KEY INPUTS

FOR

ACCELERATED DEVELOPMENT

OF

INDIAN POWER SECTOR

FOR

11TH PLAN & BEYOND

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(A) KEY INPUT ISSUES - GENERATION

1.0 11TH PLAN CAPACITY ADDITION PROGRAMME

1.1 Introduction

The total Installed Capacity in the country at the end of 10th plan (as on 31.03.2007) was **1,32,330 MW** details are given in **Table 1;**

Table 1
SUMMARY OF INSTALLED CAPACITY AS ON 31.03.2007

(Figures in MW)

Sector	Hydro	*Thermal*					Nuclear	R.E.S. @	Total
		Coal	Lignite	Gas$	Diesel	Total			
Central	7562	25270	2490	5899	0	33659	3900	0	45121
State	25786	38530	590	3610	605	43334	0	976	70096
Private	1306	3741	500	4183	597	9022	0	6785	17113
Total	34654	67541	3580	13692	1202	86015	3900	7761	132330

Source : DMLF Division, CEA
@ R.E.S. = Renewable Energy Sources includes Small Hydro Project(SHP), Biomass Gas (BG), Biomass Power (BP) Urban and Industrial waste power (U&I) & Wind Energy
$ Includes Liquid Fuel based Kayamkulam Project-350 MW

1.2 Power Supply Position

The actual power supply position during 2006-07 (end of 10th plan) is given in Table 2;

Table 2
ACTUAL POWER SUPPLY POSITION (ALL INDIA BASIS)

Year	Peak				Energy			
	Require-ment (MW)	Avail-ability (MW)	Surplus (+) / Shortage (–) (MW)	Shortage/ Surplus %	Require-ment (MU)	Availability (MU)	Surplus (+)/ Shortage (–) (MU)	Shortage / Surplus %
2006 -07	100715	86818	-13897	-13.8	690587	624495	-66092	-9.6

1.3 11th Plan (2007-12)

(i) The National Electricity Policy envisages "Power for all by 2012" and per capita availability of power to be increased to over 1,000 units by 2011-12. To achieve this, a total capacity addition of about 1,00,000 MW is required during 10th and 11th Plan period. To meet the energy generation requirement of 1038 BU and a peak load of 1,52,746 MW with diversity and 5% spinning reserve, a capacity addition of about 82,500 MW is required during 11th plan. Based on the 10th plan actual capacity addition of 21,180 MW, a capacity addition of 78,577 MW comprising of 39,865 MW (50.7%) in central sector, 27,952 MW (35.6%) in state sector and 10,760 MW (13.7%) in private sector has been proposed during 11th plan. It may be stated here

that out of 78,577 MW, 220 MW (Kaiga U3) has already been commissioned and projects totalling to 48,955 MW (62.3% of the proposed capacity) are already under construction. For projects totalling to 29,402 MW, Letter of Award is yet to be placed. Table 3 gives the position. Detailed List of the projects is given at Annex I.

Table 3
CAPACITY ADDITION PROPOSED DURING 11TH PLAN

Figures in MW

	Hydro	Total Thermal	Thermal Break Up			Nuclear	Total
			Coal	Lignite	Gas		
A. PROJECTS COMMISSIONED							
Central Sector	0	0	0	0	0	220	220
ALL-INDIA	**0**	**0**	**0**	**0**	**0**	**220**	**220**
B. PROJECTS UNDER CONSTRUCTION							
Central Sector	8565	12680	11190	750	740	3160	24405
State Sector	3075	13947	12735	450	762	0	17022
Private Sector	2791	4737	2700	0	2037	0	7528
ALL-INDIA	**14431**	**31364**	**26625**	**1200**	**3539**	**3160**	**48955**
C. COMMITTED PROJECTS (ORDERS YET TO BE PLACED)							
Central Sector	1120	14120	13120	250	750	0	15240
State Sector	530	10400	10400	0	0	0	10930
Private Sector	472	2760	2760	0	0	0	3232
ALL-INDIA	**2122**	**27280**	**26280**	**250**	**750**	**0**	**29402**
D. TOTAL							
Central Sector	9685	26800	24310	1000	1454	3380	39865
State Sector	3605	24347	23135	450	762	0	27952
Private Sector	3263	7497	5460	0	2037	0	10760
ALL-INDIA	**16553**	**58644**	**52905**	**1450**	**4289**	**3380**	**78577**

- Coal linkages in respect of 84% of the coal based capacity are already available.
- Out of the proposed hydro capacity addition of 16,553 MW, 14,431 MW (87%) is already under construction.
- Out of total proposed nuclear capacity of 3,380 MW, 220 MW has already been commissioned and 3,160 MW is under construction.
- Gas based projects of 4,289 MW capacity considered for benefits in 11th plan. These gas based projects are already under execution or gas has been tied up from local sources.

The details of thermal power projects totalling to 58,644 MW (projects under construction and committed) in terms of their location i.e. pithead, load centre and coastal and also in terms of unit sizes is given in Table 4 and 5.

Table 4
DETAILS OF THERMAL POWER PROJECTS- BY TYPE

Figures in MW

Region	Pit Head* Coal	Load Centre Coal	Coastal Coal	Total Coal	Lignite	Gas/ LNG	Total
Northern	2500	9805		12305	625	220	13150
Western	9090	6210	500	15800	325	2248	18383
Southern	500	4560	3800	8860	500	1001	10361
Eastern	12120	3070		15190			15190
N-Eastern		750		750		810	1560
All-India	24210	24395	4300	52905	1450	4289	58644

*Pit Head Stations are those stations having their own dedicated coal transportation system (MGR/Rope way) and are independent from Railways for coal movement.

Table 5
DETAILS OF THERMAL POWER PROJECTS-BY UNIT SIZE

Region	800/660 MW Units	500 / 600 MW Units	210/250/ 300 MW Units	110/125 MW Units	Total	Gas/ LNG Module	Total
Northern		17	14	5	36	1	**37**
Western	4	16	20	3	43	5	**48**
Southern	1	14	6		21	3	**24**
Eastern	7	13	16		36		**36**
N-Eastern			3		3	5	**8**
All-India (Nos.)	**12**	**60**	**59**	**8**	**139**	**14**	**153**
All-India (MW)	**8060**	**30160**	**15185**	**950**	**54355**	**4289**	**58644**

- In addition to above, thermal projects totalling to 11,545 MW have been put under best effort category (Annexure II) and if concerted efforts are made in tying various inputs and obtaining early clearances, these may also be commissioned in 11th plan.
- During the recently held conference of Chief Secretaries of the states on 23rd and 24th April, 2007 the states have indicated additional projects totalling to about 25,000 MW on which sufficient work have been done by them by way of inviting competitive bids, obtaining clearances, identification of land and developing agency etc. A list of these projects is enclosed at Annex III. The projects considered doable during 11th Plan are enclosed in Annex IV.

1.4 Strategy Adopted for 11th Plan

In order to avoid slippages while planning for capacity addition during 11th Plan, efforts have been made to set 11th Plan targets realistically.

Following approach has generally been adopted while including the candidate projects in the list of 11th Plan projects.

- Those projects already taken up for execution in the 10th Plan period itself and due for commissioning in the 11th Plan period.

- Those thermal projects whose LOA has already been placed by the State and Central Public Sector Corporations.
- Those thermal projects whose LOA has already been placed and the financial closure achieved by private developers.
- Those thermal projects whose LOA is expected to be placed by 30th September, 2008 and commissioning is expected during the 11th Plan keeping in view the normal gestation period.
- Those hydro projects whose concurrence has been issued by CEA and order for main packages are likely to be placed by June 2007.
- Apart from the above, some small hydro projects which are ROR type surface power houses and whose gestation period is less than 5 years are also included. This would need to be rigorously followed up for completion of other formalities. The key to successful implementation of the plan is that the orders for plant and equipment and construction contracts are placed well in time. About 49,175 MW (62.6%) capacity out of 78,577 MW planned during 11th plan is under execution. All efforts should be made to obtain necessary clearances and place orders for remaining capacity during the first year of 11th plan itself.

The above guidelines would ensure a higher degree of confidence in fulfilling of the target as compared to 10th Plan.

1.5 Status of 11th Plan Projects

- **Thermal projects:** The total thermal power plant capacity in 11th plan is 58,644 MW which is about 75% of total capacity additions in 11th plan. The coal based capacity is about 90% of thermal capacity. Due to uncertainty in availability of gas and its high price only about 4,289 MW gas based projects have been included for benefits during 11th Plan. These projects are already under construction or have already tied up the gas supply. A large number of gas based power plants totalling to about 13,000 MW have been identified at various locations in the country. If gas becomes available at reasonable price some more gas based projects may materialize during later half of 11th Plan. List of additional gas based projects is indicated as Annex V.

  Hydro projects: The status of Hydro projects totalling to 16,553 MW included in the 11th Plan is as under :

- 14,431 MW (87%) are under construction;
- 1,537 MW (9.5%) have been accorded concurrence by CEA/State Government and are awaiting investment decision/work award;
- 585 MW (3.5%) the DPR is ready and concurrence of CEA/State Government is awaited.

  Besides capacity addition, a strong inter-state and inter-regional transmission system has also been planned not only to evacuate the planned generation capacity but also to provide open access for transfer of power from surplus to deficit areas.

Nuclear projects: Nuclear projects totalling to 3,380 MW have been proposed for likely benefits during 11th plan. Out of this, 220 MW (Kaiga U-3) has already been commissioned and the remaining projects are under construction.

1.6 Status of Fuel Linkage

Coal

Out of the total likely coal based capacity addition of 52,905 MW,

- 37,975 MW have been allocated linkage;
- 6,580 MW have been allocated captive coal blocks;
- 4,500 MW linkages are yet to be allocated and 2,500 MW coal blocks to be allocated
- 1,350 MW are likely to be based on imported coal for which formal fuel supply arrangements are yet to be made.
- 24,210 MW capacity is pithead based;
- 24,395 MW is load centre based and
- 4,300 MW coastal power plants.

1.7 LOA Status

Projects totalling to 29,402 MW are under committed category for which various inputs/clearances are being arranged. Orders for these projects are yet to be placed. Efforts have to be made to place orders for these projects during 2007-08, i.e., first year of 11th Plan.

In addition to above, thermal projects totalling to about 11,545 MW have been put under projects with additional efforts category (best efforts). Efforts should be made to bring some of these projects during 11th plan. It is understood that EPC contract in respect of projects totalling to 1,615 MW (Rosa 600 MW and Nagarjuna 1015 MW) under best efforts category has been recently placed. In addition LOA has been placed for Rayalseema TPS U 5 (210 MW) of APGENCO.

1.8 Captive Power Plants

The installed capacity of captive power plants with capacity of 1 MW and above is about 19500 MW. Out of this, about 14900 MW is connected to the grid and balance 4600 MW is operating in isolation meeting their own captive power requirements. Details are given in Table 6.

Installation of Captive Plants in Future

To estimate the future installation of captive power plants, various manufacturers were requested to furnish the details of orders in hand as well as their estimation of future orders in the next five years so as to assess the additional captive power plants capacity to be installed in the country. The details were asked for the captive power plant capacity of 1 MW and above in the year 2006. The total estimated capacity as reported by the manufacturers is about 12000 MW.

Table 6

(Figures in MW)

Type of prime mover	Installed capacity as on 31-03-2006 (provisional)	Capacity connected to the grid	Capacity not connected to the grid
1. Steam	9081	7148	1933
2. Gas	2928	2059	869
3. Diesel	7270	5524	1746
4. Hydro	59	36	23
5. Wind	147	99	48
Total	19485	14866	4619

1.9 Non-Conventional Energy Sources

Our country has significant potential for generation of power from Non-Conventional Energy Sources such as Wind, Small Hydro, Bio mass and Solar Energy. The total estimated medium-term potential (2032) for power generation from renewable energy sources such as wind, small hydro, solar, waste to energy and biomass in the country is about 1,83,000 MW. The details are given below:

(Figures in MW)

Sources / Systems	Estimated Mid-Term (2032) Potential
Wind Power	45,000
Bio-Power(Agro Residues & Plantations)	61,000
Co-generation Baggasse	5,000
Small Hydro (up to 25 MW)	15,000
Waste to Energy	7,000
Solar Photovoltaic	50,000
Total	1,83,000

The Installed Capacity at the beginning of the 10th plan was about 3500 MW. A target of 3075 MW was set during 10th plan. A capacity of about 6,750 MW had been achieved during the 10th plan. The Installed Capacity at the end of 10th Plan(as on 31.3.2007) is 10, 256 MW.

Considering the progress made during the 10th plan, the Working Group for 11th Plan proposals for New and Renewable Energy has proposed physical target of 14,000 MW Grid interactive renewable power as furnished below :

11TH PLAN TENTATIVE TARGETS FOR GRID INTERACTIVE RENEWABLE POWER

(Figures in MW)

Sources / Systems	Target for 11th plan
Wind Power	10,500
Biomass Power Baggasse Co-generation Biomass Gasifiers	2,100
Small Hydro (up to 25 MW)	1400
TOTAL	14,000

Source : MNRE

2.0 12TH PLAN AND BEYOND

The Working Group on Power has recommended a plan size of about 82,200 MW for 12th Plan also. This would comprise hydro projects totalling about 30,000 MW, thermal projects totalling 42,200 MW and nuclear projects of about 10,000 MW capacity.

MOP projections till 2031-32 are as under:

Year	Billion kWh		Installed Capacity (GW)	
	8%	9%	8%	9%
2006-07	700	700	140	140
2011-12	1029	1077	206	215
2016-17	1511	1657	303	331
2021-22	2221	2550	445	510
2026-27	3263	3923	655	785
2031-32	4793	6036	962	1207

3.0 SECTORS FOR AUGMENTATION OF MANUFACTURING CAPABILITIES

- **Main Plant and Equipments** - In the 10th Plan, the total capacity addition was only 21180 MW. About 11000 MW capacity slipped from 10th Plan due to causes attributable to equipment suppliers and contractors. The 11th Plan target is about four times then what was achieved during the 10th Plan. This calls for augmentation of manufacturing capacity of main plants and balance of plant manufacturers like coal handling plants, water treatment plants, cooling water system etc. Commensurate augmentation will be required in handling of equipments such as transformers, switchgears, control panels, conductors, cables etc.
- **Key Inputs** - This would call for augmentation in manufacturing capacities of steel, cement, aluminium etc.
- **Construction Agencies** - This area also needs large augmentation as at present there is lack of qualified contractors for taking up construction of large hydro and thermal power plants in civil, mechanical and electrical works.
- **Man Power and Training** - In accordance with the growth in capacity addition, it is essential to train and recruit adequate manpower for erection, commissioning as well as operation of power stations. All state Govts. public sector power utilities, large manufacturers and contractors have to undertake a mission to train workers and supervisors for the power sector.

