1975-76*
(d) Dadra & Nagar Haveli	14·75	18.3
(e) Delhi	321·74	315·8
(f) Goa, Daman & Diu	131·11	150·0
(g) Lakshdweep	11·88	12·0
(h) Pondichery	225·07	220·0
ALL INDIA		

*Provisional.
@Included in Assam.

APPENDIX IV

(*Vide* Para 2.202)

Statement showing classification of Hydro Electric Schemes on the basis of time taken for technical examination.

Sl. No.	Name of the Scheme	Time taken Yrs. Months	Remarks
1	2	3	4
CATEGORY A. One year or below			
1.	Yamuna Stage-II—Revised Estimates	0—7	Examination continuing.
2.	Giri (Original)	0—10	
3.	Koyna Dam Power House	1—0	
4.	Lower Sileru	1—0	
5.	Idukki Stage I (Original)	0—5	
6.	Kyrdekulai	0—10	
7.	Loktak Stage I (Revised P/R)	0—10	
CATEGORY B. Between 1 and 2 Years.			
1.	Bassi (Revised)	1—8	
2.	Chenani (Original)	1—9	
3.	Koyna Stage III (Original)	1—7	
4.	Vaitarna (Original)	1—1	
5.	Vaitarna (Revised)	1—8	Examination continuing.
6.	Nagarjuna Sagar H.E. (1x110 MW) Conventional	1—7	
7.	Kalinadi Stage I (Phase II)	1—6	
8.	Linganamakki Dam Powe House	1—4	
9.	Kundah Stage IV (First P/R)	1—6	
10.	Loktak Stage I (First P/R)	1—11	
11.	Loktak Stage II	1—5	
12.	Baira Siul (First P/R)	1—4	
13.	Salal (First P/R)	1—5	

1	2	3	4
	CATEGORY C. Above 2 Years		
1.	Rishikesh—Hardwar (Original) . .	2—5	
2.	Rishikesh—Hardwar (Revised) . . .	2—7	
3.	Yamuna Stage IV (Original) . . .	3—9	
4.	Giri (Revised)	2—1	
5.	Bassi Extn. (Original)	2—6	
6.	Chenani (First Revised) . .	2—3	
7.	Chenani (2nd revised)	2—9	
8.	Koyna Dam Power House (Revised) . . .	2—6	
9.	Koyna Stage III (Revised) . . .	6—3	(This was revised twice subsequently —Examination continuing).
10.	Idukki Stage I (Revised)	2—2	
11.	Kalinadi Stage I Phase II	6—8	(Scheme report received in 7/64 was only preliminary. Formal P/w was submitted in 1/70 and examination took only 9 months)
12.	Suruliar	2—9	
13.	Kundah Stage II (2nd P/R) . . .	2—1	
14.	Rinchington	2—6	
15.	Jaldhaka Stage. II	6—5	
16.	Subernarekha H.E. (First P/R) . .	5—1	
17.	Subernarekha H.E. (2nd P/R) .	4—2	continuing
18.	Baira Siul (Revised)	2—10	Do.
19.	Salal (Revised) . .	2—2	Cleared by Central Electricity Authority in 11/76.

APPENDIX V

(*Vide* Para 2.241)

Statement showing net requirement (anticipated unrestricted) and Availability state-wise during 1974-75, 1975-76 & 1976-77

(All figures are in GWh)

Name of State/Region	1974—75			1975—76			1976—77		
	Requirement	Availability	Surplus(+) Deficit(—)	Requirement	Availability	Surplus (+) Deficit (—)	Requirement	Availability	Surplus(+) Deficit(—)
1	2	3	4	5	6	7	8	9	10
Northern Region									
Haryana	2446	1635	(—)811	2528	2055	(—)473	2523	2332	(—)191
Himachal Pradesh	315	280	(—)35	316	305	(—)11	336	306	(—)30
J. & K.	455	331	(—)124	484	375	(—)109	493	413	(—)80
Rajasthan	2234	2256	(—)28	2558	2486	(—)72	2861	2841	(—)20
Delhi	1700	1625	(—)75	1834	1795	(—)39	1984	1923	(—)61
Chandigarh	191	130	(—)61	194	166	(—)28	170	162	(—)8
Uttar Pradesh	9135	7253	(—)1882	10080	8716	(—)1364	10829	10593	(—)236
Punjab (including Nangal Fertilizer)	3532	2636	(—)896	4290	3964	(—)326	4511	4299	(—)212
TOTAL	20058	16146	(—) 3912	22284	19862	(—)2422	23707	22869	(—)838
Western Region									
Gujarat	6084	5856	(—)228	6501	6110	(—)391	6793	6719	(—)74

Madhya Pradesh	3460	3476	(—)16	4331	4100	(—)231	4706	4518	(—)188
Maharashtra	12107	11147	(—)960	12984	11467	(—)1517	13847	13088	(—)759
Goa	236	143	(—)93	238	165	(—)73	237	183	(—)54
TOTAL	21887	20622	(—)1265	24054	21842	(—)2212	25583	24508	(—)1075
Southern Region									
Andhra Pradesh	4335	3269	(—)1086	4603	3782	(—)821	4757	4662	(—)95
Karnataka	6021	4635	(—)1386	6288	5353	(—)935	6952	5680	(—)1272
Kerala	2470	2268	(—)202	2586	2474	(—)111	2704	2606	(—)98
Tamil Nadu	8656	7338	(—)1318	8952	7917	(—)1035	9026	8042	(—)984
TOTAL	21502	17510	(—)3992	22428	19526	(—)2902	23439	20990	(—)2449
Eastern Region									
Bihar	2029	1797	(—)232	2286	2154	(—)132	2600	2526	(—)74
West Bengal	4867	4068	(—)799	5367	4658	(—)709	5560	5040	(—)520
Orissa	2261	1898	(—)363	2558	2527	(—)31	2698	2606	(—)92
D.V.C.	4357	4049	(—)308	3784	3705	(—)79	3989	4090	(+)101
TOTAL	13514	11812	(—)1702	13995	13044	(—)951	14847	14262	(—)585
NORTH-EASTERN REGION	639	557	(—)82	747	635	(—)112	913	736	—177
TOTAL ALL INDIA	77600	66647	(—)10953	83508	74909	(—)8599	88489	83365	(—)5124

APPENDIX VI

(*Vide* Para 2·241)

Statement showing net requirement (anticipated) & availability State-Wise during 1977-78 & 1978-79

All figures are in GWh

Name of State/Region	1977-78			1978-79		
	Requirement	Availability	Surplus + Deficit —	Requirement	Availability	Surplus + Deficit —
1	2	3	4	5	6	7
Northern Region						
Haryana	2921	1770	—1151	3550	2322	—1228
Himachal Pradesh	307	688	+381	474	777	+303
Jammu & Kashmir	661	623	—38	774	1005	+231
Rajasthan	3447	2844	—603	4024	3463	—561
Delhi	2126	1593	—533	2324	1593	—731
Chandigarh	196	73	—123	217	106	—111
Uttar Pradesh	12153	10680	—1473	13415	12337	—1078
Punjab	5317	4183	—1134	6012	4922	—1090
Central Projects	..	1424	+1424		2035	+2035
Common Projects	..	498	+498	..	3236	+3236
TOTAL	27128	24376	—2752	30790	31796	+1006

Western Region :						
Gujarat	7909	7916	+7	8628	8965	+337
Madhya Pradesh	5925	4098	—1827	6892	5269	—1623
Maharashtra	15112	12876	—2236	16492	13712	—2779
Goa	543	..	—354	458	..	—458
TOTAL	29300	24890	—4410	32470	27947	—4523
Southern Region :						
Andhra Pradesh	5297	6067	+770	6022	8077	+2055
Karnataka	7231	4881	—2350	7865	5884	—1981
Kerala	3147	4717	+1570	3460	4717	+1257
Tamil Nadu	9985	9678	—307	10817	9806	—1011
TOTAL	25660	25343	—317	28164	22484	+320
Eastern Region						
Bihar	6183	3240	—2943	7050	3596	—3454
West Bengal	7767	5825	—1942	8562	6442	—2120
Orissa	3041	3454	+413	3497	3691	+194
D.V.C.	*	5690	+5690	*	6035	+6035
TOTAL	16991	18209	+1218	19109	19764	+655
North-Eastern Region	1181	916	—265	1358	1049	—309
TOTAL ALL INDIA	100269	93734	—6526	111891	109040	—2851

Notes : (*i*) The requirement & availability for the year 1974-75 to 1976-77 are actual.

(*ii*) The anticipated requirements for the years 1977-78 and 1978-79 are as per the Tenth Annual Power Survey and anticipated availability for these years does not take into account the inter-State exchange of power except the shares from the joint projects.

(*iii*) In Northern Region the availability from Pong and Dehar is given under common projects.

* The requirements of the areas supplied by DVC in the States of Bihar and West Bengal are included in the respective States.

APPENDIX VII

(*Vide* para 2·249)

Statement showing generating capacity and generation state-wise for each year of the Fifth Plan

State/Region	1974-75		1975-76		1976-77		1977-78		1978-79		Remarks
	Capacity (MW)	Generation (GWh)	Capacity (MW)	Generation (GWh)	Capacity (MW)	Generation (GWh)	Capacity (MW)	Generation (GWh)	Capacity (MW)	Generation (GWh)	
1	2	3	4	5	6	7	8	9	10	11	12
Northern Region											
Haryana . .	80	120	140	323	140	543	204	956	424	1135	
Himachal Pradesh	45	152	45	163	45	171	110	511	110	576	
Jammu & Kashmir	82·5	292	92·5	298	92·5	309	162	560	197	942	
Rajasthan .	491	1939	491	1673	491	2326	759	2474	759	2924	
Delhi . . .	617	2650	629·5	2941	610·5	3465	282*	1175*	262*	1175*	*Capacity & Generation at Badarpur included in Central Projects.
U P . .	1853·9	7035	2164·6	8945	2576·6	10727	3128	10680	3564	12337	
Punjab. . .	198	622	308	980	308	1304	313	1686	533	1911	
B.M.B. . .	1205	3924	1205	5569	1205	5703	1205	4412	1205	4412	
Central Projects .							500	1424	560	2035	
Common Projects .							450	498	900	4349	
TOTAL . .	4572·4	16734	5075·6	20892	5468·6	24548	7113	24376	8534	31796	

Western Region:										
Gujarat . .	1131·5	5644	1324	5662	1564	6418	2151	7916	2351	8965
Madhya Pradesh .	779·5	3939	917·5	4580	917·5	4811	1133	4098	1533	5269
Maharashtra .	2526	12380	2928	13090	3040·5	15156	3007	12876	3407	13713
TOTAL . .	4437	21963	5169·5	23332	5522	26385	6291	24890	7291	27947
Southern Region:										
Andhra Pradesh .	919·2	3684	1019·2	4048	1229·2	5188	1621	6067	2041	8077
Karnataka . .	939	4648	1028·1	5324	1028·1	5336	1144	4881	1442	5884
Kerala . .	621·5	2655	751·5	2783	1011·5	3164	1012	4717	1012	4717
Tamil Nadu. .	2254	7365	2364	8234	2364	8247	2474	9678	2709	9806
TOTAL . .	4733·7	18352	5162·2	20389	5632·8	21935	6251	25343	7439	28484
Eastern Region:										
D.V.C. . .	1241·5	4464	1241·5	5008	1241·5	5244	1422	5690	1622	6035
West Bengal .	1073	4375	1227	4566	1227	5061	1587	5825	1595	6442
Bihar . .	560	2075	560	2061	670	2399	915	3240	915	3596
Orissa . .	760	2199	820	3045	880	2856	914	3454	1024	3691
TOTAL . .	3634·5	13113	3848·5	14680	4018·5	13560	4838	18209	5156	19764
NORTH-EASTERN REGION . .	176·7	548	206·7	614	216·7	772	219·7	916	309·7	1049
TOTAL ALL INDIA	17554·3	70710	19463·1	79907	20858·6	89200	24712·7	93734	28729·7	109040

NOTES— 1. The capacity and generation figures for the years 1974-75 to 1976-77 are actual and include the schemes lying within the territories of the respective States.

2. Anticipations for the years 1977-78 and 1978-79 are based on the latest commissioning schedule and the shares of the participating States in joint projects have been taken in the respective States except in case of Northern Region. Benefits from Bhakra Nangal Project (BMB) have been shown separately.

APPENDIX VIII

(*Vide* Para 2.260)

On going schemes presently under implementation and likely to yield benefits during 1978—83

HYDRO

Sl. No.	Name of the Schemes	Total Capacity	Benefits during 1978—83
1	2	3	4
	Northern Region		
1.	Lower Jhelum (Unit II & III)	3x35	70
2.	Shanan Exten.	1 x 50	50
3.	Yamuna Stage II (Khodri)	4 x 30	110
4.	Rishikesh Hardwar	4 x 36	144
5.	Maneri Bhali Stage I	3 x 30	90
6.	Bassi Extn.	1 x 15	15
7.	Beas St. I (Unit III & IV)	4 x 165	330
8.	Beas St. II (Unit II, III & IV)	4 x 60	180
9.	Baira Siul	3 x 60	180
10.	Salal	3 x 115	115
		Sub Total :	1294
	Western Region		
11.	Kadana	4 x 60	120
12.	Koyna Dam Power House	2 x 20	40
13.	Tillari	1 x 60	60
14.	Bhandardara	1 x 10+1 x 33·5	43·5
15.	Pench	2 x 80	160
		Sub Total	423·5

1	2	3	4
	Southern Region		
16.	Upper Sileru Extn.	2 x 60	120
17.	Srisailam	4 x 110	440
18.	Kalinadi Stage I	6 x 135+2 x 50	910
19.	Linganamakki	2 x 27·5	55
20.	Idamalayar	2 x 37·5	75
21.	Suruliar	1 x 35	35
		Sub Total	1635
	Eastern Region		
22.	Subernrekha (Unit II)	2 x 65	65
23.	Rengali	2 x 50	100
24.	Upper Kolab	3 x 80	80
25.	Rinchington	2 x 1	2
26.	Jaldhaka	2 x 4	8
27.	Lower Lagyap	2 x 6	12
		Sub Total	267
	North Eastern Region		
28.	Kyrdemkulai (Unit I & II)	2 x 30	60
29.	Loktak	3 x 35	70
		Sub Total	130
		GRAND TOTAL	3749·5

THEMRMAL

Sl. No.	Name of the Scheme	Total Capacity	Benefits during 1978—83
	Northern Region		
1	Panipat Unit I & II	2 X 110	220
2	Gurunanak Extn.	2 X 110	220
3	Obra Stage II (Unit II & III)	3 X 200	400
4	Obra Stage III	2 X 200	400
			1240

1	2	3	4
	Western Region		
5	Ukai Extn. (Unit IV)	2 X 200	200
6	Satpura	2 X 200	400
7	Nasik Extn.	1 X 200	200
8	Bhusawal Extn.	1 X 200	200
9	Koradi	3 X 200	400
10	Ahmedabad Elec. Co. (Pvt.)	1 X 110	110
			1510
	Southern Region		
11	Vijayawada	2 X 200	400
12	Tuticorin	2 X 200	400
			800
	Eastern Region		
13	Patratu (9th & 10th Unit)	2 X 110	220
14	Barauni (6th & 7th Unit)	2 X 110	220
15	Talcher Extn.	2 X 110	220
16	Chandrapura (Unit VI)	6 X 120	120
17	Durgapur (DVC)	1 X 200	200
18	Bandel Extn.	1 X 200	200
19	Santaldih (Unit IV)	4 X 120	120
20	Kolaghat	3 X 200	600
			1900
	North Eastern Region		
21	Bongaigaon	2 X 60	120
22	Lakwa		45
		TOTAL	165
	GRAND TOTAL THERMAL :		5615
	Nuclear Capacity		
23	N. A. P. P.	2 X 235	470
24	K. A. P. P.	2 X 235	470
			940
	TOTAL (THERMAL & NUCLEAR)		6555 MW
	GRAND TOTAL (HYDRO, NUCLEAR & THERMAL)		10304·5 MW

APPENDIX IX

(*Vide* Para 2·260)

Recently Sanctioned Schemes

HYDRO

Sl. No.	Name of the scheme	Total Capacity (MW)	Benefits during 1978-83 (MW)
1	2	3	4
	Northern Region		
1	Andhra	5 × 5	10
2	Binwa	3 × 2	2
3	Rongtong	2 × 1	2
4	Dehar Extn	2 × 165	330
5	Pong Extn.	2 × 60	120
	Sub-Total :		464
	Western Region		
6	Ukai L. B. Canal	2 × 2·5	5
7	Paithan	1 × 12	12
	Sub-Total :		17
	Southern Region		
8	Nagarjunasagar Pumped	4 × 100	400
9	Balimela Dam P H.	2 × 30	60
10	Don-Karayi	1 × 25	25
11	Nagarjunasagar R B	2 × 30	60
12	Kakkad	2 × 25	25
13	Sarvalar	1 × 20	20
	Sub-Total		590
	Eastern Region		
14	Ramman.	4 × 12·5	25
15	Panchot Hill 2nd Unit	1 × 40	40
	Sub-Total		65
	North Eastern Region		
16	Kopili	2 × 50 + 2 × 25	75
	Sub-Total : (HYDRO TOTAL—1211)		75

1	2	3	4
	THERMAL		
	Northern Region		
1	Faridabad Extn	1 × 60	60
2	Kota	2 × 110	220
3	Singarauli (STPS)	5 × 210 + 2 × 500	630
4	Parichha	2 × 110	220
	Sub Total :		1130
	Western Region		
5	Wanakbori	3 × 210	630
6	Korba East	1 × 120	120
7	Korba West	2 × 210	420
8	Satpura Extn	2 × 210	420
9	Parli Extn	1 × 210	210
10	Chandrapur	2 × 210	420
11	Nasik Extn	2 × 210	420
12	Gas Turbines (Maharashtra)	4 × 60	240
13	Trombay	1 × 500	500
	Sub Total ;		3380
	Southern Region		
14	Tuticorin Extn	1 × 210	210
	Eastern Region		
15	Bokaro 'B'	1 × 210	210
	North Eastern Region:		
16	Namrup Waste Heat Utilisation Plant	22	22
	Sub Total :		22
	TOTAL THERMAL :		4052 MW
	GRAND TOTAL HYDRO AND THERMAL :		6165 MW

APPENDIX X

(*Vide* Para 2·260)

