Chapter 1

DEMAND FOR POWER AND GENERATION PLANNING

1.1 REVIEW OF CAPACITY ADDITION DURING 11TH PLAN

During the 11th Plan, significant achievements in capacity addition have taken place as compared to any previous Plan period. The total capacity addition during the 11th Plan has been the highest so far as compared to any previous Plan period. The capacity addition of 12,160 MW during 2010-11 has also been the highest during any previous single year. Thus, 11th Plan may be considered as a transitional Plan to achieve higher generation capacity additions in the country in the future.

The total Installed Capacity at the beginning of the 11th Plan i.e. 1.4.2007 was 1,32,330 MW comprising 34,654 MW Hydro, 86,015 MW Thermal (including Gas and Diesel), 3,900 MW Nuclear and 7,761 MW from Renewable Energy Sources. With this Installed capacity, the country faced peak shortages of 13,897 MW (13.8%) and energy shortage of 66,092 MU or 66 BU (9.6%) at the beginning of 11th Plan.

With a view to plan the future capacity addition requirement to meet the forecasted demand, planning studies were carried out to assess the additional capacity required to meet the demand in full by the end of the 11th Plan. It was assessed that a capacity addition of about 82,000 MW would be required during the 11th Plan including creating a spinning reserve of 5% in the system. Based on the Report of the Working Group on Power for the 11th Plan submitted to the Planning Commission, and taking into account the resources available, the target for capacity addition during 11th Plan was set at 78,700 MW comprising 15,627 MW Hydro, 59,693 MW Thermal and 3,380 MW Nuclear. The sector wise, type wise Summary of this capacity addition target is given in Table 1.1 below:

Table 1.1

11TH PLAN CAPACITY ADDITION TARGET-SECTOR WISE

(Figures in MW)

SOURCE	Central	State	Private	TOTAL
Hydro	8,654	3,482	3,491	15,627
Thermal	24,840	23,301	11,552	59,693
Nuclear	3,380	-	-	3,380
Total	36,874	26,783	15,043	78,700

Region wise/ Sector wise Summary of this capacity addition target of 78,700 MW is furnished in **Appendix 1.1**.

The goal of capacity addition of 78,700 MW during the 11th Plan was a great challenge to the central, state and private sector generating companies. MOP and CEA formulated a strategy for achieving the planned target of capacity addition during the 11th Plan and carried out rigorous monitoring of the progress of construction of the various projects. The efforts of CEA and MOP have yielded good results. Critical projects not making satisfactory progress were identified and focused efforts were made to resolve the constraints being faced in their implementation. However, in spite of best efforts by Project Authorities, MOP and CEA, few projects are still likely to slip from the 11th Plan target. At the same time, action has also been taken to add new additional capacity which was not initially included in the target for the 11th plan. This was done to supplement the capacity addition as some of the plants included in the target are likely to slip.

1.1.1 Mid Term Appraisal Target for 11th Plan

The target set for capacity addition during the 11th Plan was 78,700 MW. As per Mid Term Appraisal (MTA) of Planning Commission, certain projects totalling to 21,802 MW were likely to slip from 11th Plan on account of various reasons viz. delay in placement of order for main plant, slow progress of civil work, poor geology etc. Further, certain additional projects which were originally not included in the 11th Plan target were identified for benefits during 11th Plan by expediting the process of project implementation and compression of the construction schedule. This has been possible through sustained efforts made by Ministry of Power & CEA in pursuing the developers and other Stake holders. These additional projects total to 5,156 MW.

Based on the above, capacity addition likely during 11th plan as per Mid Term Appraisal (MTA) was fixed as 62,374 MW. A Summary of the likely slippages and additional projects identified is given in Table 1.2 below:

Table 1.2

SUMMARY OF CAPACITY SLIPPING / ADDITIONAL CAPACITY FOR LIKELY BENEFITS DURING 11TH PLAN

(Figures in MW)

11th Plan Capacity Addition Target (A)		**78,700**
Slipped From Target (B)		**21,802**
Balance Capacity (C)		**56,898**
Change in Capacity of projects as included in Target (D)		**320**
Increase in capacity of Anpara C	**200**	
Increase in capacity of Sugen CCGT	**20**	
Increase in capacity of Mettur Ext	**100**	
Additional Capacity Likely during 11th Plan Outside Target (E)		**5,156**
Total Capacity (F) = (C+D+E)		**62,374**

Thus capacity addition likely during 11th Plan as per Mid Term Appraisal (MTA) is 62,374 MW. A Sector wise Summary of this capacity addition target of 62,374 MW is furnished in **Appendix 1.2** and consolidated Project-wise list of projects for 78,700 MW, 62,374 MW and likely addition is furnished in **Appendix 1.3.** Reasons for projects slipping from 78,700 MW target viz-a-viz

62,374 MW totaling to 21,802 MW are furnished in **Appendix 1.4.** List of additional projects (i.e. outside target) totaling to 5,156 MW is furnished in **Appendix 1.5**.

1.1.2 Actual Capacity Addition and Power Supply Position during 11th Plan

Year-wise Target and Actual Capacity Addition during 2007-08, 2008-09, 2009-10, 2010-11

A capacity addition of 34,462 MW has been achieved during the first four years of the 11th Plan. Year wise details of the targeted and actual capacity addition during 11th Plan up to 31.03.2011 is given in Table 1.3 below and the project wise details are given in **Appendix 1.6**:

Table 1.3

ALL INDIA TARGET AND ACTUAL CAPACITY ADDITION DURING 11TH PLAN UPTO 31.3.2011

(Figures in MW)

Year (MW)	Type	Target	Actual Achievement
2007-08	Hydro	2,372	2,423
	Thermal	9,007	6,620
	Coal	7,880	5,620
	Lignite	0	0
	Gas	1,127	1,000
	Nuclear	660	220
	Total	12,039	9,263
2008-09	Hydro	1,097	969
	Thermal	5,773	2,485
	Coal	3,820	2,010
	Lignite	200	0
	Gas	1,753	475
	Nuclear	660	0
	Total	7,530	3,454
2009-10	Hydro	845	39
	Thermal	13,002	9,106
	Coal	9,105	6,655
	Lignite	1375	335
	Gas	2,522	2,116
	Nuclear	660	440
	Total	14,507	9,585
2010-11	Hydro	1,346	690
	Thermal	17,793	11,251
	Coal	14,000	9,725
	Lignite	1,185	635
	Gas	2,608	891
	Nuclear	1,220	220
	Total	20,359	12161
Grand Total (Up to 31st March 2011)			34,462

Year-wise Actual Power Supply position during 2007-08, 2008-09, 2009-10 & 2010-11 of 11th plan is given in Table 1.4 below:

Table 1.4
ACTUAL POWER SUPPLY POSITION (ALL INDIA BASIS)

Year	Peak (MW)				Energy (MU)			
	Peak Demand (MW)	Peak Met (MW)	Peak Deficit/ Surplus (MW)	Peak Deficit/ Surplus (%)	Energy Requi-rment (MU)	Energy Avail-ability (MU)	Energy Deficit/ Surplus (MU)	Energy Deficit/ Surplus (%)
10TH PLAN END	**100715**	**86818**	**-13897**	**-13.8**	**690587**	**624495**	**-66092**	**-9.6**
2007-08	108866	90793	-18073	-16.6	739343	666007	-73336	**-9.9**
2008-09	109809	96785	-13024	-11.9	777039	691038	-86001	**-11.1**
2009-10	119,166	104,009	-15,157	-12.7	830,594	746,644	-83,950	**-10.1**
2010-11	**125,077**	**112,167**	**-12,910**	**-10.3**	**862,125**	**789,013**	**-73,112**	**-8.5**

1.1.3 Installed Capacity as on 31.3.2011

The total Installed Capacity as on 31.3.2011 was 1,73,626 MW comprising 37,567 MW Hydro, 1,12,824 MW Thermal including gas & diesel, 4,780 MW nuclear based power plants and 18,455 MW from renewable energy sources including wind. The sector– wise details of installed capacity is given in Table 1.5 below:

Table 1.5
SUMMARY OF INSTALLED CAPACITY AS ON 31.03.2011
(Figures in MW)

Sector	Hydro	Thermal				Nuclear	R.E.S@	. Total
		Coal	Gas	Diesel	Total			
STATE	**27,257.00**	**47,257.00**	**4,327.12**	**602.61**	**52,186.73**	**0.00**	**3,008.85**	**82,452.58**
PRIVATE	**1,425.00**	**12,616.38**	**6,677.00**	**597.14**	**19,890.52**	**0.00**	**15,445.67**	**36,761.19**
CENTRAL	**8,885.40**	**34,045.00**	**6,702.23**	**0.00**	**40,747.23**	**4,780.00**	**0.00**	**54,412.63**
TOTAL	**37,567.40**	**93,918.38**	**17,706.35**	**1,199.75**	**1,12,824.48**	**4,780.00**	**18,454.52@**	**1,73,626.40**

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 and Solar Power.

Power supply position during 2007-08, 2008-09, 2009-10 and 2010-11 of 11th plan shows peak deficit ranging from 10 to 17% and energy deficits ranging from 8 to 11%.

1.1.4 Actual/ Likely Capacity Addition during Eleventh Plan

A capacity of 34,462 MW has been commissioned during first four years of 11th Plan. Capacity addition programme during the year 2011-12 is 17,601 MW. The details of these projects are given in **Appendix-1.7** . With the addition of new projects and dropping of the projects likely to slip from the 11th Plan, even though stringent monitoring of projects has been done, the likely capacity addition during 11th Plan would be about 52,063 MW out of

which 34,462 MW has already been commissioned during 11th Plan as on 31.03.2011 and 7155.5 MW capacity has already been commissioned till 30.09.2011 during the year 2011-12 as detailed in **Appendix-1.8**. Thus the total capacity commissioned during 11th Plan till 30.09.2011 is 41,617.5 MW. In addition, during the 11th Plan, a capacity totalling to 10,694 MW has already been commissioned from Renewable Energy Sources as on 31.03.2011.

Gas based projects with shorter gestation period have also been initiated during 11th Plan in order to augment likely capacity addition during the Plan. Of these three projects (not included in 11th Plan target) with a total capacity of 1,763 MW (Vemagiri Exp CCGT 768 MW, LANCO Kondapalli Exp. CCGT 770 MW, & Sravanthi Ph-I CCGT 225 MW) are likely to be commissioned during 11th Plan, if gas is made available.

1.1.5 Likely Installed Capacity at the end of 11th Plan i.e. as on 31.03.2012

The installed capacity as on 31.3.2011 is 1,73,626 MW (including renewables) and the likely capacity addition from conventional sources during 2011-12 is 17,601 MW. Therefore likely Installed Capacity at the end of 11th Plan i.e. as on 31.03.2012 would be of the order of 1,91,227 MW. This does not include additional capacity likely from projects being advanced to 11th Plan and capacity addition from renewables during 2011-12.