3.1 Key Input Materials

There are several inputs which are required for implementation of power projects which involves Main Plant Equipment as well as Erection / Construction activity. Out of these **Steel, Cement, Copper, Aluminium** etc. are the key inputs needed for power projects. The huge capacity addition plan requires that all key inputs required are made available matching with the schedules for implementation of the Power projects. With a view to help Steel, Cement and other related industries

to plan / allocate / build up their capacities over a longer time frame, assessment of material requirement for 11th plan and for 12th plan period on a broad basis have been worked out based on the power capacity addition programme and corresponding transmission and distribution system to be executed.

In the case of thermal projects the requirement of steel and cement would vary depending upon the site conditions and consequent civil works involved for individual projects. This will also depend on whether the project is **Greenfield or expansion project**. In case of hydro projects the requirement of steel and cement are site specific. The civil engineering work and consequent consumption of key inputs depends upon the features of the projects. The requirement of cement for transmission and distribution works are mainly required for foundation works of transmission line towers, pole protection arrangement for Transmission/ Distribution (T&D) lines and for construction of electric sub-stations and switchyards. Steel for T&D works is mainly required for towers and structures.

For estimating the requirements of steel, cement and other inputs for thermal, hydro plants and also for transmission and distribution works, actual consumption of key inputs for the completed projects during the past and also for projects under execution have been assessed. Further, detailed study has been made by CEA, particularly for working out the steel requirement. Material consumption norms as used by CEA in the National Electricity Plan have also been used. As regards Copper and Cold Rolled Grain Oriented (CRGO) Steel the estimates and projections made by IEEMA have been used. In case of Castings & Forgings and Insulation requirements the typical consumptions norms provided by BHEL have been used. On the basis of these norms the requirements of various materials have been worked out for power projects and associated T&D systems up to the end of 11th Plan.

TOTAL REQUIREMENT OF VARIOUS MATERIALS FOR CAPACITY ADDITION PLANNED DURING 11TH & 12TH PLANS

Figures in (Million Tonnes)

Material	**11th Plan**	**12th Plan**
	78,577 MW	**82,200 MW**
Cement	30.63	47
Structural Steel	8	9.4
Reinforcement Steel	5.1	7
CRGO Steel	1.1	1.4
Castings	0.04	0.05
Forgings for TG sets	0.04	0.05
Special Steel for Sub-Stations	.33	.33
Steel for Conductors in Transmission system Lines	.27	.27
Steel for Conductors in distribution system Lines	.45	.57
Aluminium	1.6	1.9
Copper	.81	.81
Zinc	.15	.15
Thermal Insulation	.25	.31
Static Meters with downloading facility (Nos.)	124.4 Million	49.6 Million

3.2 Availability / Supply of Key Materials

As per the data compiled by Centre for Monitoring of Indian Economy (CMIE) for the year 2005-06 the Production of Cement, Aluminium, Copper and Zinc in the country was 141.8 Million Tonnes, 1 Million Tonnes, .52 Million Tonnes and .29 Million Tonnes respectively. Further, as per data from Ministry of Steel the availability (including imports) of Structural Steel, Reinforcement Steel, CRGO Steel and Other Steel is 4.2 Million Tonnes, 12.5 Million Tonnes, 0.6 Million Tonnes and 24.8 Million Tonnes respectively.

3.3 Constraints

(a) CRGO is a critical input for power transformers. In the past, non-availability of the same has led to delays in Project implementation. Hence, it is necessary to encourage domestic steel producers to go for indigenous production of CRGO. While on the other hand transformer manufacturers have to do advance planning for their material requirement and place orders sufficiently in advance.

(b) The number of static meters required for 11th Plan is of the order of 124.4 millions. The manufacturers of static meters need to be geared up to meet such huge requirements

4.0 STATUS AND AUGMENTATION OF MAIN PLANT AND EQUIPMENT

The established capacity for manufacture of various kinds of boilers, turbines is around 6000-7000 MW per annum in the country, which is largely dominated by the public sector giant, BHEL. The manufacturing range of BHEL includes steam boilers and turbines up to 500 MW unit rating which they are planning to enhance to 660 MW and beyond. Further, steps are also underway to augment the existing capacities to cater to the unprecedented order book and foreseeable future demand. In view of the large capacity addition planned in the coming years, there is a possibility of bunching of orders from the various utilities which may in turn lead to slippages in the schedules for manufacturing these critical equipment. It is felt that the country needs to develop additional players in the Indian market to adequately meet the projected capacity addition demands and also provide competition.

Balance of Plant Packages

(i) **HP Piping:** In the area of high pressure piping also, there is a dearth of players apart from BHEL. Considering the extent of capacity addition envisaged in the coming years, development of atleast more vendors in the area is required.

(ii) **LP Piping:** Only limited manufacturers are presently available in the market for the work related to low pressure piping. Accordingly, foreseeing the future demand, additional vendors need to be developed for undertaking the low pressure piping works.

(iii) **Air-conditioning and Ventilation:** The power sector suffers from the poor response of good players in this field as the manufacturers are generally more interested in providing services to the lucrative hotel industry and Commercial Centers as compared to Power Sector. Accordingly, a need is felt to attract these vendors towards Power Sector also.

(iv) **Fire Protection:** The situation in this area has become better than in the past with the entry of new players; however, the desired comfort level is still not there. Accordingly, foreseeing the future demand, more manufacturer/ suppliers would need to be developed in this area.

(v) **Ash Handling:** Ash Handling continues to be one critical area which has suffered from the lack of adequate number of players and continues to do so. Unless steps are taken to encourage new players to enter into this area, especially indigenous sources, this area may prove to be one of the bottlenecks to the future capacity addition plans.

(vi) **Coal Handling Plant:** The present scene in the Coal handling business is not very different to that of Ash Handling considering that a number of old players have either turned sick or closed their business. It is felt that there is a need to have a review of the existing specifications pertaining to these equipment so as to attract global vendors.

(vii) **Cooling Towers**

(viii) **Water System Packages:** The Water System business has lately witnessed the entry of some new players in the segment, thereby making the situation comfortable from the future perspective.

(ix) **CW System:** This package is also one of the key areas which suffer on account of dearth of players in the field with only one major player available in the country. It has come to the fore that BHEL is also contemplating to enter into this field which might provide some relief; however, a need is felt to develop further new sources in this area and also to have a re-look at the existing specifications in a bid to attract global vendors.

(x) **Fuel Oil Handling and Unloading System:** The main constraint in this area is the limited availability of manufacturers for Fuel Oil Storage Tank and experience of vendors relating to handling inflammable material. A need is, therefore, felt to develop additional vendors in this segment.

(xi) **Wagons:** The current availability / capacities of the manufacturers for the subject package may be adequate.

(xii) **Control & Instrumentation:** The major global players in this area are either present in India or have shown interest in the tenders for these packages. Accordingly, the availability / capacity of the manufacturers for the subject package is considered as sufficient to meet the requirements.

(xiii) **High Voltage Transformers:** With regard to 'Extra High Voltage Transformers' i.e., 765 kV Class all the manufacturers available in the field

globally have evinced interest in Indian market.
For 400 kV transformers, only two major manufacturers have been left in the field. However, in recent times a few more parties viz., ABB, AREVA, SIEMENS, EMCO, VIJAY have also entered into the field.

(xiv) **LT Transformers**

(xv) **Medium Voltage Switchgear:** It is viewed that though there are a few reputed manufacturers in the field, however, there was a need to further increase the vendor base.

(xvi) **Low Voltage Switchgear:** A number of manufacturers like L&T, Siemens, Control & Switchgear, GE are offering their services in this area. However, considering the future requirement, it is felt that it would be better if a few more parties are encouraged in this field.

(xvii) **Generator Bus Duct:** Presently only two manufacturers namely BHEL and Control & Switchgear are available for the package and there is a need to broaden the vendor base.

(xviii) **HT Motors:** Considering the demands that the planned capacity addition is likely to place in this area, more vendors need to be developed for higher capacity 11/6.6 kV motors.

(xix) **HT Bus Duct:** The availability / capacity of the manufacturers for the subject package is considered as adequate.

(xx) **Switchyard Equipment:** It was felt that adequate capacity exists for supply of Breakers, Isolators etc. and the situation in this segment is comfortable. This feeling has also expressed by IEEMA during their presentation to MOP on this aspect.

(xxi) **6.6 kV / 11 V Cables:** The availability / capacity of the manufacturers for the subject package are considered adequate.

(xxii) **132 kV Cables:** Foreseeing the future requirements, a need is felt to augment the number of vendors in this area. Further, it is felt that taking the future requirements into perspective when the demand for 400 kV Cables would also increase significantly, adequate steps are required right at this stage to develop adequate capacities for the same.

(xxiii) **Battery:** A need is felt to attract more manufacturers to provide competition in this area.

(xxiv) **Erection and / or Commissioning Agencies / Contractors:** There is a need for players having sufficient Project Management experience and ability to undertake Quality Field work. Accordingly, vendors having adequate experience of Project Management and Quality Field Work need to be developed in this critical area.

5.0 CONSTRUCTION CAPABILITY

The capacity addition plan of adding 78,577 MW in the 11th Plan period entails several concrete measures to be taken to improve the present construction technology and enhance the construction capabilities of the executing agencies in terms of manpower and equipment. For achieving the speedy progress of project implementation, certain basic changes may be required in the contract conditions, use of construction techniques, deployment of equipments & manpower and existing duty structure.

5.1 Availability/Capability of Construction Agencies

Construction Industry in India have grown significantly and have acquired adequate experience in the field of construction and infrastructure projects. Some international companies bearing big names in Hydro Sector have also started operating in India in the recent past.

Though a number of projects considered for 11th Plan are already under construction, a large number of projects that are planned for commissioning in 12th Plan will also start in 11th Plan. Thus for the purpose of manpower and equipment planning, it is assumed that construction on 78,577 MW capacity projects would continue for all the five years.

5.2 Requirement of Construction Equipment Hydro Projects (Main Equipments)

Main Equipment required to be procured during 11th plan could be summarized as below :

Sl. No.	Particulars of equipment	Estimated Requirement	Available	Augmentation Required
1.	Hydraulic Drill Jumbos (1 to 3 boom)	210	85	125
2.	Hydraulic Excavators (0.2 to 5.2 cum)	520	210	310
3.	Loaders	540	220	320
4.	Dozers	420	165	255
5.	Dumpers (12T to 35 T)	730	290	440
6.	Road Rollers	55	20	35
7.	Raise Borer/Climber	45	20	25
8.	Aggregate Processing Plant (50 to 600 TPH)	110	40	70
9.	Tower Crane (6.5 to 10 T)	120	45	75
10.	Shutter with travellers	470	190	280
11.	Dry Shotcrete machines	440	180	260
12.	Wet Shotcrete machines	130	50	80
13.	Cranes (5 T to 60T)	405	160	245
14.	EOT/ Gantry Cranes (10T to 20T)	175	70	105

5.2.1 Thermal Projects (Main Equipments)

The major equipment required to be deployed for simultaneous construction of 24 projects of less than 500 MW and 21 projects of more than 500 MW is summarized below :

Sl. No.	Particular of Equipment	Estimated Requirement	Available	Augmentation Required
1.	325 T Fm crane or equivalent	47	12	30
2.	Sumitomo crane or equivalent 150 t	177	120	57
3.	Crawler mounted crane 100 t	90	72	18
4.	Crawler mounted crane 75 t	444	312	132
5.	Mobile crane - 20 mt / 8 mt	1206	732	474
6.	Mobile crane – 40 mt	156	98	58
7.	Heavy duty trailer 20-50 mt	1206	732	474
8.	Dumpers	3540	3540	–
9.	Dozers (heavy duty d-6 & d-8) (hydraulic)	132	68	64
10.	Vibro compactors	444	312	132
11.	Concrete pump	444	312	132
12.	Truck mounted concrete pumps with placing boom	177	100	77
13.	Transit mixer (min. 5 cum. capacity)	884	528	356
14.	Batching plant (more than 30 cum. / hr. capacity)	288	166	122
15.	Rotaritory hydraulic piling rig	177	100	77
16.	Compressors	177	100	77
17.	DG sets	354	200	154
18.	Boring equipment for trench less construction	45	31	14
19.	Welding machines	12060	12060	–
20.	Slip form equipment	45	31	14
21.	Strand and jack arrangement for boiler	21	1	20
22.	ETDA cleaning arrangement for boiler	21	1	20
23.	Passenger cum goods lifts for boiler	156	98	58
24.	Induction heating machines	156	98	58
25.	Gantry Crane	156	98	58
26.	Pock lain	444	312	132
27.	Tipper	3120	1960	1160

The above requirement of construction equipment is based on the amount of annual concreting of 2800000 m^3, fabrication and erection of 460000 mt of structural steel, 35000 nos. of 760 dia bored piles, 13000000 m^3 of excavation, 900000 mt of equipment erection comprising of boiler/ESP/CHP/AHP/CT/ WTP/ PIPING etc. required to create annual thermal capacity of 10000 MW involving 40 concurrently running projects.

5.3 Status of Equipment with Industry

Construction Industry Development Council (CIDC) has furnished the macro level information regarding the availability of various categories of equipments (in terms of value) in India and the equipment which are available for immediate deployment. The total equipment available in the country are of value Rs. 12,32,000 millions out of which equipment of value of Rs. 5,23,610 millions (42%) are more than 10 years old and the equipments worth Rs. 52,960 millions (4.2%) are available for immediate deployment.

CIDC have also indicated that for commissioning of 14000 MW per year, equipment worth Rs. 78,630 millions will be required out of which equipment of value of Rs. 17,340 millions (22%) are available and augmentation would be required for equipment worth Rs. 61,290 millions.

Current trend in the construction industry is to have own equipment for speedier mechanized construction. With availability of various alternative sources of finance for purchase/lease of equipment and as per information gathered from leading construction/ erection agencies, it would be possible by the construction industry to mobilize the additional resources/equipments to meet the targeted capacity addition in 11th Plan.

5.4 Limitations

Sufficiency of Transport Trucks

Transportation of Construction Material

Apart from transportation of locally available construction material in tippers and dumpers, substantial construction material like cement, steel etc. will have to be transported to the project site from manufacturing plants and railway sidings. It is considered that railway siding are not located very close to the new power projects sites proposed for 11th plan.