Statement giving Present Position of New Hydro Schemes yet to be Sanctioned

Sl. No.	Name of the Scheme	Total Installed Capacity MW	Benefits during 1978-83 MW	Present position.
	Northern Region			
1.	Mukerian . . .	6 × 15+ 6 × 19·5	138	Pending due to inter-State aspects not yet resolved.
2.	Anandpur Sahib . .	4 × 33·5	134	
	Western Region			
1.	Bhira Tail Race . .	2 × 40	40	Cleared provisionally in the 17th meeting of CEA held on 18th April, 1977.
	Southern Region			
	NIL			
	Eastern Region			
	NIL			
	North Eastern Region			
	NIL			
	GRAND TOTAL.		312 MW	

APPENDIX XI

(*Vide* Para 2·260)

Statement giving present Position of New Thermal Schemes yet to be Sanctioned

Sl. No.	Name of Scheme	Total Installed Capacity (MW)	Benefits during 1978-83 (MW)	Present Position
1	2	3	4	5
	Northern Region			
1.	Panipat Extn. . . .	2 X 110	220	Under examination and processing in C.E.A.
2.	Kota Extn. . . .	2 X 210	210	Project Report not received. The Board has been requested to expedite.
3.	Anpara . . .	3 X 210	630	It was decided in the CEA meeting held on 26-10-77 that a perspective plant for thermal power development around Singrauli complex would be prepared & circulated before this can be accorded techno-economic approval.
4.	Tanda . .	4 X 110	440	Was placed before C.E.A. Consideration deffered in the CEA meeting held on 26-10-77.
5.	Uchhahar .	3 X 210	420	Just received. Under examination in C.E.A.
6.	Badarpur 5th . . .	1 X 210	210	Cleared by C.E.A.
7.	Singrauli Super Thermal .	2 X 210 + 2 X 500	210	Cleared by C.E.A.
	Sub Total: . .		2340	
	Western Region			
1.	Ukai 5th . . .	1 X 210	210	Cleared by C.E.A.
2.	Wanakbori Extn. . .	3 X 210	210	Under Examination in C.E.A.
3.	Satpura Extn. . . .	1 X 210	210	Project report not received. Board has been reminded.
4.	Bhusawal . . .	1 X 210	210	Under Examination in C.E.A.
5.	Korba Super Thermal .	5 X 210 + 2 X 500	630	Cleared by C.E.A.
	Sub Total : . .		1470	

1	2	3	4	5
	Southern Region			
1.	Neyveli Second Mine-cut	3 x 210	420	Cleared by C.E.A.
2.	Ramagundam Super	3 x 210	210	Under Examination in C.E.A.
	Sub Total:		630	
	Eastern Region			
1.	Bokaro 'B' Extn.	2 x 210	420	Under Examination in C.E.A.
2.	Farakka Super Thermal	3 x 210	420	Project Report under preparation by N.T.P.C.
	Sub Total:		840	
	North Eastern Region			
1.	Bongaigaon Extn.	2 x 60	120	Cleared by C.E.A.
	Sub Total:		120	
	GRAND TOTAL :		5400	

APPENDIX XII

(*Vide* Para 5·26)

Statement Showing number of Villages Electrified as on 31-7-1976.

Sl. No.	State/Union Territories	Total No. Villages	Villages electrified as on 31-3-76	Villages electrified as on 31-7-76	% Villages electrified as on 31-7-76
1.	Andhra Pradesh	27,221	11,136	11,653	42·8
2.	Assam	21,995	1,524 (a)	1,524 (a)	6·9
3.	Bihar	67,566	14,535 (*)	15,407 (b)*	22·8
4.	Gujarat	18,275	6,307	6,460	35·4
5.	Haryana	6,731	6,731	6,731	100·0
6.	Himachal Pradesh	16,916	6,721	6,778	40·1
7.	Jammu & Kashmir	6,503	1,960	1,995 (c)	30·7
8.	Karnataka	26,826	14,209	14,370	53·7
9.	Kerala	1,268	1,202	1,204	95·0
10.	Madhya Pradesh	70,883	11,822	11,984 (b)	16·9
11.	Maharashtra.	35,778	19,309	19,454 (b)	54·4
12.	Manipur	1,949	231 (a)	235 (b)	12·1
13.	Meghalaya	4,583	261	261	5·7
14.	Nagaland	960	175	182	19·0
15.	Orissa	46,992	11,507	11,582 (b)	24·7
16.	Punjab	12,188	9,926	12,126 (†)	100·0
17.	Rajasthan	33,305	7,053	7,268	22·0
18.	Sikkim	215	6	11 (b)	5·1
19.	Tamil Nadu	15,735	15,446	15,449	98·2
20.	Tripura	4,727	170	197	4·2
21.	Uttar Pradesh	1,12,561	31,862	31,982	28·4
22.	West Bengal	38,074	9,825	10,220	26·9
	Total (States) :	5,71,251	1,81,918	1,87,073	32·8
	Total (U. Ts.).	4,685	1,092	1,096	23·4
	TOTAL (ALL INDIA) :	5,75,936	1,83,010	1,88,169	32·7

FIGURES PROVISIONAL

(a) As on 29-2-1976 (b) As on 30-6-1976

(c) Includes the progress of Jammu Province upto 30-6-1976 and Kashmir Province upto 31-3-1976.

(*) Figures of Bihar State are under reconciliation.

(†) 62 villages have been declared as un-inhabited.

APPENDIX XIII

(*Vide* Para 5·31).

Fifth Plan Target and Achievement in the Electrification of Villages.

Sl. No.	States	Target for villages to be electrified as given in Draft Fifth Plan			Villages electrified during the period 1-4-74 to 31-7-76
		N.D.P. Of the State	M.N.P.	R.E.C.	
1.	Andhra Pradesh	5,300	481		1,473
2.	Assam	510	2,800		378(a)
3.	Bihar	1,542	7,500		5,802(b)**
4.	Gujarat	1,030	..		784
5.	Haryana	..	..		— (*)
6.	Himachal Pradesh	130	800		2,278
7.	Jammu & Kashmir	..	1,000		615 (c)
8.	Karnataka	3,211	736		1,726
9.	Kerala	150	..		31
10.	Madhya Pradesh	2,055	6,948	Break-up not given	1,281
11.	Maharashtra.	3,110	..		2,683 (b)
12.	Manipur	..	650		22 (b)
13.	Meghalaya	..	1,000		93
14.	Nagaland	..	— 200		46
15.	Orissa	2,314	2,312		3,506 (b)
16.	Punjab	2,132	..		5,048
17.	Rajasthan	1,542	2,000		1,490
18.	Sikkim	..	..		6 (b)
19.	Tamil Nadu	..	..		53
20.	Tripura.	..	1,000		94
21.	Uttar Pradesh	6,166	5,250		2,217
22.	West Bengal	2,860	3,800		1,705
	Total (States) :	32,052	36,477		31,330
	Total (U. Ts.)	497	74		124
	TOTAL (ALL INDIA) :	32,549	36,551	41,108	31,454

(a) Upto 29-2-1976

(b) Upto 30-6-1976

(c) Includes the progress of Jammu province upto 30-6-1976 and Kashmir province upto 31-3-1976

(*) 100% village electrification has already been achieved.

(**) Achievement of Bihar is under reconciliation.

APPE NDIX

(*Vide* Para

Details of Tariff for Agriculture

Sl. No.	Name of the State Electricity Board/ Undertaking	Fixed Charges/ Month	Energy Charges/ KWH	Electricity duty	Fuel Surcharge
1	2	3	4	5	6
1.	Andhra Pradesh State	Rs. 2/- per H.P. of contracted load subject of a maximum of Rs. 10/- per services.	16 P.		..
2.	Assam State Electricity Board.		18 P.	..	
3.	Bihar State Electricity Board	Private Tubewell Rs. 10/- per BHP	3P.	2 P/Kwh	
4.	Gujarat State Electricity Board.	*Option I* ; First 5 BHP Rs. 1·25 per BHP Next 10 BHP: Rs. 1·50 per BHP Next 10 BHP Rs. 1·75 per BHP All in excess Rs. 2/- per BHP	14 P.	1·2 P/Kwh.	..
		Option II ; Same as in Option I.	First 50 units/ BHP—19P Next 1000 units/ —15 P. All in excess—9P	..	..

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in Various States

Minimum Charges	Any other charges	Average Rate 5 HP 10% L.F. P/KWH including Electricity duty, excluding fuel Surcharge	Remarks
7	8	9	10
Rs. 60/- per H.P. of contracted load	*Customer* charges Rs. 5/- per month per service	19·68 P	
Rs. 5/- per KVA of contracted demand.	..	18·00 P	
		21·83 P	In North Bihar Chotanaghar and Santhal pargana platenus the fixed charges levied on the basis of 9 months only. In other areas the fixed charges will be Rs. 7·50 per BHP per month for 3 months and Rs. 10 per BHP per month for 49 months.
Rs. 35/- per BHP of contracted or connected load whichever is higher.	*Additional Charges*	8 P/Kwh: 24·77 P.	

1	2	3	4	5	6
5.	Haryana State Electricity Board.	Rs. 2/-per BHP	20 P	--	--
6.	Himachal Pradesh State Electricity Board.	..	First 1500 units 9P All in excess 8 P	1·00 P/Kwh	...
7.	Jammu & Kashmir Electricity Board.	..	10 P	1·60 P/Kwh	...
8.	Karnataka Electricity Board;	Rs. 10 per installation	15 P	1·00 P/Kwh	--
9.	Kerala State Electricity Board;	(i) Rs. 5 (for motors below 5 Kw). (ii) Rs. 10 (for others)	10 P 10 P	1·18	--
10.	Madhya Pradesh Electricity Board;	.. Rs. 5 per BHP	16 P 16 P	--	--
11.	Mahrarashtra State Electricity Board;	..	22 P	--	5·75 P/Kwh (July 77)
12.	Meghalaya State Electricity Board;	...	14 P	...	--
13.	Orissa State Electricity Board;	--	15 P	2·50	0·65 P/Kwh (July 76)
14.	Punjab State Electricity Board;	(a) *Metered Supply* Rs. 1·00 per BHP as demand charges in lieu of service rentals (b) *Flat Rate* Rs. 11·50 per BHP + Rs. 1·50 per BHP as demand charges in lieu of service rentals	12·5 P	--	--
15.	Rajasthan State Electricity Board		21 P	..	..

7	8	9	10
Demand Charges.1	..	23·68 P	For tubewells under T.C Scheme No demand charges are leviable.
..		10·00P	
Rs. 24 per H. P. per year.	..	11·50Ps	Rebate of 25% on the billed amount of supply is taken from 10 P.M. to 6 A. M. only.
Rs 50 per H P per annum.	..	19·68 P	
Fixed Charges	.	13·02 P	
Fixed Charges			
360 Units/BHP/Year		16·00 P	(i) For consumers who give 12 1/2% annual guarantee in respect of cost of extension subject to a minimum of Rs. 125/BHP/Year.
Rs. 40 per year per BHP	..	22·00 P	(ii) For consumers who do not give guarantee.
Rs. 36 per Kw per year.		14·00 P	
Rs. 1 per BHP for June to Oct, and Rs. 3 per BHP for rest of the year.		17·50 P	
Rs. 6 per month per BHP of connected load	..	12·50 P	
Upto 3 HP Rs. 90 HP /Year Above 3 HP upto 5 HP Rs. 100/HP/Year, Above 5 HP upto 7·5 HP Rs. 1·40 HP/ Year Above 7·5 HP upto 10 HP Rs. 160/HP/Year above 10 HP Rs. 175/HP/Year.	..	21·00 P	

1	2	3	4	5	6
16.	Tamil Nadu Electricity Board ..	Rs. 1·25 per HP maximum of Rs.	subject to a 5 per service 14 P. for small farmers* 16 P. for others	..	
17.	Uttar Pradesh State Electricity Board.	Rs 12 per BHP	..	..	..
18.	West Bengal State Electricity Board.	...	32 P	6·00	..
19.	DESU .	..	20 P	1·00	..

7	8	9	10
..	..	17·84 P	*Those possessing not more than 2 acres of wet land or 4 acres dry land
—	—	22·06 P	
Rs 75 per H.P per year		38·00 P	
—	—	21·00 P	

APPENDIX XV

(*Vide* Para 5-98)

Details of Triff for

Sl. No.	Name of the State Electricity Board/Undertaking.	Fixed Charges/ Month	Energy Charges kwh	Electricity Duty	Fuel Surcharge
1.	2	3	4	5	6
1.	Andhra Pradesh	—	32 P*	—	—
			35 P*		
2.	Assam	..	First 5000 units 22P	1.00	..
			All in excess 21 P		
3.	Bihar		200 Units/ BHP 22 P All in excess 20 P	2.00	7.661 /P/ kwh (June, 76)
4.	Gujarat	—	First 100 units/BHP 17.5P Next 150 units/BHP 16 P All additional units 15 P	1.00	
5.	Haryana	..	21 P	3.15	
6.	Himachal Pradesh	..	First 500 units 18 P Next 1000 units 15.5P All in excess 15 P	2.00	..

Minimum Charges	Any other charges	Average Rate (including electricity duty excluding Fuel Surcharge 10 HP 15% L.F.P/kwh	Remarks
7	8	9	10
Rs. 7/-per HP of contracted load	*Customer Charges* Rs. 5/- per month Per service.	32 P	*For floor mills, oil mills, stone crushing mill.
Rs. 10/-HP of connected load			
Rs. 10/-per KVA of contract demand	..	23 P	
67 Units/BHP/month	...	24 P	
For Seasonal Consumers Rs. 75/-per BHP	*Additional Charges* 11P/kwh	28.64 P	
For other consumer Rs. 6/-per month per BHP			
10.50 per kw of connected load.	..	24.15 P	
Rs. 6/-per Kw per -month of connected load.	..	19.03 P	

1	2	3	4	5	6
7.	Jammu & Kashmir Electricity Board.	(1) Rs. 4/—per KVA or HP	Kashmir Province 4 P Jammu Province 6 P	Kashmir 1.38 Jammu 1.63	
		(2) Rs. 15.5 per KVA or HP in Kashmir Province. Rs. 18.0 Per KVA or HP in Jammu Province.	..	..	
8	Karnataka . . .	Rs. 10/-per-installation.	25 P	4.50	
9.	Kerala . . .	..	First 2000 units:15 P: All in excess 14 P	1.50	..
10.	Madhya Paradesh		22 P:	1.50	..
11	Maharashtra: . .	—	25 P:	1.00	5.75 (July 77)
12	Meghalaya .	First 5000 17 P Next 5000 16 P All in excess 15 P		1.00	—
13	Orissa .	*Unrestricted supply*			
		First 200 Kwh 18 P All in excess 17 P		2.79	0.65 P /Kwh (July, 76)
		Restricted Supply			
		(10 PM to 8 AM)			
		All consumption 15.5 P			
14	Punjab .		18.5 P	3.70	
15	Rajasthan		23 P	1.00	
16	Tamil Nadu		20 P		
17	Uttar Pradesh .		24 P	1.00	
18	West Bengal		32 P	0.33	
19	DESU .		22 P/Kwh	1.00	..

7	8	9	10
..	Kashmir Jammu	10.22 P 12.52 P	
--	--	--	
Rs. 7/-per month per NHP connected load	15% surcharge	23.15 Ps	
Rs. 4/-per KW of connected load.	20% extra for supply to welding sets.	16.50	
Rs. 10.75 per month per BHP of installed capacity.	..	23.50	
Rs. 5/-per BHP per month.	..	26.00	
Rs. 7 per KW of connected load		18·00 P	
Unrestricted Supply			
Rs. 8 per Kw connected load		20·79* P	
Restricted supply :			
Rs 7 per KW of connected load;			
Rs. 9 per Kw connected load		22·20 P	
Rs 10 per HP of connected load;	..	24·00 P	
Rs 5 per HP of contracted load	50% surcharge plus 1 P/Kwh as special surcharge	31·00 P	An additional levey of 2 P/ Kwh will be charged in the Metropolitan areas.
Rs 15 per BHP		25·00 P	
Rs 75 per HP per year	..	32·33 P	
Rs. 6 per HP	..	23·00 P	

APPENDIX

(*Vide* Para

Detail of Tariff for large

S.No.	Name of the State Electricity Board/ Undertakings.	Fixed Charges/ month	Energy Charges/Kwh
1	2	3	4
1	Andhra Pradesh State Electricity Board	First 1000 KVA-Rs. 21 per KVA above 1000 KVA—Rs. 19 per KVA	First 1,00,000 units—21 P Next 1,00,000 units—19 P Next 18,00,000 units—19 P Above 20,00,000 units—15P
2.	Assam State Electricity Board.	First 500 KVA-Rs. 15 per KVA Next 500 KVA—Rs. 14 per KVA Next 1000 KVA—Rs. 13 per KVA Balance—Rs. 12/- per KVA	First 1,00,000 units—18 P Next 2,00,000 units—17 P. Next 2,00,000 units—16 P. Balance—15 P
3.	Bihar State Electricity Board	Rs. 20/- per KVA	Upto 220 units /KVA—17 P Over 220 units/KVA Upto 280 units/KVA—15.5P Over 280 units/KVA Upto 340 units/KVA — —14.5 P Over 340 units/KVA —12.5 P

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Industry in various States

Electricity charge	Fuel Surcharge	Minimum Charges	Any other Charges	Average Rate (Including Electricity duty, excluding Fuel Surcharge) 1000 kw 50% L..FP/ KWH	Remarks
5	6	7	8	9	10
—	—	Demand Charges plus energy charges on 50 units per KVA of Billing demand	Customer Charges Rs. 15J- per month per service	25.77 P	
0.08P/ KWh	10 P/KWh (March '77)	Rs. 12/—per KVA of contract demand	—	21.78 P	
2.00	7.661 P/kwh (June' 76)	Demand Charges plus energy charges equal to 25% Load Factor and 80% Power Factor on the contract demand.	For supply at 6.6 KV or 3.3 KV addi- of 7.5% will be tional Chareg levied on demand and energy charges	23.91 P	