1.1.6 Analysis of Reasons for 11th Plan Slippages

The target of 78,700 MW capacity additions during 11th Plan was revised to 62,374 MW as per the Mid Term Appraisal (MTA) of Planning Commission. The major reasons for slippage of power projects from the capacity addition target of 78,700 MW are as follows:

➢ Delay in placement of orders for Main plant	: 6,660 MW
➢ Delay in placement of orders for Civil works	: 1,860 MW
➢ Slow progress of Civil works	: 900 MW
➢ Poor Geology	: 4,432 MW
➢ Contractual dispute between project developer and contractor and their sub-vendors / sub-contractor	: 4,760 MW
➢ Delay in Land Acquisition	: 810 MW
➢ Environmental Concerns	: 1100 MW
➢ Law and Order Problem/Local Issues	: 580 MW
➢ E&M work critical	: 600 MW
➢ Difficult area and accessibility	: 100 MW
Total	**21802 MW**

As per the latest assessment, capacity addition likely during 11th Plan is 52,063 MW. Projects totalling to about 12,977 MW are likely to slip from the 62,374 MW capacity additions as per MTA. In addition projects totalling to 2,666 MW (some of this capacity has already been commissioned) not included in the capacity addition of 62,374 MW (i.e. capacity outside the MTA target) are likely to yield benefits during 11th Plan.

The main reasons for slippage of power plants from the likely capacity addition of 62,374 MW during 11th Plan, as per the Mid Term Appraisal of Planning Commission, to the 12th Five Year Plan are as follows:

- Slow progress of Civil works
- Poor Geology
- Flash Flood
- Local agitation
- R&R issues
- Law and Order problem
- Shortage of Manpower and difficult site conditions

1.2 DEMAND PROJECTIONS

Demand Projections form an essential input to the Generation Planning exercise. Demand in terms of Peak demand in MW, Energy Requirement in BUs and the load profile for the entire year is used as the basis for estimating the Generation Capacity addition required to meet the demand in full. Since electricity demand is dependant on a large number of factors and since the correlation with some of these factors is not easy to define, accurate demand assessment is a challenging task.

Deliberations were held on the demand to be adopted for planning generation capacity addition for the 12th & tentative 13th Plan periods. It was decided that different demand Scenarios may be worked out based on actual requirement during 2009-10 and the GDP growth rate and likely values of elasticity. Also, the impact of DSM and Energy Conservation Measures during the 12th and 13th Plans on the demand of the country may also be suitably taken into account while finalizing the demand.

The projections of capacity addition are based on All India studies (since the National Grid is expected to be in place and free power flows from one Region to another are likely) while considering the All India demand figures.

The 18th EPS Committee has been constituted and its Report is under finalisation.

1.2.1 Impact of DSM and Energy Conservation Measures on Demand Projections

Demand Side Management and Energy Efficiency programmes initiated by Bureau of Energy Efficiency are also expected to result in reduction of Peak Demand and Energy Requirement of the country. Various Schemes initiated by BEE choosing base year as 2011-12 for Demand Side Management and Energy Conservation are as follows:

Standard & Labeling (S & L)
This scheme is the star rating system of different appliances and the savings on account of this Scheme has been estimated considering the following:

- Higher penetration of S & L scheme
- Introduction of more number of appliances
- Moving from voluntary to mandatory participation

The projections in savings by 12th Plan end have been worked out considering actual savings achieved between 2007-08 to 2010-11 and based on these figures, a regression equation has been established with Logarithmic scale using base year as 2011-12.

National Energy Conservation Award (NECA)

This is a scheme introduced by Government of India to award every participating unit. Savings on account of this Scheme has been estimated considering the following:

- Participation from bigger industries will stabilize
- Reported savings would decrease as industries will move towards energy efficiency
- There may be more participation from SME sector
- Regression equation follows Logarithmic scale

State Designated Agency (SDA)

This is the extended arm of BEE in various states and they initiate conservation schemes. Savings on account of this Scheme has been estimated considering the following:

- More involvement of state Governments in implementing energy efficiency projects (More demonstration projects)
- Replication of already demonstrated projects
- Implementation of inspection system in designated consumers for compliance
- Regression equation is Logarithmic.

Energy Conservation Building Code (ECBC)

Savings on account of this Scheme has been estimated considering the following:

- Mandatory implementation of ECBC in Govt. buildings, new establishments

As no past data is available to have a Regression equation, yearly savings of 10 MW have been assumed.

Bachat Lamp Yojana (BLY)

Savings on account of this Scheme have been estimated considering the following:

- The scheme is expected to stabilize by 2013-14because adoption of the scheme by major States
- The regulations of UNFCC may also influence further implementation
- Logarithmic growth followed upto 2013-14, then stabilized

Perform, Achieve & Trade (PAT)

462 no. of Industries in 8 sectors are currently participating in this scheme. Savings on account of this Scheme has been estimated considering the following:

- Involvement of energy intensive sectors in this mandatory scheme
- PAT scheme will focus on reduction of all forms of energy consumption with respect to product output (Electrical + Solid fuel like Coal, Lignite + Liquid fuel + Gaseous fuel)
- The savings would be in terms of Million Tons of Oil equivalent (Mtoe) or avoided generation capacity in MW
- The national target saving of 6.5 Million Tons of Oil equivalent (Mtoe) has been considered for first PAT Cycle (i.e. about 3000 MW of avoided generation capacity)
- Increase of 1000 MW/year has been considered upto 2016-17
- More no. of industries as well as sectors be taken into this umbrella during 2013-14 to 2016-17

All the reported savings are achieved / to be achieved in that year only. However, a cumulative figure is also estimated based on base year 2011-12.

On account of the above Schemes of BEE, it is envisaged that there would be additional savings in terms of energy on account of Energy Efficiency measures and reduction in peak demand on account of Energy Efficiency and DSM measures. It has been estimated by BEE that the net savings in terms of energy in the year 2016-17 would be about 60 BU. Considering about 50% of these energy savings during peak hours (about 4 hours per day), it would be reasonable to assume that this energy savings during peak hours would contribute to reduction in peak demand to an extent of about 12,350 MW in 2016-17. Considering DSM measures which are going to continue during 13th Plan, the savings in terms of Peak reduction by 13th Plan end i.e. 2021-22 would be of the order of about 15,000 MW.

1.2.2 Demand to be adopted for Assessment of Generation Capacity Addition Programme for 12th & 13th Plan

A number of demand scenarios were worked out corresponding to actual requirement up till 2009-2010 and 9% GDP growth rate & varying values of elasticity (of GDP vs Energy Requirement).

For the Generation Planning Studies, demand corresponding to actual requirement in 2009-10 and thereafter 9% GDP growth rate and 0.9 & 0.8 elasticity during 12th & 13th Plans respectively has been considered to assess capacity addition requirement for 12th and 13th plan periods. Thereafter, reduction in Peak Demand and Energy Requirement, as indicated above, on account of BEE's Energy Efficiency Measures and DSM programmes has also been accounted for while arriving at the final Peak Demand & Energy Requirement for the generation planning studies.

The actual load factor in 2009-10 was 79.5 %. The Load factor assumed in the 17th EPS in 2011-12 & 2016-17 is 72.4% and 72.8% respectively. In the past, the demand has not grown

as anticipated and due to various other reasons the decreasing trend of load factor as anticipated has not taken place. It was therefore considered prudent to assume a modest decline in load factor, rather then that assumed by the 17th EPS, and a load factor of about 78% was considered while estimating the peak demand for 2016-17 & 76% up to 2021-22.

Based on the above, the demand to be adopted by 12th and 13th Plan end considering impact of DSM & Energy conservation measures for the purpose of Generation Planning Exercise is as follows:

Table 1.6
DEMAND ADOPTED FOR GENERATION PLANNING STUDIES

	Energy Requirement (BU)	Peak Load (MW)
	9% GDP Growth rate (0.9/ 0.8 Elasticity in 12th / 13th Plan)	9% GDP Growth rate (0.9/ 0.8 Elasticity in 12th / 13th Plan)
2016-17 (12TH Plan end)	**1403**	**1,97,686**
2021-22 (13th Plan end)	**1993**	**2,89,667**

It is pertinent to mention that the above projections by 12th Plan end are close to the projections of the draft 18th EPS Report with peak demand of 1,99,540 MW and energy requirement 1354 BU.

Another demand scenario with 9% GDP growth rate with an Elasticity of 1 has also been considered for capacity addition planning as a sensitivity analysis. The demand projections with 9% GDP growth rate and an Elasticity of 1 are as given below:

Table 1.7
DEMAND ADOPTED FOR SENSITIVITY STUDIES

	Energy Requirement (BU)	Peak Load (MW)
	9% GDP Growth rate 1.0 Elasticity in 12th Plan	9% GDP Growth rate 1.0 Elasticity in 12th Plan
2016-17 (12TH Plan end)	1489	2,09,339

1.3 PLANNING NORMS

1.3.1 Objective of Planning Norms

The Indian Power Sector comprises of units of different type of power plants i.e. hydro, coal, lignite, gas based, DG Sets and nuclear power plants. The unit size of coal based plants has also been steadily increasing over the years from 30 to 50 to 67.5 MW during the 70's to 500 MW at present. During the 12th & 13th Plan periods supercritical units of 660 MW and 800 MW have also been planned. In respect of nuclear plants, 200-220 MW unit size plants are in operation and 540 MWe reactors have recently been put in operation during the 10th Plan. 1000 MW units are also under construction by the Nuclear Power Corporation. In the

Planning exercise, generation norms are used as representative performance parameters of various types of generation sources to estimate the availability of peaking power and energy from each generating unit. These norms are then used to assess the availability of energy from each source of generation and thus assess generation capacity addition required to meet the stipulated demand.

The planning studies require accurate performance parameters of various type of generating units to assess their availability and energy generation capabilities. Availability and generation capacity are important parameters for meeting the projected demand in the country and also in various regions. Therefore, Availability, PLF, Auxiliary Power Consumption and Heat Rate of the generating units are key performance parameters. Different types of generating units have varied operational performance and accordingly different norms have been used for thermal (coal), gas, hydro and Nuclear projects to make a fair assessment of the new generation capacity requirement.

The planning Norms are in accordance with the norms stipulated by CERC.

1.3.2 Parameters covered by Norms

Norms for thermal, hydro and nuclear stations have been evolved as all India average figures. The parameters covered under Norms are as follows.

(a) Availability
(b) Auxiliary Power Consumption
(c) Unit Heat Rate
(d) Plant Load Factor

Availability

The Availability (gross) of the various types of generating units is given in Table 1.8 below:

Table 1.8
AVAILABILITY

PEAKING AVAILABILITY (GROSS) in % OF THERMAL/ NUCLEAR/ HYDRO POWER STATIONS			
	Unit Size	Existing Units	Future Units
Thermal (Coal)	800/660 MW	-	88
	500/250/210/200 MW	85	85
	Below 200 MW	75	85
	Below 200 MW operating below 20 % PLF at present	50	-
Gas Based	OCGT all sizes	90	90
	CCGT all sizes	88	88
DG Sets	All sizes	75	75
Lignite Based	All sizes	80	80
Nuclear	All sizes	68	68
Hydro	All sizes	87.5	87.5

Auxiliary Power Consumption (APC)

The auxiliary consumption of the various types of generating units considered is given in Table below:

Table 1.9
AUXILLIARY POWER CONSUMPTION

I	**Coal Based Power stations**	
1.	800/ 660 MW class units	7.5%
2.	500 MW class units	7.5%
3.	250/210/200 MW class units	8.5%
4	Below 200 MW units	12.0
5	Lignite based units	12 % for <200 MW 9 % for >200 MW
II	**Gas Based Power Stations**	
1	Combined cycle	3.0%
2	Open cycle	1.0%
3	DG sets	1.0%
III	**Hydro Power Stations**	**0.7%**
IV	**Nuclear Power Stations**	
	160 MW BWR	10%
	200/220 MW PHWR	12.5%
	1000 MW LWR	7.8%
	220/ 540 MW PHWR	12.5%
	500 MW FBR	6.0%

Unit Heat Rate

The Unit heat rates (Gross) used for planning studies for thermal units of various capacities as arrived at by the past average data are given in Table below.