6.0 MANPOWER REQUIREMENTS

Another area which needs immediate attention is the training of appropriate manpower for design, engineering, manufacturing, erection and commissioning of power plants. Besides these, trained manpower would be required for operation and maintenance of power plants as also associated transmission and distribution system. Following tables show the availability and requirement of manpower at different levels :

MANPOWER REQUIREMENT FOR HYDRO PROJECTS (SUPERVISORY STAFF)

Category	Estimated Requirement	Available	Augmentation Required
Senior level Executives	550	330	220
Middle level Executives	2000	1200	800
Junior level Executives	4300	2600	1700
Non-Executives	1700	1000	700
Total	**8550**	**5130**	**3420**

MANPOWER REQUIREMENT FOR HYDRO PROJECTS (WORKERS)

Sl. No	Type of Worker	Estimated Requirement	Available	Augmentation Required
1.	Skilled	33000	20000	13000
2.	Un-skilled	50000	30000	20000
	Total	**83000**	**50000**	**33000**

MANPOWER REQUIREMENT FOR THERMAL PROJECTS (SUPERVISORY STAFF)

Category	Estimated Requirement	Available	Augmentation Required
Senior Level Executive	1014	660	354
Middle Level Executive	3702	2400	1302
Junior Level Executive	7308	5040	2268
Supervisors/ Non-Executive	12780	8280	4500
Total	**24804**	**16380**	**8424**

MANPOWER REQUIREMENT FOR THERMAL PROJECTS (WORKERS)

Category	Estimated Requirement	Available	Augmentation Required
Mechanics	1770	1200	570
Electricians	1062	720	342
Crane operators	3540	2400	1140
Drivers	8820	5760	3060
LP welders	7080	4800	2280
HP welders	1062	720	342
Aluminium welders	177	120	57
Fitters	10620	7200	3420
Riggers	9570	6020	3550
Insulation applicators	354	240	114
Cable jointers	885	600	285
Carpenters	3312	2196	1116
Masons	7080	4800	2280
Bar benders	2478	1680	798
Total	**55090**	**37736**	**17354**

(B) KEY INPUT ISSUES – TRANSMISSION

1.0 SCENARIO AT THE BEGINNING OF 11TH PLAN

1.1 Introduction

Transmission system in the country at the end of 10th plan (as on 31-03-07) at 220 kV and above was 198089 ckt kms of transmission lines, 251439 MVA of AC substation capacity and 8200 MW of HVDC. Voltage level wise details are given in Table I.

Table I
SUMMARY OF TRANSMISSION CAPACITY AS ON 31.03.2007

TRANSMISSION LINES	**Unit**	
765 kV	ckm	1704
HVDC ± 500 kV	ckm	5872
HVDC 200 kV Monopole	ckm	162
400 kV	ckm	75722
230/220 kV	ckm	114629
Total Transmission Line	**ckm**	**198089**
SUBSTATIONS	**MW / MVA**	
HVDC BTB	MW	3000
HVDC Bipole + Monopole	MW	5200
Total – HVDC Terminal Capacity	MW	8200
765 kV	MVA	2000
400 kV	MVA	92942
230 / 220 kV	MVA	156497
Total – AC Substation Capacity	**MVA**	**251439**

1.2 Scenario - By the Beginning of 11th Plan

At the beginning of 10th plan, while the regional grids were operating in a fairly unconstrained and uncongested manner, there were substantial constraints in the inter-regional transmission system. Power of the order of 3000 MW was bottled up in the Eastern Region which was in surplus condition while the power needy Northern and Western Regions were in acute deficit.

The focus of development in transmission system during the 10th plan was towards national grid by interconnecting the regional grids by providing inter regional transmission links together with corresponding required intra regional transmission system. Western region was interconnected to ER-NER system synchronously through 400 kV Rourkela-Raipur D/C line in 2003 and NR was interconnected to ER-NER-WR system in 2007 with commissioning of Muzzaffarpur – Gorakhpur 400 kV D/C line. Inter regional Patna – Balia 400 kV quad D/C line between ER and NR and Agra-Gwalior 765 kV lines operating at 400 kV between NR and WR were also completed during the 10th plan. The total

inter regional transmission capacity was increased from 5000 MW at the beginning of 10th plan to 14,100 MW by the end of 10th plan.

2.0 11TH PLAN TRANSMISSION PROGRAMME

2.1 In transmission on system development in the country, the focus of XI Plan programme is formation of the National Power Grid. A strong all-India Grid would enable exploitation of unevenly distributed generation resources in the country to their optimum potential. The transmission capacity together with the margins provided for required redundancies as per planning criteria would provide a reliable transmission system. This would meet the firm transmission needs and, with open access in transmission, would facilitate increased real time trading in electricity, leading to market determined generation dispatches thereby resulting in supply at reduced prices to the distribution utilities and ultimately to the consumers. Development of National Grid has been necessitated by the large thermal generation potential in eastern part of the country, and equally large hydro generation potential in the north-eastern part. It has also been spurred by the opportunity provided by open access, variation in hydrology/hydro potential and diversity of load across the country.

2.2 Evolving the Perspective Transmission System for XI Plan

2.2.1 Identification of 11th Plan transmission expansion plan was done based on Power System Studies corresponding to the scenario at the end of 11th Plan. This transmission expansion plan is based on the generation addition programme of 78,577 MW during the 11th plan period. The implementation programme was subsequently worked out keeping in view identification of projects, schemes and transmission elements that should be implemented matching with programme of generation capacity addition and load growth on yearly basis upto 2011-12. Timely development of transmission network requires firming-up of the specific schemes and proposals, particularly in respect of inter-state transmission system, which need to be done at least 5 years ahead of the target date of completion. Meeting this requirement, most of the 11th Plan schemes have already been identified, discussed in the Regional Standing Committee on Transmission Planning, finalized, scheme formulated and process of investment approval initiated. Investment approvals for some of the schemes have already been obtained and have taken off into the construction stage.

2.2.2 The above process was adopted to evolve the inter-state transmission system for the 11th Plan. Of the evolved system, most of the transmission system has been firmed up in consultation with the stakeholders through the process of discussions in the Regional Standing Committees on Transmission Planning. A few schemes are under final stages of firming-up.

3.0 INTER-REGIONAL TRANSMISSION CAPACITY PROGRAMME

It is planned and programmed to add inter-regional capacities of 23600 MW, at 220 kV and above level, during the XI Plan period. This would increase the total inter-regional transmission capacity of National Power Grid to 37700 MW by end of XI Plan, i.e., 2011-12. The details are given in Table II.

Table II
DETAILS OF INTER-REGIONAL TRANSMISSION – EXISTING AND PLANNED FOR 11TH PLAN: (200KV AND ABOVE)

Name of System	Power Transfer Capacity (MW)		
	At the end of 10th Plan i.e. end of 2006-07	Additions during 11th Plan 2007-12	At the end of 11th Plan i.e. end of 2011-12
ER – SR :			
Gazuwaka HVDC back to back	1000		1000
Balimela-Upper Sileru 220 kV S/C	120		120
Talcher-Kolar HVDC Bipole	2000		2000
Upgradation of Talcher–Kolar HVDC bipole		500	500
ER-SR total	**3120**	**500**	**3620**
ER –NR :			
Muzaffarpur - Gorakhpur 400 kV D/C (Quad Moose) with TCSC	2000		2000
Dehri-Sahupuri 220 kV S/C	120		120
Sasaram HVDC back to back	500		500
Patna-Balia 400 kV DC quad	1600		1600
Biharshariff-Balia 400 kV D/C quad		1600	1600
40% series comp on Biharshariff-Balia 400 kV D/C quad to increase loadability		200	200
Barh-Balia 400 kV D/C quad		1600	1600
40% series comp on Barh-Balia 400 kV D/C quad to increase loadability		200	200
Sasaram–Fatehpur 765 kV S/C		2100	2100
Gaya–Balia 765 kV S/C		2100	2100
Sasaram-Balia 400 kV D/C quad		1600	1600
ER-NR total	**4220**	**9400**	**13620**
ER - WR :			
Rourkela-Raipur 400 kV D/C	1000		1000
TCSC on Rourkela-Raipur 400 kV D/C	400		400
Budhipara-Korba 220 kV D/C+S/C	360		360
Ranchi-Sipat 400 kV D/C (40% SC)		1200	1200
Ranchi-Rourkela-Raipur 400 kV D/C with fixed series capacitor, TCSC in parallel line		1400	1400
Ranchi – Sipat Pooling Point 765 kV S/C (or 1200 kV operated at 765kV) with series comp.		2300	2300
ER-WR total	**1760**	**4900**	**6660**
ER - NER :			
Birpara-Salakati 220 kV D/C	240		240
Malda-Bongaigaon 400 kV D/C	1000		1000

Name of System	Power Transfer Capacity (MW)		
	At the end of 10th Plan i.e. end of 2006-07	Additions during 11th Plan 2007-12	At the end of 11th Plan i.e. end of 2011-12
Bongaigaon-Siliguri 400 kV D/C Quad		1600	1600
ER-NER Total	**1240**	**1600**	**2840**
NR - WR :			
Vindhychal HVDC back to back	500		500
Auria-Malanpur 220 kV D/C	240		240
Kota-Ujjain 220 kV D/C	240		240
Agra-Gwalior 765 kV S/C line-1 400 kV op.	1100		1100
Agra-Gwalior 765 kV S/C line-2 400 kV op		1100	1100
Kankroli-Zerda 400 kV D/C		1000	1000
NR-WR Total	**2080**	**2100**	**4180**
WR-SR :			
Chandrapur HVDC back to back	1000		1000
Barsur–L.Sileru 200 kV HVDC mono pole	200		200
Kolhapur-Belgaum 220 kV D/C	240		240
Ponda – Nagajhari 220 kV D/C	240		240
Sholapur-Raichur 765 kV S/C line-1 for synchronous inter connection of SR – 400 kV operated		1100	1100
Narendra HVDC back-to-back with Narendra-Kolhapur 400 kV D/C line		1000	1000
WR-SR Total	**1680**	**2100**	**3780**
NER/ER-NR/WR :			
Biswanath Chariyali–Siliguri–Agra ± 800 kV HVDC bi-pole line of 6000 MW capacity with 3000 MW terminal modules at Bishwanath Chariyali and Agra		3000	3000
NER/ER-NR/WR Total	**0**	**3000**	**3000**
TOTAL ALL INDIA	**14100**	**23600**	**37700**

4.0 TRANSMISSION SCHEMES FOR POWER EVACUATION

4.1 The transmission schemes for power evacuation and regional system strengthening corresponding to additional generation capacity of the following 11th Plan Central sector generation projects have already been identified and mostly firmed up:

Northern Region: Koldam HEP (800 MW), Parbati-II HEP (800 MW), Parbati-III HEP (520 MW), Chamera- III HEP (231 MW), Uri-II HEP (240 MW), Rampur HEP (412 MW), Tehri-II PSS HEP (1000 MW), Koteshwar HEP (400 MW), Lohari Nagpala HEP (600 MW), Tapovan Vishnugarh HEP (520 MW), RAPP U 5&6

APP (440 MW), Sewa-II (120 MW), Nimboo Bazgo (45 MW), Chutak (44 MW), Lakhwar Vyasi (420 MW), Kotlibhel st-IA (195 MW), Kotlibhel st-IB (320 MW), Karcham Wangtoo (1000 MW) and Barsinghsar+Extn. (2x250 MW), Badarpur Ext(1000 MW), Jhajjar TPS-Delhi (1500 MW) and Dadri-Ext (1000 MW).

Western Region: Sipat-II+I (1000 + 1980 MW), Kawas-II (725 + 575 MW) and Gandhar-II (725 + 575 MW), Bhilai JV TPS (2x250 MW) and Korba-III (500 MW).

Southern Region: Kudankulam U1&2 (2000 MW), PFBR (500 MW), Kaiga U3&4 (220 + 220 MW), Neyveli TPS II (500 MW), Chennai JV (1000 MW) and Tuticorin JV (1000 MW).

Eastern Region: North Karanpura (1980 MW), Maithon RB (1000 MW), Barh (1980 MW), Teesta Low Dam III &IV (292 MW), Teesta IV (495 MW), NabiNagar JV Rlws. (1980 MW), Kahalgaon-II (1000 MW), Mejia U6 (250 MW), Bokaro Ext (500 MW), Koderma (1000 MW) and Farakka-III (500 MW), Mejia Extn (1000 MW), Raghunathura (1000 MW) and Durgapur Steel TPS(1000 MW).

N-Eastern Region: Kameng HEP (600 MW), Ranganadi II (130 MW), Dikrong HEP (110 MW), Tripura Gas (750 MW) and Subansiri Lower HEP (2000 MW).

4.2 Most of these transmission schemes are firmed-up and some are already under execution and some are in process of taking-up. A few schemes particularly those associated with generation projects identified relatively recently and being programmed for commissioning towards end of the XI plan, are yet to be firmed-up and if necessary, may be suitably modified or changed during the process of firming up. A few transmission schemes, particularly those required for completion towards the last years of the 11th Plan, are yet to be finalised. These include evacuation system and regional system strengthening schemes corresponding to those newly identified generation projects. These generation projects are Mauda (1000 MW) in Western Region, Simhadri Ext (1000 MW) in Southern Region, Chandrapur (500 MW), Barh-II (1320 MW) in Eastern region and Bongaigaon (750 MW) in NER.

4.3 Transmission schemes for 11th Plan generation capacities under the State sector and the Private sector have also been tentatively evolved. These transmission schemes are required to be firmed up by the State transmission utilities.

5.0 GROWTH IN 765 KV TRANSMISSION SYSTEM DURING 11TH PLAN PERIOD

Growth in 765 kV transmission lines during 11th Plan period is expected to be from 1704 ckm at the end of 10th Plan to about 7132 ckm by end of 11th Plan. 765 kV substation transformation capacity would increase from 2000 MVA at the

end of 10th Plan to 53000 MVA by end of 11th Plan. The details are given below in Table III.

Table III
GROWTH IN 765 KV TRANSMISSION SYSTEM DURING 11TH PLAN PERIOD

Transmission Systems at 765 kV, Programmed for 11th Plan 2007-12	Type	Unit	As at the end of 10th Plan	Additions during the 11th Plan 2007-12	As at the end of 11th Plan i.e. March 2012
765 kV Transmission Lines :					
Anpara-Unnao	S/C	ckm	409		409
Kishenpur-Moga L-1(W)	S/C	ckm	275		275
Kishenpur-Moga L-2(E)	S/C	ckm	287		287
Tehri-Meerut Line-1	S/C	ckm	186		186
Tehri-Meerut Line-2	S/C	ckm	184		184
Agra-Gwalior Line-1	S/C	ckm	128		128
Gwalior-Bina Line-1	S/C	ckm	235		235
Sipat-Seoni Line-1	S/C	ckm		351	351
Sipat-Seoni Line-2	S/C	ckm		354	354
Sasaram-Fatehpur	S/C	ckm		400	400
Fatehpur-Agra	S/C	ckm		330	330
Agra-Gwalior Line-2	S/C	ckm		110	110
SipatPP-Seoni Line-3	S/C	ckm		340	340
SipatPP-Sipat	S/C	ckm		30	30
Seoni-Bina	S/C	ckm		293	293
Seoni-Wardha Line-1	S/C	ckm		270	270
Seoni-Wardha Line-2	S/C	ckm		270	270
Gwalior-Bina Line-2	S/C	ckm		250	250
Gaya-Sasaram	S/C	ckm		180	180
Gaya-Balia	S/C	ckm		250	250
Balia-Lucknow	S/C	ckm		250	250
Lucknow-Bareilly	S/C	ckm		250	250
Bareilly-Meerut	S/C	ckm		200	200
Ranchi-SipatPP	S/C	ckm		350	350

Transmission Systems at 765 kV, Programmed for 11th Plan 2007-12	Type	Unit	As at the end of 10th Plan	Additions during the 11th Plan 2007-12	As at the end of 11th Plan i.e. March 2012
Agra-Mundka	S/C	ckm		250	270
Agra-Meerut	S/C	ckm		250	270
Mundka-Meerut	S/C	ckm		100	70
Mundka-Moga	S/C	ckm		350	370
Total		**ckm**	**1704**	**5428**	**7132**
765 kV Sub-stations :					
Seoni		MVA		4500	4500
Sipat		MVA	2000		2000
Unnao		MVA		2000	2000
Agra		MVA		3000	3000
Meerut		MVA		4500	4500
Fatehpur		MVA		2000	2000
Gwalior		MVA		2000	2000
Bina		MVA		2000	2000
Wardha		MVA		3000	3000
Sipat Pooling Point		MVA		2000	2000
Sasaram		MVA		2000	2000
Ranchi		MVA		3000	3000
Gaya		MVA		3000	3000
Balia		MVA		3000	3000
Lucknow		MVA		3000	3000
Bareilly		MVA		3000	3000
Tehri		MVA		3000	3000
Mundka		MVA		3000	3000
Moga		MVA		3000	3000
Total		MVA	**2000**	**51000**	**53000**

6.0 GROWTH IN HVDC TRANSMISSION SYSTEM DURING 11TH PLAN PERIOD

Two HVDC Bipoles are planned for 11th Plan period. These are Balia – Bhiwadi 500kV HVDC Bipole system and Biswanath – Agra ±800kV HVDC Bipole system.