1	2	3	4
4.	Gujarat Electricity Board	First 500 KVA—Rs. 12/- per KVA Next 500 KVA-Rs. 11/- per KVA Next 4000 KVA-Rs. 10/- per KVA All in excess-Rs. 8.50 per KVA Rs. 20/-per month per KVA of Billing demand in excess of contract demand.	First 200 units/KVA —8 P Next 200 units/KVA —7 P Next 150 Units/KVA —6 P All in excess —5 P
5.	Haryana State Electricity Board.	Rs. 15/-per KVA	10 P
6.	Himachal Pradesh State Electricity Board	Rs. 12/-per KVA	First 1,00,000 units—12P Next 2,00,000 units—10P All in excess —8P
7.	Jammu & Kashmir Electricity Board	Rs. 4/-per KVA or HP	Kashmir province—2.5 P Jammu Province —4.0 P
8.	Karnataka Electricity Board	Rs. 10/-per KVA	6 P
9.	Kerala State Electricity Board	Rs. 22/-per KVA	First 250 units/KVA —6P Next 250 units/KVA —5P All in excess —4P
10.	Madhya Pradesh Electricity Board	First 500 KW-Rs. 14.65/KW Next 1000 KW-Rs. 13.95/KW Above 1500 KW-Rs. 12.50/ KW	Fisrt 50,000 units —13.10P Next 150,0000 units-12.80P Next 300,000 units —12.50P over 500,000 units —11.80P
11.	Maharashtra State Electricity Board	Rs. 16/-per KVA	11 P
12.	Meghalaya state Electricity Board	First 500 KVA-Rs. 13/-per KVA Next 500 KVA-Rs. 12 per KVA Next 1000 KVA-Rs. 11 per KVA Next 3000 KVA -Rs. 10/- per KVA	First 100000 —13 P Next 200000 —12 P Next 200000 —11 P Next 500000 —10 P A 11 in excess —9P
13.	Orissa State Electricity Board	First 4000 KVA -Rs. 10/-per KVA All in excess -Rs. 9/- per KVA	First 400 units/KVA —12 P All in excess —11 P

5	6	7	8	9	10
3.00	5.50 (March '77)	Demand Charges	Additional Charges 8 P/kWh		22.45 P
4.45	—	Demand Charges	The above tariff covers supply at 11 KV or 3.3 KV for supply at 400 Volts surcharge at 10% is leviable.		19.28 P
2.00		Demand Charges	The above tariff covers supply at 11 KV or above. For supply at 400 Volts 15% surcharges is leviable		16.06 P
0.57 0.79	—	——	——		4.36 P 6.08 P
2.25	—	Demand Charges	15% Surcharges		12.85 P
3.87	—	Demand Charges	——		16.77 P
1.50	5.70 (March '77)	Demand Charges	——		18.12 P
1.00	5.75 (July '77)	Demand Charges	——		17.16 P
0.08	—	Rs. 10/- per KVA per month	——		16.13 P
4.82	0.66 P/ kWh (July'76)	Bill 80% of contract demand and on units at an average Power Factor at 0.9 and an average Load Factor at 10%	——		19.92 P

1	2	3	4
14.	Punjab State Electricity Board	Rs. 14/- per KVA	11 P (subject to a minimum overall rate at 18 P/KWH)
15.	Rajasthan State Electricity Board	Alternative I (Single Part Tariff)	First 5,00,000 units —20P Next 10,00,000 units —18P Next 15,00,000 units —16P All above 30,00,000 units —14 P
16.	Tanil Nadu Electricity Board	Rs. 15/-per KVA	First 5,00,000 units —12 P All in excess —11.50 P
17.	Uttar Pradesh Electricity Board	First 1000 KVA-Rs. 15 Per KVA Next 4000 KVA -Rs. 12 per KVA All in excess -Rs. 10 per KVA	First 200 kwh/KVA-13P Next 200 kwh/KVA-11P All in excess —9P
18.	West Bengal State Electricity Board	Rs. 30/-per KVA	12 P
19.	Delhi Electricity Supply Undertaking	First 500 KW -Rs. 20/-per KW Next 1000 KVA -Rs. 16.50 per KVA Next 5000 KVA -Rs. 16/- per KVA All in excess -Rs. 15.50 per KVA	First 5,00,000 -19.5P Next 5,00,000 -19.0 P Next 10,00,000 -18.5 P All in excess —18 P

5	6	7			10
3.88	—	Demand Charges	——	19.39 P	
4.00	0.40 P/kWh (March' 77)	Alternative-I (a) 110 units /KVA for consumer having contract demand from 125 KVA to 1000 KVA. (b) 130 units/KVA for consumers having contract demand of above 1000 KVA. !		21.00 P	
		Alternative II Demand Charges			
2.89	—	Half the contracted load in KVA Rs. 225/- per annum	50% surcharge plus 1P/KWh as special 5% Surcharge	29.14 P	
1.00	7.284 P/kWh (July '77)	Rs. 30/-per KVA per month	——	17.98 P	
4.50	5.1 P/kWh (March '77)	Demand Charges	——	23.17 P	(1) For 6/11 KV Supply (Maximum Demand 50 KVA and above
4.00	2.38 (July '76)	Demand Charges	——	25.90	
		AB States		Rs. in Crores	

APPENDIX XVII

STATEMENT IV

Statement showing Meter Rentals in different State Electricity Boards

SEB's	Single Phase Meters	Agricultural & Small Industries (Polyphase Meters 400 V	Demand or Spl. Type Meters	HT Metering	Time Switches	Temporary		Remarks
						Single Phase 230V	Polyphase 400V	
1	2	3	4	5	6	7	8	9
1. Andhra Pradesh								Not available
2. Assam . .	1·00	4·00	15·00	60·00 (11KV)				Not available
3. Bihar . .								
4. Gujarat .	1·00	3·00	30·00	30·00"	10·00	2·00	6·00"	
5. Haryana .							Not available	
6. Himachal Pradesh	0·50	1·50 (0-25A) 2·00 (25-50A) 1% of cost above 50A					Not available	
7. Jammu & Kashmir .								
8. Karnataka .							Not available	
9. Kerala . .	0·50	1·00	5·00	15·00				
10. M. P. .	0·50	1·25 first 1·00 subsequent	3·75 or 1·5% of cost	1·25% of cost				

1	2	3	4	5	6	7	8	9
11. Maharashtra	1·00	2·00	50·00	50·00	5·00 upto 15A 7·00 above 15 to 50A	5·00	10·00	
12. Manipur .								Not available
13. Meghalaya .								,,
14. Nagaland .								,,
15. Orissa :								,,
16. Punjab . .								,,
17. Rajasthan	1·00	3·00	20·00	100·00 200·00 (EHT)	10·00	2·00	6·00	
18. Tamil Nadu .	2·00	5·00	24·00	24·00	10·00			
19. Tripura .								,,
20. U. P. .								,,
21. West Bengal .	1·50	4·50		15 00 60·00 (Trivector meter)				
22. D.V.C. . .								,,
Union Territories								
1. A. & N. Island								,,
2. Arunachal Pradesh . .								,,
3. Chandigarh .								,,
4. D. N. H. .								,,
5. Delhi . .								,,
6. G. D. D. .								,,
7. Lakshadweep								,,
8. Mizoram								,,
9. Pondicherry .								,,

APPENDIX XVIII

(*Vide* Para 7·20)

Statement showing the allocation of Funds during the Fourth and Fifth Plans and the actual provision in the annual Budget documents and the funds required upto 1990-91 *for the development of the proposed Nuclear capacities.*

(Figures in crores of Rupees)

Name of the Project	Sacntioned cost	IVth Plan						Vth Plan																
		69-70	70-71	71-72	72-73	73-74	Total	74-75	75-76	76-77	77-78	78-79	Total	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91
RAJASTHAN ATOMIC POWER PROJECT—I	73·27																									
Approved Plan outlay							19·00						5·14													
Annual Budget Allocation		7·03	7·30	4·68	1·79	0·22	21·12	0·61	0·72	0·76	0·66	—	2·75	1·27	1·50	1·16	..	..	..	..	..	..	..	..	..	..
RAJASTHAN ATOMIC POWER PROJECT—II	92·26																									
Approved Plan outlay							53·51						33·39													
Annual Budget Allocation		7·20	12·40	9·46	8·55	5·62	43·22	8·69	5·19	8·00	8·66	—	22·54	3·48	5·81	1·25	..	..	..	..	..	..	..	..	..	..
MADRAS ATOMIC POWER PROJECT—I	77·09																									
Approved Plan outlay	107·53						53·81						55·07													
Annual Budget Allocation		4·34	6·26	8·43	15·99	14·44	49·46	15·01	15·18	13·67	10·00	—	53·86	6·73	7·42	4·00	0·54	..	..	..	..	..	..	..	..	..
MADRAS ATOMIC POWER PROJECT—II	70·63																									
Approved Plan outlay	(95·91)						26·25						65·24													
Annual Budget Allocation		0·20	1·30	1·18	4·99	7·76	15·43	9·87	10·31	14·00	11·80	—	45·98	9·71	11·50	12·50	12·00	1·30	..	..	..	..	..	..	..	..
NA RORA ATOMIC POWER PROJECT	209·39																									
Approved Plan outlay							7·00						82·63													
Annual Budget Allocation		0·04	0·04	0·05	0·05	0·01	0·19	1·00	3·76	13·00	22·00	—	39·76	30·56	42·92	53·93	47·04	24·05	13·55	1·64		..	..	..	..	..
NEW PROJECT—1 & 2	(266·00)																									
Approved Plan Outlay													1·00													
Annual Budget Allocation											0·01	—	0·01	0·20	18·42	26·60	47·88	47·88	47·88	31·92	21·28	15·96	7·98	..	..	..
NUCLEAR POWER PLANT TRAINING SIMUIATOR	2·03	Stands included under PPED-Development.																								
Approved Plan Outlay													2·03													
Annual Budget Allocation																										

Name of the Project	Sanctioned cost	69-70	70-71	71-72	72-73	73-74	Total	74-75	75-76	76-77	77-78	78-79	Total	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91
PPED (Development)																										
Approved Plan Outlay .													3·03													
Annual Budget . .																										
Allocation . . .		0·10	0·01	0·10	0·51	0·34	1·06	1·05	0·65	0·86	0·42	..	2·98	0.75	0·38	0·40	0·59	0·38								
NEW PROJECT—3 & 4	(266·00)																2·66	15·96	26·60	47·88	47·88	47·88	31·92	21·28	15·96	7·98
5 NP—1	(235·00)																..	2·35	14·10	23·50	42·30	42·30	42·30	27·00	14 10	7·05
5 NP—2 1×500	(235·00)																..	..	2·38	14·10	23·50	42·30	42·30	42·30	27.00	14·10
5 NP—3 —MW	(235·00)																..	..	..	2·35	14·10	23·50	42·30	42·30	42·30	27·00
5 NP—4 each	(235·00)																				2·35	14·10	23·50	42·30	42·30	42·30
5 NP—5	(235·00)																		..		..	2·35	14·10	23·50	42·30	42·30
5 NP—6	(235·00)																						2·35	14·10	23·50	42·30
5 NP—7	(235·00)																						..	2·35	14·10	23·50
5 NP—8	(235·00)																								2·35	14·10
5 NP—9	(235·00)																									2·35
TOTAL . .	18·91	27·41	23·89	31·83	28·39	130·48		33·23	35·61	50·29	48·55	..	167·88	52·70	87·95	99·84	110·71	91·92	104·48	121·39	151·41	188·39	206·75	215·13	223·91	222·98

NOTE. (1) Figures in brackets in Col. 2 represent latest estimated cost.

APPENDIX XIX

(*Vide* para 8.10)

Statement showing the benefits from the various Schemes taken up by the Central Board of Irrigation and Power

(1) *Reclamation of used Transformer Oil*:

The process developed by C.P.R.I. to reclaim the used transformer oil by using Korvi-Fullers earth is being used by C.B.I. & P. to set up research plants in the fields by State Electricity Boards of Andhra Pradesh, Karnataka and West Bengal. It is claimed to effect economy to th extent of more than 50 per cent. Research is still being continued.

(2) *Single Wire Earth Return System for Rural Electrification*:

It is considered economical to extend power supply to the villages by utilising single wire earth return system as this will result in a saving of 30 to 40 per cent. To achieve this object, phase converters for using 3 phase motors in single phase have been developed and employed by Karnataka State Electricity Board on an experimental basis. These are working satisfactorily. Also, solid state earth fault relay suitable for the SWER system has been developed and is being used in Karnataka State Electricity Board. In addition pilot schemes of SWER have been undertaken by MP and West Bengal State Electricity Boards.

(3) *Development of Different Types of Relays*:

(a) The University of Roorkee and Indian Institute of Science, Bangalore have developed fast acting solid state relays which can replace the Russian relays at present imported by B.H.E.L. and effect considerable saving in term of foreign exchange.

(b) A solid state earth fault relay to act when a conductor snaps in places where the earth resistance is quite high has been developed to trip the feeders effectively. The Tamil Nadu State Electricity Board Research Station has developed a distance relay testing kit with indigenous equipment which can be used for testing different types of relays supplied by different manufacturers. This would help to conserve considerable foreign exchange.

(c) The Tamil Nadu Electricity Board has developed a solid state protection system of bus bars protection which can be used even in sub-stations where there are CT's with un-equal ratios. In view of the integrated operation of the system this protection will prove to be of vital importance in important E.H.T. sub-stations.

(d) A method to find incipient faults in the transformer by analysing the gases that liberate from the transformer oil and to pin point the possible fault has been developed by the Research Station of Karnataka State Electricity Board.

(e) A solid state transient step type voltage regulator for recording potential rise on grounding grids of 11 KV feeders under fault conditions has been successfully developed. The regulator has been installed on trial basis at some sub-stations of T.N.E.B.

(4) *Reduction in Power System Losses*:

A comprehensive study has been made with regard to location of the capacitors with reference to the load points and the transformers to reduce the system loss and improve power factor.

(5) *Automatic Load Rostering in Rural Areas*:

The Research Station of Andhra Pradesh State Electricity Board has developed a load rostering box which will help in staggering agricultural pump sets loads thereby reducing the overload on the transformers at peak loads. It will improve the voltage conditions and aslo reduce the line losses. The apparatus is under field trials.

(6) *Development of Instruments*:

In order to carry out the research activities the same instruments which were being imported are being developed indigenously.

(7) *Thermal Stations*:

Investigations regarding the problem of failure of condenser tubes at Dhuvaran Thermal Power Station had been carried out and the factors responsible for the failure identified. Application of the results of studies has facilitated in checking further failure of the condenser tubes.

(8) *Transmission Line Problems*:

Investigations relating to vibration of overhead conductors in making analytical computations for determining the dynamic behaviour of stock bridge dampers have been carried out by the Punjab

State Electricity Board. The studies were also conducted in the tripping of transmission lines in pollution laden atmosphere. As a result, remedial measure such as adoption of most suitable and economical compounds on surface of insulators inhibiting frequest tripping have been suggested.

(9) *Dissemination of Research Results*:

The results of the Research carried out are disseminated to the users i.e. the State Electricity Boards through publications and seminars etc.

Statement showing the Benefits from the various schemes taken up by the Central Power Research Institute, Bangalore.

(1) *Development of electrical grade insulation Paper*:

A 33 KV cable has been manufactured by Cable manufacturers out of indigenously developed insulation paper, and tested at C.P.R.I. Lab. Development of the indigenous insulating paper is continuing. Presently, the insulating papers are being completely imported.

(2) *Recycling of used Transformer Oil*:

A process has been developed for recycling of used transformer oil which will help in conserving the transformer oil. As the crude for manufacture of transformer oil is being imported, this process will result in saving of a large amount of foreign exchange.

(3) *Testing of transmission towers for Export orders*:

The C.P.R.I. have created facilities for testing of transmission towers and in view of this special facility available, some of our tower manufacturers were able to get export orders from West Asian countries, Ceylon etc.

(4) *Rationalisation of steel sections for transmission towers*:

The C.P.R.I. have conducted studies on this question which will facilitate a better inventory control of transmission line material.

(5) *Development of Cable Fault Locator*:

The C.P.R.I. have developed a cable fault locator using a standing wave principle and this technique has been patented.

(6) *Assistance to development of PVC cables*:

Manufacturing of PVC cables for higher voltage has been taken up by a number of manufacturers. Facilities of partial discharge detection at C.P.R.I. are being used by all the Cable manufacturers in the development of PVC cables for higher voltages. During the last three years PVC cables upto 6.6 KV have been perfected. The programme to manufacture PVC cable is again an import substitution project as lead and insulation papers for PILC cables have to be fully imported.

(7) *Testing of Switchgear*:

The laboratories of CPRI have rendered assistance to manufacturers of switchgear in indigenous developmeint of switchgear of use in mines which is presently being imported. Similarly assistance was also rendered for development of special type of HRC fuses, arc-chutes etc. More than 200 organisations are availing of testing facilities in C.P.R.I. and getting their equipment tested at CPRI. It has also helped them to manufacture equipment of international standard for export.

(8) *Long Direction Electronic Timber*:

Long direction electronic timber with 3 hours 'ON' and 9 hours 'OFF' was developed and put under exhaustive field trials. The work is being continued to develop alternative design and also alternative time schedules. This type of timber could be used to stagger the operation of irrigation pump sets automatically and thus achieves savings in transmission losses.

RESEARCH SCHEME ON POWER

List of problems—Details of continued approved schemes:

I. *Andhra Pradesh State Electricity Board*:

1. Incidence of Lightning.
2. Insulator contamination.
3. Study and development of cheap protective devices for the protection of 11 K.V. Rural Feeders.
4. Study of application of capacitors for the improvement of voltage.

5. Developmental work relating to elimination of failure of condenser tubes in large power houses.

6. Study and development of optimum size, shape, material and angle of Horn-gap for protection of high voltage distribution transformers.

II. *Assam State Electricity Board*:

1. Incidence of storms and lightning on H.V.

2. Transmission lines.

3. Study of soil resistivity.

4. Single wire earth return system.

III. *Bihar State Electricity Board*:

1. Study of lightning surges and performance of lightning arresters.

2. Study of insulator contamination.

3. Study of corrosion of buried steel works.

4. Study of definite time current characteristics of out-door fuses for various weather conditions and study and development of cheap protective device, for 11 K.V. Rural Feeders.