Table 1.10
UNIT HEAT RATES

Unit Size	Gross Heat rate (Kcal/kWh)
800 MW	2300
660 MW	2300
500 MW	2425
200/210/250 MW KWU	2460
200/210/250 MW LMZ	2500
250/210/125 MW (lignite)	2750
100 MW	2750
50 MW class of units	3000
30 MW class of units	3300
Combined cycle Gas turbine	2000
Open cycle Gas turbine/DG Sets	2900

Plant Load Factor

The Plant Load Factor (PLF) to be adopted for thermal units of various capacities and as agreed by group are furnished in Table below.

Table 1.11
PLANT LOAD FACTOR

PLANT LOAD FACTORS OF THERMAL/ NUCLEAR POWER STATIONS		
Units	PLF (%)	Remarks
Thermal		
Coal Based		
800/660 MW	**82.5**	**Future Units**
500/250/210/200 MW	**82.5**	**Existing and Future Units**
Below 100/110 MW	**60**	**80% for future units**
	40	**Units in ER and NER operating Below 20% PLF.**
Lignite Based 125/ 200/250 MW	**75**	
Gas Based		
CCGT	**68.5**	
OCGT	**33**	
Nuclear Units		
All sizes	**68**	**Normative Capacity Factor**

For hydro units it was the energy generation shall be taken as the designed energy generation in a 90 % dependable year.

1.3.3 Norms adopted for Reliability Criteria

The Power System is planned to meet the forecasted demand and ensure an expected level of reliability. Reliability is a measure of the ability of a system to perform its designated function under the designed conditions. In our Studies, Loss of Load Probability (LOLP) is the criteria adopted to reflect the capacity of the system to meet the peak load and Energy Not Served (ENS) to reflect the Energy Requirement not met in the System. LOLP is the probability that a system will fail to meet its peak load under the specified operating conditions. It is the proportion of days per year or hours per year when the available generating capacity is insufficient to serve the peak demand. This index is dimensionless and can also be expressed as a percentage.

ENS is the expected amount of energy which the system will be unable to supply to the consumers as a fraction of the total energy requirement. This index again is dimensionless and can also be expressed as a percentage. In other words these indicate as to how many

units of energy requirement in a year are not met and correspondingly how many hours in a year the power demand is not met.

In the Generation Planning Studies carried out while formulating the earlier Report of the Working Group on 11th Plan, an LOLP of 1% and ENS of 0.15 % was considered. However, in keeping with the trend worldwide more stringent reliability parameters in terms of LOLP and ENS have now been considered while planning for 12th and 13th Plan periods. USA adopts an LOLP of 0.03 % which appears to be reasonable for a developed economy. LOLP standard adopted by some developing countries is 0.27%. It is therefore proposed that an LOLP of 0.2 % and ENS of 0.05 % shall be adopted for planning purposes.

1.3.4 Norms for Cost and heat value of GAS/ LNG

Table 1.12

Fuel	Cost (Rs./th.cum)	Calorific value (Kcal /cum)
LNG	8,000	9,800
Gas (HBJ)	4,400	9,500
Gas (Reliance)	5,760	9,500
Gas (NER)	3,000	9,500

Financial Parameters

Financial parameters have been considered as per CERC guidelines.

1.4 CAPACITY ADDITION REQUIREMENT FOR 12th PLAN AND 13th PLAN

Generation expansion planning studies for 12th plan end (2012-17) have been carried out using EGEAS (Electric Generation Expansion Analysis System) software to assess the requirement of additional generating capacity during the 12th plan period (2012-17), considering capacity addition of 62,374 MW during the 11th Plan. The study has been carried out for the demand estimates based on actual energy requirement during the year 2009-10 and 9% GDP growth, with elasticity of 0.9 during 12th Plan and 0.8 during the 13th Plan, as detailed in Clause 2. Sensitivity Study has also been carried out to assess the capacity addition requirement corresponding to elasticity of 1.0 during 12th Plan. While carrying out the studies, the requirement of 5% Spinning reserve as stipulated in the Electricity Policy, effect of uprating of hydro power plants and expected retirement of thermal units by 2012-17 are also considered. A capacity of about 4,000 MW from old and inefficient thermal units has been retired during 12th Plan.

1.4.1 Capacity Addition required during 12th Plan

Base Case Scenario:

The capacity addition requirement during 12th Plan corresponding to demand as per 9% GDP growth and elasticity of 0.9 during 12th Plan works out to 75,715 MW. In accordance with the

Low Carbon Growth Strategy, priority has been accorded to renewable energy sources, hydro and nuclear generation capacity. Accordingly, a feasible hydro capacity addition of 9,204 MW and nuclear capacity addition of 2,800 MW has been taken as must run during 12th Plan while assessing generation capacity addition requirement. Gas based capacity of 1,086 MW only has been considered while carrying out studies, as gas for these projects is assured since it is tied up from local sources. Besides 1200 MW import from Bhutan has also been considered. Based on Studies, balance capacity addition to meet the demand would be from coal based capacity which is 62, 625 MW. However, against this requirement of 62,625 MW, projects totalling to, 62,695 MW have been identified as most likely projects to yield benefits during 12th Plan. Details of the projects are furnished in **Appendix 1.9(a).**

The capacity addition planned during the 12th Plan is detailed below:

Table 1.13
CAPACITY ADDITION PLANNED DURING 12th PLAN
(Figures in MW)

Type of Capacity	Demand corresponding to 9% GDP GR & 0.9 Elasticity
Thermal	**63,781**
Coal	**62,695**
Gas	**1,086**
Hydro	**9,204**
Nuclear	**2,800**
Total	**75,785**

The above capacity addition requirement during 12th Plan is based on the likely capacity addition of 62,374 MW during 11th plan.

In addition, a grid interactive renewable capacity addition of about 18,500 MW during 12th Plan comprising of 11,000 MW wind, 1,600 MW small hydro, 2,100 MW Biomass power, Bagasse Cogen and waste to energy put together and 3,800 MW Solar has been considered for the generation planning studies.

Generation planning has been carried out considering 5% capacity as spinning reserve as stipulated by the National Electricity Policy.

The gestation period of hydro and nuclear projects is about 6-7 years. Hence, only those hydro and nuclear projects which are under construction at present are expected to yield benefits during 12th Plan period. In view of uncertainty of gas availability for 12th Plan projects, only those projects totalling to 1086 MW have been considered which have tied up gas linkage from local sources. This comprises of 826 MW in central Sector, and 260 MW in State Sector. It may also be mentioned that presently an additional gas based capacity of about 13,000 MW is under construction in the country and this capacity can be commissioned during 11th Plan/12th Plan, if gas is made available for testing /commissioning and commercial operation of these projects.

List of hydro, nuclear and gas projects for likely benefits during 12th Plan is given at **Appendix 1.9 (b)**.

Projects totalling to 62,695 MW coal based capacity have been identified as most likely projects yielding benefits during 12th Plan. The coal based capacity of 62,695 MW is expected to have 10,600 MW in Central sector and 12,080 MW in State Sector and 40,015 MW in private sector. The sector wise breakup of under construction hydro projects of 9,204 MW is 5,632 in Central sector, 1,456 MW in State Sector and 2,116 MW in private sector and nuclear capacity addition of 2,800 MW is in Central sector. Thus the tentative sector-wise breakup of the 75,785 MW capacity addition required during 12th Plan would be 19,858 MW in Central Sector, 13,796 MW in State Sector and 42,131 MW in Private Sector.

Out of the most likely coal based projects totalling to 62,695 MW; 23,940 MW is based on supercritical technology and 38,755 MW is based on sub-critical technology. Also out of 62,695 MW coal based capacity, 38,548 MW capacity is based on coal linkage, 17,825 MW is coal block based, 6,292 MW is imported coal based and capacity totalling to 30 MW requires coal linkage on account of change in capacity of some of the projects. 25,955 MW of this capacity is located at Pithead, 25,160 MW at load centre and 11,540 MW in Coastal belt.

Sector-wise Summary of the capacity addition is given in Table below:

Table 1.14
Sector-wise Break-up of 12th Plan Capacity
(Figures in MW)

Sector	Hydro	Coal	Lignite	Gas	Total Thermal	Nuclear	TOTAL
Central	5632	10600	0	826	11426	2800	**19858**
State	1456	12080	0	260	12340	0	**13796**
Private	2116	40015	0	0	40015	0	**42131**
TOTAL	**9204**	**62695**	**0**	**1086**	**63781**	**2800**	**75785**

Likely status of coal tie up of the capacity totalling to 62,695 MW is as follows:

Table 1.15-A

Coal tie up status	MW
Coal linkage	38548
Coal Block	17825
Imported coal	6292
Coal Linkage to be tied up	30
Total	**62695**

Table 1.15-B

Location-wise Break up	MW
Pit head	25,995
Load Centre	25,160
Coastal	11,540
Total	**62695**

A capacity of about 4000 MW is from coastal plants based on imported coal.

1.4.1.1 Sensitivity Studies for 12th Plan

Sensitivity studies for 12th Plan have also been carried out based on demand projections with 9% GDP growth rate and an Elasticity of 1 and the capacity addition in various scenarios worked out. For sensitivity analysis two additional scenarios in capacity addition have been worked out as follows:

- **High Gas Scenario**- Additional 12,000 MW gas based capacity under construction has been considered over and above 1086 MW already taken in the Report.
- **High Gas + High Renewable Scenario** - As per revised programme of MNRE, total renewable capacity addition of 30,000 MW during 12th Plan has been taken instead of 18,500 MW considered earlier.