7.0 TRANSMISSION SYSTEM DEVELOPMENT–PROGRAMME FOR 11TH PLAN

Table IV gives the transmission system in the country at achieved at the end of VIII, XI and X Plan periods and targets for the end of XI Plan:

Table IV
CUMULATIVE GROWTH IN TRANSMISSION SECTOR AND PROGRAMME FOR ELEVENTH PLAN

	Unit	At the end of X Plan i.e. March 2007	Target at the end of XI Plan i.e. March 2012
TRANSMISSION LINES		**X Plan**	**XI Plan**
765 kV	ckm	1704	7132
HVDC +/- 500 kV	ckm	5872	11078
HVDC 200 kV Monopole	ckm	162	162
400 kV	ckm	75722	125000
230/220 kV	ckm	114629	150000
Total Transmission Line	ckm	198089	293372
SUBSTATIONS		**X Plan**	**XI Plan**
HVDC BTB	MW	3000	3000
HVDC Bipole + Monopole	MW	5200	11200
Total- HVDC Terminal Capacity	**MW**	**8200**	**14200**
765 kV	MVA	2000	53000
400 kV	MVA	92942	145000
230 / 220 kV	MVA	156497	230000
Total - AC Substation Capacity	**MVA**	**251439**	**428000**

8.0 FUND REQUIREMENT FOR TRANSMISSION SYSTEM DEVELOPMENT AND RELATED SCHEMES DURING 11TH PLAN PERIOD

Total Fund requirement for transmission system development and related schemes has been estimated as following:

Rs millions

Central Sector	7,50,000
State Sector	6,50,000
TOTAL	14,00,000

9.0 ASSESSMENT OF REQUIREMENT OF MAJOR EQUIPMENTS AND MATERIAL FOR TRANSMISSION SYSTEM DURING 11TH PLAN

9.1 The expected requirement of major transmission equipment during 11th Plan is given in following Tables V to VIII:

Tables V
REQUIREMENT OF MAJOR TRANSMISSION EQUIPMENT DURING (2007 – 2012)

Table V (A) – 765 kV

Requirement of S/S equipment (Number)	2007-12
HVDC Bipole projects	2
765 kV 500 MVA 1ph units	90
765 kV 333 MVA 1 ph units	42
765 kV reactors 80 MVAR 1 ph units	174
765 kV Bays	112
765 kV Circuit Breakers	224
765 kV Current Transformers (sets)	1008
765 kV CVT's (sets)	336
765 kV Isolators (sets)	672

Table V (B) – 400 kV

Requirement of S/S equipment (Number)	2007-12
400 kV 105 MVA 1ph units	580
400 kV reactors 80, 63 & 50 MVA 3 ph units	370
400 kV Bays	846
400 kV Circuit Breakers	1523
400 kV Current Transformers (sets)	7614
400 kV CVT's (sets)	1396
400 kV Isolators (sets)	4399

Table V (C) – 220 kV

Requirement of S/S equipment (Number)	2007-12
220/132, 220/66, 220/33, 220/11 kV 160, 100, 50 MVA 3 ph units	740
220 kV Bays	3250
220 kV Circuit Breakers	3250
220 kV Current Transformers (sets)	9750
220 kV CVT's (sets)	2960
220 kV Isolators (sets)	13000

Table VI
TRANSMISSION EXPANSION PROGRAMME DURING XI PLAN (2007-12)

Sector/Region	All India
	Total All India
HVDC Bipole +/- 500 kV CkM	1606
HVDC Bipole +/- 800 kV CkM	3600
HVDC MW	6000
765 kV Ckm	5428
765/400 kV MVA	51000
400 kV Ckm	49300
400/220 kV, 400/132 kV MVA	53000
220 kV Ckm	35400
220/132, 66, 33, 11 kV MVA	73500
132/110 kV Ckm	18700
132/33, 11 & 110/33, 11 kV MVA	52000

Table VII
REQUIREMENT OF ELECTRICAL EQUIPMENTS FOR SWITCHYARDS ASSOCIATED WITH THERMAL STATIONS (2007- 2012)

A.	**765 kV Switchyard Equipment - Breaker and a half scheme (For projects having unit size of 800 MW)**		
	Item	**Requirement for one Bay**	**11th Plan (2 Projects) (12 Bays)**
a.	Circuit breaker	3 nos. per 2 bays	18
b.	Isolators	4 isolators per bay	48
c.	Current Transformer	2 sets per bay	24
d.	CVT/PT	1 set per line bay & 1 set per bus bar	16
e.	Lightning arrestor	1 set per bay	12
B.	**400 kV Switchyard Equipments - Breaker and a half scheme (For projects having unit size of 660 MW & 500 MW)**		
	Item	**Requirement for one Bay**	**11th Plan (34 Projects) (204 Bays)**
a.	Circuit beaker	3 nos. per 2 bays	306
b.	Isolators	4 isolators per bay	816
c.	Current Transformer	2 sets per bay	408
d.	CVT/PT	1 set per line bay & 1 set per bus bar	272
e.	Gapless lightning arrestor	1 set per bay	204

C.	132 kV Equipments- Main and transfer Scheme (For projects having unit size of 800 MW, 660 MW & 500 MW)		
	Item	**Requirement for one Bay**	**11th Plan (36 Projects) (216 Bays)**
a.	Circuit beaker	1 no. per bay	216
b.	Isolators	3 isolators per bay	648
c.	Current Transformer	1 sets per bay	216
d.	CVT/PT	1 set per line bay & 1 set per bus bar	324
e.	Gapless lightning arrestor	1 set per bay	216
D.	**220 kV Switchyard equipment-Double main and transfer (For projects having unit size of 300/250 MW & Gas modules having unit size of 360 MW)**		
	Item	**Requirement for one Bay**	**11th Plan (34 Projects) (218 Bays)**
a.	Circuit beaker	1 nos. per bays	218
b.	Isolators	3 isolators per bay	654
c.	Current Transformer	1 sets per bay	218
d.	CVT/PT	1 set per line bay & 1 set per bus bar	320
e.	Lightning arrestor	1 set per bay	218

Note: 1 set = 3 single phase units

Table VIII
TOTAL REQUIREMENT OF EQUIPMENT FOR HYDRO PROJECTS OF 11TH PLAN

Equipment	(No.)
132 kV / 220 kV / 400 kV Outdoor switchgear (Units)	
Circuit breaker	476
Isolators	497
Current Transformers	1128
CVT/PT	484
Lighting Arresters	967
220 / 400 kV GIS (Bays)	134

10.0 AUGMENTATION OF TRANSFORMER MANUFACTURING CAPABILITIES

Transformation capacity of 100000 MVA per annum is required during 11th Plan. This includes Generators Transformers and ICTs up to 132 kV voltage levels. It is estimated that a total of about 450000 MVA of transformation capacity would be required in 11th Plan and additional 50,000 MVA would be needed for preparedness for 12th Plan. Presently M/s BHEL who is the major electrical

equipment supplier under public sector in India has a market share of around 40% for development of transformation capacity and balance 60% share lies with private manufacturers.

Necessary preparedness shall have to be developed by M/s BHEL and other private manufacturers to meet out the massive growth requirement of electrical equipment as envisaged above. Urgent augmentation of their manufacturing capabilities, upgrading the test facilities available at CPRI / other testing institution in India and improvements in design and technology, raw-material procurement, manufacturing process, quality systems shop-floor environment etc. would be the need of the hour. Also engagement of experienced consultants preferably having past experience in manufacturing of 800 kV transformers & converter transformers for design, review, manufacturing, testing, repair services etc. and revamping of sales services/repair resources specially for Power Transformer for repair at sites/works/refurbishment would be other facilitating factors required for the purpose. Commercial manufacturing of Gas Insulated Switchgear for voltage levels upto 400 kV by indigenous manufacturers, which is presently not available, is another area which needs immediate attention and necessary efforts from all Indian manufacturers to meet out growing requirement of GIS equipment in the country.

11.0 HUMAN RESOURCE REQUIREMENTS IN TRANSMISSION/GRID

11.1 Expertise and Skills Needed in Transmission

The human resource requirement in transmission sector range from high level engineering expertise and managerial skills needed in planning, design, project management, system operation activities to basic engineering knowledge engineers and high skill set workers in substations and also moderate skill set field workers in transmission line construction and maintenance activities. The system also requires adequate human resources for support and auxiliary services and also for the organizational system of the various utilities, equipment vendors, project executors and serviced providers in the transmission sector and other entities auxiliary to the transmission services. This needs to be further topped up with the transmission expertise resource needed in government and regulatory organizations who are responsible for formulating the policies and plans and the implementation of monitoring and regulatory mechanism for steering the transmission sector in the desired direction on the path of progress with desired speed towards the ultimate National goal.

The country's transmission programme should be supported by an adequate research and development effort. This would also require additional human resources in field of transmission in the research institutes as well as in the utilities and the organizations so that a fruitful programme of coordinate research and development could be achieved.

11.2 Manpower Requirement – POWERGRID

In order to meet future power transfer requirement from various central sector generation projects, POWERGRID is developing National Grid integrated

with modern technologies in a progressive manner interconnecting all the five (5) regions. At present, National Grid of 11,500 MW is already existing which shall be enhanced to four (4) fold i.e. about 40000 MW by 2012 to ensure optimal utilization of resources and conservation of eco-sensitive Right-of-Way as well as development of open electricity market. Towards, this POWERGRID has an ambitious plan of adding more than 58000 ckt. km 400 kV / 765 kV transmission line along with 47 nos. 765 / 400 / 200 kV substations in all the five (5) regions by 2012. In addition, various latest technologies are also being adopted like high capacity 800 kV HVDC/AC system, FACTS, GIS/GPS based line route survey, High Surge Impedance Loading Line (HSIL), high temperature endurance conductor, multi-circuit lines, substation automation & remote operation etc.

Besides above, POWERGRID is also operating the modern load dispatch centres in all the five (5) regions along with dedicated communication facilities for secured and reliable operation of the Grid. However, keeping in view the growing complexities and change in market mechanism, it is necessary to continuously upgrade and modernize the Grid operation & control and communication facilities to operate large grid on real time basis dynamically with safety, security and reliability. Towards this, POWERGRID is initiating developing of Intelligent Grid with State-of-the-art features like wide area measurement, adoptive islanding, probabilistic assessment, Dynamic Stability Assessment (DSA) & Voltage Stability Assessment (VSA) technique, self healing grids etc.

To accomplish above challenging tasks in a time bound manner as well as operation & maintenance of such a vast transmission network including Grid management, trained manpower in adequate number is required at every stage of development and operation. As per an estimate, by 2012 additional about 8500 manpower shall be required out of which about 3500 at Technical/ Executive level of various fields including IT/communication field and balance 5000 at non-technical/supervisor/workman level. Further, training of manpower on different aspects of transmission system development is required for imparting requisite skills to continuously update the knowledge and skills of serving personnel to absorb the latest technologies & innovations as well as its successful implementation and operation/management.

12.0 NORMATIVE HUMAN RESOURCE REQUIREMENT IN TRANSMISSION

The above manpower requirement is based on exercise done by PGCIL. Each utility would need to make an assessment of its manpower requirement. For an indicative over-all assessment, the following normative requirements for utilities in transmission sector can be taken:

Man Power Requirement of Utilities for Implementation and O&M of Transmission System at 66 kV and above:

- 200 persons for O&M of inter-state transmission system for every 1000 MW of Installed Generation Capacity giving rise to inter-state transmission.
- 200 persons for implementation of inter-state transmission system for each 1000 MW of new Installed Generation Capacity requiring inter-state transmission.

- 200 persons for O&M of inter-state transmission system for every 1000 MW of Installed Generation Capacity.
- 200 persons for implementation of intra-state transmission system for each 1000 MW of new Installed Generation Capacity.

The above includes manpower requirement of utilities only. Manpower requirement of equipment manufacturer, suppliers, contractors and service vendors would be additional.

Based on above, manpower requirement of utilities corresponding to the programme of the order of 65000 MW additional generation capacity during the XI plan, of which about 45000 MW would require inter-state transmission, would works out to:

CTU: additional manpower of 9000 corresponding to 45000 MW of inter-state generation capacity addition. All of this additional manpower would subsequently be utilized for O&M of added capacity.

STU: additional manpower of 13000 corresponding to 65000 MW of additional generation capacity.

13.0 REQUIREMENT OF ACTION PLAN FOR IMPLEMENTATION OF TRANSMISSION PROGRAMME

13.1 As experienced from previous plans, there had been differences between the planned targets and actual achievements. Notwithstanding the deviations in generation schedules and actual load growth in different parts of the country implementation of transmission system need to be adjusted matching the changing scenarios. This would require more dynamic and more professional approach at all the stages of implementation starting from planning and scheme approvals.

13.2 The inter-state transmission system is developed based on various dispatch scenarios considering the seasonal and time of day variations. The inter-state transmission system is evolved keeping in view the overall optimization on a National level. In this process the total investment in transmission including the inter-state as well as intra-state system is optimized. Based on the perspective plan developed by CEA and depending upon as to which generations are likely to be available during the next 2-3 years and taking into account the load growth in particular areas, CTU has to prioritize and to firm up the inter-state transmission system requirements on studies required for intermittent load generation scenarios.