IV. *Gujarat State Electricity Board*:

1. Break-down due to contamination of insulators and steps to be taken to eliminate it.

2. Development work relating to elimination of failure of condenser tubes in large power houses.

V. *Haryana State Electricity Board*:

1. Improvement in continuity of supply to rural and urban areas.

2. Voltage regulation and improving the voltage conditions in distribution system.

3. Study of losses in power systems.

VI. *Himachal Pradesh State Electricity Board*:

1. Study of Wood and Jointed Wood Poles for Rural Lines.

2. Induced Melting of Snow by Spraying Coal Dust.

VII. *Karnataka State Electricity Board*:

1. Study of Lightning Incidence on Transmission Lines.
2. Study of Corrosion of Ferrous and Non-Ferrous metals in natural and artificially Treated Soils.
3. Study of Insulation of Generator and H.V. Power Transformers under Operating conditions.
4. Single Wire Earth Return System for Rural Electrification.
5. Study of Inductive Interference and Corona on Telephone Lines and PLC Equipment.
6. Development of Cheap H.R.C. expulsion and Dropout Power Fuses.
7. Line Losses in 11 KV and 33 KV Systems.

VIII. *Kerala State Electricity Board*:

1. Study of Incidence of Storms and Lightning on Power Systems by using Magnetic Links.
2. Functional Evaluation of Lightning Protection Facilities in 11 KV Distribution System.
3. Control of Shrubs and Bushes Growth under Transmission Lines by Chemical Spraying.
4. Study of Incipient Fault in Transformers.
5. Evaluation of Full Current in different Sections in Vulnerable Lines Sections.

IX. *Madhya Pradesh State Electricity Board*:

1. Distribution Transformer Failure, Causes and Preventive action.
2. Single Wire Earth Return Systems.
3. Evaluation of Line Losses and necessary measures to minimise the same.

X. *Maharashtra State Electricity Board.*

1. Study of Losses in Distribution Systems.
2. Study of Damage to ACSR Conductors, Hardware, and Line Supports under Severe Chemical Pollution.

3. Suppression of Noise in Under-ground Hydro-Power Houses.

4. Over-voltage due to switching and Load rejection—A computer Programme.

XI. *Orissa State Electricity Board.*

1. Study of incidence and Magnitude—of lightning on Power Systems.

2. Control of bushes and Shrubs Growth under Transmission Lines by Chemical Spray Methods.

3. Study of Insulator Contamination.

XII. *Punjab State Electricity Board.*

1. Study of Incidence and Magnitude of Lightning on Transmission System.

2. Study of Vibration of Conductors in Transmission Lines.

3. Elimination of Earth Wire for Voltage up to 132 KV covering its entire aspect including that of projection.

4. Study of the extent of rushint of embeeded structures of Towers and other Metallic Supports.

VIII. *Rajasthan State Electricity Board.*

1. To study the Effect of Lightning on Overhead Transmission Lines.

2. To study and Evolve Effective Method of E.H.T. Sub-station Grounding.

3. Vibration of Over-head Conductors.

XIV: *Tamil Nadu Electricity Board.*

1. Insulator Contamination.

2. Vibration of Overhead Line Conductors.

3. Temperature Rise of Overhead Conductors.

4. Corrosion and Tuber-culation of Penstock Pipes.

5. Corrosion of Insulator Fittings.

6. Generator Insulation/Insulation Studies of Power Equipment.

7. Line Loss Studies.

8. Economisation in Rural Electrification—Provision of Magnetic Links.

9. Relay and Protection Problems.

10. Reliability Studies on Power Systems.

11. Improvement of Plant Factor.

12. Communication and Telemetry.

XV. *West Bengal State Electricity Board.*

1. Measurement of Frequency and Intensity of Lightning Stroke.

2. Use of Insulated Ground Wire of H. V. Line of Singlephase Distribution and for Tapping of Small Power.

3. Development of Portable Vaccum Drying out—set for Transformers.

4. Study of Interference on Magneto Telephone Lines.

5. Study of Distribution System problems; viz. Losses Voltage Regulation and Application of Capacitors.

XVI. *Tripura Electrical Circle.*

1. Study of Soil Resistivity.

XVII. *Punjab Engineering College:*

1. Behavious of Grounding System Under Impulse and High Frequency Currents.

XVIII. *University of Roorkee.*

1. Investigation of Losses, and Induced currents in Shielding provided by the Enclosurers of Bus-bars carrying heavy alternating current.

2. Transient Stability Studies of Power System in Dynamic Modelling.

3. Development of Instrumentation applied to Power System Studies and Automatic Control.

4. Control Co-ordination of Dynamic Statbility of Inter-connected System.

5. Use of Silicon Controlled Rectifiers of H. V. D. C. Transmission and Protection of HVDC Lines.

XIX. *Electrical Engineering Department, I. I. Sc.*

1. Design, Development and Construction of Electronic differential analyser
2. Development of Computer Programming for Power system problems.
3. Development of Static Sensitive Under and Over-voltage relays and development of automatic starting control schemes for induction motors on voltage dips.
4. Designing, Development and Construction of Solid State Hydrid Computor.
5. Development of Solid State Static Excitation System for Synchronous Machines.

XX. 1. Radio Interference Measurement on Insulators and Hardware in the design of 400 KV Lines.
2. Evaluating the performance of Insulators and Lightning Arresters for Operation in Polluted Atmospheres.
3. Development of 2 Million Volt Van-De-Graaff Generator.
4. 400 KV Experimental Line.
5. Studies on Luquid Dialectrics (Natural Ester Like Caster oil Cotton Seed oil etc.)
6. Choice of Insulation Level in 400 KV Transmission Lines and network.
7. Lightning Arrester Application for E. H. V.—400 K V.
8. Development of Voltage Time Characteristics for Rod-Gaps Bushings Insulator Strings etc.
9. Isolator Using Aluminium Contacts.

APPENDIX XX

(*Vide Para* 8.11)

NEW RESEARCH SCHEMES ON PROBLEMS OF THERMAL POWER STATIONS

The following Research Schemes on problems of thermal power stations are proposed to be taken up from 1977-78 onwards:—

(i) Abrasive effect of different varieties of high ash coal.

(ii) Investigation into possibility of setting up of a by-product plant in the power system by utilisation of coal mill rejects.

(iii) Use of different grades of steel as I. D. for blades and their hard facing to resist erosion.

(iv) Air conditioning by use of flue gas.

(v) Utilisation of fly-ash in the power station area or a linked mine.

(vi) Review of the performance of boilers installed in several typical thermal plants in Eastern States, possible methods of improvement upon existing conditions in performance and availability.

(vii) "THERMAL STATIONS"—Development work relating to elimination of failure of condenser tubes in large power house.

(vii) Combustion problems with different type of coal effect on boiler plant and ash handling plant possible methods of improvement upon existing conditions.

(ix) Optimus solution for various conditions of humidity in bus-duct of power generating units.

(x) Measurement of heat rate and methods to reduce the same in Badarpur Thermal Station.

(xi) Pollution control.

APPENDIX XXI

(*Vide* Para 6 Introduction)

Summary of Recommendations/Observations contained in the Report

Sr. No.	Reference to Para No.	Summary of Recommendations/Observations
(1)	(2)	(3)
1	2.21 to 2.26	The Committee noted in their 39th Report (1972-73) that as against the additional power to be created to the tune of 1.40 MKW, 3.48 MKW, 7.04 MKW, 6.88 MKW and 4.13 MKW, during the First Plan, Second Plan, Third Plan, and the three Annual Plans (1966—69) and the first three years of the Fourth Plan respectively, the actual achievements amounted to 1.12 MKW, 2.73 MKW, 4.52 MKW, 4.12 MKW and 2.60 MKW in each of these Plan periods, resulting in a shortfall to the tune of 20, 36, 35, 38 and 37 per cent respectively. These shortfalls, resulted mainly from the delay in delivery of plant and equipment by manufacturers and delay in construction work at site which was due to delayed supply of essential materials like steel, cement and paucity of funds etc. The Committee, however, find that the situation during the Fifth Plan is still more distressing, though on different account. In accordance with the Ninth Annual survey, the Fifth Plan had envisaged an additional capacity of 16.5 MKW. That the target was first lowered to 12.42 MKW and reduced further to 11.90 MKW. This is stated to be due to the overall slackening of the economy of the country during the last few years resulting in lowering of growth rate in industrial sector. The progress in rural electrifications was also slow which in turn had its repurcussions on the growth trends to some extent. All these factors are stated to have contributed towards slackening of demand for power

(1)	(2)	(3)
		from the major consuming sectors, and consequently the targets for creation of power generation capacity laid down for the Fifth Plan had to be lowered. The Committee are not convinced that the lowering of the target for additional capacity for power generation to be added in the Fifth Plan was at all justified. If previous experience is any guide, the demand for power both for industry and agriculture has been significantly in excess of availability with the result that the industry had to suffer long-term shut-downs/chronic under-utilisation of capacity and agriculture also suffered for want of availability of electrical energy for tube-wells, pumpsets etc. The Committee reiterate their observations made by them in paragraph 22 of their Thirtieth Report (Third Lok Sabha, March 1963) the above observations which are as pertinent today as they were in 1963 and regret to have to point out that Government do not appear to have learnt the requisite lesson from the persistent power shortages which have plagued the industrial and the agricultural sectors in successive plans and retarded the pace of development. The Committee are inclined to think that the reduction in two stages of the target for addition of electric power from 16.5 MKW to 11.90 MKW has been done with a view to cover up the shortfall that is likely to occur during the Fifth Plan as compared to the original targets envisaged.
2	2.27	The Committee find that the reasons now adduced for the delay in the execution of hydel projects and other projects are largely the same as have been repeated from one Plan period to the other. This is also indicative of the fact that hardly any perceptible improvement has been effected in the institutional arrangements for survey, investigation. preparation of project reports, communication of sanction, execution etc. with the result that the projects drag on for years rendering the entire planning

(1)	(2)	(3)
		for power unrealistic. The Committee cannot too strongly emphasise that at least now Government should improve the institutional arrangements to see that large power projects which have a vital role and contribution to make towards power development are selected and implemented in the field in accordance with the Plan programme and no slippage on any account is allowed to take place.
3	2.28	The Committee are distressed to note that there has been a revision of priorities in taking up certain projects, mainly hydel projects, during this period. These projects which were envisaged to come up by the beginning of the Fifth Plan, failed to come up because investigations were not completed in respect of these projects or detailed project reports in respect of these were not upto the mark.
4	2.52 & 2.53	The Committee note that the hydro-electric potential of the country was estimated at 42 million KW at 60 per cent load factor. This assessment is based on the Survey conducted in the fifties. The Committee were further informed that if the latest topographical and hydrological data for all the river basins and the latest technological advances on the possibilities of hydro electric development are taken into account, the hydro electric potential of the country would be much higher.
		Though two decades had elapsed since the last assessment, it is only now that Government had felt the need for up-dating the old survey. The Committee understand that a scheme has been drawn up for setting up of a specialised cell in the Central Electricity Authority for up-dating the hydro-electric potential of the country through a comprehensive national survey and that the Ministry of Energy has conveyed the sanction of the scheme during October, 1977 at an estimated cost of Rs. 30 lakhs. This work of re-assessment is scheduled to be completed in five years. The Committee feel that considering the fact that the reassessment of hydro-electric potential has already been delayed for long, at least the period of completing the assessment now being undertaken should be

(1)	(2)	(3)
		as short as possible so that a long term perspective plan for development of power could be drawn up earlier in the light of the reassessment. They would therfore urge the Government to examine the feasibility of completing the work in shorter time. The Committee would also like to stress that while making the assessment of the potential, the possibility of development of small and micro level projects should not be lost sight of. The Committee would urge that this aspect should be specifically included as one of the items to be looked into while assessing the potential.
5	2.54	It is an admitted fact that the hydro-electric power is ultimately cheaper as its operating and generation costs are exceedingly low, apart from the other benefits accruing from the fact that the hydro-electric projects are in the nature of multi-purpose projects. Besides, it is a very clean energy compared to coal and is replenishable. In view of these obvious advantages of developing the hydro-electric potential the Committee had expected that there should have been speedier development of this potential. The Committee however, find to their regret that hardly 13 per cent of the potential as assessed in the fifties had been utilised till the end of the Fourth Plan and only about 27.9 per cent of the potential is now either developed or under development.
6	2.55	The Committee note that there have been wide disparities in developing the hydro-electric potential in the various regions and States in the country. The development of the potential at the end of 1978-79 region-wise, would be 45.98 per cent in the Southern region, 26.02 per cent in the Northern Region, 16.60 per cent in the Eastern Region, 15.78 per cent in the Western Region and 0.54 per cent in the North-Eastern Region. Even at the end of the 1983-84 according to the present indications, the development region-wise would be 70.99 per cent in the Southern region, 38.71 per cent in the Northern region, 29.30 per cent in the Eastern region,

(1)	(2)	(3)
		17.84 per cent in the Western region and 1.94 per cent in the North Eastern region. The development of the potential in the various States at the end of 1978-79 would range from 2.13 per cent in Sikkim to 142.32 per cent in Tamil Nadu. The Committee are greatly concerned at this imbalance in the development of hydro electric power as compared to the known potential in the various regions/States in the country.
7	2.56	The Committee need hardly point out that the availability of power is one of the key factors in the development of a region or a State. It is, therefore, no wonder that the States with less availability of power are comparatively backward. The Committee would like Government to pay serious attention to this aspect and take necessary remedial measures to correct the imbalance in the development of hydro-electric potential in the various States. They would like that priority in the development of hydro-electric potential should be given to those States which are lagging for behind in such development in spite of having promising potential and wide gap between requirements and availability of power.
8	2.57	The Committee cannot but express their deep disappointment that the progress in harnessing the hydro-electric potential in the country should have been so slow. The Committee hope that in the view perspective plan for development of power hydro-electric power development would find its due place and Government would take concerted measures to step up the development of hydro-electric potential in the various States of the country.
9	2.64 to 2.66	The Committee are glad to note that an award of Krishna Water Disputes Tribunal has been given in May, 1976, and it has become possible to accord approval to some of the projects in the Krishna basin. Similarly, agreement has also been reached on sharing the waters of Godavari basin, and this

(1)	(2)	(3)
		would enable processing of Upper Indravathi multi-purpose project and other projects in this basin. The Committee hope that no time should now be lost in clearing all the remaining projects which were held up due to Krishna and Godavari Water dispute.
		The Committee also note that sharing of waters of the Narmada basin is still under adjudication of the Narmada Water Disputes Tribunal, whose award is awaited. The Committee hope that the Tribunal award would be available soon and thereafter no time would be lost in finalising the various hydel projects in the Narmada valley.
10	2.67 to 2.70	The Committee are, however, distressed to note that some hydro electric projects have been held up in the Northern region on account of inter-State disputes. The Committee note that no solution is in sight as regards the Mukerian Anandpur Sahib and UBDC State II projects inspite of the repeated efforts made by the former Ministers of Energy. The Committee also note that the Thien Dam located on river Ravi is held up due to similar disputes between Himachal Pradesh, Punjab and Jammu and Kashmir and also the States of Haryana and Rajasthan. The Committee view this state of affairs as extremely unfortunate as the power potential available in the region would remain untapped for long periods for want of suitable solutions to the disputes.
		The Committee are dismayed over the helplessness exhibited by the Central Government so far in the whole affair of inter-state River Water Disputes and the indifference shown by the State authorities concerned in a matter which has a vital bearing on the economic well-being of the people of the area. The Committee would like Government to give this matter their most serious consideration. The Committee at the same time would appreciate if Government would evolve very early a framework of a

(1)	(2)	(3)
		broad policy in regard to these disputes, based on justice and keeping in view the economic interests of the people so that amicable solutions could be found to these problems without delay and a major bottleneck standing in the way of development of hydel projects and economic prosperity of the regions and welfare of the people could be removed. The Committee would like the Central Government and all other authorities concerned to redouble their efforts to see that an amicable and workable solution is found about the sharing of power from the proposed Thien Dam Hydel project so that it could be taken up for implementation without any further delay.
11	2.73 & 2.74	The Committee note that a number of hydel projects have been sanctioned after 1973-74 and in most of the cases, orders have also been placed for generating plants, to yield benefits during the Fifth and Sixth Plans. The Committee further note that a number of them have already been taken up for construction. The Committee would like to emphasise that investigations of the hydro projects which are likely to yield benefits, beyond the Sixth Plan may also be initiated and the projects kept ready in the pipeline so that the same could be taken up without let or hinderance at the appropriate time. The Committee have been stressing the need for perspective and detailed planning for the next ten to fifteen years and they desire that learning from experience Government should see that hydel projects in particular are got investigated and a shelf of schemes got ready for selection and implementation so as to achieve in time the Plan targets envisaged.
12	2.75 & 2.77	The Committee learn that there is no obligation under Sec. 30 of the Electricity (Supply) Act to refer the hydel projects to National Committee on Environmental Planning & Coordination for clearance while such a clearance in the case of thermal

(1)	(2)	(3)

power project is obligatory. Even so, the Committee observe that the National Committee on Environmental Planning & Co-ordination had suggested the dropping of the Silent Valley Hydro Electric Project of Kerala on account of sub-mergence of virgin forest and ecological disturbances. The objection was raised by the NCEPC in 1977 at a time when an amount of Rs. 52.21 lakhs had been reportedly spent on preliminary works of the project and the project itself was sanctioned as early as February, 1973. The Committee learn that the NCEPC (National Committee on Environmental Planning Co-ordination) had stated that they would be able to reconcile themselves for the execution of the project provided certain safeguards were taken in respect of environmental protection during the course of execution, operation and maintenance of the project. Kerala Government have agreed to provide these safeguards and the matter has been taken up with the Department of Science and Technology.

The Committee have also been informed that there was a suggestion from the adviser (Energy) of the Planning Commission in October, 1977 that the hydel projects should also be referred to the NCEPC for clearance in the same way as thermal projects, and that three such projects which have been cleared from the techno-economic angle by the CEA are awaiting clearance of the NCEPC.