A Summary of above study results is as given below:

A: Capacity addition required during 12th Plan with Demand corresponding to 9% GDP Growth Rate & 0.9 Elasticity

Table 1.16

(Figures in MW)

Type of Capacity	Capacity addition required during 12th Plan with Demand corresponding to 9% GDP GR & 0.9 Elasticity		
	Base Case Scenario	High Gas Scenario	High Gas + Higher Renewables Scenario
Thermal	63,781	63,686	60,486
Coal	62,695	50,600	47,400
Gas	1,086	13,086	13,086
Hydro	9,204	9,204	9,204
Nuclear	2,800	2,800	2,800
Total	75,785	75,690	72,490
Renewables	18,500	18,500	30,000
Imports	1,200	1,200	1,200
Total with Renewables and Imports	95,485	95,390	1,03,690
Coal Requirement (MT)	842	772	764

B: Capacity addition required during 12th Plan with Demand corresponding to 9% GDP Growth Rate & 1 Elasticity

Table 1.17

(Figures in MW)

Type of Capacity	Capacity addition required during 12th Plan with Demand corresponding to 9% GDP GR & 1.0 Elasticity		
	Corresponding to Base Case Scenario with 1.0 Elasticity	High Gas	High Gas + Higher Renewables
Thermal	84,486	85,286	82,086
Coal	83,400	72,200	69,000
Gas	1,086	13,086	13,086
Hydro	9,204	9,204	9,204
Nuclear	2,800	2,800	2,800
Total	96,490	97,290	94,090
Renewables	18,500	18,500	30,000
Imports	1,200	1,200	1,200
Total with Renewables and Imports	1,16,190	1,16,990	1,25,290
Coal Requirement (MT)	905	844	837

1.4.2 Coal demand and availability during 12th plan

Availability of coal for the coal based thermal power stations is a matter of serious concern. Although thrust is being accorded to maximize generation from other conventional and non-conventional sources, coal based generation is likely to be the main stay of electricity generation for 12th and 13th Plan to support the targeted GDP growth envisaged by the Government. The coal based capacity addition programme is worked out after taking into account the electricity generation availability from other sources i.e. Hydro, Nuclear, Gas, Lignite and renewable sources. Studies show that the likely system energy requirement that is to be met by coal based plants during the year 2016-17 would be 1095 Billion Units. Further, assuming that the estimated generation available from hydro stations to be 30% less than their design energy, the total generation, to be met by coal based plants works out to be 1155 Billons Units.

In order to meet this generation requirement, coal requirement (at SPCC 0.73 Kcal/ Kg) works out to around 842 MT. Against the requirement of 842 MT, 54 MT coal is to be

imported by Thermal Power Stations designed on imported coal. SCCL has confirmed a coal availability of 35 MT and around 100 MT coal is expected to be available from captive coal blocks. Thus, 653 MT coal needs to be made available by CIL .

Scenario-I Business As Usual (BAU) - Base Case:

Against the requirement of 653 MT coal, CIL have committed to supply 415 MT which is about 75% of their total production of 556 MT in BAU scenario. The availability/shortfall of indigenous coal is detailed below:

(i)Coal requirement during the year 2016-17	=	842 MT
(ii)Coal availability from:		
(a)CIL	=	415 MT
(b)SCCL	=	35 MT
(c)Captive Blocks allocated to Power Utilities	=	100 MT
(d)Coal to be imported by TPSs designed imported coal =		54 MT
Total, coal availability	=	604 MT
(iii)Shortfall	=	238 MT

In order to bridge the above gap between demand and coal availability as referred above, Power Utilities are expected to import around 159 MT to meet shortage in coal supply from CIL. However, such a huge quantity of imported coal for blending may not be feasible as in the existing boilers maximum 15% of blending of imported coal is possible. This quantity of imported coal would be in addition to 54 MT coal likely to be imported by Thermal Power Stations designed on imported coal. Therefore, the total quantity of coal expected to be imported is about 213 MT.

It may be noted that the availability of coal as indicated by CIL would support only about 7,500 MW of CIL linked new capacity during 12th Plan, as against 38,000 required (as per 75,785 MW). Accordingly, the 12th Plan target of 76,000 would need to scaled down to about 45,000 MW. Thus, CIL is to be impressed upon for formulating exigency plan to enhance their production to meet the requirement the power stations.

Scenario-II- Optimistic Projections of CIL - Sensitivity Analysis of Coal Availability

As per the Optimistic Scenario, the total coal production of CIL in 2016-17 is expected to be 615 MT. Considering 75% availability to Power Sector, 461 MT coal shall be supplied to the Power Sector. This also implies that 80% of the additional 59 MT coal production in the Optimistic Scenario shall be supplied to the Power Sector.

In this scenario, the availability/shortfall of indigenous coal is detailed below:

(i)	Coal requirement during the year 2016-17	=	842 MT
(ii)	Coal availability from :		
	(a) CIL	=	461 MT
	(b) SCCL	=	35 MT
	(c) Captive Blocks allocated to Power Utilities	=	100 MT

	(d) Coal to be imported by TPSs designed imported coal	=	54 MT
	Total, coal availability	=	650 MT
(iii)	Shortfall in domestic coal	=	192MT

In order to bridge the above gap between demand and coal availability as referred above, Power Utilities are expected to import around 128 MT to meet shortage in coal supply from CIL. However, such a huge quantity of imported coal for blending may not be feasible as in the existing boilers maximum 15% of blending of imported coal is possible. This quantity of imported coal would be in addition to 54 MT coal likely to be imported by Thermal Power Stations designed on imported coal. Therefore, the total quantity of coal expected to be imported is about 182 MT.

It may be noted that the availability of coal as indicated by CIL would support only about 19,000 MW of CIL linked new capacity during 12th Plan, as against 38,000 required. Accordingly, the 12th Plan target of 76,000 would need to scaled down to about 57,000 MW.

Thus, CIL is to be impressed upon for formulating exigency plan to enhance their production as projected in Optimistic Scenario to meet the requirement the power stations.

As per the indications available from various Power Utilities, DISCOMS are reluctant to buy costlier power i.e. electricity generated either by TPSs designed on imported coal or Power Utilities using blending of imported coal in higher proportion.

In order to overcome the coal crisis following measures are suggested:

i) MOC/ CIL needs to be impressed upon to formulate a contingency plan to meet the coal demand of the power sector. After assessing the potential of existing coal blocks, sanctioning of additional coal blocks from MoE&F needs to be expedited by the Government.

ii) Captive Blocks allocated to various utilities may be advised to enhance their production through some incentive oriented strategy and surplus production after meeting their coal requirement may be supplied to power station.

iii) Power Sector must be allocated 80% of total coal production by CIL.

1.4.3 Efficient use of coal in sub critical plants

Severe constraints in availability of adequate coal for power plants are being experienced at present and the same is expected to continue in future as well. Even through CIL is being pursued to increase production of coal; efforts are being made for most efficient use of coal in sub critical plants. Steps being taken in this regard are as follows:

1. Retirement of old and inefficient coal based plants – about 4,000 MW of capacity shall be retired during the 12th plan.
2. Renovation and Modernization of plants with a view to improve its efficiency and performance. This would facilitate efficient use of coal in existing sub critical plants.

3. Energy audits and better O&M Practices
4. Initiatives by Bureau of Energy Efficiency (BEE) to introduce Energy Efficiency measures through their various schemes. These have been dealt with in detail in Chapter 5.

1.4.3.1 Policy On How to Incentivise the Retirement of Old Power Plants

Experience has revealed that the Agencies/Organizations owning the generating plants are reluctant to retire old power plants mainly because of following:-

- Due to poor power availability position
- Due to loss of generation asset in the absence of new generating plants likely to be commissioned in the near future.

As a result, the generating agencies/organizations are continuing to use old and inefficient generating plants. There should be incentive for the generating agencies to retire the old plants so that they are willing to phase out old and inefficient power plants which would also result in lower specific green house gases in case of Thermal Power Plants. Some of the recommendations are:-

1. That in the regulatory frame work, there should be provision to the effect that the generating plants which have completed more than 30 Years of service and have operating heat rate higher than 20% of the designed value during the last five years should be retired within a fixed time frame.

2. There should be incentive in terms of interest subsidy etc. for these plants to be retired and new plants to be commissioned in place of old plant. It has been observed that the old plants have adequate infrastructure in terms of land, water so that building up of new plants in the same area will not be a problem and would be feasible.

1.4.4 Fund requirement for generation projects during 12th Plan:

A capacity addition of about 1,07,000 MW (comprising 75,785 MW Conventional, 13,000 MW Captive and 18,500 MW Renewables) is envisaged during 12th Plan, corresponding to the demand projection based on the actual energy requirement during the year 2009-10 and 9% GDP growth, with elasticity of 0.9 during 12th Plan as indicated. The estimated requirement of funds during 12th Plan works out to about Rs. 6,38,600 Crore for the Generation projects (including Rs. 2,72,582 Cr for advance action for 13th Plan projects).

Assumption for funds requirements calculation for Generation projects:
Conventional: (Coal-Rs 5 Cr/MW; Hydro-ROR-Rs 5.50 Cr/MW; Hydro-Storage-Rs 6.50 Cr/MW; Gas-Rs 3.75 Cr/MW; Nuclear-Rs 7 Cr/MW); Captive-Rs 5 Cr/MW; Solar-Rs 13 Cr/MW; RES-Rs 4 Cr/MW

1.4.5 Capacity addition required during 13th Plan

The peak demand and energy requirement during the terminal year of 13th Plan (2021-22) would be 2,89,667 MW and 1993 BU respectively. The capacity addition requirement during

13th Plan to meet this demand is estimated to be 93,400 MW (assuming a capacity addition of 62,374 MW in 11th Plan & 75,785 MW in 12th Plan from conventional sources) as detailed below:

Table 1.18
CAPACITY ADDITION REQUIREMENT DURING 13th PLAN

(Figures in MW)

Type of Capacity	Demand corresponding to 9% GDP GR & 0.8 Elasticity
Thermal	63,400
Hydro	12,000
Nuclear	18,000
Total	93,400

Feasible hydro capacity addition of 12,000 MW and nuclear capacity addition of 18,000 MW as intimated by Nuclear Power Corporation has been considered as must run during 13th Plan while assessing generation capacity addition. A capacity of about 4,000 MW has been retired for 13th Plan studies.

In addition, MNRE has projected a grid interactive renewable capacity addition of about 30,500 MW during 13th Plan, comprising of 11,000 MW Wind, 1,500 MW from Small Hydro, 2,000 MW Biomass power, Bagasse Cogen and waste to energy put together and 16,000 MW Solar.

1.4.6 CO_2 emission from power generation at the end of 12th /13th Plan

The estimated CO_2 emission from power generation at the end of 12th Plan and 13th Plan, based on the projected capacity addition of 75,785 MW during 12th Plan and 93,400 MW during 13th Plan is given below.

Table 1.19
CO_2 emission from Power Generation

CO_2 emission	Thermal Gross Generation (Coal + Lignite + Gas) MU	Total CO_2 emission in Million Tonne	Average Emission factor from thermal generation kg/kwh	Total Gross Generation (including generation from Renewables) MU	Average Emission factor from total generation kg/kWh
Anticipated at the end of 12th Plan	1211848	1078	0.889	1493011	0.722
Anticipated at the end of 13th Plan	1625343	1421	0.874	2119897	0.670

1.5 CAPTIVE POWER PLANTS

Large number of captive plants including co-generation power plants of varied type and sizes exist in the country which are either utilized in process industry or used for in-house power consumption. A number of industries have set up their own captive plants so as to get reliable and quality power. Some Captive plants are also installed as stand-by units for operation only during emergencies when the grid supply is not available. The installed capacity of CPPs has increased from 588 MW in 1950 to about 22,235 MW by the end of 10th Plan. The same has increased to about 30,000 MW in March 2011. Captive plants including co-generation power plants could, therefore, play a supplementary role in meeting the country's power demand.

After the enactment of Electricity Act 2003, there is a renewed interest in captive generation. Surplus power, if any, from captive power plants is being fed into the grid as the Electricity Act 2003 provides for open access, in non-discriminatory way.

Around 12,000 MW of addition of Captive Capacity is likely during 11th Plan, out of which about 9250 MW has been commissioned during the first 4 years of 11th Plan. A capacity addition of approximately 13,000 MW is likely to be commissioned during 12th Plan (April 2012 to March 2017).