13.3 The inter-state transmission system includes inter-regional as well as intra-regional system and caters to the power evacuation, transmission and delivery to the state grid of the power from generating stations for regional as well as inter-regional benefits and also caters to the requirement of transmission system for inter-regional as well as intra-regional transfer capacity for exchanges of power on account of trading between the utilities or generating companies and utilities. The requirement of the transmission system is developed on the basis of the power system studies and firmed up through the Regional Standing Committees for transmission system Planning. These Regional Committees

constituted by the CEA have representation of CEA, Transmission utilities of the constituent states of the Region, POWERGRID, representatives of Central Sector Generating Companies, RPCs and PTC. The inter-state transmission system developed either for evacuation of the generation or for system improvement is discussed in the Standing Committees on Transmission Planning and finalized. It is observed in the past that there have been delays in agreement between different constituents due to commercial reasons particularly for some of the interstate transmission proposals where the utilization of the incremental transmission system is projected to be in much different proportion as that of regional transmission charges shared based allocation of Central sector generation. New methods of allocation of transmission charges are in the process is evolving and there is need to evolve a suitable mechanism so that inter-state transmission projects can be taken up at faster rate. The Standing Committees on Transmission Planning have a special responsibility in this task.

13.4 After finalization of the transmission proposals in respect of regional/inter-regional transmission system by the Regional Standing Committees, POWERGRID, in its role as CTU goes ahead with project formulation and the process of implementation. So far the project implementation in respect of inter-state transmission has been done by POWERGRID in its capacity as a Transmission Company in all cases except in the case of Tala Transmission system, part of which has been executed through a Joint Venture Company of POWERGRID and Tata Power. The situation is set to change towards participation of Private Sector in transmission through competitive route. The government has issued guide line for private sector participation in transmission through competitive route and also constituted an Empowered Committee.

13.5 Practice of periodical review of the progress of implementation of the power evacuation scheme for a given power project is in vogue. However, more efforts are needed to address the likely operational problems that would prevail, when the first unit of the power project is connected to the grid or when up-gradation of lines from lower to higher voltages are carried out. It is therefore required to identify potential operational problems, about a year before the commissioning of such schemes based on simulation studies and evolve suitable remedial measures to mitigate the identified problems.

13.6 The inter-state transmission system is to be developed by the State utilities. Their network planning, scheme formulation and the programme of inter-state transmission development should match with progress of generation, load growth and inter-state transmission. The Central Transmission Utility would have to co-ordinate with the State Transmission Utilities and the other stakeholders for preparing a well-coordinated transmission system implementation schedule detailing mile stone activities in respect of each of the transmission system elements.

13.7 As the thermal generation sector has been de-licensed, the actual development may be at variance with respect to the programme at the time of firming-up of the scheme. As the process of identification of scheme for private sector participation, preparation of FR, investment approval for schemes to be

implemented by CTU or selection of successful bidder for transmission schemes through private sector participation, etc. would be time consuming, it would be necessary to rework the time schedules of the transmission schemes and also incorporate changes that may be desirable to capture the needs corresponding to most updated generation scheme progresses.

13.8 It is expected that unfolding market system in generation trading may influence the pattern of power flows requiring reassessment of adequacies/ inadequacies in the transmission network and suitable system strengthening to be taken up from time to time. The Central Transmission Utility and the State Transmission Utilities would have to plan the transmission system, keeping this aspect in view. For the power flows arising from trading in electricity, the augmentation of the power system, which would dovetail into the perspective transmission plan would be required to be planned and executed in a short term time frame.

13.9 As the power sector and also the transmission system in the country is in a phase of high growth rate of development, the transmission tariffs should encourage investment in the sector and also facilitate the development of required transmission networks.

13.10 With the all round development of our country and the increase in population, difficulty in obtaining corridors for power transmission has been increasing. Therefore, early initiation of action of acquiring right of way is the need of the hour. The procedures for forest clearances should be taken up in parallel with the regulatory procedure.

13.11 The gestation period of transmission projects would have to be compressed suitably keeping in view the reduction in gestation period of generation projects and also the possibility of deviation from the National Electricity Plan, and trading of electricity under non-discriminatory open access regime. New construction practices/technologies wherever available would be required to be implemented for compressing the gestation period of transmission projects. It would be desirable to adopt emerging technologies like satellite imaging for carrying out detailed survey and route alignment and minimize the import due to environmental issues. The wind zone mapping and standard design of various types of towers and soil investigation could be done in advance so that construction time for the transmission system could be substantially reduced.

13.12 With sustained efforts by Central PSUs and States, and close coordination by Ministry of Power/CEA with CPSUs and State most of the transmission schemes were commissioned in time and by and large there was no bottling up of power from Generating stations. However, transmission utilities faced difficulties in implementation and completion of some schemes viz. Dhauliganga-Bareilly 400 kV D/C line due to progress of work in Ascot wild life area adversely affected due to refusal of permission for working in Ascot Wild Life Sanctuary, Dadri-Panipat 400 kV S/C line due to Right of Way constraints and law & order problem, LILO of 400 kV Dadri-Ballabgargh D/C line due to clearance not received from NOIDA Authority, Tehri – Meerut 765 kV S/C line due to work in Rajaji National Park was not allowed by forest authorities until

clarification was received from Hon'ble Supreme Court, and Pykara-Arasur 230 kV D/C line due to time consumed in forest area the clearance from Hon'ble Supreme Court and further delay in tree cutting/clearances under the direct supervision of Regional Conservator of Forests.

13.13 It is also important that the finances for the Transmission Schemes of the National Grid are arranged at low cost so that required reliability and margins for open access could be provided in the transmission system within acceptable costs.

13.14 Hydro power development in NER would requirement of power to other regions through the chicken neck. The total requirement would be 7 or 8 numbers of HVDC bipole lines and 4 or 5 numbers of 400 kV double circuit lines – a total of 12 numbers of high capacity transmission corridors for which a total width of about 1.5 km. in two or three corridors would be needed. The total right of way in chicken neck area needs to be reserved on priority. To supply the power from the various generation schemes catering to increasing demand within the North-eastern Region, system strengthening within the NER would be needed. The required transmission system in NER needs to be developed along with the power evacuation system. For achieving accelerated load growth in NER, efforts are needed on all fronts. Specific efforts are needed in development in transmission at the regional level as well in the transmission, sub-transmission and distribution system at the state level.

13.15 The evolved transmission system expansion plan provides sufficient transmission capacities with inherent margins for trading transactions. This also meets the intra-regional transmission needs. Taking-up the execution of the transmission schemes for timely completion would depend on timely tie-up of pre-construction activities and thereafter construction being ensured within specified time period. Agreement on the proposal together with commercial tie-up for payment of transmission charges based on long-term open access application becomes a critical issue in this context.

13.16 As the Merchant plants would basically be long-term user of the transmission system, the transmission system for their connectivity and meeting their primary transmission needs can be planned and taken up for construction based on commitment for the transmission charges by the developers of the Merchant plants. The process for long-term open access application and tying-up the transmission schemes should be done at the earliest as building the transmission system including obtaining necessary approvals, pre-construction and construction/commissioning activities for the transmission schemes require almost same time, if not more, as that for implementation generation projects.

13.17 Timely and coordinated Implementation of all schemes is necessary to Ensure Delivery of a Reliable Power System to the System Operators. This can be achieved through:

- Parallel Processing of Activities
- Packaging Concept of breaking-down the total transmission project in to packages which could be implemented with minimal co-ordination & interfacing and speedy/cost effective procurement/work execution.

- Standardization of Designs
- Standardization of Qualifying requirements for Vendors/Bidders
- Completeness and clarify of Bidding Document
- Route Alignment, Detailed Survey & Soil Investigations based on new technology/techniques such as use of satellite imagery, GPS, total stations, computer-aided tower spotting etc.
- Mechanization in Construction, Quality Management System etc.
- Advance action for Environment & Forest Clearance and Rehabilitation & Resettlement (R&R)
- Vendor Development
- Efficient Project Monitoring

13.18 Continuously upgrading and modernize the Grid operation & control and communication facilities to meet the growing complexities and change in market mechanism.

13.19 Best practices in maintenance, R&M programme, Residual Life Assessment and restoration efficiencies in Transmission.

13.20 Focused implementation of all types of schemes viz. Transmission schemes for interstate transmission system, Load dispatch schemes for National and Regional dispatch centers, National level Power Exchange, Comprehensive upgrading of protection system for total integrated system for security of National and Regional grids, Evolving perspective transmission plan for the 12^{th} Plan period and Augmentation of test facilities in the Central Sector and Transmission schemes for intra-state transmission system, Load dispatch schemes for State and Area dispatch centres and Schemes for upgrading of protection systems for security of State grids in the State sector.

13.21 Ensuring availability of funds to meet the requirement for transmission system development and related schemes. Total 11^{th} Plan fund requirement for transmission system development and related schemes has been estimated as Rs. 7,50,000 millions in the Central Sector and Rs. 6,50,000 millions in the State Sector, totalling to Rs. 14,00,000 millions.

13.22 Focused approach and timely taking-up the schemes for technology development and adoption in the identified areas viz. $\pm$ 800 kV HVDC system, 765 kV AC Transmission System, Ultra High Voltage AC Transmission System (1000kV), FACTS, Upgradation / Uprating of transmission line, High temperature endurance conductor, Tall / Multi-circuit & Compact tower, High Surge Impedance Loading Line (HSIL), Remote operation of substation, substation automation and Gas Insulated substation(GIS), All Aluminum Alloy Conductors (AAAC) and Polymer/Composite Insulators, Disc insulators of 320 kN & 420 kN, etc.

13.23 Efforts to attract and retain the required expertise and human resources in transmission sector and continued up-gradation of their skills.

(C) KEY INPUT ISSUES – DISTRIBUTION
(INCLUDING VILLAGE AND HOUSEHOLD ELECTRIFICATION)
(REPORT OF THE WORKING GROUP ON POWER FOR THE 11TH PLAN)

1.0 OVERVIEW OF DISTRIBUTION SECTOR

The electricity distribution section is the most daunting sector due to its interface with the public at large with different needs and expectations and varying degrees of capacity to pay. The need to improve this sector was realized, in the 10th plan with emphasis on steps to reduce the huge aggregate technical and commercial losses, control the theft & pilferage and rationalise the tariff structures. Major schemes like Accelerated Power Development & Reform Program for urban areas and the Rajiv Gandhi Grameen Vidyutikaran Yojana was initiated in the 10th plan which aimed at bringing in investment in urban areas and creating an electricity infrastructure in rural areas. There is however a pressing need to continue these efforts in the 11th plan so as to reduce the AT&C losses and to continue with the reforms in the distribution sector to provide an affordable, good quality and reliable power supply to the citizen of India, be it in urban or rural areas.

2.0 QUALITATIVE APPROACH

2.1 Distribution of Power in Urban Areas

The task force constituted MOP The Accelerated Power Development & Reform Program (ARDRP) was aimed at bringing about improvement in the urban distribution sector by funding investment in the distribution network, and by incentivising the states who performed well in reducing losses. The Ministry of Power constituted a task force in 2006 under Shri P. Abraham which has recommended that APDRP may be continued with investment and incentive component beyond the 10th plan. However the conditions may be made more stringent and reform oriented. While broadly agreeing with recommendations of the Abraham Committee report, it is felt that APDRP needs to be continued in 11th plan with revised terms and conditions. The focus of the programme should be on establishment of base line data, which shall enable reduction of AT&C losses in major towns of the country through strengthening, upgradation of sub-transmission and distribution network and adoption of Information Technology in the areas of energy accounting & auditing and improvement in consumer services through establishment of Bijlee Sewa Kendras. The programme may focus on the town and cities covering all district headquarters and town with population of more than 50,000 and town with lesser population in special category sates. The investment and incentive components may be merged and funding may be in form of loan assistance with the provision of conversion of loan to incentives to the distribution companies on achieving specified milestones with regard of reforms and reduction of AT&C losses. There also needs to be a provision of incentive to the employees of the utilities. The loan assistance may be converted to grant (50% for general category states and 90 % for special category states) and the loan should be from Central Sector with a moratorium of

three years on interest and on repayment. The rate of interest may be as determined by Ministry of Finance from time to time. ADDRP assistance should be also available to private distribution companies as the ultimate beneficiary was the consumer. The loan / grant needs to be funded under Central sector through REC / PFC.

2.2 Distribution of Power to Rural Areas

RGGVY (Rajiv Gandhi Grameen Vidyutikaran Yojna) aims to achieve power for all by 2009 and in the long run accelerate rural development, adequate employment and eliminate poverty through irrigation, development of small scale industries, provision of health care and promotion of education and information technology. RGGVY also aims at bridging the urban rural gap and provide reliable quality power supplies to rural areas. However, in order to bring about access to electricity to all rural households, there would be need to widen the electricity coverage to hamlets / habitations of the country. In case the funding of RGGVY becomes a constraint it is proposed that in the first phase all un-electrified villages and hamlets with more than 300 population are covered. Those hamlets with less then 300 populations may be excluded except those in hilly, forest, desert and tribal areas. The total cost of phase 1 is estimated at Rs. 2,40,000 millions. Phase 1 would be completed by 2009 and would reach electricity to all the un-electrified villages and about 0.3 Million hamlets. The second phase would start from 2009 onwards and would reach electricity to the balance un-electrified hamlets and complete the task of providing access to all rural households by 2012. Second phase is estimated around Rs. 1,60,000 millions. The two phases is estimated around at Rs. 4,00,000 millions.

2.3 Prioritization of RGGVY

Maximum number of un-electrified villages exist in the under developed States. RGGVY programme should give top priority in the allocation of funds for these States. Second priority should be given for intensive electrification of such States where the household electrification is below the national average. Third priority should be on the intensive electrification for the remaining States.

2.4 Public Private Partnership through Rural Franchisees

Management of rural infrastructure has to be based upon all inclusive growth model that involves rural set ups and provides the local Panchayat Raj institutions a supervisory function to ensure the durability and sustainability of electricity infrastructure.

Franchisee system for management of rural distribution has been made mandatory under RGGVY to make the revenue model sustainable. RGGVY allows enterprising individuals, NGOs, private entrepreneurs, co-operatives, Panchayat Raj institutions to become franchisees. The franchisees system needs major push in 11th plan with initiatives for capacity building and financial support.

2.5 Financial Support to Franchisees

Not many people are coming forward for franchisee ship especially from remote rural areas where loads are small and sustainability difficult. As franchisees will be mainly rural entrepreneurs, they will have difficulties in raising small funds for their micro level projects to guarantee their performance or meet working capital requirements. No funds have been allocated under RGGVY for development of franchisees. It is necessary to develop institutions that extend micro credit to meet the franchise level financing needs.