The Committee appreciate the need to ensure that the execution of power projects does not lead to ecological disturbances. What the Committee would like to emphasise is that in order to expedite the entire process of approval, sanction and execution a hydel project should be taken up simultaneously with the Central Electricity Authority for clearance from techno-economic angle and with the NCEPC for clearance from ecological angle so that once the project is cleared from techno-economic angle, there is no further held-up in the process of sanction and

(1)	(2)	(3)
		execution. The Committee would like the procedure in this regard to be settled after due consultation with the State Governments, Planning Commission and the Department of Science and Technology and necessary guide-lines issued to all concerned in the preparation and approval of future projects.
13	2.80 & 2.81	The Committee note that one of the reasons for overruns in the construction and commissioning of power plants has been the inadequacy in investigations and preparation of detailed project reports. The Committee note that guidelines have been issued by the Central Water Power Commission for investigation for river valley projects. A Committee has also been appointed to lay down parameters for the preparation of detailed project report. They desire that the Committee appointed by Government to revise the guidelines should complete their work with expedition so that the authorities can be provided firm guidance for investigating and preparing the schemes along the approved lines to facilitate selection of projects for the Sixth Plan.
14	2.82	The Committee need hardly point out that there should be a monitoring arrangement in the Central Water and Power Commission to continuously review the guidelines in the light of experience so as to supplement and modify them as necessary and notify them to the authorities concerned contemporaneously to bring about the necessary improvement. The Committee also suggest that these guidelines may be reviewed at least once during each Plan period so that these could provide firm and up to date basis for investigation and preparation of schemes along approved lines for the succeeding plan period.
15	2.97 to	The Committee in their 39th Report (1972-73) had recommended that Government should examine the feasibility of locating the new thermal stations at the pitheads in the larger economic interest.

(1)	(2)	(3)

The Committee have been informed during evidence that locating the new thermal stations at the pitheads would be economical from the point of view of cost of generation of power.

Government, it is stated, propose to establish in a phased manner one large thermal station each in Northern, Western, Eastern and Southern regions. Feasibility reports have already been prepared for Singrauli (2000 MW), Korba (2000 MW), Farakka (2000 MW), Ramgundam (1000 MW), and Neyveli (1000 MW). Proposals have been forwarded to the World Bank for financial assistance. The Committee note that negotiations with the World Bank in respect of Phase I of the Project at Singrauli are in an advanced stage. The Committee have been informed that an assistance of 150 million dollars would be available for Phase I. The Committee would like to be apprised of the outcome of the negotiations, and the progress made in the setting up of the Singrauli Project.

As regards the Project at Korba, Ramagundam and Farrakka, the Committee observe that Government have accorded approval for setting up super thermal power stations for the projects at Korba and Ramagundam and in respect of the super thermal project at Farakka, the project report has been prepared and is being apprised in the Central Electricity Authority for techno-economic clearance and thereafter the project will be processed for an investment decision.

The Committee would like to emphasise that implementation of all these projects may be taken up in accordance with the relative priorities fixed, keeping in view the need for development of the various regions and in accordance with a time-bound programme.

(1)	(2)	(3)
16	2.116 &	The Committee note that the thrust of research on the solar energy is towards its application to rural areas with a view to complement the other sources of energy. The Committee recommend that considering the special significance this source of energy has for a tropical and agricultural country such as ours, R&D efforts should be intensified to make a break-through in this field.
17	2.117	The Committee also note that some investigations are being conducted in the field of Geo-thermal energy to find its possible uses, but these are at a preliminary stage. They hope this source of energy will also receive due R&D attention.
18	2.118 & 2.119	The Committee also note that Bio-gasis yet another non-conventional source which appears to have great potential for development particularly in rural areas. Needless to say, the use of this source of energy, can be of great help in conserving large quantities of kerosene which is being burnt in rural areas for cooking and lighting purposes and easing pressure on the demand for power in rural areas.
		The Committee are informed that at the beginning of the Fifth Plan, the number of bio-gas plants was about 7,000. A target of one lakh plants was set for the Fifth Plan. As against this target, the number of plants set up at the end of the second year of the Fifth Plan was only 30,000. The Committee urge Government to take vigorous steps to ensure that the target set for the Fifth Plan is fully achieved by 1978-79.
19	2.120	The Committee would, however, point out that the cost of setting up a small size bio-gas plant which is between Rs. 3016 and Rs. 4175 appears to be beyond the reach of a common man in the rural parts of the country. They would therefore, urge Government to direct their efforts towards reducing the

(1)	(2)	(3)
		cost of setting up plants through economy in design and enable the villagers to benefit from this programme.
20	2.121	The Committee would like to point out that the rapid development of the vast bio-gas potential available in the country for meeting the rural energy needs, would require establishment of large sized community type bio-gas projects.
21	2.140 & 2.141	The Committee in paragraph 3.189 of their 39th Report (1972-73) had expressed their unhappiness at the dismally low per capita consumption of electricity in the country which was 93 Kwh in 1971-72, compared to the world average of 1200 Kwh. They had noted that even at the end of 1978-79, the per capita consumption of electricity was anticipated to be only 200 Kwh as against the per capita consumption of 1000 Kwh in the USA and 2,000 to 3,000 Kwh in Europe. The Committee are very much perturbed to note that even the anticipated 200 Kwh per capita consumption of electricity by 1978-79 is now not likely to be achieved before the end of 1983-84. The Committee are not convinced by the reasons advanced by the Ministry that the target of 200 Kwh of per capita consumption at the end of the Fifth Five Year Plan (1978-79) related to the total generation of electricity. Considering that per capita consumption of electricity in 17 countries out of the 28 developing countries, was above 200 Kwh in 1974-75 and in 6 of them, it was over 1,000 Kwh, it is evident that the target of 200 Kwh of per capita consumption by the end of 1978-79, was a very modest one. It is regretted that even this modest target is now proposed to be achieved by the end of 1983-84. The Committee need hardly stress that power is an essential input for agricultural, industrial and economic development of the country. It is, therefore, imperative that there should be an acceleration in the programme for development of power. They would, there-

(1)	(2)	(3)
		fore, like Government to prepare an accelerated programme for the development of power-hydel, thermal and nuclear—so as to achieve the target of 200 Kwh per capita consumption of electricity at the earliest. The Committee have no doubt that if the programme for development of power is accelerated the target of 200 Kwh would be achieved earlier than the end of 1983-84.
22	2.142	The Committee further note that there were wide disparities in the per capita consumption of electricity between the various State/areas at the end of the Fourth Plan. The per capita consumption in 1973-74 (i.e. at the end of the 4th Plan) ranged from 6 Kwh in Tripura, 8 Kwh in Manipur, 21.2 Kwh in Assam to 197 Kwh in Punjab, 170 Kwh in Maharashtra, 154 Kwh in Gujarat. The Committee regret to observe that determined efforts do not apear to have been made in this regard. They note that the additions to the per capita consumption of electricity during the Fourth Plan period were not made to the desired extent in the low per capita consumption States/areas. The Committee strongly urge that effective measures may be taken by Government to reduce these wide disparities by according higher priority to the generation, transmission and distribution of power in such areas with potential consumption for industrial and agricultural development.
23	2.143	The Committee would further like to point out that lack of availability of power acts as a constraint on the growth and development of rural and semi-urban areas. It is well known that there is high consumption in metropolitan and big urban areas. The per capita consumption of electricity at Delhi and Chandigarh was 316 and 425 respectively against the All India average of 108.8 Kwh in 1975-76. The easy availability of power in these big cities has been one of the main factors for concentration of industries and employment potential in these areas resulting in migration of population from rural areas to

(1)	(2)	(3)
		these centres. The Committee consider that in the interest of development of rural and semi-urban areas, it is imperative that power is made easily available in the rural areas. They would, therefore, like Government to give high priority to make power available to these areas in the interest of integrated rural development and creating employment potential there.
24	2.157 to 2.160	The Committee would like the Government to keep a careful watch on the losses arising out of force outages, equipment and auviliary constraints and bring them down through vigorous implementation of the measures which are stated to have been taken such as reduction in down-time, modernisation of maintenance procedures adequate preventive maintenance of units and auxiliaries and employing proper working procedures in case of forced outage to bring back the unit on outage to service at the earliest.
		The Committee hope that plant by plant review be undertaken of the forced outages, partial outages, and constraints on output of the plant by the technical experts to diagnose the problems and find urgent technical solutions the above review would be completed at an early date and the quality and performance of power stations improved so as to ensure maximum output from the existing capacity.
25	2.173	The Committee note that as against the targetted additional installed capacity of 9.26 million KW during the Fourth Plan period, the actual addition was only 4.16 million KW., resulting in a shortfall of 5.10 million KW and in percentage terms, the achievement had been about 45 per cent. The Committee observe that apart from increase in the cost of projects due to escalation in prices and increase in labour costs, the other main reasons for the shortfall were inadequate investigation and deficiencies in project preparation, delays in availability of essential construction materials and funds, delays in obtaining plant and equipment and organisational/management deficiencies. The Committee need hardly point out that with greater care in planning, greater determina-

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		tion to implement the schemes and necessary coordination with concerned authorities these difficulties could have been easily overcome. The Committee hope that Government have learnt the lessons from their past experience and would ensure that at least in future such short-comings do not hold up commissioning of power plants according to the stipulated schedules and the country is not denied the availability of power which provides vital sinews for industrial and agricultural advancement.
26	2.174 2.176	The Committee find that in so far as Fifth Plan is concerned, the target for additional installed capacity of 16.55 million KW as originally envisaged in the draft plan document has been steeply scaled down to 12.5 million KW. The Committee note that during the first two years of the Fifth Plan, the capacity added was only 3.52 million KW and during the third year viz. 1976-77, the target was 2 million KW. The Committee observe from the Annual Report of the Ministry of Energy (Paragraphs 3.35 to 3.37) for 1976-77, that out of this targetted additional capacity of 2 million KW, only a capacity of 0.64 million KW till 30th November, 1976 has been achieved, and the construction works of some of the projects scheduled for commissioning during that year with capacity totalling 1.276 million KW were still at various stages of completion. The Committee would like to point out that even if the target of 2 million KW were achieved during 1976-77, the balance additional capacity left to be built up during the last two years of the Fifth Plan (i.e. 1977-78 and 1978-79) would be about 7 million KW. The Committee have been assured by the Ministry of Energy that no shortfall is expected in the achievement of the revised physical target during the original Fifth Plan period (i.e. 1974-75 to 1978-79). The Committee have no doubt that Government are fully aware of the stupendous nature of the task before them, namely, of adding a capacity of more than 7

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		million KW in the last two years of the original Fifth Plan (i.e. 1977-78 and 1978-79) against a likely achievement of 5.2 million KW during the first three years of the Plan. Needless to say, that if the target is to be fully achieved, Government will have to redouble their efforts and ensure that there is no complacency or slippage at any level and bottlenecks, if any, are immediately, identified and removed through a system of strict monitoring of the projects under construction.
27	2.187 & 2.188	The Committee note that at the Centre, the monitoring of the power projects under construction in the Central and State sectors is being done by the monitoring of the power projects under construction in the Central and State sectors is being done by the CEA. The Committee have been informed that a proposal for setting up a full fledged construction Monitoring Organisation in the CEA, has been approved. The Committee need hardly emphasise the importance of construction monitoring, particularly in the context of the shortfall in achieving the power generation target in the Fourth Plan. The Committee trust that with the strengthening of the monitoring organisation at the Centre, all avoidable delays in the construction and commissioning of power projects will be eliminated.
28	2.189 2.190	The Committee are, however, distressed to find that the arrangements for monitoring at State Electricity Board level leave much to be desired. The Committee need hardly point out that a majority of the bottlenecks that arise in the implementation of projects could be to a very large extent avoided or remedied by timely action through effective monitoring at project level and upwards and through close coordination with the Central Electricity Authority. The Committee urge the Central Government to pursue this matter vigorously with the States and ensure that proper monitoring arrangements exist for all individual projects so that no avoidable delay occurs in their commissioning.

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29	2.204 to 2.206	The Committee note that no time schedule has been laid down for examination and clearance of power projects. The Committee have been informed that it was difficult to make any comment on the impact of time taken in project preparation and clearance on the cost of the project. The Committee observe that as per provisions of the Indian Electricity (Supply) Act every scheme estimated to involve a capital expenditure exceeding Rs. 1 crore is required to be submitted to the Central Electricity Authority for its concurrence. This Authority carries out detailed techno-economic examination of the project to make sure that it is justified on techno-economic considerations before giving concurrence. The scheme is discussed at the full meeting of the C.E.A. and the representatives of the Planning Commission is co-opted as a part-time Member of the C.E.A. when the project is discussed. The C.E.A. then conveys its approval to the Ministry of Energy who then approach the Planning Commission for formal approval to the inclusion of the project in the Plan. The Committee find that in the case of 7 projects technical examination was completed within a year, in the case of 13 projects, it took between one and two years and in the case of 18 projects, the time taken exceeded 2 years and in a few cases it took 6 years and more. While the Committee realise that the process of technical examination of projects takes time, they do not see any justification for taking more than a year in this process as preparation of project reports may have already taken its own time. The Committee feel that the Ministry should streamline the procedure for technical examination and issue guidelines indicating in detail about the kind of technical and other relevant data which should be submitted by the State Governments, so that all avoidable delays in obtaining

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		clarifications are obviated and the projects are cleared for investment decisions expeditiously. The Committee would like to be apprised of the steps taken in this regard. The Committee need hardly emphasise that delays in the preparation of project reports and their sanction result in escalation of costs, apart from belated supply of power. The Committee would also like to emphasize that when a project is once cleared by the Central Electricity Authority from techno-economic angle after a full and detailed examination with which representative of Planning Commission is also associated there should be no case for reconsideration of the Project from techno-economic angle by either the Ministry of Energy or the Planning Commission and the clearance given by the Central Electricity Authority should be treated as final.
30	2.207	The Committee note that so far as Central Hydro-electric Projects are concerned, the constitution of the Control Board for Central Hydro-electric Projects and the procedures adopted by it have helped in processing of the proposals and in issuing of formal sanctions after decisions are taken by the Control Board. The Committee hope that the work relating to the projects in the Central Sector would be processed smoothly and the plants commissioned within the target dates.
31	2.218 & 2.219	The Committee note that delay in delivery schedules and supply of defective equipment by BHEL is stated to be partly responsible for delay in the commissioning of power plants. The Committee are constrained to observe that the continued delays in the deliveries of equipment are a pointer to the fact that there has not been the necessary coordination between the BHEL on the one hand the Project authorities/State Electricity Boards and the C.E.A. on the other. The Committee are unable to appreciate why such a vital mat-

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		ter was not attended to in time. The Committee would like Government to take suitable remedial steps so as to ensure that the orders are placed on BHEL well in advance and delivery schedules worked out in a phased and realistic manner. The Committee have no doubt that through strict monitoring and effective coordination at various levels concerted measures would be taken to ensure that the supplies are made on schedule by BHEL and arrangements are made to inspect the equipments before despatch and later before installation at the projects. The Committee would like to be apprised of the concrete step taken in this regard.
32	2.232 & 2.233	The Committee were informed that there was quite a lot of silt flow in the Himalayan rivers and in addition there were a lot of boulders which caused severe damage to turbines. The Committee would like Government to ensure that suitable safeguards are taken to obviate damage from silt and boulders to the turbines and other equipment in Lower Lagyap Project.
33	2.234	The Committee further note that Kosi Project has also to contend with heavy siltage problem. The Committee were informed that in 1973, Y. K. Moorthy Committee went into this matter and made certain recommendations. The Committee understand that silt problem of the Kosi canal which had become acute before 1973 has since been considerably moderated. The Committee would like to urge that the recommendations made by the Moorthy Committee should be implemented early so that the silt may not assume serious proportions in this project.
34	2.235	The Committee feel that these phenomena should have been known at the investigation stage of the various projects in the Himalayan region. They regret that adequate steps were not taken in

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		time to prevent boulders and silt causing damage to the turbines of these projects. The Committee would like Government to undertake an overall survey of all the projects which are prone to the problem of silt and provide necessary safeguards in time to mitigate it. The Committee hope that the new projects which are likely to face this problem would have in-built devices to prevent silt etc., causing damage to the power equipment.
35	2.264 to 2.267	The Committee note further that a number of measures have been taken to augment the availability of power in the country and ensure rational and equitable distribution with a view to meeting the essential requirements of all the priority sectors of economy. Inspite of the steps stated to have been taken by Government, the Committee cannot help observing that the position is still far from satisfactory. The Committee have been informed that the requirement of power in the years 1974-75, 1975-76 and 1976-77 was 77600, 83508 and 88489 Gwh. respectively, and the availability during these years was 66647, 74909 and 83365 Gwh. So far as the remaining two years viz. 1977-78 and 1978-79 are concerned, the anticipated requirement during these years would be 100260 and 111891 Gwh. and the availability would be 93734 and 109040 Gwh. The Committee would also like to point out that there is not a single State or Union Territory in the country where the supply of power has kept pace with its requirements and what causes more concern is that the shortage is likely to persist for the years to come. The Committee note that particularly in the States of Haryana, Uttar Pradesh, Punjab, Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Tamil Nadu and West Bengal, the gap between the availability and the anticipated requirement at the end of 1978-79 will continue to be very wide. Thus the total power picture that emerges is one that cannot but causes great deal of anxiety.

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86	2.268 2.272	The Committee find that according to present indications, the installed generating capacity at the end of March, 1978 is expected to be 24,000 MW, whereas the 10th Annual Power Survey had anticipated the installed capacity as 25004 MW at the end of 1977-78. According to the assessment made by the 10th Annual Power Survey, the energy requirements for the years 1978-79 would be 111796 MKWH which is likely to go up to 185064 MKWH at the end of 1983-84. Bosed on these projections of requirements of energy made by the 10th Annual Power Survey, the Central Electricity Authority has made a study of the capacity requirements of power and according to their study a capacity of 22,000 MW will have to be added in the next five years (i.e. 1978-79 to 1982-83) to meet these requirements. The projects for generating this additional capacity have been identified. A Working Group has been constituted to formulate the power programme for this period, and the power plan for 1978-79 to 1982-83 is still under formulation.
		The Committee observe from the study carried out by C.E.A. that the projected additional capacity of 22000 MW, the on-going schemes and the sanctioned schemes would together provide 16467.5 MW and for the rest certain new hydel and thermal projects will have to be considered.
		The Committee also note that the basic objective of the power plan for 1978-79 to 1982-83 is to achieve self-sufficiency in the next seven years. While the Committee welcome the objective of the Government to achieve self-sufficiency in power in the next seven years, they cannot help observing that in this field the past performance had not been inspiring or encouraging to lend optimism regarding achievement of this objective. There had been wide gaps

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		between targets fixed and the actual achievement in Plan after Plan. The Committee have dealt with in this matter elsewhere in the Report. It would suffice here to point out that all impediments noticed in the past coming in the way of achieving the declared goals will have to be ruthlessly removed so as to ensure that the targets once fixed are achieved in full without fail. The Government will have to ensure that ongoing schemes and the already sanctioned schemes are completed by the target schedules which would provide as much as 16467 MW of power. The Committee need hardly emphasise that the funds for the schemes will have to be provided on an assured basis and adequate organisational capacity created and developed well in time to sustain the tempo of progress and that there should be close and strict monitoring of the project schedules in close coordination between the concerned authorities and above all an unwavering determination to achieve the targets. As regards new schemes, they should be so selected that the benefits of these schemes do become available within the seven years period.
		The Committee need hardly repeat that power being the basic infra-structure for the overall development of the economy Government would give the highest priority to this core sector and thereby provide the necessary impetus for the rapid growth in industrial and agricultural fields.
37	2.284 to 2.286	The Committee would like to point out that there is a clear statement made by the then Minister of Energy in the Lok Sabha on 4 November, 1976 that the Government are interested in 'evolving a national power policy'. It appears to the Committee that there is some mixup between having a National Power Policy and a National Energy Policy. While admittedly, power being a source of energy it would be covered by National Energy Policy, the Commit-

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tee have to point out that Government as such have not brought out any White Paper or official document spelling out in detail even the National Energy Policy.