It is estimated that about 20% of the likely capacity addition during 11th Plan shall be surplus and can be fed to the grid. However, to harness surplus capacity from captive power plants it is essential that various bottlenecks being faced are addressed and technical and commercial issues are resolved to make the export arrangements attractive and commercially viable.

1.6 MAXIMIZING GENERATION FROM EXISTING PLANTS

Optimization of generation from the existing generation capacity is of utmost importance in the resource crunch environment. The installation of new power projects involves large investment and long gestation period. Therefore, following options are recommended for maximizing generation from existing projects:

1. Renovation & Modernization of Power Plants
2. Energy Audits
3. Better O&M practices

1.6.1 Renovation & Modernisation and Life Extension(R&M and LE) of Thermal Power Plants

The coal based thermal plants are the backbone of Indian power sector. Most of the old smaller size non-reheat type units are on the verge of retirement. Though the 200 MW and above size units, barring a few, are performing at the national average PLF, however, some of these units have crossed their economic life of 25 years and are also having high specific fuel consumption. It is of prime importance to improve their performance level in terms of efficiency in order to not only save fuel but also to reduce environmental impact. Such units provide a good opportunity for capacity uprating and extended period of operation.

Renovation and Modernisation (R&M) and Life Extension (LE) of existing old power plants is therefore, considered as an economical option to supplement the capacity addition programme for increased power availability.

The R&M programme is primarily aimed at generation sustenance and overcoming problems arising due to generic defects, design deficiencies/ modifications, obsolescence of equipments/ systems, inadequacies due to poor quality of coal, change in terminal parameters w.r.t. design, stringent environmental conditions and safety requirements.

The life extension (LE) programme on the other hand focuses on plant operation beyond their original design life after carrying out specific life assessment studies of critical components. After about 20 years of life or 1,60,000 hours of operation, a detailed condition assessment along with performance evaluation of various systems/ sub-systems is carried out to identify the modifications/ replacements required to enable plant operation for a longer period.

The old and small size units of early post-independence period were based on technology as available at that time having a very low efficiency. These units are therefore near obsolescence. The LMZ Russian design larger size units (200/210MW) and initial KWU design machines are now at the fag end of their economic life. Further, though there has been gradual improvement in plant load factor over the years, there exists a lot of scope for further improvement. There exists a potential for enhancing their rated capacity by 4 – 8 % and efficiency by 8 to 10% in various 200/210 MW LMZ machines. Few such units have been taken up as pilot projects under Energy Efficient R&M (EE R&M) programme through funding support from World Bank and KfW, Germany.

1.6.1.1 Review of R&M programme in the country

R&M Programme in a structured manner was initiated in 1984 as a centrally sponsored programme during 7th Plan and the programme continued during the two Annual plans 1990-91 & 1991-92. The momentum for undertaking R&M works continued during the 8th & 9th Plan periods. However, the same could not be sustained during the 10th Plan. The Plan-wise details are given below:

Table 1.20

Sl. No.	5-Year Plan	Year	No. of TPS / No. of Units	Capacity (MW)	Additional Generation Achieved MU/ Annum	Equivalent MW**
1	7th Plan & 2 Annual Plans	85-86 to 89-90 & 90-91, 91-92	**34 / 163**	**13570**	10000	**2000**
2	8th Plan (R&M) (LEP)	92-93 to 96-97	**44 / 198** 43/(194) 1 (4)	**20869** (20569) (300)	5085	**763**
3	9th Plan (R&M) (LEP)	97-98 to 2001-02	**37 / 152** 30/ (127) 7/ (25)	**18991** (17306) (1685)	14500	**2200**
4	**10th Plan** **(R&M)** **(LEP)**	**2002-03 to 2006-07**	**9/25** **(14 units out of 57 planned)** **(11 units out of 106 *)**	**3445** **(2460)** **(985)**	**2000**	**300**

*Out of 106, 23 units were considered under PIE programme and 45 units were found techno-economically unviable.
** Equivalent MW has been worked out considering PLF during the respective plan period.

1.6.1.2 Formulation of R&M / LE programme & Achievement during 11th Plan

Based on the discussions held with Ministry of Power, various utilities, PFC and BHEL, CEA prepared a 'National Perspective Plan for R&M and Life Extension & Uprating (LE&U) for 11th Plan. 53 units (7318 MW) for LE works and 76 units (18965 MW) for R&M works were programmed for 11th Plan, out of which works relating to 18 units (1931 MW) for LE and 69 units (17435 MW) for R&M have been completed during 11th Plan. A Summary of Programme & tentative Achievement during 11th Plan is given in Table 1.21.

TABLE 1.21
LE/R&M Programme-Tentative Achievement during 11th Plan (2007 – 2012)

Sl No.	Particular	State Sector		Central Sector		Total (State sector + Central Sector)	
		No. of units	Capacity (MW)	No. of units	Capacity (MW)	No. of units	**Capacity (MW)**
1.	LE works (Programme)	33	4524	20	2794	53	**7318**
	(Tentative Achievement)	15	1664	3	267	18	**1931**
2.	R&M works (Programme)	27	6015	49	12950	76	**18965**
	(Tentative Achievement)	20	4485	49	12950	69	**17435**
	Total (Programme)	**60**	**10539**	**69**	**15744**	**129**	**26283**
	(Tentative Achievement)	**35**	**6149**	**52**	**13217**	**87**	**19366**

1.6.1.3. 12TH Plan Tentative Programme Including Units Slipping From LE/R&M

72 units (16532 MW) for LE work and 23 units (4971 MW) for R&M work have been programmed during 12TH Plan. In addition to this 33 units (5147 MW) from LE works & 7 Units (1530 MW) from R&M Works are Slipping from 11th Plan Target which would also be taken up during 12th Five Year Plan. Therefore Tentative programme for 12TH Five Year Plan is 105 units (21679.19 MW) from LE Works & 30 Units (6501 MW) from R&M Works aggregating to 135 units (28180.19 MW) would be taken up during 12th Five Year Plan. A Summary of R&M/LE programme for 12th Plan is given in Table below:

TABLE 1.22
R&M/ LE Programme of Thermal Units during 12th Plan (2012 – 2017) including Units Slipping From 11th Plan.

Sl No.	Particular	State Sector		Central Sector		Total (State sector + Central Sector)	
		No. of units	Capacity (MW)	No. of units	Capacity (MW)	No. of units	Capacity (MW)
1.	**LE works**						
	(Programmed)	30	5860	42	10672.19	72	**16532.19**
	(Slipping From 11th Plan)	16	2620	17	2527	33	**5147**
	Sub-Total	46	8480	59	13199.19	105	**21679.19**
2.	**R&M works**						
	(Programmed)	03	630	20	4341	23	**4971**
	(Slipping From 11th Plan)	07	1530	-	-	07	**1530**
	Sub-Total	10	2160	20	4341	30	**6501**
	Total						
	(Programmed)	**33**	**6490**	**62**	**15013.19**	**95**	**21503.19**
	(Slipping From 11th Plan)	**23**	**4150**	**17**	**2527**	**40**	**6677**
	Grand Total Of LE/R&M	**56**	**10640**	**79**	**17540.19**	**135**	**28180.19**

The details of progamme of units taken up for LE/R&M during 12th Five Year Plan are given in **Appendix 1.10 & 1.11.** There are 66 units (13720 MW) of 200 / 210 MW LMZ design units installed in India which are potential candidates for Energy Efficient R&M.

1.6.1.4 Potential candidate units for LE and R&M works during 13th Plan (2017-2022)

The Summary of 13th Plan R&M/LE programme is given in Table below:

Table 1.23
13TH PLAN R&M/LE PROGRAMME (POTENTIAL CANDIDATE UNITS)

Name of the Programme	State Sector		Central Sector		Total identified units (State + Central Sector) during 13th Plan	
	No. of Units	Capacity (MW)	No. of Units	Capacity (MW)	No. of Units	Capacity (MW)
LE						
Coal	55	12130	16	3940	71	**16070**
Gas	6	672	5	765.71	11	**1438**
Sub Total	**61**	**12802**	**21**	**4706**	**82**	**17508**
R&M						
Coal	16	3560	6	2420	22	**5980**
Gas			6	1172	6	**1172**
Sub Total	**16**	**3560**	**12**	**3592**	**28**	**7152**
Grand Total	**77**	**16362**	**33**	**8298**	**110**	**24660**

It may be mentioned that all the 66 nos. 200/210 MW size LMZ units installed in the country would be covered for LE works starting from 11th Plan to 13th Plan.

1.6.2 R&M of Hydro Plants

The normal life expectancy of a hydroelectric power plant is 30 to 35 years after which it needs life extension. Many of the existing hydro power stations could be modernized to generate reliable and higher yield by minor modifications. By adopting modern equipment like static excitation, micro-processor based controls, electronic-micro processor based governors, high speed static/Numerical relays, data logger, optical instruments for monitoring vibrations, air gaps, silt content in water etc. availability of hydro power stations could be improved and outages minimized.

In situations like run-of-the river schemes in Himalayan and Sub-Himalayan region, excessive silt contained in the inflows causes enormous damage to the under water parts of turbines, requiring rehabilitation almost every year.

Upgrading / Uprating of hydro plants calls for a systematic approach in view of a number of influencing parameters pertaining to the prime mover besides its repercussions on the total hydro electric development which itself may be a sub system of an integrated power development. A number of hydraulic, mechanical, electrical and above all economic factors play a vital role in deciding the course of action and the modalities of an upgrading / uprating programme. Uprating of hydro power plant cannot thus be considered in isolation. It has to be strategically planned, may be in certain steps, keeping in view all the techno-economic considerations.

1.6.2.1 11TH Plan Review of Programme of R&M, Life Extension & Uprating – Hydro

A Summary of the projects planned, completed and on which work is ongoing in the 11th Plan is as furnished in **Table below:**

Table 1.24

SUMMARY OF R&M, LIFE EXTENSION & UPRATING PROGRAMME AND ACHIEVEMENTS FOR 11TH PLAN - HYDRO

Description	R&M	LE & Uprating
No. of Projects Covered	15	**5**
Capacity (MW)	4883.50	**935.00**
Estimated Cost (Rs. Crores)	**512.87**	
Expenditure incurred (Rs. Crores) till 31.03.2011	**354.76**	
Targeted Benefits (MW)	-	**491**
Actual Benefits achieved	**-**	**380**

1.6.2.2 Programme for 12th Plan – Hydro

A Summary of the 12th Plan programme for hydro R&M, Life Extension & Uprating Schemes and of the projects planned, completed and on which work is ongoing in the 12th Plan is as furnished in **Table below.**

Table 1.25
SUMMARY OF R&M AND LIFE EXTENSION PROGRAMME AND ACHIEVEMENTS FOR 12TH PLAN - HYDRO

Description	R&M	LE & Uprating
No. of projects Covered	5	**37**
Capacity (MW)	1390.00	**3858.80**
Estimated Cost (Rs. Crores)	**3887.55**	
Expenditure incurred (Rs. Crores) till 31.03.2011	**674.70**	
Targeted Benefits (MW)	-	**4063.45**
Actual Benefits achieved	**-**	**-**

Project-wise details of Hydro R&M, Life Extension & Uprating Schemes for completion during the 12th Plan are furnished in **Appendix 1.12.**

1.6.3 Energy Efficiency Improvement through Energy Audit

As per Energy Conservation Act 2001, Energy audit means the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption. Also under the provision of Energy Conservation Act 2001, all designated consumers declared by the Government would have to undertake mandatory Energy Audit studies by accredited Energy Auditors.