2.6 Distribution of Power in Rural Areas through Decentralized Distributed Generation (DDG)

Electricity Act, 2003 provides the requisite framework for accelerating electrification in rural areas with necessary empowerment. It permits operation of stand alone systems independent of the regulatory regime. Integrated Energy Policy 2006 has estimated the requirement of power at 8,00,000 MW by 2031. It implies that India must add 25000 MW or more every year for a quarter century. It is a colossal task and would require exploitation of all renewable and fossil resources. Secondly, the creation of huge rural village and block level electricity infrastructure will require immediate supply of power. Village level energy resources like biomass, hydro and solar energy will help to reduce the dependence on grid based thermal, gas nuclear and hydro power. India has a potential to generate 10-15000 MW of power from the available biomass. DDG based on this resource will meet the critical needs of parched villages asking for timely power. Cost of electricity should be based on cost to serve basis and DDG to be taken up on a mission mode. Viability gap funding may be adopted in case of grid interconnected schemes. Bio mass cultivation may be encouraged to support DDG and bio-fuel cultivation to be funded by Financial Institutions (FIs) / Banks. However, multi-fuel technologies may be encouraged.

2.7 Pilot Programmes on DDG

The problem of providing power to rural areas would be critical when the infrastructure under RGGVY becomes ready but remains without the supply of power. To attract the entrepreneurs, REC may be encouraged to put up pilot projects in the selective rural areas to have a demonstrative effect. Such projects could be linked to the neighbouring substations and incorporated as the long-term lease infrastructure under RGGVY on cheaper finance. DDG will go a long way to ameliorate the shortages of power in rural areas. Nationwide survey of available resources in each villages to be undertaken in fixed time frame through a nodal agency like REC.

2.8 One Megawatt Power Plants in Rural Areas

To meet the power supply requirements of rural areas stand alone / grid connected power plants of optimum one megawatt capacity power plants should be encouraged. REC should act as nodal agency for providing technical and financial support under the scheme.

2.9 Akshay Prakash Yojana

Maharashtra has launched a new programme called Akshay Prakash Yojana aimed at demand side management. This programme has shown good results in ensuring quality and reliable supply of power to the villages. Both consumers and utilities are benefiting under this programme. It is recommended that this programme should be popularized among other utilities.

2.10 Centres for Excellence for Distribution of Power

The Electricity Act has opened new avenues for variety of players to take up distribution of power. In the changed environment and to seize the new opportunities REC should set up centres of excellence for distribution of power in all the states to take up rural distribution by setting up a subsidiary company.

2.11 Non-Discriminatory Supply Option

RGGVY scheme provides for making adequate arrangements for supply of Electricity and there should be no discrimination in the hours of supply between rural and urban areas. To achieve this, there should be a clear allocation of Power Supply for the rural areas.

2.12 Agricultural Sector

Agricultural consumption comprises of approx 20% to 40% of the total consumption of the utility in the states. There is a fear with regard to depletion of water table due to unrestricted exploitation of the ground water. The adoption of flat rate pricing for agricultural power is cause for this perverse state of affairs. Under this system, a farmer pays a fixed price per horsepower per month for electricity. Therefore, the marginal cost of pumping water is zero. This leads to energy wastage, over-pumping and inefficient selection of crops. Flat rate pumping also masks the true cost of power to farmers. Agriculture consumption is mostly un-metered and this allows manipulation of the loss by the utilities in the name of Agriculture Consumption therefore, during the 11th plan all agriculture connections need to be compulsorily metered.

2.13 Energization of Pumpsets in Eastern Region

Eastern sectors' irrigation potential should be fully exploited during 11th Plan by launching a special scheme for energization of pumpsets. It is estimated that Eastern region has only 10% agricultural consumers. A targeted programme will not only provide livelihood to the poor farmers but also provide food security to the nation. Out of 35 lakh pumpsets energisation targeted for 11th Plan, 20 lakh should be taken up in the Eastern region and other states where huge potential exists.

2.14 North-East and Backward Regions

In all the backward and north-eastern States the programme of electricity distribution projects need to be supported with low cost funds along with substantial portion of subsidy or grants. Rural Infrastructure Development Funds (RIDF) available with NABARD should be utilized for the development of electricity distribution in the North-eastern and other backward regions of the country. For the System Improvement Schemes in these regions RIDF funds

may be allowed to be utilized for making available cheaper credit for an accelerated development of these regions.

2.15 Tariffs

Performance based regulation through Multi Year Tariff (MYT) framework, is an important incentive to minimize risks for utilities and consumers, promote efficiency and rapid reduction of system losses. It would also bring greater predictability to consumer tariffs by restricting tariff adjustments to known indicators. Benchmarking should be properly adopted after adequate studies to establish the desired performance standards. Regular review of the performance levels also need to be suitably undertaken. As regards Agricultural tariff it should be in consonance with the sustainable water management requirements. A higher level of subsidies could be considered to support poorer farmers of the region where adverse ground water table condition requires larger quantity of electricity for irrigation purposes but restricted suitably for maintaining ground water levels for a sustainable usage. Even a combined tariff in such cases for electricity and water may be an option to consider. Differential tariffs for usage during different time of the day, i.e., distribution based on peaking or off peak hours etc. needs to be introduced expeditiously by introducing Time of the day Metering to flatten the demand curve to more manageable levels.

2.16 Open Access

Access to transmission and distribution network is one of the most important elements of Electricity Act 2003 and National Electricity Policy 2005. At the retail level the consumers with a minimum requirement of 1 MW are to be granted the right to avail open access by 2009 in a phased manner. A consumer allowed open access under the regulations is therefore free to choose any electricity supplier other than the distribution licensee of its area. The major issue in making open access operational is the level of cross-subsidy and other charges applicable to open access consumers. Most states have released open access regulations with the open access phasing plan time frame. The incumbent licensee may not like migration of creamy customers and put barriers to prevent it. The open access customers may also fear discrimination on availing supply from alternative source to the current retail supplies. In this context the regulators have an important role to play in encouraging open access. The 11th plan should focus on creating awareness, providing communication, customer protection and promoting open access to the consumers as envisaged in the Electricity Act 2003. Open access in distribution should be in place including phasing out of cross subsidy surcharge by end of 11th plan.

2.17 APDRP Assistance

APDRP assistance is likely to be continued during the eleventh plan also with focus on auditing and accounting and reducing AT&C losses in major towns and cities.

3.0 TECHNOLOGY ASSESSMENT AND NEEDS

3.1 Pre-paid Meters

Pre-paid meters, should be promoted in the 11th Plan. This will enable efficient use of power for agricultural use and will also eliminate adverse impact on water table due to excessive exploitation of ground water. Though it involves huge capital cost the gains from the system would offset such costs in the long run. It is also expected that large scale use would bring down the cost of the technologies.

3.2 HVDS System

The advantages of HVDS system are well known particularly in containing theft of electricity. Besides, it improves the quality of power significantly and thereby customer satisfaction. HVDS system needs to be given a special focus in the 11 th Plan to get immediate results in loss reduction. Efforts should be made to bring down HT/LT ratio during the 11th Plan.

3.3 Priority to IT Applications

It is well established that IT application can play a major role in AT&C loss reduction and provide management of distribution utilities. The IT task force clearly laid out a plan for introduction of IT on a large scale in the power distribution sector. The task force recommendation should be implemented. It is also suggested that the incentive fund under APDRP should be re-deployed for promoting cost effective IT in the entire distribution sector.

3.4 Customer Indexing & GIS based Database

Customer indexing is absent in most of the utilities. This is a major impediment for any reform in the sector. Consumer indexing has been done by some utilities but incomplete. Consumer indexing based on GIS application needs to be given priority in the 11 th Plan.

3.5 Load Management

In the scenario of energy and peak shortages, load management plays a very important role for efficient use of energy. Feeder separation programme needs to be given a major push in those states where agricultural consumption is more than 20%. In addition SCADA/DA should be introduced in all the million plus towns by the end of 11 th Plan.

3.6 Demand Side Management and Energy Efficiency

Using of energy efficient devices should be incentivised. The focus should be on use of efficient pumpsets in the agricultural sector. Use of CFL lighting etc. should be encouraged. An awareness campaign should be launched to educate stakeholders at all levels and quantifiable targets should be fixed to improve energy efficiency gains.

3.7 Reliability Monitoring of Power Distribution System

Present reliability of power is carried out by CEA in terms of outages of 11 kV feeders on monthly basis in respect of State capitals and major urban

conglomeration. There are number of reliability indices which are in practice internationally. The international practices should be adopted for proper monitoring of reliability. The reliability monitoring is to be gradually brought in line with the world practice i.e. to measure the outage in terms of consumer hours and number of consumer interruptions. The reliability monitoring will become more fruitful once "Consumer Indexing", i.e., linking of every consumer to the feeder is completed by all the Discoms / SEBs and will provide a direct index for customer satisfaction.

3.8 Distribution Network Planning

Inadequate network planning is one of the reasons for haphazard and scientific development of the distribution system. The utility should move to proper distribution network planning both for demand forecasting on medium and long term basis and for determining need for system expansion and improvement to meet the load growth. Utility should prepare perspective network plan for 10 year period and this should become part of the conditionalities for sanction of grants under various programmes.

3.9 Energy Accounting & Auditing

Energy Accounting & Auditing is done in many utilities but not comprehensive. In absence of complete energy accounting and auditing, the system losses can not be measured accurately and also identification of areas of losses becomes difficult. 11th Plan should make efforts to standardize energy accounting and auditing practices and incentivize utilities undertakings complete accounting and auditing exercise.

(D) ASSESSMENT OF FINANCIAL REQUIREMENTS

An estimate of the total fund requirement for generation, transmission & distribution sectors during 11th Plan as made by working group on power is as below :

(Rs. Millions)

Particulars	State	Central	Private	Total
Generation including Nuclear	12,37,920	20,20,670	8,50,370	41,08,960
DDG		2,00,000		2,00,000
R & M	1,58,750			1,58,750
Transmission	6,50,000	7,50,000		14,00,000
Distribution including Rural Electrification	28,70,000			28,70,000
HRD		4,620		4,620
R&D Outlay		12,140		12,140
DSM		6,530		6,530
Total Power Sector	49,16,670	29,93,960	8,50,370	87,61,000
NCES and Captive	2,25,000		9,30,000	11,55,000
Merchant Plants			4,00,000	4,00,000
Total Funds Requirements	51,41,670	29,93,960	21,80,370	1,03,16,000

Annex I

LIST OF PROJECTS PROPOSED FOR LIKELY BENEFITS DURING 11th PLAN

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
	NORTHERN REGION						
A	**CENTRAL SECTOR**						
	NHPC						
1	PARBATI - II	HP	NHPC	Under Construction	HYDRO	800	2010-12
2	CHAMERA-III	HP	NHPC	Under Construction	HYDRO	231	2010-11
3	PARBATI - III	HP	NHPC	Under Construction	HYDRO	520	2010-11
4	SEWA-II	J&K	NHPC	Under Construction	HYDRO	120	2009-10
5	URI-II	J&K	NHPC	Under Construction	HYDRO	240	2009-10
6	VYASI	UKND	NHPC	LOA to be Placed	HYDRO	120	2010-11
	SUB TOTAL (NHPC)					**2031**	
	NLC						
1	BARSINGSAR LIG	RAJ	NLC	Under Construction	LIGNITE	250	2008-09
2	BARSINGSAR EXT	RAJ	NLC	LOA to be Placed	LIGNITE	250	2010-11
	SUB TOTAL (NLC)					**500**	
	NPC						
1	RAPP U5&6	RAJ	NPC	Under Construction	NUCLEAR	440	2007-08
	SUB TOTAL (NPC)					**440**	
	NTPC						
1	KOL DAM	HP	NTPC	Under Construction	HYDRO	800	2008-10
2	LOHARI NAGPALA	UKND	NTPC	Under Construction	HYDRO	600	2011-12
3	TAPOVAN VISHNUGARH	UKND	NTPC	Under Construction	HYDRO	520	2011-12
4	DADRI EXT(U-5)	UP	NTPC	Under Construction	COAL	490	2009-10
5	DADRI EXT(U-6)	UP	NTPC	Under Construction	COAL	490	2009-10
6	BADARPUR-X U-1&2	DELHI	NTPC	LOA to be Placed	COAL	980	2010-11
7	TPS for DELHI/JHAJJAR	HAR	NTPC	Under Construction	COAL	1500	2010-12
	SUB TOTAL (NTPC)					**5380**	
	SJVNL						
1	RAMPUR	HP	SJVNL	Under Construction	HYDRO	412	2011-12
	SUB TOTAL (SJVNL)					**412**	
	THDC						
1	KOTESHWAR	UKND	THDC	Under Construction	HYDRO	400	2009-10
2	TEHRI PSS	UKND	THDC	LOA to be Placed	HYDRO	1000	2010-12
	TOTAL (THDC)					**1400**	
	SUB TOTAL CENTRAL SECTOR					**10163**	

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
B	**STATE & PRIVATE SECTOR**						
	HARYANA						
1	YAMUNA NAGAR	HAR	HPGCL	Under Construction	COAL	600	2007-08
2	HISSAR TPS	HAR	HPGCL	Under Construction	COAL	1200	2009-10
	SUB TOTAL (HARYANA)-State Sector					**1800**	
	HIMACHAL PRADESH						
1	UHL - III	HP	HPJVVNL	Under Construction	HYDRO	100	2009-10
2	SAWARA KUDDU	HP	PVC	Under Construction	HYDRO	110	2010-11
	SUB TOTAL (HP)-State Sector					**210**	
3	BUDHIL	HP	LANCO IPP	Under Construction	HYDRO	70	2009-10
4	ALLAIN DUHANGAN	HP	RSWML	Under Construction	HYDRO	192	2008-09
5	MALANA II	HP	EVREST PC	Under Construction	HYDRO	100	2009-10
6	KARCHAM WANGTOO	HP	JPKHCL	Under Construction	HYDRO	1000	2011-12
7	LAMBADUG	HP	IPP	LOA to be Placed	HYDRO	25	2010-11
8	SORANG	HP	SORAND PC	LOA to be Placed	HYDRO	100	2011-12
9	TIDONG-I	HP	PCP/IPP	LOA to be Placed	HYDRO	100	2011-12
10	TANGU ROMAI	HP	PCP/IPP	LOA to be Placed	HYDRO	50	2010-11
	SUB TOTAL (HP)-Private Sector					**1637**	
	SUB TOTAL (HP)					**1847**	
	JAMMU&KASHMIR						
1	BAGLIHAR-I	J&K	JKPDC	Under Construction	HYDRO	450	2007-08
	SUB TOTAL (J&K) State Sector					**450**	
	PUNJAB						
1	GH TPP-II	PUN	PSEB	Under Construction	COAL	500	2007-08
2	TALWANDI SABO	PUN	PSEB	LOA to be Placed	COAL	500	2011-12
	SUB TOTAL (PUN)-State Sector					**1000**	
3	UBDC- III	PUN	MALANA POWER	LOA to be Placed	HYDRO	75	2009-10
4	GOINDWAL SAHIB	PUN	GVK	LOA to be Placed	COAL	600	2011-12
	SUB TOTAL (PUN)-Private Sector					**675**	
	SUB TOTAL (PUNJAB)					**1675**	
	RAJASTHAN						
1	CHABRA TPS	RAJ	RRVUNL	Under Construction	COAL	500	2008-09
2	KOTA U7	RAJ	RRVUNL	Under Construction	COAL	195	2008-09
3	SURATGARH EXT	RAJ	RRVUNL	Under Construction	COAL	250	2008-09
4	KALISINDH TPS	RAJ	RRVUNL	LOA to be Placed	COAL	500	2011-12
5	DHOLPUR	RAJ	RRVUNL	Under Construction	GAS/LNG	110	2007-08
6	DHOLPUR	RAJ	RRVUNL	Under Construction	GAS/LNG	110	2007-08