What is available, is a statement which has been laid on the Table of Rajya Sabha on 12 August, 1976 by Government in response to an Unstarred Question asking for details of decisions taken by Government on the report of the Fuel Policy Committee. A perusal of the detailed statement laid on the Table indicates that in the case of power the Fuel Committee had relied on whatever limited data was made available to them by the Central Power Commission, nuclear power authorities etc. They had clearly pointed out in several places the need for further investigation and survey with a view to update the data and prepare perspective plans in depth. This does not appear to have been done. Besides, the Committee consider that the National Power Policy should cover in detail the role allotted to hydel, thermal and nuclear power, having regard to the overall economics of their generation, transmission etc. The power requirements particularly for industrial development of backward areas and rural areas for the next 20—25 years have also to be projected in some detail in the National Power Policy.

The Committee feel that it would have been more appropriate for Government to have brought out a White Paper on Energy so that there was a nation-wide debate on this matter which has a direct and intimate bearing on the developmental requirements. The Committee in this connection note the statement of the Minister of Energy made in Lok Sabha on 14 July, 1977 in reply to the discussion on Demands for Grants of his Ministry that "we are preparing an action plan for adding to installed capacity with a view to achieving self-sufficiency in meeting the power demands at least by the end of the Sixth Plan." The Committee would like Government to bring forward

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		a White Paper on National Power Policy at the earliest which would cover *inter alia* the projections of power requirements for the next 20—25 years and the extent to which these requirements would be met by hydel, thermal and nuclear power etc. The White Paper may be placed in time before Parliament so that there is well informed discussion both inside and outside the House.
38	3.15 to 3.17	The Committee note that in pursuance of the recommendation made in their 39th Report (1972-73), regarding advance action to be taken to finalise the generation and load demand of various regions and undertaking extensive studies to decide the important trunk lines within the States as well as the inter-State/Regional lines, Government are stated to have completed power flow studies corresponding to the load and generation conditions envisaged in 1980-81 and identified important trunk transmission lines at 220 KV and 400 KV to be constructed in the States as well as in the inter-State/Regional lines for all the regions. The Committee further note that a Task Force for Transmission and Distribution Programme for the Fifth Plan had been set up to take into account the programme and details of power generation and system loads in the Fifth Plan and beyond. The Task Force had made a number of recommendations relating to building up planning and design capabilities in the CW&PC (now CEA) and the State Electricity Boards, and data collection. The Committee note that the Central Electricity Authority is being re-organised and strengthened with a view to enabling it to effectively guide and promote the power development programme in the country of which transmission and distribution is an integral part. A separate organisation has been created in the Central Electricity Authority for undertaking power system studies

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		and framing guidelines for systems planning in respect of the transmission net work. A separate post of a Member (Power systems) has been created in the Central Electricity Authority.
		The Committee have been informed that though generally, the transmission network is ready for evacuation of power by the time the generating stations are commissioned, there have been cases where the construction of the transmission lines has not progressed according to schedule. The Committee are surprised that in a country which has been in continuous grip of power famine, leading to halting growth in the industrial and agricultural sectors, a situation should have been allowed to develop in which the transmission network did not progress according to scheduled resulting in delayed evacuation of power from the generating stations. That such cases should have arisen at all is an ample proof to show that in the scheme of power development, transmission/distribution systems have not been properly integrated.
39	3.18	The Committee note that the power systems organisation is proposed to be strengthened to undertake studies on high voltage transmission system and distribution planning. They desire that these studies may be undertaken at an early date to facilitate efficient and economic execution of high voltage transmission and distribution schemes.
40	3.19	The Committee note that for creation of suitable organisation at the Centre to coordinate the procurement and supply of key material and equipment, Government have a cell dealing with the timely availability of controlled and non-controlled items required for transmission and otherwise. The Committee stress that the cell responsible for dealing with the supply of key materials should maintain greaetr

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		coordination with the State Electricity Board and assist them in timely procurement of materials for transmission and distribution systems.
41	3.20	The Committee note that the Task Force for Transmission and Distribution Programme in their Report had also recommended that the Trunk Transmission lines at 220 KV and above proposed to be taken up during the period 1974-75 to 1978-79 might be finalising in consultation with the States' representatives and that the construction and completion of the various links should be planned so as to strictly match with the commissioning dates of the connected generation schemes. The Committee note that these transmission lines had been finalised in consultation with the State Electricity Boards and and construction and completion of these lines had generally been planned in such a way that they matched with the commissioning of various generating units. The Commitee would like a close watch to be kept on the actual execution of the programmes for the construction of the transmission lines and distribution net work so that there are no slippages and their completion is synchroinised with if not completed well ahead of the commissioning of the concerned generation schemes.
42	3.24	The Committee note that a power systems Monitoring Directorate has recently started functioning in the Central Electricity Au'hority to monitor the progress of the trunk transmission lines and inter-State/Regional lines under the construction and to render assistance to the States in removing bottlenecks, if any, so as to ensure the timely completion of these lines. The Committee would like to judge the working of the Monitoring Directorate by the results it achieves of ensuring that the transmission lines for the projects under construction are completed well before the commissioning of the projects.

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42	3.25	The Committee note that necessary power system planning studies have already been initiated in so far as the transmission programme for the Sixth Plan is concerned and that the States are being associated with these studies at appropriate stages with a view to enable them to simultaneously formulate their plan proposals within the overall framework of EHV net work evolved. The Committee note that advance action has been taken for planning the transmission programme for the Sixth Plan in consultation with the State Authority. They have no doubt that such an arrangement should enable the formulation of well thought out transmission programmes and their clearance and implementaiton in time.
44	3.56 to 3.61	The Committee in their earlier report in 1973 had expressed their distress at the high incidence of 18 to 25 per cent of transmission/distribution losses in the country, compared to 5.7 to 12 per cent in other countries. The Committee are of the view that imbalance in the planning of generation *vis-a-vis* transmission and distribution and investment in transmission/distribution facilities not being upto the desired level were some of the factors responsible for such high losses and recommended a continuous watch over efficiency of operation in generation, distribution and transmission system. They also drew attention to the points of action recommended by the Power Economy Committee in regard to improvements in the transmission and distribution designs to reduce such losses. The Committee observe from the replies of the Government that the main reasons for losses were inherently low power factor of agricultural pumping loads and long lengths of sub-transmission and distribution lines in the rural areas, and that wherever there had been extensive rural electrification, the power losses were found to be high.

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The guidelines issued by Government to the State Governments for reducing transmission distribution losses include (i) setting up of special units in the State Electricity Boards to prepare schemes, (ii) amendment to the conditions of supply to make it obligatory on the part of consumers to instal shunt capacitors (which would bring down the loss to 50 per cent before new connections are given, (iii) election of new transmission lines and sub-stations to reduce over loaded lines etc., and (iv) measures to prevent pilferage of energy and tampering of metering equipment etc.

The Committee also note that the Rural Electrification Corporation has granted loan assistance to States to the tune of Rs. 10.74 crores for 55 system improvement schemes till November, 1976.

The Committee would have been happy if all these and other measures stated to have been taken by Government had brought about substantial reduction in the transmission/distribution losses, which the country can ill afford in the context of our critical energy situation. The Committee, however, find to their dismay that since 1970-71 the losses instead of coming down have been rising every year. In 1971-72, they were 18.75 per cent, compared to 17.5 per cent in 1970-71, then rose to 19.94 per cent in 1972-73, registered further increase in 1973-74 when it stood at 20.46 per cent and further rose to 20.48 per cent in 1975-76.

The Committee have noted the claim of Government that the percentage increases in losses during these years have shown a downward trend inspite of large scale rural electrification and pumpset enorgisation programme, indicating thereby that the measures taken had the definite impact in arresting substantial increase in losses. The Committee are not convinced by the claim made by Government. They feel that the losses are very high and with effective measures could be brought down considerably. The

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		Committee would, therefore, like Government to take determined measures to bring down the losses to 14 per cent which is the suggested limit to which losses could be reduced at the earliest so that more power is available for agriculture and industrial purposes from the existing systems.
45	3.62	The Committee are also surprised to note that so far, no study has been carried out to determine the optimum level to which the losses in transmission/distribution can be reduced. The Committee would suggest that Central Government should urge each State Government to determine, after a study in depth, the optimum level to which such losses could be reduced in the power systems and take concerted measures to reach this level.
46	3.63	The Committee note that already the Central Government are extending loan assistance through the Rural Electrification Corporation for strengthening and improving the systems. The Committee feel that what is required now is the formulation of time-bound programme by each State urgently to bring down the losses to the optimum level on the basis of the guidelines issued by Government and to take concrete and concerted measures to implement such programmes. The Committee would like to be apprised of the details of such schemes drawn up by each State Government/State Electricity Board and the steps taken to implement the schemes.
47	3.64	The Committee would also like to reiterate their earlier recommendation regarding making responsible an officer of the level of a Divisional Engineer for watching and reporting the performance of the system under his control in respect of losses, and would urge the Government to take up the matter with the State Governments/State Electricity Boards in this behalf.
48	3.65 & 3.66	The Committee would also like the Central Government to review the steps taken by States in

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		preventing piferage or theft of power and urge upon them to strengthen the vigilance machinery and provide for technical safeguards to prevent tampering with meters etc.
		The Committee regret to observe that the thefts of transformers and other Departmental materials continue to occur on large scale in spite of the measures stated to have been taken. In terms of value of the materials stolen the Committee find that it was as high as Rs. 19.46 lakhs in West Bengal, Rs. 12.79 lakhs in Haryana, Rs. 10.10 lakhs in Tamil Nadu and so on in the year 1975-76. The Committee feel that it is high time that concerted measures are taken in close concern with the State Police authorities to prevent such thefts. The Committee would also suggest that necessary technological innovations should be found by which removal of transformers or their parts is made difficult if not altogether impossible.
49	4.16	The Committee note that Load Despatch Centres which are required for "controlling a system comprising a number of generating stations, a grid net-work and load centres" have been set up in all States except Jammu and Kashmir, Himachal Pradesh, Haryana, Assam, Manipur, Meghalaya, Nagaland and Tripura. In these States the need for such Load Despatch Centres has not been felt so far. The Committee hope that Government will periodically review the questioning of setting up such Centres in these States also in the light of the future developments, and take speedy measures to establish such centres if the situation so warrants.
50	4.17	The Committee further note that in order to facilitate integrated operation of systems on a Regional basis and to coordinate the activities of the States/ System Load Despatch Centres for ensuring optimum utilisation of generation and transmission facilities in the region, regional Load Despatch Centres are required. The Committee find that so far the Govern-

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		ment have established only Interim Regional Load Despatch Centres in the Northern, Western, Southern and Eastern Regions and one such Centre in the North-Eastern region would also be commissioned soon. As regards permanent Regional Load Despatch Centres are concerned, the Committee were earlier informed that the bulk of the work pertaining to the establishment of Regional Load Despatch Centres would be completed during the Fifth Plan period. The Committee were also informed that while the first phase of the Southern Regional Centre would be commissioned in December, 1976, and the second phase in 1970, the Centres in Northern, Western and Eastern Regions would be in operation by 1980-81. The Committee, however, find that while the first phase of the Southern Regional Centre was expected to be commissioned "in about two months from December, 1976", specifications for equipment for the Regional Load Despatch Centres in Northern, Western and Eastern Regions were still stated to be under preparation and procurement action for the equipment would be initiated by floating of tenders under the IDA Transmission Credit after the specifications were ready. The Committee need hardly stress the importance for setting up of Regional Load Despatch Centres at an early date. The Committee trust that Government would ensure that these permanent Centres would be in operation by the targetted time namely 1978 for the Southern Region and 1980-81 for the other three Regions.
51	4.22	The Committee note that a National Despatching Centre which would be responsible for coordination of the activities of the Regional Load Despatching Centres and regulation of inter-Regional Power Exchanges is proposed to be established in Delhi. Phase I of this Centre is estimated to cost Rs. 67.47 lakhs, which includes a provision of Rs. 12 lakhs made in the annual plan for 1977-78 for purchase of land. According to anticipations, the total estimated cost

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		of the scheme under Phase II would be Rs. 6-7 crores, though the estimates for Phase II have not been prepared as yet. The funds for this Centre would be provided by the Central Government. The Committee urge that all formalities necessary for the establishment of the National Despatch Centre should be cleared and suitable steps taken to initiate work on this Centre expeditiously.
52	4.28 to 4.30	The Committee note that in setting up the regional grids, the only tangible progress that has been made so far relates to the first phase of the Southern Region. Government expect that the second phase of the Southern Region would be completed in about two years from now. In the case of other three regions, namely Northern, Western and Eastern regions, the Committee observe that Government is yet to acquire land in the Northern and Western Regions. The Committee have also been informed that the preparation of specifications of the equipment would take one year and the supply of equipment would take another two years. According to the Government, the four regional grids would come into operation within four years from now. The Committee are distressed to note that in an important matter such as establishment of regional grids, Government should have allowed such a long time to elapse and even then the preliminaries for setting up such Grids have not been cleared so far. The Committee trust that Government would expedite matters and set up the Regional Grids within the shortest possible time and take necessary steps to interconnect these Grids to form a National Grid ultimately, so that the periodic power famine in certain regions could be overcome.
53	4.44 to 4.46	The Committee in paragraph 5.45 of their 39th Report (1972-73) noted that out of the 38 inter-State links taken up, 24 lines would be completed during

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		the Fourth Plan period and the remaining lines within the next year or two. The Committee in paragraph 5.49 of their Report expressed their unhappiness at the lack of enthusiasm on the part of the State authorities to pursue the inter-transmission programme vigorously even though the Centre had decided to provide 100 per cent loan assistance to States under centrally sponsored schemes outside the State ceiling for construction of various inter-State links during the Fourth Plan period. The Committee are informed that out of 24 lines targetted for completion during the Fourth Plan period, only 8 lines were actually completed during that period, and 6 lines have been completed upto March, 1976, i.e., during the first two years of the Fifth Five Year Plan. Fourteen lines are expected to be completed upto 1978-79 and one line (viz. Dehri-Mughalsari) is likely to be completed in the early Sixth Plan period. The Committee cannot but view with great concern the tardy progress made in constructing these important inter-State links, particularly when the Centre had decided to provide 100 per cent loan assistance to States for the inter-transmission programme under centrally sponsored schemes outside the State ceiling. The Committee would urge that Government should take up the question of early construction of inter-State links with the State authorities concerned and impress upon them the necessity of giving adequate priority for their speedy completion. On their own part, the Government should strictly monitor the progress of these schemes and extend all necessary assistance that the States may require to ensure their speedy completion.
54	4.47	The Committee also find that one of the various objectives of the National Hydro Electric Power Corporation recently incorporated is to undertake wherever necessary the construction of inter-State

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transmission and ancillary works for timely and co-ordinated inter-State exchange of power. The only line taken up by this corporation is the Imphal line. The Committee trust that in order to speed up the projects Government would impress upon the State Govts./State Electricity Boards the need for entrusting construction of more inter-State lines to the National Hydro Electric Power Corporation, which is a Central Government Undertaking.

55 5.15 & 5.16

The Committee note that out of a total number of about 5.76 lakh villages in the country, according to 1971 census about 3.5 lakh villages have a population of less than 500. The progress made in rural electrification has been as follows:

	No. of villages electrified
At the beginning of the First Plan to 1951	3061
At the end of the First Plan	9047
At the end of the Second Plan	24891
At the end of Third Plan	43932
At the end of 1968-69	73722
At the end of Fourth Plan	172169
As on 31-7-1976	188169
As on 31-8-1977	192635

While the Committee appreciate that the pace of electrification of villages has picked up momentum in recent years, they cannot help pointing out that much leeway is yet to be covered. In percentage terms, the number of villages electrified upto July 1976 works out to about 33 per cent. The Committee would therefore, urge that Government should redouble their efforts in the direction of covering most of the villages within the shortest possible time.

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56	5.18	The Committee have been informed that the progress of rural electrification was dependent on various factors, viz., availability of power, transmission and distribution net work in rural areas, terrain, resources, organisational set up, availability of funds etc. and it was not, therefore, considered practicable to prepare a time-bound programme fixing a target date for electrification of every village in the country. While the Committee realise the difficulties in fixing the target date of electrification for each village in the country, they would like to point out that the objective of total electrification of villages can be achieved only through realistic and perspective planning. The Committee also note in this connection, that Government have prepared a long term plan for the decade 1971—81 and this plan envisages electrification of 3.4 lakh villages by 1981. This programme would cover all villages with a population of 500 and above and 50 per cent of villages with lower population. The Committee find that if this programme is fully implemented it would cover only about 61 per cent villages in the country by 1981. The Committee, would, therefore, urge the Government to prepare a long term perspective plan, in close consultation with the States, to cover all the villages for electrification so that work relating to allocation of resources, generation of power, construction of transmission and distribution lines etc. can be taken up well in advance and the objective realised.
57	5.19 & 5.20	There should be well-coordinated programme for energising pumpsets, establishment of rural industries and widespread growth of infra-structure such as transport, agro-based industries, forestry etc. The Committee note that as on 31 July, 1977, 31,09,194 pumpsets have been energised. Considering the need for attaining a rapid and sustained development of agriculture, it is imperative that greater and determined efforts are made to energise pumpsets in larger number.