Energy Audit studies aim at determining the present level of performance of main power plant equipment and selected sub-systems and comparing them with design parameters. Reasons for deterioration are analysed. Techno-economic viability of introducing new efficient technologies is also included in the energy audit studies. In fact the basic objective is to reduce the consumption of various inputs (coal, oil, power, water) per unit of power generation.

It is suggested that an "Energy Efficiency Cell" shall be created at all thermal power stations. This cell shall be responsible for the following:

1. Setting up of Internal Energy Audit groups in each power plant. Capacity building of the efficiency group must be done to enable them to carry out Energy Audit tests on their own.
2. Regular audits shall also be got conducted from accredited Energy Auditors.
3. All recommendations that emerge from these audits must be implemented if these are techno-economically feasible. Short term measures can be made part of the

annual plan/annual overhaul of the unit whereas long term measures can be taken up under the R&M schemes of these stations.

4. Energy Efficiency Awareness campaign shall be taken up among staff of the power plant.

1.6.3.1 Better O&M practices

Better O&M practice is also an effective tool to improve the performance of existing plants

1.7 NEW AND RENEWABLE ENERGY SOURCES

Generation of power from New and Renewable Energy Sources such as Wind, Small Hydro, Bio mass and Solar Energy is extremely vital in view of the fact that it is green power with minimum impact on the environment. Limited availability of fossil fuels like coal and gas & rising trend of cost & lower availability of indigenous conventional fuels, has further highlighted the importance of power from renewable energy sources. All efforts are therefore being made to tap these resources for generation of power to supplement power from Conventional Sources. Renewable sources of energy provide a particularly attractive solution for meeting requirement of power at remote locations, in case of which it is not feasible to extend the grid. The National Solar Mission is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's energy security challenge. It will also constitute a major contribution by India to the global effort to meet the challenges of climate change.

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 grid interactive installed capacity from renewable is likely to increase from about 3,500 MW at end of 9th Plan, 10,258 MW at the end of 10th Plan to 22,600 MW at the end of 11th Plan. The grid interactive Installed Capacity as on 31.03.2011 is **19,975 MW**.

Table 1.26

CUMULATIVE POTENTIAL AND ACHIEVEMENTS FOR GRID INTERACTIVE RENEWABLE POWER AS ON 31.03.2011

(Figures in MW)

Sources / Systems	Estimated mid-Term (2032) Potential	Cumulative Installed Capacity (As on 31.03.2011)
Wind Power	45,000	14,157
Bio- Power(Agro residues & Plantations)	61,000	2,737*
Co-generation Baggasse	5,000	-
Small Hydro (up to 25 MW)	15,000	3,043
Waste to Energy	7,000	-
Solar Photovoltaic	50,000	38
TOTAL	1,83,000	19,975

***** *Includes Biomass power, bagasse cogeneration, urban and industrial waste to energy.*

Source MNRE

1.7.1 Review of Eleventh Plan – Target and Achievement

A target of 12,230 MW was set by MNRE for the 11th Plan in respect of grid interactive renewable power against which an achievement of 9,717 MW has been made during the 1st four years of the 11th Plan and balance capacity is expected to realize during terminal year of the plan i.e 2011-12.

TWELFTH PLAN PROGRAMME

Details of 12th Plan Programme of Grid Interactive renewable power as considered in the Generation Planning studies are furnished in Table below:

Table 1.27
12TH PLAN TENTATIVE PROGRAMME FOR GRID INTERACTIVE RENEWABLE POWER
(Figures in MW)

Sources / Systems	Programme for 12th plan
Wind Power	11,000
Biomass Power, Baggasse Co-generation, Biomass Gasifiers	2,100
Small Hydro (up to 25 MW)	1,600
Solar Power	3800
TOTAL	**18,500**

THIRTEEN PLAN PROGRAMME

Details of 13th Plan programme of Grid Interactive renewable power as considered in the Generation Planning studies are furnished in Table below:

Table 1.28
13TH PLAN TENTATIVE PROGRAMME FOR GRID INTERACTIVE RENEWABLE POWER
(Figures in MW)

Sources / Systems	Programme for 13th plan
Wind Power	11,000
Biomass Power, Baggasse Co-generation, Biomass Gasifiers	2,000
Small Hydro (up to 25 MW)	1,500
Solar Power	16,000
TOTAL	**30,500**

SUMMARY OF INSTALLED CAPACITY FROM RENEWABLE ENERGY SOURCES (likely by the end of 12th Plan)

Considering the 11th Plan and tentative 12th Plan capacity addition as detailed above, Summary of Installed Capacity is furnished below**:**

Installed capacity by the end of 10th Plan (As on 31.3.2007)		10,258 MW
Installed capacity by the end of 2010-11 (As on 31.3.2011)		19,975 MW
Programme for 2011-12		2,513 MW
12th Plan programme for 2012-17		18,500 MW
Total Installed Capacity by the end of 12th plan		40,988 MW
	Say	**41,000 MW**

Extension programmes of the MNRE are largely implemented through the State Renewable Energy Development Agencies. These agencies, in turn, mobilize participation of the State level machinery, local institutions, Non- Governmental Organizations (NGOs) and village level organizations for implementation of these programmes. MNRE has set up a Solar Energy Centre near Delhi with the state-of-art facilities for testing of solar thermal and solar photovoltaic materials, devices and systems which will soon become an apex Centre of Excellence. A Centre for Wind Energy Technology has been set up in Chennai for providing technical support to the Ministry in the implementation of its wind energy programmes. Research and Development programmes are sponsored in research institutions, national laboratories and in industries, both public and private sectors. For market development and financing of renewable energy projects, a separate financing institution called the Indian Renewable Energy Development Agency (IREDA) has been set up as a public sector undertaking.

1.8 REQUIREMENT OF PEAKING POWER AND RESERVE PLANTS

The generation system must be designed to meet the base-load as well as the peak load of the power system with the characteristics to respond dynamically or efficiently to the variation in demand within a short time. Apart from variation in demand, there is expected to be wide variation in generation as well, when the installed base of renewable energy plants increases as a result of pressure on DISCOMs to source their requirement from renewable energy sources (to meet Renewable Purchase Obligation- RPO). Since system stability requires matching of generation with the demand at all instances of time, a certain degree of flexibility and ability of the generators to respond rapidly to the changing demand/availability for renewable energy sources must be introduced into the system through appropriate generation plants.

It is expected that although in next 5 yrs or so our country may become base load power surplus but peak power deficits will still prevail. In this scenario necessary measures for

improving the peaking power requirements of our system need to be taken to ensure desired and targeted benefits to the economy.

Since our system has vide variations in demand during peak and off peak period due to our typical load duration curve, there is need for peaking support with very high ramping rate. Peaking power can ideally be provided by pondage / reservoir based hydro plants. However, hydro capacity alone may not be able to meet the peaking demand. Fast response during peak hours could be provided by other suitable generation options such as the gas based generation, in particular engine based technology, because of excellent peaking support capability.

1.8.1 Requirement of Reserve Plants

The Optimal power system should have adequate reserves in order to meet the contingency of outage of certain operating generation capacity.

System reserves can be classified into:

i) Primary Control Reserves or Frequency Control Reserves
ii) Secondary Reserves or Spinning and Non-spinning Reserves
iii) Tertiary Reserves or Replacement Reserves

The deployment of the primary control reserves is from 0 to 30 seconds. The primary frequency control systems are activated if the frequency deviation is more than the dead band of the controller. Half of the primary control reserves should be in operation in 15 seconds, and all reserves should be in full power in 30 seconds. In the Indian context, frequency reserves can be built, in such a way that at least half of these reserves are in operation within a time span of 15 seconds and remaining reserves are put in service within 30 seconds. In addition to the standard frequency control reserves, Secondary Reserves are also to be created. The reserves should be activated within a period of 30 seconds and should give full output within the next 15 minutes, with a view to release the primary control reserves. In addition, the system should have tertiary reserves also which can take over from the secondary reserves within fifteen minutes of the disturbance and release these secondary reserves. These are generally non spinning reserves which can be brought into service at very short notice.

1.8.2 Option for Peaking Power Generation

The peaking power demand could be supplemented by storage type hydro generating station including pumped storage schemes, open cycle gas turbine station, and gas based reciprocating engines. Peaking plants shall be environmentally-friendly and must comply with emission norms, so as to be located close to load centres. They must be able to start up (and stop) instantaneously and ramp up quickly, and in required steps, to match the spike in load. Their efficiency curve must be high and flat at different plant loads. They must be 'all-season' plants and use a fuel which is available throughout the year.

1.8.3 Peaking Tariff

Operation of Combined Cycle Plants in peaking mode as suggested above and Open Cycle Plants for peaking may result in higher heat rate and O&M costs (on account of higher repair and maintenance cost) for which the power plant will have to be compensated. Therefore, it is apparent that peaking power would be costlier as compared to off peak power. The notification for separate tariff for peak and off peak power would address this issue as well as help in flattening of Load Duration Curve and ultimately it would result in lesser capacity addition to meet the same power demand in the country.

Further, the Working Group recommends planning for at least 2000 MW gas based peaking power plants during 12th Plan, 400 MW each in five major metro cities of India with proper regulatory support. The experience gained from operation of these peaking plants would pave the way for creation of additional peaking plants in other major cities and higher capacity in future plans. There is need to take measures like having separate tariff for peak and off peak power and regulations to enable fixed cost of peaking plants to be fully recovered during peak hour operation etc. to promote peaking plants. In case of future projects gas should be allocated to power plants meant for meeting peak and intermediate load, with proper regulatory supports so that these power plants could recover their cost.

Working Group also recommends for setting up Task Force under CERC to deliberate upon the various aspects associated with setting up of peaking plants and creation of adequate system reserve. Further, the subject of Ancillary Services has already been covered in Chapter 4 of the Report and recommended suitably.

Combined Heating and Cooling (CHP) plants which have a high efficiency must be promoted. Gas allocation to such plants preferably located in urban areas should be on priority.

1.9 TECHNOLOGICAL DEVELOPMENT, ENVIRONMENTAL ASPECTS, POLLUTION AND ASH DISPOSAL, R&R ISSUES OF HYDRO PROJECTS

Technology development plays an important role in the evolution of the power sector. Improved technology implies increased efficiency, lesser consumption of fuel and ensures reasonable cost of power to all with high reliability. With increasing development leading to high pollution, environmental aspects are also of major concern sustainable development implies development while at the same time conserving the environment for future generations.