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
7	GIRAL U-2	RAJ	RRVUNL	Under Construction	LIGNITE	125	2008-09
	SUB TOTAL (RAJASTHAN) State Sector					**1790**	
	UTTAR PRADESH						
1	PARICHHA EXT	UP	UPRVUNL	Under Construction	COAL	500	2009-10
2	HARDUAGANJ	UP	UPRVUNL	Under Construction	COAL	500	2009-10
3	ANPARA-D	UP	UPRVUNL	LOA to be Placed	COAL	1000	2011-12
4	OBRA REP	UP	UPRVUNL	LOA to be Placed	COAL	500	2011-12
	SUB TOTAL (UP)-State Sector					**2500**	
5	ANPARA-C	UP	LANCO	LOA to be Placed	COAL	1000	2010-12
6	BARA	UP	IPP	LOA to be Placed	COAL	500	2011-12
	SUB TOTAL (UP)-Private Sector					**1500**	
	SUB TOTAL (UP)					**4000**	
	UTTARAKHAND						
1	MANERI BHALI	UKND	UJVNL	Under Construction	HYDRO	304	2007-08
	SUB TOTAL (UKND)-State Sector					**304**	
2	SRINAGAR	UKND	GVK	Under Construction	HYDRO	330	2011-12
	SUB TOTAL (UKND)-Private Sector					**330**	
	SUB TOTAL (UTTARAKHAND)					**634**	
	SUB TOTAL (CENTRAL SECTOR)					**10163**	
	SUB TOTAL (STATE SECTOR)					**8054**	
	SUB TOTAL (PRIVATE SECTOR)					**4142**	
	TOTAL (NORTHERN REGION)					**22359**	
	WESTERN REGION						
A	**CENTRAL SECTOR**						
	NHDC						
1	OMKARESHWAR	MP	NHDC	Under Construction	HYDRO	520	2007-08
	SUB TOTAL (NHDC)					**520**	
	NTPC						
1	SIPAT-II U 4 & 5	CHG	NTPC	Under Construction	COAL	1000	2007-08
2	RATNAGIRI (DHABOL) JV	MAH	NTPC	Under Construction	GAS/LNG	740	2007-08
3	SIPAT I	CHG	NTPC	Under Construction	COAL	1980	2007-09
4	BHILAI JV	CHG	NTPC	Under Construction	COAL	500	2007-08
5	KORBA III	CHG	NTPC	Under Construction	COAL	500	2009-10
6	MAUDA	MAH	NTPC	LOA to be Placed	COAL	1000	2011-12
	SUB TOTAL (NTPC)					**5720**	
	SUB TOTAL (CENTRAL SECTOR)					**6240**	

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
B	**STATE & PRIVATE SECTOR**						
	CHHATTISGARH						
1	KORBA EAST EXT U2	CHG	CSEB	Under Construction	COAL	250	2007-08
2	KORBA WEST EXT	CHG	CSEB	LOA to be Placed	COAL	600	2009-10
	SUB TOTAL-state sector					850	
3	RAIGARH TPP-I	CHG	JIN. POWER	Under Construction	COAL	250	2007-08
4	RAIGARH PH II	CHG	JIN. POWER	Under Construction	COAL	750	2007-08
5	PATHADI (LANCO) U1	CHG	LANCO-IPP	Under Construction	COAL	300	2008-09
6	PATHADI (LANCO) U2	CHG	LANCO-IPP	Under Construction	COAL	300	2009-10
	SUB TOTAL-Private Sector					**1600**	
	SUB TOTAL (CHG)					**2450**	
	GUJARAT						
1	UKAI EXT	GUJ	GSECL	LOA to be Placed	COAL	500	2011-12
2	SIKKA EXT	GUJ	GSECL	Under Construction	COAL	500	2009-11
3	DHUVRAN	GUJ	GSECL	Under Construction	GAS/LNG	40	2007-08
4	UTRAN	GUJ	GSECL	Under Construction	GAS/LNG	350	2009-10
5	SURAT LIGNITE EXT	GUJ	GIPCL	Under Construction	LIGNITE	250	2008-09
6	KUTCH LIGNITE TPS	GUJ	GSECL	Under Construction	LIGNITE	75	2007-08
	SUB TOTAL-State Sector					**1715**	
7	SUGEN TORRENT	GUJ	TORRENT	Under Construction	GAS/LNG	376	2007-08
8	SUGEN TORRENT	GUJ	TORRENT	Under Construction	GAS/LNG	752	2007-08
	SUB TOTAL-Private Sector					**1128**	
	SUB TOTAL (GUJARAT)					**2843**	
	MAHARASHTRA						
1	GHATGHAR PSS	MAHA	GOMID	Under Construction	HYDRO	250	2007-08
2	PARLI EXT U-2	MAH	MAHA GEN	Under Construction	COAL	250	2009-10
3	PARAS EXT U1 &2	MAH	MAHA GEN	Under Construction	COAL	500	2007-10
4	KHAPER KHEDA EX	MAH	MAHA GEN	Under Construction	COAL	500	2009-10
5	BHUSAWAL	MAH	MAHA GEN	Under Construction	COAL	1000	2010-11
6	KORADI REP& OTHERS	MAH	MAHA GEN	LOA to be Placed	COAL	500	2010-11
7	KORADI EXT	MAH	MAHA GEN	LOA to be Placed	COAL	1000	2011-12
8	CHANDRAPUR	MAH	MAHA GEN	LOA to be Placed	COAL	500	2010-11
	SUB TOTAL -State Sector					**4500**	

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
9	TROMBAY TPS	MAH	TATAPOWER	Under Construction	COAL	250	2008-09
	SUB TOTAL -Private Sector					**250**	
	SUB TOTAL (MAHARASHTRA)					**4750**	
	MADHYA PRADESH						
1	BIRSINGHPUR ETN.	MP	MPGENCO	Under Construction	COAL	500	2007-08
2	AMARKANTAK	MP	MPGENCO	Under Construction	COAL	210	2007-08
3	MALWA	MP	MPGENCO	LOA to be Placed	COAL	1000	2011-12
4	SATPURA EXT	MP	MPGENCO	LOA to be Placed	COAL	500	2011-12
	SUB TOTAL-State Sector					**2210**	
5	MAHESHWAR	MP	IPP	Under Construction	HYDRO	400	2010-11
6	ULTRA MEGA SASAN	MP	LANCO	LOA to be Placed	COAL	660	2011-12
	SUB TOTAL-Private Sector					**1060**	
	SUB TOTAL (MP)					**3270**	
	SUB TOTAL (CENTRAL SECTOR)					**6240**	
	SUB TOTAL (STATE SECTOR)					**9275**	
	SUB TOTAL (PRIVATE SECTOR)					**4038**	
	TOTAL (WESTERN REGION)					**19553**	
	SOUTHERN REGION						
A	**CENTRAL SECTOR**						
	NLC						
1	TUTICORIN JV	TN	NLC	LOA to be Placed	COAL	1000	2010-12
2	NEYVELI - II LIG	TN	NLC	Under Construction	LIGNITE	500	2008-09
	SUB TOTAL (NLC)					**1500**	
	NPC						
1	KUDANKULAM U 1,2	TN	NPC	Under Construction	NUCLEAR	2000	2008-10
2	PFBR(Kalapakkam)	TN	NPC	Under Construction	NUCLEAR	500	2010-11
3	KAIGA U- 3	KAR	NPC	Commissioned	NUCLEAR	220	2007-08
4	KAIGA U- 4	KAR	NPC	Under Construction	NUCLEAR	220	2007-08
	SUB TOTAL (NPC)					**2940**	
	NTPC						
1	SIMHADRI-EXT	AP	NTPC	Under Construction	COAL	1000	2011-12
2	ENNORE-JV	TN	NTPC	LOA to be Placed	COAL	1000	2010-11
	SUB TOTAL (NTPC)					**2000**	
	SUB TOTAL (CENTRAL SECTOR)					**6440**	
B	**STATE & PRIVATE SECTOR**						
	ANDHRA PRADESH						
1	JURALA PRIYADARSHNI	AP	APGENCO	Under Construction	HYDRO	117	2007-08
2	JURALA PRIYADARSHNI	AP	APGENCO	Under Construction	HYDRO	117	2008-09

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
3	NAGARJUNA SAGAR TR	AP	APGENCO	Under Construction	HYDRO	50	2009-10
4	LOWER JURALA	AP	APGENCO	LOA to be Placed	HYDRO	240	2011-12
5	RAYALSEEMA U4	AP	APGENCO	Under Construction	COAL	210	2007-08
6	KAKTIYA (BHOPALAPALLY)	AP	APGENCO	Under Construction	COAL	500	2009-10
7	VIJAYWADA TPP	AP	APGENCO	Under Construction	COAL	500	2008-09
8	KOTHAGUDEM ST-V	AP	APGENCO	Under Construction	COAL	500	2009-10
9	KAKATIYA EXT	AP	APGENCO	LOA to be Placed	COAL	500	2011-12
10	KRISHNAPATNAM	AP	APGENCO	LOA to be Placed	COAL	800	2011-12
	SUB TOTAL -State Sector					**3534**	
11	KONASEEMA	AP	OAKWELL	Under Construction	GAS/LNG	445	2007-08
12	GAUTAMI	AP	GAUTAMI POW	Under Construction	GAS/LNG	464	2007-08
	SUB TOTAL -Private Sector					**909**	
	SUB TOTAL (AP)					**4443**	
	TAMIL NADU						
1	NORTH CHENNAI EXT	TN	TNEB	LOA to be Placed	COAL	500	2010-11
2	METTUR EXT	TN	TNEB	LOA to be Placed	COAL	500	2010-11
3	VALUTHUR EXT	TN	TNEB	Under Construction	GAS/LNG	92	2007-08
4	BHAWANI BARRAGE II & III	TN	TNEB	Under Construction	HYDRO	60	2009-11
	SUB TOTAL -State Sector					**1152.2**	
	SUB TOTAL (TN)					**1152**	
	KERALA						
1	ATHIRAPALLI	KERL	KSEB	Under Construction	HYDRO	163	2010-11
2	KUTAYADI EXT.	KERL	KSEB	Under Construction	HYDRO	100	2008-09
3	PALLIVASAL	KERL	KSEB	Under Construction	HYDRO	60	2010-11
4	MANKULAM	KERL	KSEB	LOA to be Placed	HYDRO	40	2010-11
5	THOTTIAR	KERL	KSEB	LOA to be Placed	HYDRO	40	2010-11
	SUB TOTAL -State Sector					**403**	
	SUB TOTAL (KERALA)					**403**	
	KARNATAKA						
1	VARAHI EXTN.	KAR	KPCL	Under Construction	HYDRO	230	2008-09
2	BELLARY	KAR	KPCL	Under Construction	COAL	500	2007-08
3	BELLARY TPS U-2	KAR	KPCL	Under Construction	COAL	500	2010-11
4	RAICHUR U 8	KAR	KPCL	Under Construction	COAL	250	2009-10
	SUB TOTAL -state sector					1480	
5	TORANGALLU	KAR	JINDAL	Under Construction	COAL	600	2009-10
	SUB TOTAL -Private Sector					**600**	
	SUB TOTAL (KARNATAKA)					**2080**	
	SUB TOTAL (CENTRAL SECTOR)					**6440**	
	SUB TOTAL (STATE SECTOR)					**6569**	
	SUB TOTAL (PRIVATE SECTOR)					**1509**	
	TOTAL (SOUTHERN REGION)					**14518**	

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
EASTERN REGION							
A	**CENTRAL SECTOR**						
	DVC						
1	MEJIA U-6	WB	DVC	Under Construction	COAL	250	2007-08
2	CHANDRAPUR	JHAR	DVC	Under Construction	COAL	500	2007-08
3	MEJIA PH II (DELHI)	WB	DVC	Under Construction	COAL	1000	2009-11
4	BOKARO EXP	JHAR	DVC	LOA to be Placed	COAL	500	2010-11
5	KODERMA U1&2 (DELHI)	JHAR	DVC	Under Construction	COAL	1000	2010-11
6	DURGAPUR STEEL	WB	DVC	LOA to be Placed	COAL	1000	2010-12
7	MAITHAN RBC	JHAR	DVC	LOA to be Placed	COAL	1000	2010-12
	SUB TOTAL (DVC)					**5250**	
	NHPC						
1	TEESTA V	SIKKIM	NHPC	Under Construction	HYDRO	510	2007-08
2	TEESTA LOW DAM-III	WB	NHPC	Under Construction	HYDRO	132	2008-09
3	TEESTA LOW DAM-IV	WB	NHPC	Under Construction	HYDRO	160	2009-10
	SUB TOTAL (NHPC)					**802**	
	NTPC						
1	KAHALGAON II U6,7	BIH	NTPC	Under Construction	COAL	1000	2007-08
2	BARH-I	BIH	NTPC	Under Construction	COAL	1980	2009-11
3	FARAKKA STAGE-III	WB	NTPC	Under Construction	COAL	500	2010-11
4	BARH II	BIH	NTPC	LOA to be Placed	COAL	1320	2011-12
5	NABINAGAR	BIH	NTPC	LOA to be Placed	COAL	750	2010-12
6	NORTH K PURA	JHAR	NTPC	LOA to be Placed	COAL	1320	2011-12
	SUB TOTAL (NTPC)					**6870**	
	SUB TOTAL (CENTRAL SECTOR)					**12922**	
B	**STATE & PRIVATE SECTOR**						
	ORRISSA						
1	BALIMELA ST-II	ORRISA	OHPC	Under Construction	HYDRO	150	2007-08
	SUB TOTAL -State Sector					**150**	
	SUB TOTAL (ORRISSA)					**150**	
	SIKKIM						
1	CHUJACHEN	SIKKIM	GATI	Under Construction	HYDRO	99	2009-10
2	SADAMANDER	SIKKIM	GATI	LOA to be Placed	HYDRO	71	2009-10
3	BHASMEY	SIKKIM	GATI	LOA to be Placed	HYDRO	51	2010-11
4	TEESTA III	SIKKIM	TEESTA URJA	Under Construction	HYDRO	600	2011-12
	SUB TOTAL -Private Sector					**821**	
	SUB TOTAL (SIKKIM)					**821**	