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		The Committee note from the Budget speech of the Finance Minister in June, 1977 that under the programme of rural electrification for energising pumpsets, a provision of Rs. 175 crores, which will also be augmented to significant extent by institutional finance, has been made in the budget for 1977-78. The Committee hope that in the years to come, the programme of energising pumpsets will be given a high priority leading to a sustained and abiding green revolution.
58	5.21	The Committee are surprised that Government do not have statistical data in regard to the setting up of agro-based industries and the employment generated as a result of rural electrification. All that the Committee have been informed is that under the scheme sanctioned by the Rural Electrification Corporation, electricity has been provided to 16,509 LT| Agro-Industries and 4,30,440 domestic|commercial services upto June, 1976. The Committee feel that it is high time that a systematic and scientific assessment of the impact of electrification on rural economy is made so that it may facilitate preparation of integrated schemes for future rural development through electrification. The Committee hope that Government would address themselves urgently to this task and inform the Committee of the results of such an assessment in due course.
59	5.48 to 5.50	The Committee note that the national average for village electrification is 33.7 per cent. While some of the States such as Haryana, Tamil Nadu, Punjab and Kerala have attained 100 per cent coverage, in 12 States, the level of village electrification is below the national average of 33.7 per cent. Among these 12 States, Sikkim, Meghalaya, Tripura, Assam and Manipur have percentages varying from 5.1 to 12, while Bihar, Orissa, Rajasthan, West Bengal and UP have percentages varying from 23.1 to 28.7. Madhya Pradesh has a percentage of 17.7 and Nagaland 20.2.

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		The Committee are distressed that as many as 12 States should be below the national average in the matter of rural electrification. The Committee would urge that the Central Government should take up this matter with these State Governments at the highest level and stress the need for accelerating the pace of rural electrification and come forward with positive assistance to these States both in the matter of providing resources and in formulation of schemes for rural electrification, so that the wide gap in the percentage of rural electrification among the various States is narrowed down at the earliest.
60	5.50	The Committee understand that with a view to reducing the regional imbalance, the rural electrification programme has been taken up as part of the Minimum Needs Programme in the Fifth Plan. For this programme only such States which have not reached the coverage of 40 per cent population with electricity by the end of the Fourth Plan are eligible for allocation. The Committee have also been informed that the Rural Electrification Corporation has been giving special consideration and high priority for projects for electrification in under-developed and backward areas. The Committee would urge that Central Government and the REC should extend liberal assistance to the backward States so that the pace of rural electrification is accelerated and they come up to the level of more advanced States.
61	5.52	The Committee note that a total of 1702 schemes involving loan assistance of Rs. 711.06 crores have been sanctioned so far (upto 2nd December, 1977) by the REC. Out of these 1702 schemes, 989 schemes accounting for a loan assistance of Rs. 456.24 crores are for the States which are lagging behind the All India average of village electrification. The Committee, however, note that out of Rs. 456.24 crores sanctioned for the schemes pertaining to the States lagging behind the national average of village

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		electrification, only Rs. 254.64 crores have been drawn so far. The Committee are surprised that these States which lag behind in rural electrification have not come forward to fully utilise the loan assistance sanctioned by the REC. The Committee would like Government to take up this question with the concerned State Governments and urge them to utilise the loan sanctioned by the REC by speedily implementing the schemes.
62	5.53	The Committee note that 713 schemes, involving loan assistance of Rs. 254.82 crores have also been sanctioned by the REC for States which are above the national average. The Committee would like that Central assistance for rural electrification may be mainly concentrated in the States which are lagging behind so as to enable them to come upto the level of the more advanced States at the earliest.
63	5.54	The Committee note that the REC had been suggesting to the States Electricity Boards to set up separate organisations dealing with rural electrification programme right from the point of formulation of schemes and upto the point of their implementation. They have, therefore, suggested to the State Electricity Boards that there should be at the district level, Committees consisting of officials and non-officials concerned with the development of that particular area to formulate the schemes and then to monitor the schemes from time to time. Further that there should be coordination committees to monitor the progress of different schemes. A recommendation for more efficient coordination at State and district level with other related Departments was also made by the Committee of Members of Parliament on Rural Electrification (1971).
64	5.55	The Committee feel that inadequacy of funds alone has not been a major factor for the slow progress in rural electrification in the States which are below the national average. The Committee are of the view

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		that, as indicated by the REC these States do not have the necessary organisational structure for formulation of schemes and monitoring their progress, and for ensuring their speedy completion. The Committee would like the Central Government to give concrete assistance to these States in formulating their schemes and formulate necessary guidelines in this regard. It may also be impressed upon the State Governments that they strengthen their organisational structure so that the pace of rural electrification is accelerated in their areas.
65	5.64 & 5.65	The Committee trust that with the increasing realisation of the vital role of rural electrification in the rural economy and the development of rural areas, lack of resources would not be allowed to act as a constraint in the progress of rural electrification and on the contrary liberal allocation would be made to step up the pace of rural electrification in the country.
66	5.75 to 5.79	The Committee had in their 39th Report recommended that the provision of public lighting to the economically weaker sections of the society particularly in the Harijan and Adivasi areas and 'bastis' should be given special consideration by the Government, and if necessary, further incentives *viz.*, interest free loans etc. should be given to the State authorities concerned for this purpose. The Committee note that a provision of Rs. 5 crores during the Fourth Plan had been made for giving loan assistance against specific schemes for provision of street lighting in Harijan 'bastis' adjacent to electrified villages with street lights. The Committee note that as part of the programme of the Silver Jubilee year of the country's Independence, instructions were issued to State Governments/State Electricity Boards to electrify one Harijan 'Basti' per day in every state of the country during the Silver Jubilee year *i.e.*, from 15-8-1972 to 14-8-1973. The Committee note that according to the scheme introduced by Government of India in December, 1971, for providing electricity to Harijan Bastis in

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		Electrified villages loan assistance was being made available on concessional terms through the agency of REC to State Electricity Boards. Since then, the Rural Electrification Corporation has sanctioned 109 schemes of the various State electricity Boards for a total amount of Rs. 4.5 crores envisaging extension of electricity to 10,460 Harijan Bastis adjoining the already electrified villages. So far 8,673 Harijan Bastis have been electrified under this programme and 787 Harijan Bastis are yet to be electrified. The Committee also note that it is estimated that there are still about 8,500 villages where street light has been provided in the main village, but it has not been extended to the adjoining Harijan Bastis and that after all the schemes sanctioned by the Rural Electrification Corporation for extension of electricity to the Harijan Bastis adjoining electrified villages have been fully implemented, about 4,500 more Harijan Bastis would still remain to be provided with street light facility. The Committee have been informed that the power supply could be extended to these remaining 4,500 Harijan 'bastis' from the States' Annual Plan provisions made for Normal Development Works and/or Normal Rural Electrification Programme, and that the State Electricity Boards have been informed to take necessary action accordingly. The Committee would have liked if the remaining 4,500 Harijan 'bastis' had also been covered by REC under the programme of extending loan assistance to States on concessional terms. The Committee hope that Central Government would urge the States to provide enough funds in their Annual Plans so that all the Harijan 'bastis' are electrified within a short period.
67	5.91 to 5.93	The Committee note that a high powered Committee named the 'Committee on Rural Consumers' Complaints' had gone into the difficulties faced by

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		the rural consumers of electricity and made a number of recommendations for remedial action to mitigate the difficulties.
		The Committee hope that the progress of the implementation of the recommendations of the Committee on 'Rural Consumers' Complaints' made by the State Electricity Boards would be monitored through periodical reports so that the difficulties faced by the rural consumers are removed and necessary assistance rendered.
68	5.100 to 5.102	The Committee note that the State Electricity Boards are empowered under section 49 of the Electricity (Supply) Act, 1948 to fix tariffs for supply of electricity for various categories of consumers from time to time keeping in view, *inter alia* (a) the nature of supply and the purpose for which it is required, (b) co-ordinated development of supply and distribution of electricity within the State in the most efficient and economic manner, with particular reference to development in areas not adequately served with electricity, (c) the simplification and standardisation of methods and rates of charges for such supplies; and (d) the extension of supplies of electricity to sparsely developed areas. It has also been stated under section 59 of the Electricity (Supply) Act, 1948 the Boards are required to carry out operations and adjust the tariffs in such a manner as not to incur loss. In fixing tariffs considerations emanating out of general policy of the State Governments, such as speeding up of agricultural development and augmenting employment opportunities are generally kept in view. It has been further stated that the Electricity Boards have framed generally uniform tariffs for both rural and urban areas though it is usually much costlier to deliver power to rural areas. The Ministry have also stated that the tariffs for agricultural purposes and for small scale industries are generally kept below the cost of supply with a

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view to encouraging consumption of electricity for agricultural purposes and for running small scale industries.

The Committee also note that according to the Ministry of Energy some element of loss is inherent whenever electricity passes through transmission and distribution systems and the cost thereof is to be covered from the consumers in the interest of the commercial viability of the Boards and that the costs of extending power supply for agricultural pumpsets and rural areas are comparatively high because of the extensive distribution systems to be erected and the low density. The Committee were further informed that "even so the tariffs for agricultural consumers are generally lower than for other categories of consumption".

The Committee, however, find from the information furnished by Government that except for Kerala and Delhi, large industrial consumers pay less tariff for electricity consumption than the small industrial consumers. In states like Karnataka, Maharashtra, Uttar Pradesh and West Bengal, the difference in tariff is in fact as much as 10.30 8.84, 8.2 and 9.16 paise per unit. The Committee also find contrary to the claim of the Ministry of Energy, that the tariffs for agricultural consumers are generally lower than other categories of consumption; the agricultural consumers in States like Gujarat, Haryana, Jammu and Kashmir, Karnataka, Maharashtra, Uttar Pradesh and West Bengal pay more tariff than the large industrial consumers. The Committee need hardly point out that if any real break-through is to be made in encouraging agricultural consumers to utilise electric energy for agriculcultural purposes, the present tariff schedules would have to be made reasonably economical for them. The Committee feel that it is high time that a review of the tariff charged by different State Electricity Boards for different categories of consumers is made, keeping in view not only the viability of the Boards but also the

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		paying capacity of different categories of consumers. The Committee would like that such a re-appraisal is done at the earliest and new norms and guidelines evolved in regard to the electricity tariffs to be charged from different categories of consumers.
69	5.103 & 5.104	While the Committee apreciate that certain quantum of loss of power is inherent in the transmission and distribution and the cost of extending power for agricultural pumpsets is comparatively high, they are unable to agree with the view that purely on consideration of commercial viability of the Boards, the cost arising out of these factors should be passed on to the economically non-too strong agricultural consumers. The Committee had already suggested earlier a re-appraisal of the electricity tariff. Such a review, should also take into account, in the context of the need for giving impetus to agricultural growth, the extent to which, if at all, the cost of transmission/ distribution as also transmission losses should be passed on to the agricultural consumers. The Committee would also like to appoint out in this connection that while agriculturists need assured supply of power so that agricultural operations can go on unhampered, the picture that obtains today is different. The agriculturists depending on pumpset has to contend with frequent breakdowns of power supply and damage to motors due to violent fluctuations in voltage etc. The Committee, therefore, feel that merely energising of pumpsets without guaranteed supply of electricity will not inspire the agriculturists to go in for more pumpset. The Committee hope that this matter would also receive an urgent consideration from the Central and State Governments and the power supply would be so managed that the agriculturists are assured of their minimum needs of power.
70	6.20 to 6.23	The Committee have been informed that with the present capacity, power plant equipment with total generating capacity varying from 4000 MW to

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		5000 MW (depending upon the mix of various unit ratings) can be produced within the country. The Committee hope that the equipment manufactured within the country incorporates the latest technology for the most efficient and economical generation, transmission/distribution of power. The Committee would also like the Government to ensure that the manufacturers supply the required equipment according to the stipulated schedules so that there are no delays in erecting and commissioning of the power plants, which, apart from delayed supply of power, result in avoidable escalation of costs.
71	6.24	In order to review the performance of indigenous Power Plants, a Standing Committee has been constituted, consisting of the representatives of Central Electricity Authority, Bharat Heavy Electricals Ltd., Instrumentation Ltd., Kota, and others. This Committee has been reviewing continuously the performance of indigenous power plant and equipment commissioned in the recent past. It had studied in depth, units commissioned upto December, 1974. As a result problem are as have been identified and plans of action drawn up, identifying the role of BHEL, Instrumentation Ltd., Kota, and the CEA to improve the units. The Committee learn that as a result of such a review and the efforts of the Standing Committee, the performance of certain Power stations has shown considerable improvement. The Committee would urge that this Standing Committee should cover all the power Stations within a time bound programme so that the optimum performance of all the existing power plants is ensured and break-downs in power supply are eliminated.
72	6.49 to 6.52	The Committee in their earlier Report had recommended that keeping in view the requirement of coal for large power stations, the methods of mining, loading and unloading as well as transport would have to be revolutionised introducing the latest techniques for efficiency and economy.

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The Committee note that the following important measures have been initiated:

a) The number of loading points in the Raniganj and Mugma coal fields is being reduced from 379 to 121 and the work is in progress.

b) Mechanisation of loading arrangements is to be confined to collieries producing over 25,000 tonnes per month, and is being planned in nearly 1000 collieries.

c) The number of splits in a rake is to be reduced from average of seven to an average of five in the Raniganj coalfields.

d) Weighbridges of 60 tonnes is to be replaced by 100 tonnes at major coal loading points where loading was more than 10 rakes a month.

The Committee have also been informed that in the allotment of wagons for haulage of coal to thermal stations at present there are no bottlenecks and that the supply position is 'extremely satisfactory'.

The Committee, however, find that in the matter of supply of coal of a particular type to a particular thermal power station, there is still scope for improvement and that an exercise is going on bilaterally between Coal India and the various Power Stations for evolving a final agreement, preferably on a long term basis, so that there can be a commercial binding on the delivery dates and a certain quality is ensured. The Committee also note that the coal Linkage Committee reviews the linkages of coal to various Power Stations every three months wherein the quantities and qualities of coal are discussed and finalised. In addition the Central Electricity Authority and the Department of Power also take up the matter wherever there are persistent reports of poor

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quality of coal being supplied to the power stations. The Committee need hardly emphasise that for efficient and economical generation of power in the coal based thermal stations and to avoid shut-downs, it is necessary that the requisite quality of coal is supplied. Now that there are no bottlenecks in adequate supply of coal to the power stations, the Committee trust that the Coal Linkage Committee would give greater attention to this aspect while reviewing the linkages of collieries to the power stations and ensure that no complaints in regard to the quality of coal arise. The Committee also hope that the exercise undertaken for entering into formal agreement for a commercial binding in regard to delivery dates and for ensuring supply of coal of a certain quality would be completed expeditiously so that there are no difficulties in regard to the timely supply of coal in adequate quantity and of requisite quality.

79 6.53 to 6.55 The Committee note that a system study had been made to determine the economics of rail-*cum*-sea movemnt of coal as against all rail-movement of coal for the transportation of coal frm the Bihar-Bengal coalfields through Haldia to Madras, Tuticorin and Trombay Thermal Stations. According to this study the Committee note that if suitable type of ship is used and proper system of loading and unloading is adopted, the average cost of transportation coal to these three stations would not only compare very well with rail movement but would in fact be cheaper. The cost of transportation of coal by rail-*cum*-sea route from Bihar-Bengal coalfields to Madras has been estimated as Rs. 68 per tonne as against Rs. 88 by all rail route. Similarly as against the present all rail cost of Rs. 125 per tonne for Tuticorin, the rail-*cum*-sea transportation charges are estimated to come down to Rs. 86 per tonne.

The Committee were earlier informed that necessary action for acquisition of second hand bulk cargo vessels of 35000 DWT and for providing shore facilities at Madras and Tuticorin by 1980 at an estimated

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		cost of Rs. 5.50 crores had been initiated and was awaiting approval of the Public Investment Board. In a later note (December, 1977), the Committee have been informed that subsequent decisions taken in the Department of Coal has ruled out the possibility of coastal movement of coal through the Madras Port. Thus movement of coal by the coastal route is now required to be done only to the Port of New Tuticorin. Interim facilities have been provided at one of the existing berths in the port till mechanised facility is completed. As regards acquisition of large vessels the Ministry have informed (December, 1977) that since in the present market conditions it is possible to acquire vessels, particularly second-hand vessels, at short notice and other alternatives such as conversion of existing vessels, were being considered for carriage of coal, it was decided to prepare an EFC paper which has now been circulated for the construction of a coal jetty at the Port of New Tuticorin.
		The Committee are unable to appreciate in the absence of detailed statement of reasons, the decision taken in the Department of Coal, ruling out the possibility of coastal movement of coal to Madras Port, though it would appear that advance action for such movement of coal was initiated and proposals were awaiting approval of the Public Investment Board. The Committee would like to be apprised of the difficulties leading to the giving up of movement of coal to Madras Port to feed the thermal stations. As regards the movement of coal to the Port of New Tuticorin, the Committee would like Government to make concerted efforts in close coordination with State Government of Tamil Nadu to ensure that the necessary facilities are available at the New Port of Tuticorin in time so that there is no bottleneck in the coastal movement of coal to that Port affecting the commissioning schedule of the Thermal Power Station being set up at Tuticorin.

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74	7.21 to 7.28	The Committee note that at present the total nuclear power installed capacity in operation in the country is 640 MW, which forms about 3 per cent of the country's total generation of power. The Committee observe from the Report of the Fuel Policy Committee (1974) that the Department of Atomic Energy's long-term strategy for development of nuclear energy envisages the following nuclear capacities: By 1978-79 — Installed Nuclear capacity 1,020 MW (w) By 1983-84 — 1,900 MW (e) By 1990-91 — 8,620 MW (e) The Fuel Policy Committee have observed that in the absence of reliable data to determine the optimal level of nuclear power generation capacity that is to be established between 1983-84 and 1990-91, it would be prudent to assume a constructive estimate of 4000 MW, and recommended that the nuclear capacity should be increased in the years beyond 1983-84 based on a re-appraisal of the nuclear power programme. The Committee further note that the Task Force set up by the Department of Atomic Energy have recommended the commissioning of a total capacity of 4,720 MW(e) based on natural uranium by March, 1989 and in case uranium availability permits take up another 3000 MW(e) at that time. The Committee were informed in March, 1977 that the installed capacity would rise to 1095 MW(e) by the end of 1978-79 from 640MW(e) at the end of the Fourth Plan and an additional capacity of 705 MW(e) would be added during the next 5 years to make it 1800 MW(e) at the end of 1983-84. The Committee, however, find from the Performance Budget document of the Department of

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Atomic Energy for the year 1977-78 and from the reply of the Prime Minister to an Unstarred Question in Lok Sabha on 20 July, 1977, that the nuclear power generation capacity expected to be achieved would be as under:—

1978-79	800MW(e)
1983-84	1680 MW(e)
1990-91	6000 MW(e)

The Committee thus find that the target of capacity has now been reduced from 1095 MW(a) to 800 MW(e) at the end of the 1978-79 from 1800 ME(e) to 1680 MW(e) at the end of the 1983-84 and from 8620 MW(e) to 6000 MW(e) at the end of 1990-91. The contribution of nuclear power to the total power generation capacity will only be 2.5 per cent at the end of 1978-79 4 per cent by the end of the Sixth Plan (1983-84) and 7 per cent by 1990-91. The Committee thus observe that the pace of development of nuclear power in the country will be slower than was envisaged originally by the Department of Atomic Energy themselves and their Task Force and the Fuel Policy Committee.