1.9.1 Technology Development in Thermal Power Generation

The present technologies used for thermal power generation are latest and mature technologies duly adapted for Indian conditions. As such no major technology gaps are foreseen during the next plan period. Thus fuel consumption and environmental emissions would invite greater attention. The advanced technologies now commercially available can be broadly categorized as follows:

For Efficiency Improvement

1 Supercritical and Ultra supercritical Technology
2 Advanced Gas Turbines

Policy Initiatives Required for Super Critical Technologies

Supercritical technology has already been introduced in the country and large numbers of supercritical units are under construction. The following policy options could be considered for making supercritical units mandatory beyond 12th Plan :

i. Issue of advisory by MoP/CEA for the utilities to install supercritical units only.

ii. Suitable provisions to install supercritical units in the coal allocation policy for coal linkages of 13th Plan projects.

iii. Suitable provision in the CEA Regulations on Technical Standards for Construction of Electric Plants And Electric Lines 2010 making supercritical units mandatory.

Provisions mandating supercritical technology in the coal allocation policy may still lead to installation of sub-critical units for the stations based on imported coal. Also, the CEA Regulations for construction of Electric Lines and Electric plants are presently applicable to all unit sizes and accordingly provide minimum efficiency criteria for units of various sizes. Thus, mandating supercritical technology through this route may require amendments to these Regulations and vetting by Ministry of Law.

Concerning Environmental considerations

1. Flue Gas Desulphurisation System
2. No_x control
3. Fluidized Bed Combustion (FBC)
4. Use of washed coal

Combined Efficiency Improvement and Environmental Aspects

1 Integrated Gasification Combined Cycle (IGCC)
2 Pressurized Fluidized Bed Combustion System (PFBC)

1.9.2 Technology for Hydro Power Generation

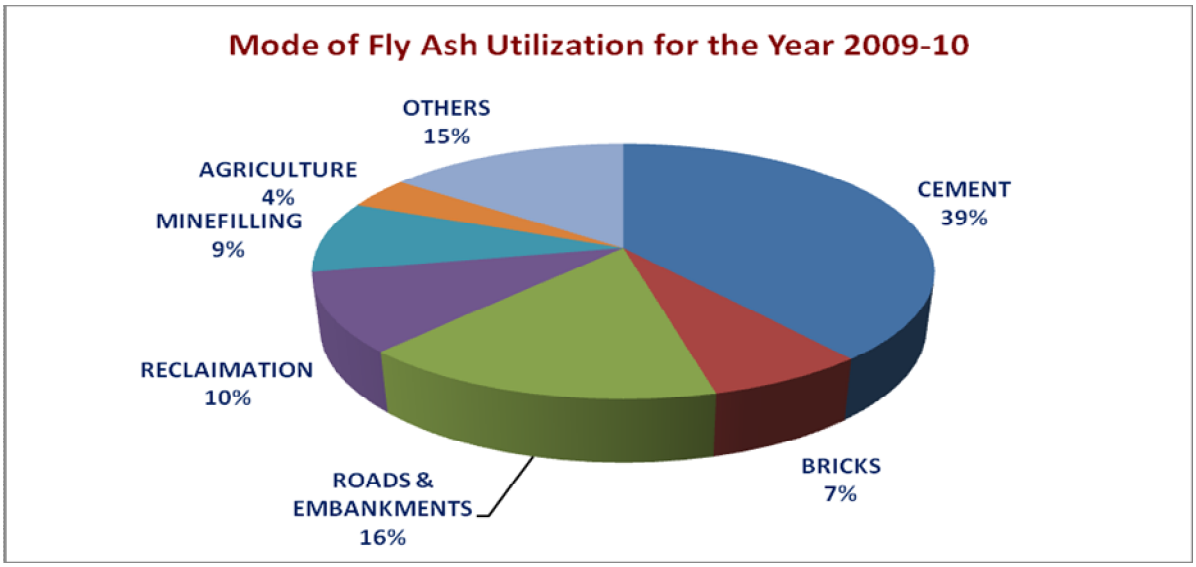
On a global base there have been a lot of technical developments for hydropower plants, these developments along with the site specific developments made to suit Indian conditions are fully incorporated in upcoming hydro power plants. With these developments increases in efficiency, output and performance have been achieved. R&D has also contributed breakthroughs in the fields of greaseless turbine components, generator components, variable speed technologies and double-stage adjustable Pump turbines.

1.9.3 Pollution and Ash Utilization

Central Electricity Authority is monitoring the ash generation at coal/lignite based thermal power stations and its utilization. The data on annual basis is obtained from thermal power stations to serve as a basic data for driving various outputs that are required from time to time. The power stations are also submitting annual compilation report to MoEF.

As per data available in CEA, the ash utilization has increased from 9.63% in 1996-97 to 62.60% in 2009-10. The quantity wise ash utilization was 6.64 mtpa (million tones per annum) during the year 1996-97 against the generation of 86.95 mtpa. The ash utilization during the year 2009-10 has gone up to 77.34 mtpa against the ash generation of 123.54 mtpa. There are 21 thermal power stations in the country which have achieved 100% or more ash utilization during 2009-10.

The pie chart showing the mode of fly ash utilization during the year 2009-10 is given below:-



It is seen from above utilization pattern that about 45% of fly ash is being utilized as a raw material in the manufacturing of pozzolana cement, bricks, blocks and pavement tiles etc.

It is estimated that by the end of 11th Plan i.e. in 2011-12, the ash generation by coal/lignite based thermal power stations would increase to 160 million ton per year and by the end of 12th Plan i.e. 2016-17, the quantity of ash generation is estimated to reach 300 million tones per year

The need to increase ash utilization and various measures required to achieve this objective has been deliberated at various different forum and at all levels, the Central, States Governments, power utilities, thermal power plants and all concerned users group agencies etc. All power utilities and thermal power plants are to plan & implement ash utilization targets keeping in view long term strategies on sustainable basis. The ash utilization is a priority.

1.10 CONCLUSION AND RECOMMENDATIONS

The Group deliberated upon various aspects of "Demand Projections and Generation Planning". Major Conclusions and Recommendations made by Working Group are summarized as below:

(i) The Mid Term Appraisal target for 11th Plan is 62,374 MW. Against this, the likely capacity addition during the 11th Plan is about 52,000 MW. The historic achievement of capacity addition during 11th Plan viz-a viz the 10th Plan is noteworthy. It has been estimated that the likely capacity addition during the 11th Plan shall be about two and a half times the capacity addition during the 10th Plan. The reasons for slippages of projects from the 11th Plan target were also analysed, in order to avoid such slippages while planning for capacity addition during 12th Plan. Working Group recommends that to meet the demand projections for the 12th Plan only those projects should be considered where all clearances have been obtained, fuel linkages tied up and the project is under construction. Also while setting the 12th Plan target, adequate availability of coal must be ensured.

(ii) The likely demand by the end of 12th & 13th Plan has been worked out considering various scenarios and also considering reduction in demand due to DSM and Energy Efficiency and various measures being taken by BEE. The demand to be adopted by 12th and 13th Plan end for the purpose of Generation Planning Exercise is as following:

Table 1.29
DEMAND ADOPTED FOR GENERATION PLANNING STUDIES

	Energy Requirement (BU)	**Peak Load (MW)**
	9% GDP GR **0.9/ 0.8 Elasticity in 12th / 13th Plan**	9% GDP GR **0.9/ 0.8 Elasticity in 12th / 13th Plan**
2016-17 (12TH Plan end)	1403	197686
2021-22 (13th Plan end)	1992	289667

(iii) The likely effect of BEE's various programmes of Energy Efficiency & DSM have been considered to effect a reduction in Peak Demand of about 12,000 MW in 2016-17 and peak reduction of 15,000 MW in 2021-22.

(iv) The requirement of generation capacity addition during 12th and 13th Plan has been worked out based on projected demand indicated above. Accordingly, Working Group recommends following capacity addition for 12th and 13th Plan.

Table 1.30
CAPACITY ADDITION REQUIREMENT DURING 12th PLAN
(Figures in MW)

Type of Capacity	Capacity Addition (As per Demand corresponding to 9% GDP GR & 0.9 Elasticity)
Thermal	**63,781**
Coal	**62,695**
Gas	**1,086**
Hydro	**9,204**
Nuclear	**2,800**
Total	**75,785**

(v) The capacity addition requirement during 12th Plan is based on the capacity addition target of 62,374 MW during 11th Plan as per MTA. About 12,977 MW capacity is likely to slip from 62,374 MW to 12th Plan. The estimated requirement of funds during 12th Plan works out to about Rs. 6,38,600 Crore for the Generation projects (including Rs. 2,72,582 Cr for advance action for 13th Plan projects).

(vi) In addition, based on inputs received from MNRE, grid interactive renewable capacity addition of about 18,500 MW has been considered for planning studies during 12th Plan comprising of 11,000 MW wind, 1,600 MW small hydro, 2,100 MW Biomass power, Bagasse Cogen and waste to energy put together and 3,800 MW Solar.

(vii) The capacity addition requirement during 13th Plan is as follows:

Table 1.31

CAPACITY ADDITION REQUIREMENT DURING 13th PLAN
(Figures in MW)

Type of Capacity	Capacity Addition (As per Demand corresponding to 9% GDP GR & 0.8 Elasticity)
Thermal	**63,400**
Hydro	**12,000**
Nuclear	**18,000**
Total	**93,400**

(viii) In addition, MNRE has projected a grid interactive renewable capacity addition of about 30,500 MW during 13th Plan, comprising of 11,000 MW Wind, 1,500 MW from Small Hydro, 2,000 MW Biomass power, Bagasse Cogen and waste to energy put together and 16,000 MW Solar.

(ix) Based on above capacity addition, there may not be power shortage in the country by the end of 12th Plan on an All-India basis; however, individual states may have

power shortage. To address this problem, States/UTs must estimate their power requirement and availability of power from different sources/states and must tie up power requirement, if any, so that they do not face shortages.

(x) Availability of coal for the coal based thermal power stations is a matter of serious concern As per the projected requirement and availability of coal, there will be shortage of coal for coal based power plants which will have to be met through import. In order to bridge the above gap between demand and coal availability, Power Utilities are expected to import around 159 MT to meet shortage in coal supply from CIL. However, such a huge quantity of imported coal for blending may not be feasible as in the existing boilers maximum 15% of blending of imported coal is possible. This quantity of imported coal would be in addition to 54 MT coal likely to be imported by Thermal Power Stations designed on imported coal. Therefore, the total quantity of coal required to be imported is about 213 MT.

(xi) MOC/ CIL needs to be impressed upon to formulate a contingency plan to meet the coal demand of the power sector. After assessing the potential of existing coal blocks, sanctioning of additional coal blocks from MoE&F needs to be expedited by the Government.

(xii) Captive Blocks allocated to various utilities may be advised to enhance their production through some incentive oriented strategy and surplus production after meeting their coal requirement may be supplied to power station.

(xiii) Availability of gas for power generation is a big issue which needs to be addressed due to reduced availability of gas from KG D6 field and also from APM sources, existing power plants in the country are operating at low PLF. In addition, gas is yet to be allocated for power plants under construction for commissioning during 11th Plan. Further, gas power projects of about 13,000 MW capacity are under construction at various stages and this capacity may materialize during 11th Plan/12th Plan, if gas is made available.

(xiv) The Working Group opines that if gas availability to projects already under construction is not ensured, it may become stranded assets and should be avoided. Some concrete policy decision towards increasing the gas availability to power plants either by increasing the production of domestic gas or increasing the share of RLNG by pooling with domestic gas is required.

(xv) To pursue with Energy Departments of all the States to identify the surplus capacity available from the captive power plants and approach State Utilities/Discoms to buy the surplus power available from the captive power plants.