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
	WEST BENGAL						
1	PURLIA PSS	WB	WBSEB	Commissioned Under Construction	HYDRO	225 675	2007-08 2007-08
2	DURGAPUR EXT	WB	DPL	Under Construction	COAL	300	2007-08
2	SAGARDIGHI U 1,2	WB	WBPDCL	Under Construction	COAL	600	2007-08
3	SANTALDIH U5	WB	WBPDCL	Under Construction	COAL	250	2007-08
4	BAKRESHWAR U 4	WB	WBPDCL	Under Construction	COAL	210	2007-08
5	BAKRESHWAR U 5	WB	WBPDCL	Under Construction	COAL	210	2007-08
6	SAGARDIGHI EXT	WB	WBPDCL	LOA to be Placed	COAL	1000	2010-12
7	SANTHALDIH EXT (U 6)	WB	WBPDCL	Under Construction	COAL	250	2009-10
	SUB TOTAL -State Sector					**3720**	
8	BUDGE-BUDGE EXT	WB	CESC	Under Construction	COAL	250	2009-10
	SUB TOTAL -Private Sector					**250**	
	SUB TOTAL (WB)					**3970**	
	SUB TOTAL (CENTRAL SECTOR)					**12922**	
	SUB TOTAL (STATE SECTOR)					**3870**	
	SUB TOTAL (PRIVATE SECTOR)					**1071**	
	TOTAL (EASTERN REGION)					**17863**	
	NORTH EASTERN REGION						
A	**CENTRAL SECTOR**						
	NEEPCO						
1	KAMENG	AR.PR.	NEEPCO	Under Construction	HYDRO	600	2010-11
	TOTAL (NEEPCO)					**600**	
	NHPC						
1	SUBANSIRI LOWER	AR.PR.	NHPC	Under Construction	HYDRO	2000	2011-12
	SUB TOTAL (NHPC)					**2000**	
	NTPC						
1	BONGAIGAON	ASSAM	NTPC	LOA to be Placed	COAL	750	2010-12
	SUB TOTAL (NTPC)					**750**	
	ONGC						
1	TRIPURA GAS ILFS	TRI	ONGC	LOA to be Placed	GAS/LNG	750	2009-10
	SUB TOTAL (ONGC)					**750**	
	SUB TOTAL (CENTRAL SECTOR)					**4100**	
B	**STATE & PRIVATE SECTOR**						
	ASSAM						
1	LAKWA WH	ASM	ASGENCO	Under Construction	GAS/LNG	37	2008-09
	SUB TOTAL (ASSAM)					**37**	
	MEGHALYA						
1	MYNTDU St-I	MEGH	MeSEB	Under Construction	HYDRO	84	2008-09
2	NEW UMTRU	MEGH	MeSEB	LOA to be Placed	HYDRO	40	2010-11

Sl. No.	Plant Name	State	Agency	Category	Type	Benefits 11th Plan (2007-12)	Likely Year of Benefit
	SUB TOTAL (MEGHALYA)					**124**	
	NAGALAND						
1	DIMAPUR DG	NAGA-LAND	ELECT. DEPT.	Under Construction	GAS/LNG	23	2009-10
	SUB TOTAL (NAGALAND)					**23**	
	SUB TOTAL (STATE SECTOR)					**184**	
	SUB TOTAL (CENTRAL SECTOR)					**4100**	
	SUB TOTAL (STATE SECTOR)					**184**	
	SUB TOTAL (PRIVATE SECTOR)					**0**	
	TOTAL (NORTH-EASTERN REGION)					**4284**	
	ALL-INDIA SUMMARY						
	CENTRAL SECTOR					**39865**	
	STATE SECTOR					**27952**	
	PRIVATE SECTOR					**10760**	
	TOTAL (ALL-INDIA)					**78577**	

Annex II

LIST OF BEST EFFORTS PROJECTS PROPOSED FOR LIKELY BENEFITS DURING 11th PLAN

Sl. No.	Plant Name	Region	State	Agency	Sector	Ultimate Capacity (Mw)	Fuel Type	Benefits 11th Plan (2007-12)	Likely Year Of Benefit
1	RIHAND-X	Northern	UP	NTPC	C	500	COAL	500	2011-12
2	NORTH K PURA	Eastern	JHA	NTPC	C	660	COAL	660	2011-12
3	INTEGRATED PROJECT DARIPALI	Eastern	ORISSA	NTPC	C	3200	COAL	800	2011-12
4	NABINAGAR	Eastern	BIHAR	NTPC	C	1000	COAL	250	2011-12
5	BOKARO STEEL	Eastern	JHA	DVC	C	500	COAL	500	2011-12
6	RAGHUNATH PUR	Eastern	WB	DVC	C	1000	COAL	1000	2011-12
7	MARGHERITA	North Eastern	ASS	NEEPCO	C	480	COAL	480	2011-12
8	CHHABRA II	Northern	RAJ	RRVUNL	S	500	COAL	500	2011-12
9	GUJARAT LIGNITE	Western	GUJARAT	NLC JV	S	1000	LIGNITE	1000	2011-12
10	DPL TPS U7A	Eastern	WB	WBPDCL	S	300	COAL	300	2011-12
11	DPL TPS U8	Eastern	WB	WBPDCL	S	500	COAL	500	2011-12
12	BAKRESHWAR EXT	Eastern	WB	WBPDCL	S	500	COAL	500	2011-12
13	MUZAFFARPUR EXT	Eastern	BIHAR	VAISHALI POWER	S	500	COAL	500	2011-12
14	ROSA	Northern	UP	ROSA POWER	P	600	COAL	600	2011-12
15	BHAIYATHAN	Western	CHG	IPP	P	1600	COAL	800	2011-12
16	LANCO NAGARJUNA	Southern	KAR	NPCL-IPP	P	1015	COAL	1015	2011-12
17	HALDIA PH I	Eastern	WB	CESC	P	600	COAL	600	2011-12
18	MALAXMI	Eastern	ORISSA	NAVABHARAT POWER	P	1040	COAL	1040	2011-12
	TOTAL (BEST EFFORTS)							**11545**	

C: Central Sector; S: State Sector; P: Private Sector; LC: Load Center; PH: Pit Head; PH-LIG: Lignite based

Annex III

LIST OF ADDITIONAL PROJECTS PROPOSED BY STATES IN CHIEF SECRETARIES CONFERENCE ON 23rd - 24th APRIL 2007

Sl. No.	Name of Project	State	Agency	Capacity (MW)	Fuel Type
1	MATANTAIL (JHAJJAR)	HARYANA	IPP-CBR	1200	COAL
	SUB TOTAL			**1200**	
1	BAGLIHAR - II	JAMMU KASHMIR	JKPDCL	450	HYDRO
	SUB TOTAL			**450**	
1	TALWANDI SABO	PUNJAB	IPP-CBR	700	COAL
2	NABHA	PUNJAB	IPP-CBR	1200	COAL
	SUB TOTAL			**1900**	
1	CHHABRA ST-III	RAJASTHAN	RRVUNL	500	COAL
2	KAWAI	RAJASTHAN	IPP-CBR	1000	COAL
	SUB TOTAL			**1500**	
1	ROSA	UTTAR PRADESH	REL. ENERGY	600	COAL
	SUB TOTAL			**600**	
1	MARWA	CHATTISGARH	CSEB	1000	COAL
2	BHAIYATHAN	CHATTISGARH	IPP-CBR	1500	COAL
3	IFFCO SARGUJA JV	CHATTISGARH	JV	1000	COAL
4	KORBA SOUTH	CHATTISGARH	CSEB	1000	COAL
	SUB TOTAL			**4500**	
1	PIPAVAV	GUJARAT	GPPC	700	GAS
2	HAZIRA	GUJARAT	GSEB	360	GAS
3	DHUVARAN ST-III	GUJARAT	GSECL	360	GAS
4	MUNDRA CBR	GUJARAT	ADANI-CBR	2000	IMP. COAL
5	PIPAVAV	GUJARAT	TORRENT	900	IMP. COAL
6	PRAYAG COAL CBR	GUJARAT	IPP-CBR	200	COAL REJ.
7	GHOGHA	GUJARAT	GPCL	500	LIGNITE
8	SOUTH GUJARAT	GUJARAT	NLC GPCL JV	900	LIGNITE
9	VADINAR CBR	GUJARAT	ESSAR-CBR	1000	IMP. COAL
	SUB TOTAL			**6920**	
1	SHAHPURA CBR	MADHYA PRADESH	IPP-CBR	1200	COAL
	SUB TOTAL			**1200**	

Sl. No.	Name of Project	State	Agency	Capacity (MW)	Fuel Type
1	RAYALSEEMA	ANDHRA PRADESH	APGENCO	710	COAL
2	KRISHNAPATANAM	ANDHRA PRADESH	APGENCO	800	COAL
3	PULICHITLA	ANDHRA PRADESH	APID	120	HYDRO
4	SINGAREDDI	ANDHRA PRADESH	APID	200	HYDRO
	SUB TOTAL			**1830**	
1	ACHENKOVIL	KERALA	KSEB	30	HYDRO
2	CHINNAR	KERALA	KSEB	28	HYDRO
3	PAMBAR	KERALA	KSEB	40	HYDRO
	SUB TOTAL			**98**	
1	ENNORE EXT	TAMIL NADU	TNEB	500	COAL
2	TUTICORIN EXT	TAMIL NADU	TNEB	1000	COAL
3	BHAWANI BARRAGE	TAMIL NADU	TNEB	20	HYDRO
4	KUNDAH PSS	TAMIL NADU	TNEB	500	HYDRO
5	SMALL HYDRO	TAMIL NADU	TNEB	75	HYDRO
	SUB TOTAL			**2095**	
1	BARAUNI	BIHAR	NTPC JV	500	COAL
	SUB TOTAL			**500**	
1	TALCHER	ORISSA	OPGC	420	COAL
	SUB TOTAL			**420**	
1	TENUGHAT	JHARKHAND	TVNL	630	COAL
	SUB TOTAL			**630**	
1	TEESTA VI	SIKKIM	LANCO	500	HYDRO
2	PANAN	SIKKIM	HIMGIRI	300	HYDRO
3	RONGNICHU	SIKKIM	MPEB	96	HYDRO
4	ROLEP	SIKKIM	ATPIL	36	HYDRO
5	RALONG	SIKKIM	ATPIL	40	HYDRO
6	CHAKUNG CHU	SIKKIM	ATPIL	50	HYDRO
7	RANGIT IV	SIKKIM	JAL POWER	120	HYDRO
8	DIKCHU	SIKKIM	SNEHA KINETIC	96	HYDRO
9	JORETHANG LOOP	SIKKIM	DANS ENERGY	96	HYDRO
	SUB TOTAL			**1334**	
1	DURGAPUR EXT. U-7A	WEST BENGAL	DPL	300	COAL
	SUB TOTAL			**300**	

Sl. No.	Name of Project	State	Agency	Capacity (MW)	Fuel Type
1	SMALL HYDRO	ARUNACHAL PRADESH	SED	70	HYDRO
	SUB TOTAL			**70**	
1	NAMRUP REPL.	ASSAM	ASGENCO	100	GAS
	SUB TOTAL			**100**	
1	GANOL	MEGHALYA	MESEB	25	HYDRO
	SUB TOTAL			**25**	
1	BARAMURA & ROKHIA	TRIPURA	TSECL	145	GAS
	SUB TOTAL			**145**	
	TOTAL ALL INDIA			**25817**	
	SUMMARY OF LIKELY CAPACITY ADDITION IN 11TH PLAN				
	FEASIBLE PROJECTS AS PER CEA			**78577**	
	ADDITIONAL PROJECTS PROPOSED BE STATES			**25817**	
	TOTAL			**104394**	
	Addition Projects in above include:				
	(i) Gas Projects Totalling to 3065 MW in Gujarat (1420 MW), Delhi (1400 MW) & North East (245 MW).				
	(ii) Hydro Projects Totalling to 2912 MW in Sikkim (1334 MW), Tamil Nadu (670 MW) & Andhra Pradesh (320 MW), etc.				
	A. Additional Gas Projects Totalling to 4364 MW Identified, Andhra Pradesh 2964 MW, Delhi 1400 MW (Subject to availability of Gas).				
	B. Of above additional projects about 3200 MW already included as best effort projects by CEA.				

Annex IV

LIST OF PROJECTS CONSIDERED DOABLE IN 11TH PLAN – OUT OF THE LIST OF ADDITIONAL PROJECTS SUPPLIED BY THE STATES DURING CHIEF SECRETARIES CONFERENCE ON 23RD - 24TH APRIL, 2007

Sl. No.	Project	State	Capacity (MW)	Status
	HYDRO PROJECTS			
1.	PULICHINTALA	ANDHRA PRADESH	120	DAM UNDER CONSTRUCTION, E&M ORDER PLACED
2.	TEESTA VI	SIKKIM	600	LOA PLACED
	TOTAL HYDRO		**720**	
	THERMAL PROJECTS			
1.	MARWA	CHHATISGARH/CSEB	1000	DPR READY, MOEF CLEARANCE APPLIED
2.	RAYALSEEMA U5	ANDHRA PRADESH	210	LOI PLACED IN APRIL 2007
3.	GOGHA LIGNITE	GUJARAT / JV	500	DPR LIKELY BY 6/07
4.	DURGAPUR EXTN 7A	WEST BENGAL	300	MOEF CLEARANCE OBTAINED
5.	MATANJALI, JHAJJAR	HARYANA	600	PROJECT THROUGH CBR, CASE II
6.	ROSA	UP/ REL	600	LOA PLACED, ALREADY INCLUDED IN BEST EFFORT LIST
7.	ENNORE EXTN.	TAMIL NADU	500	EIA STUDIES IN PROGRESS
	TOTAL THERMAL		**3710**	
	TOTAL (HYDRO +THERMAL)		**4430**	
	GAS BASED PROJECTS (SUBJECT TO AVAILABILITY OF GAS)			
1.	PIPAVAV	GUJARAT/GPPC	700	DPR READY, MOEF CLEARANCE APPLIED
2.	HAZIRA	GUJARAT/GSEB	360	DPR READY, MOEF CLEARANCE APPLIED
3.	DHUVARAN STAGE III	GUJARAT/GSECL	360	DPR UNDER PREPARATION
	TOTAL		**1420**	
	GRAND TOTAL		**5850**	

Annex V

LIST OF ADDITIONAL GAS BASED PROJECTS FOR LIKELY BENEFITS DURING 11TH PLAN

Sl. No.	Plant Name	State	Agency	Sector	Likely Benefits (MW)
1	KAYAMKULAM	KERL	NTPC	C	**1950**
2	KAWAS II	GUJ	NTPC	C	**1300**
3	GANDHAR II	GUJ	NTPC	C	**1300**
4	PRAGATI II	DELHI	PRAGATI POWER	S	**330**
5	PRAGATI III (BAWANA)	DELHI	PRAGATI POWER	S	**1000**
6	RELIANCE-DADRI	UP	RELIANCE ENERGY	P	**5600**
7	ESSAR HAZIRA	GUJ	ESSAR POWER	P	**1500**
	TOTAL				**12980**