The Committee need hardly emphasise that even if this modest capacity of 6000 MW is to be achieved by 1990-91, a long term perspective plan has to be drawn up right now taking into account the various constraints in the availability of fuel, and the long gestation period of nuclear plants etc. The Committee trust that in the light of the recommendations of the Task Force and the Fuel Policy Committee, Government would evolve such a long-term plan for further building up of nuclear power capacities in the country.

75 7.42 & 7.43 The Committee note that according to the Task Force of the Department of Atomic Energy, one of the constraints for undertaking a larger programme for nuclear power development would be the availability of uranium. According to the Fuel Policy

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		Committee Report, the present level of uranium production would meet the requirements of the envisaged nuclear programme only upto the year 1984. If the nuclear power capacity is to be substantially increased during the period 1984 to 1990-91 as envisaged in the long-term strategy for nuclear power development, it would be necessary to discover uranium deposits on a large scale and increase the uranium production capacity. The Committee trust that concerted efforts would be made not only to step up the exploration work to locate additional deposits, but also to set up production units in a planned manner in the areas of M.P., H.P., and Meghalaya where fresh deposits of uranium richer than those in Bihar have been located so that non-availability of uranium does not act as a constraint in augmenting the nuclear power capacity in the country.
		The Committee note that thorium reserves in India are the largest in the world and are estimates at about 4,51,000 tonnes. The Committee further understand and from the Report of the Fuel Policy Committee that fast breeder reactor would be able to produce fissile U 233 from Thorium. The Committee have been informed that the process of making U 233 from thorium has already been designed and a few kgs. of the material produced. The Committee hope that while formulating the long-term plan for the development of nuclear power the indigenous availability of the minerals like uranium and thorium would be taken into consideration, so that the country would not have to depend on other countries for the nuclear fuel for the reactors.
76	7.44 to 7.46	The Committee note that the Tarapur Atomic Power Station reactors use enriched uranium as fuel, and under the bilateral agreement between Government of USA and Government of India, all requirements of enriched uranium for use as fuel in these reactors "shall be made available by the United States Atomic Energy Commission (USAEC) and that India

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		shall not obtain these from other sources", and that the Tarapur station "would be operated on no other special nuclear material than that furnished by the Government of USA". This restriction, it is presumed, would not apply to the enriched uranium fabricated in our own country. The Committee had earlier pointed out in their 129th Report (1969-70) and subsequently in the 29th Report (1972-73) that Government should explore the possibility of building reserves of enriched uranium to meet unforseen contingencies in which the supply of enriched uranium might be cut off or denied. The Committee find that supply of enriched uranium by US was recently held up for a year because of various objections raised in that country. In this context they also take note of the observation made by the Prime Minister in Lok Sabha on 13 July, 1977 "I hope it (supply of enriched uranium) will be regular now, but who can say what will happen in the future". The Committee view with concern the total dependence of the Tarapur reactors on the supply of enriched uranium from the USA. The recent developments in regard to the supply of enriched uranium which was admittedly delayed for a year by the US authorities and the restrictions placed on India categorically forbidding her to get requirements of enriched uranium from any source other than USA abundantly go to show to what extent the Tarapur Atomic Power Station is dependent on supplies from USA and the developments in that country. This, the Committee feel, is not a very happy situation. Government should have a fresh look at the whole arrangement and take necessary steps to ensure uninterrupted working of the Tarapur Atomic Station.
77	7.47	The Committee would also urge that the development of technology for enrichment of uranium within

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		the country itself for which preliminary studies are stated to have already been initiated in the Bhaba Atomic Research Centre should be accelerated and no efforts spared to develop this technology within the shortest possible time so as to rid the country of dependence on foreign countries in this vital field.
78	7.57 to 7.63	The Committee note that the Department of Atomic Energy is setting up heavy water plants at Kotah, Baroda, Tuticorin and Talcher. In addition, the Department have also entered into a contract for the purchase of 200 tonnes of heavy water from the USSR. The Committee have been informed that the heavy water which would be available from these plants and the supply from USSR would meet the requirements of the Atomic Power Plants upto and including the two reactors of Narora. The Committee note that the Heavy Water Plant at Kotah which was expetced to be commissioned in 1974, has not so far been commissioned. According to the latest information (February, 1978) furnished to the Committee, the section of the plant will be completed by November/December, 1978 subject to the receipt of boosters by April, 1978, and the employees' strike being called of in the near future. It was earlier stated that the plant was expected to be commissioned by the end of 1978, but it has now been stated that the plant is expected to be commissioned in 7-8 months after the erection work is over, which is scheduled to be completed by November/December, 1978. The Committee further note that the Heavy Water Plant at Baroda was scheduled to be commissioned in 1973. However, the Committee find that after completion of various maintenance jobs and balance modifications, commissioning of the Plant was restarted in November, 1976. The Committee have now been informed that the plant met with a mishap on the 3rd December, 1977. It is expected that in case

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it does not involve the replacement of any major high pressure equipment, valves or piping, the revamping work can be completed and the plant put back on production by April, 1979. A clearer picture will, however emerge after receipt of the report of the Committee looking into the mishap and after obtaining results of the various tests being carried out.

With regard to the Tuticorin Plant, which was scheduled for commissioning during 1974-75, the Committee note from the information furnished to them in March, 1977, that the testing and commissioning of the Plant was expected to begin in April/May, 1977, and the plant commissioned by the end of 1977. The Committee have been informed in February, 1978 that the plant is under-going commissioning trials and is expected to be on stream by the end of March, 1978.

As regards Talcher Plant, the Committee have been informed that the schedule for commissioning the plant has been adversely affected by the delays in the delivery of indigenous equipment and the Plant is likely to be commissioned in middle 1978. In a later note (February, 1978), the Committee have been informed that mechanical erection is expected to be completed by the end of July, 1978. It is, however, understood that the Synthesis gas from Fertilizer Corporation of India, Talcher will be available in April, 1979. The plant would be commissioned within 4-5 months from the date of availability of Synthesis gas from Fertilizer Corporation of India, Talcher.

The Committee had, as early as 1969-70, in their 129th Report on Atomic Power, observed with regret that nothing substantial had been done in regard to the production of heavy water indigenously and they had drawn pointed attention of the Government to the urgent need to produce heavy water within the country to meet the requirements of the atomic power projects.

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		The Committee are distressed to note that in spite of government assurance given in 1971 that "all efforts are being made to complete the plant as quickly as possible", none of the four heavy water plants has been commissioned on schedule and in certain cases like the plants at Kotah and Baroda, considerable slippage has been allowed to occur. The Committee are surprised that Government should have allowed slippage in commissioning schedules in a vital field like heavy water production on which the entire nuclear power programme depends, leaving no option to the Government but to enter into an agreement with another country for the supply of heavy water. The Committee hope that Government would at least now ensure by closer and effective monitoring that no further delays occur and the plants are commissioned within the shortest possible time.
79	7.64	As regards the future programme for setting up additional heavy water plants the Committee have been informed that it would depend upon the decisions taken regarding the nuclear power programme. Considering the long time taken in commissioning heavy water plants, the Committee trust that adequate advance planning will be made for setting up such plants as a part of the long-term plan for development of nuclear power.
80	7.78	The Committee are informed that the Tarapur Atomic Power Station is "working fairly well" at 57 per cent capacity which is stated to be quite good. They are distressed to find that the Rajasthan Atomic Power Project Unit I had to face a number of problems. Earlier sand was found in the turbo set which had to be stripped out and later the blading broke and had to be replaced. The Committee observe from the Annual Report of the Department of Atomic Energy for 1976-77 that the year 1976-77 has seen considerable improvement in the operation of the unit and it has attained a continuous outage-free operation

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		during October and November, 1976. The Committee hope that this tempo would not only be maintained but further improved upon.
81	7.79 & 7.80	The Committee note that the following power plants are under different stages of construction:— (i) Rajasthan Atomic Power Project—Unit II. (ii) Madras Atomic Power Project—Kalpakkam—Units I & II. (iii) Narora. The Committee observe that the benefits of the second unit at Rajasthan Atomic Power Project and first unit of Madras Atomic Power Project are included in the Fifth Plan. The targets are December, 1981 and 1982 for Units I & II at Narora. The Committee would urge Government to take concerted measures to eliminate all delays by strict monitoring of the progress of construction of these projects, and ensure that they are commissioned according to the schedules now laid down.
82	7.84	The Committee are informed that the country is not independent yet for things like valves and forgings required for atomic power stations. The Committee also observe that this dependence has created bottlenecks coming in the way of completion of the Atomic Power Station at Kalpakkam near Madras.
83	7.85	The Committee have no doubt that with the large R & D facilities available with the Department of Atomic Energy, the necessary proto-type of all the items now being imported can be fabricated and the indigenous manufacturers such as BHEL, Instrumentation Ltd. Kotah and REC, Ranchi and other private sector manufacturers could be encouraged to produce these items. The Committee urge Government to take all necessary steps to ensure maximum indigenisation of the equipment and spares required so that the country does not remain dependent on foreign countries for these items.

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84	8.12-8.13	The Committee note that in order to step up re-research and development activities in the field of power, grants-in-aid are given to State Electricity Boards through Central Board of Irrigation and Power for conducting studies in generation, transmission and distribution problems etc. The Committee have been informed that CPRI Bangalore and CBI&P have taken up research schemes in areas of great relevance in generation, transmission and distribution systems in the country. The Committee need hardly stress that there should be close coordination among the various agencies that are engaged in research in power problems, so that overlapping and wasteful duplication of efforts is avoided.
85	8.14	The Committee would like that greater emphasis should be placed on problem oriented research and it is, therefore, necessary that priorities for research projects have to be laid down on the basis of needs and problems faced in the field. They desire that research in power problems that lead to substantial reduction in losses in generation transmission and distribution of power should be accorded higher priority.
86	8.15	The Committee would further emphasise the need for costing of research projects in terms of time and money likely to be required for their completion. They consider that this would encourage and promote cost consciousness in the staff engaged in research and would result in proper utilisation of time, energy and resources.
87	8.16	The Committee feel that if resources on research projects are to be utilised effectively and to the best advantage it would be very necessary that their progress is reviewed from time to time. The Committee desire that an objective assessment of the quality and usefulness of the research done should be made at least once in five years.

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88	8.17	The Committee would also like to lay particular emphasis that there should be widest dissemination of the results of research and the State Electricity Boards encouraged to utilise the same in their field expeditiously.
89	8.38 to 8.40	The Committee also feel that as suggested by the Committee of Ministers in 1972 each person should go through re-orientation courses at an interval of 5-7 years. The Committee need hardly point out that with the increasing accent on power expansion, the country would need more and more trained technical personnel to man the power stations. The Committee would, therefore, urge that a study may be undertaken to assess the requirements of technical personnel of various categories on a short term and long term basis and urgent steps taken by Government to augment the existing training facilities.
90	8.41	The Committee note that only three States viz., Bihar, Madhya Pradesh and Andhra Pradesh have set up training institutes. It is surprising that while power development has been taken up in a big way and rural electrification has been given greater emphasis, many States have not come forward to set up Institutes for training more personnel in operation and maintenance of power stations. The Committee consider that the training requirements can be adequately met only if the States join in the endeavour with the Centre. The Committee would urge the Central Government to take up this matter with the concerned State Governments to augment the training facilities.
91	8.42	The Committee also note that the question of separation of cadres of generation and transmission engineers to improve their operational efficiency was taken up with the States. Seven States have agreed so far to the separation of cadres. The Committee would like the Government to impress upon the other States the need to separate the cadres as early as possible.

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92	8.43	The Committee would urge that the training facilities in the North Eastern Region need greater and special attention as these States are lagging far behind the national average in rural electrification. The Committee would also like to be informed of the recommendations of the Institute of Applied Manpower Research New Delhi in this behalf and the steps taken to implement them.
93	8.44	In the matter of training on power system side, the Committee note that there is only one training institute at Bangalore. The inadequacy of the institute in meeting the training requirements is obvious from the fact that Government are proposing to avail the help of UNDP for training 1000 power system engineers, partly by deputing them to other advanced countries and partly by importing experts from UN member countries. The Committee would like Government to assess the requirements of power system engineers and to prepare a short-term programme for immediate implementation and a long-term perspective plan to train power system engineers to meet the demand.
94	8.56 & 8.57	The Committee had in their 39th Report (1972-73) emphasised the usefulness of 'Hot Line Maintenance Techniques' being adopted in the country on a large scale and expressed their concern at the closing down of the two centres—one at Bangalore and another at Ganguwal—which were set up by the Government after entering into an agreement with USAID. The Committee had urged that Government should set up training Centre/Centres for imparting training in this technique as early as possible so as to meet the needs of the State Electricity Boards and other bodies engaged in the operation and maintenance of power supply in the country. The Committee note that out of the two Hot Line Training Centres only the training centre at Bangalore has been reopened and it has started functioning from

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		August, 1975. The Committee also note that Government propose to establish a Hot Line Training Centre in the Northern region itself as early as possible, and that this Centre would impart training in 'Bare hand Method' which is stated to be a modern method and has the advantage of eliminating the use of live line tools and increasing the degree of safety. The Committee would urge the Government to expedite the opening of this Centre. They would further like that training in the 'Bare hand Technique' may also be started at the Bangalore Centre at the earliest.
95	8.65 & 8.66	The Committee note that a Committee of Ministers appointed in 1972 in their Report had recommended that the design units in the State Electricity Boards, Electricity Departments, the specialised engineering organisation of CW&PC (now CEA) and consulting engineering firms will have to develop and expand suitably in view of the ever large programme of new projects and the need for greater design and engineering support for better project execution. The Committee were informed that the CEA are designing the thermal power stations, hydro electric power stations and transmission systems and on the basis of regular feedback of operational and maintenance data, improvements in the new station design and system design are made. The Committee need hardly point out that the designs of power stations will have to incorporate the latest and the most appropriate technology so that generation, transmission and distribution of power are most efficient and entail minimum of losses. The Committee attach great importance to feedback of information on operation and maintenance from the project levels so that necessary correctives could be applied and lessons learnt leading to new improved station and system design etc. The Committee would also like Government to take concrete steps to strengthen and augment the design units at various levels.

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96	8.67	The Committee note that as far as the equipment for low voltage transmission|distribution system pertaining to the rural electrification was concerned, REC had set up a cell for standardisation of these equipments, under the overall charge of a Chief Engineer. The standardisation was being done in consultation with the various State Electricity Boards, Indian Standards Institution, Central Electricity Authority, manufacturers and other connected agencies through the forum of Helping and Technical Committees and by organising standardisation conferences. The Committee are glad to be informed that in terms of quantum of standardisation 90 per cent of the value of all equipment required had been covered. They would like that effective steps should be taken to standardize the remaining equipment expeditiously.
97	8.68	The Committee also note that for the higher voltage transmission|distribution equipment, Government have approached the World Bank for IDA loans, as the standardisation has to be made in such a manner as to satisfy not only the CEA but also the World Bank and the IDA. The Committee would urge Government to expedite the matter and take necessary action for a standardisation of higher voltage transmission|distribution equipments at the earliest.
98	8.74	The Committee note that the Rural Electrification Corporation has identified a few R&D areas for developing cheaper and better equipment and materials and has achieved results in some of these areas. The Committee need hardly stress that greater attention should be paid to identify more and more areas for developing cheaper and better equipments which would result in considerable economy in expenditure. The Committee would like the REC to step up their R&D activities and go in for large scale development of cheaper equipment and materials.
99	9.29 to 9.31	The Committee note that a new process called 'Magnetohydrodynamics' which converts heat energy

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directly into electricity through the inter-action between all electrically conducting fluid and magnetic field is being tried in various countries. The efficiencies obtained through MHD conversion process are stated to be higher than the conventional process. The Committee further note that the MHD process enables energy extraction of the order of 20—30 per cent of the total energy input to the hot gases, depending on the strength of magnetic fields. It has also been stated that a combination of the MHD and conventional power cycles makes it possible to achieve higher over-all thermal efficiencies of 50—60 per cent as compared to 37-38 per cent possible from a conventional system. As the MHD has the potential of raising the overall thermal efficiency of power generation considerably, its adoption would lead to saving of sizeable quantity of fuel, which is important in the present context of world energy situation. The other advantages of the MHD technology will be to minimise air pollution at no cost to the consumer, and it will enable to minimise in the long run, the thermal pollution of rivers and lakes.

The Committee note that leading countries like USSR, USA and Japan are making sustained efforts to develop MHD technology and have increased their efforts in this field. It is noted that USSR has a 25 MW(e) demonstration plant in operation since 1971, and often this plant had been operated as a commercial unit for study purposes and the results had been encouraging. Based on this experience, construction of a 1000 MW(e) commercial MHD Power Station has been started in USSR which is expected to be ready by 1981. Even West Germany and U.K. which had de-emphasised MHD programme in favour of nuclear power, are now considering to reactivate the programme due to the new developments of MHD and the energy crisis.

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		The Committee note that initiative has already been taken to establish an experimental plant of 5 MW based on the principle of Magneto-hydro-dynamics at Tiruchi under an agreement with the USSR. The Committee would like the Government to keep in touch with the progress made in the field all over the world so as to see that the experimental plant being set up in our country incorporates the latest technology. Careful evaluation of its suitability and economics may be undertaken to ensure conclusive follow up action.

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