(xvi) The Group recommends that R&M schemes shall be continued during 11th and 12th Plan also. However it must be ensured that routine maintenance activities are not included in these schemes. Only activities which aim at increasing the efficiency of the unit or improve the availability or are required to meet environmental norms or are aimed at renovating obsolete equipment- Controls and Instrumentation are included in R & M schemes. Further for Life Extension schemes, a cost benefit analysis should be carried out

vis-à-vis installation of new unit at the same site. The Group also recommends that the AGS&P Scheme shall continue.

(xvii) The programme for capacity addition from Renewable Energy Sources during the 12th & 13th Plan has been included as per information furnished by MNRE. The Group recommends that all efforts shall be made towards implementation of this Programme. However, the detailed programme and fund requirement are expected to be finalized by the Working group for 12th Plan for Non- Conventional Energy Sources

(xviii) The Working Group recommends setting up of a Task Force under CERC to deliberate upon the various aspects associated with setting up of peaking plants and creation of adequate system reserves. The Task Force shall comprehensively address all the issues involved to facilitate a feasible and viable scenario for creation and operation of generation reserves and peaking plants in the system.

(xix) The Group recommends planning for at least 2,000 MW gas based peaking power plants during 12th Plan, 400 MW each in five major metro cities of India with proper regulatory support. The experience gained from operation of these peaking plants would pave the way for creation of additional peaking plants in other major cities and higher capacity in future plans. Further, Group recommends that in view of limited availability of gas in the country, in case of future projects gas should be allocated to power plants meant for meeting peak and intermediate load, with proper regulatory supports so that these power plants could recover their cost.

(xx) Combined Heating and Cooling (CHP) plants which have a high efficiency must be promoted. Gas allocation to such plants preferably located in urban areas should be on priority.

(xxi) In view of successful operation of Super Critical units in developed countries and commissioning of few units based on super critical technology in the country, it is felt that Super Critical units of 660 MW (steam parameters of 247 kg/cm^2 and 535/565 ^{O}) and 800 MW (Temp 565/593 ^{O}) need to be promoted aggressively.

(xxii) Supercritical technology has already been introduced in the country and large numbers of supercritical units are under construction. The following policy options could be considered for making supercritical units mandatory beyond 12th Plan :

1. Issue of advisory by MoP/CEA for the utilities to install supercritical units only.
2. Suitable provisions to install supercritical units in the coal allocation policy for coal linkages of 13th Plan projects.
3. Suitable provision in the CEA Regulations on Technical Standards for Construction of Electric Plants And Electric Lines 2010 making supercritical units mandatory.

(xxiii) Working Group recommends that all project developers should meet the stringent requirement of environmental norms for setting up thermal power plants to minimize the air and water pollutions.

(xxiv) There is a greater stress on utilization of ash being generated in coal/lignite based Thermal Power Stations and MOEF has issued various notifications for achieving 100% utilization of fly ash within a prescribed time frame. With greater utilization of fly ash, the quantity of ash which has to be disposed off in ash ponds has reduced significantly and it has helped in addressing the problem of air pollution to some extent. The Working Group recommends that all utilities should make all out efforts to increase percentage utilization of ash generated by their plants to meet the environmental requirement.

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Appendix –1.1

SUMMARY STATEMENT OF ORIGINAL TARGET DURING THE 11TH PLAN (REGION WISE, SECTOR WISE AND TYPE WISE)

(Figures in MW)

Sl. No.	REGION	Hydro	Thermal				Nuclear	Grand Total
			Coal	Lignite	Gas	Total		
1	NORTHERN	7488	9825	1455	1720	13000	440	20928
2	WESTERN	1170	16550	325	3335	20210	0	21380
3	SOUTHERN	1094	9385	500	1001	10886	2940	14920
4	EASTERN	3151	14060	0	0	14060	0	17211
5	NORTH EASTERN	2724	750	0	787	1537	0	4261
	TOTAL (ALL INDIA)	**15627**	**50570**	**2280**	**6843**	**59693**	**3380**	**78700**

Sl. No.	SECTOR	Hydro	Thermal				Nuclear	Grand Total
			Coal	Lignite	Gas	Total		
a	CENTRAL	8654	22600	750	1490	24840	3380	36874
b	STATE	3482	19535	450	3316	23301	0	26783
c	PRIVATE	3491	8435	1080	2037	11552	0	15043
	TOTAL (ALL INDIA)	**15627**	**50570**	**2280**	**6843**	**59693**	**3380**	**78700**

Appendix –1.2

SUMMARY STATEMENT OF MID TERM APPRAISAL TARGET AND LIKELY CAPACITY ADDITION DURING THE 11TH PLAN (SECTOR WISE AND TYPE WISE)

(Figs in MW)

	HYDRO	TOTAL THERMAL	THERMAL BREAKUP			NUCLEAR	TOTAL
			Coal	Lignite	Gas/ LNG		
CENTRAL SECTOR	**2922**	**14920**	13430	750	740	**3380**	**21222**
STATE SECTOR	**2854**	**18501**	14735	450	3316	**0**	**21355**
PRIVATE SECTOR	**2461**	**17336**	13725	1080	2531	**0**	**19797**
ALL-INDIA	**8237**	**50757**	41890	2280	6587	**3380**	**62374**

SUMMARY OF LIKELY CAPACITY ADDITION DURING 11TH PLAN

	Hydro	Thermal				Nuclear	Total
		Lignite	Gas	Coal	Total		
CENTRAL SECTOR	2005	500	740	10050	11290	2880	16175
STATE SECTOR	2744	450	2098	11945	14493	0	17237
PRIVATE SECTOR	1362	405	2494	14390	17289	0	18651
ALL-INDIA	**6111**	1355	5332	36385	**43072**	**2880**	**52063**

Appendix-1.3

LIST OF PROJECTS COMMISSIONED/ BEING MONITORED FOR LIKELY BENEFITS DURING 11TH PLAN

Sl.No.	Plant Name	State	Agency	Status	Fuel Type	Capacity (MW)	Capacity as per 78,700 MW	Capacity as per 62,374 MW	Capacity as per 52,063 MW
	CENTRAL SECTOR								
1	Chandrapura U-7,8	Jharknd	DVC	Comnd	Coal	500	500	500	500
2	Mejia U-6	WB	DVC	Comnd	Coal	250	250	250	250
3	Mejia Ph II U7,8	WB	DVC	Comnd	Coal	1000	1000	1000	1000
4	Kodarma U1	Jharknd	DVC	Comnd	Coal	500	500	500	500
5	Kodarma U2	Jharknd	DVC	UC	Coal	500	500	500	
6	Durgapur Steel U1	WB	DVC	Comnd	Coal	500	500	500	500
7	Durgapur Steel U2	WB	DVC	UC	Coal	500	500	500	
8	Raghunathpur Ph-I U1,2	WB	DVC	UC	Coal	1200	1200	1200	
9	Bokaro Expansion	Jharknd	DVC	UC	Coal	500	500		
10	Maithan RBC JV U1*	Jharknd	IPP	Comnd	Coal	525	525	0	0
11	Maithan RBC JV U2*	Jharknd	IPP	UC	Coal	525	525	0	0
12	Kameng HEP	Ar.Pr	NEEPCO	UC	Hydro	600	600		
13	Omkareshwar HEP	MP	NHDC	Comnd	Hydro	520	520	520	520
14	Teesta V U 1,2,3 HEP	Sikkim	NHPC	Comnd	Hydro	510	510	510	510
15	Sewa-II U1,3,2 HEP	J&K	NHPC	Comnd	Hydro	120	120	120	120
16	Chamera-III HEP	HP	NHPC	UC	Hydro	231	231	231	231
17	Parbati - II HEP	HP	NHPC	UC	Hydro	800	800		
18	Parbati - III HEP	HP	NHPC	UC	Hydro	520	520	520	
19	Uri-II HEP	J&K	NHPC	UC	Hydro	240	240	240	180
20	Nimoo Bazgo HEP	J&K	NHPC	UC	Hydro	45	45	45	
21	Chutak HEP	J&K	NHPC	UC	Hydro	44	44	44	44
22	Teesta Low Dam-III HEP	WB	NHPC	UC	Hydro	132	132	132	
23	Teesta Low Dam-IV HEP	WB	NHPC	UC	Hydro	160	160	160	
24	Subansiri Lower HEP	Ar.Pr	NHPC	UC	Hydro	2000	2000		
25	Barsingsar Lig U1,2	Rajas	NLC	Comnd	Lignite	250	250	250	250
26	Neyveli - II Lig	TN	NLC	UC	Lignite	500	500	500	250
27	Tuticorin JV	TN	NLC	UC	Coal	1000	1000		
28	Kaiga U-3,4	Karntk	NPC	Comnd	Nuclear	440	440	440	440
29	RAPP U-5,6	Rajas	NPC	Comnd	Nuclear	440	440	440	440
30	Kudankulam U 1,2	TN	NPC	UC	Nuclear	2000	2000	2000	2000
31	PFBR(Kalapakkam)	TN	NPC	UC	Nuclear	500	500	500	
32	Ratnagiri (Dhabol) JV	Maha	NTPC	Comnd	Gas/LNG	740	740	740	740
33	Sipat-II U4,5	Chattis	NTPC	Comnd	Coal	1000	1000	1000	1000
34	Sipat-I U1	Chattis	NTPC	Comnd	Coal	660	660		660
35	Sipat I U2-3	Chattis	NTPC	UC	Coal	1320	1320		660
36	Bhilai JV U 1,2	Chattis	NTPC	Comnd	Coal	500	500	500	500
37	Korba III U-7	Chattis	NTPC	Comnd	Coal	500	500	500	500
38	Kahalgaon II U6,7	Bihar	NTPC	Comnd	Coal	1000	1000	1000	1000
39	Dadri Ext U-5,6	Up	NTPC	Comnd	Coal	980	980	980	980
40	Indira Gandhi TPP (Jhajjar) JV U1	Haryana	NTPC	Comnd	Coal	500	500	500	500
41	Indira Gandhi TPP (Jhajjar) JV U2,3	Haryana	NTPC	UC	Coal	1000	1000	1000	500
42	Farakka Stage-III U6	WB	NTPC	Comnd	Coal	500	500	500	500
43	Simhadri-Ext U-3	AP	NTPC	Comnd	Coal	500	500	500	500
44	Simhadri-Ext U-4	AP	NTPC	UC	Coal	500	500	500	
45	Bongaigaon TPP U 1-3	Assam	NTPC	UC	Coal	750	750	500	
46	Lohari Nagpala HEP	Ut.Khand	NTPC	UC	Hydro	600	600		
47	Tapovan Vishnugarh HEP	Ut.Khand		UC	Hydro	520	520		

Sl.No.	Plant Name	State	Agency	Status	Fuel Type	Capacity (MW)	Capacity as per 78,700 MW	Capacity as per 62,374 MW	Capacity as per 52,063 MW
48	Koldam HEP	HP		UC	Hydro	800	800		
49	Mauda TPP U1,2	Maha		UC	Coal	1000	1000		
50	Barh I U 1,2,3	Bihar		UC	Coal	1980	1980		
51	Barh II U1	Bihar		UC	Coal	660	660		
52	Nabinagar JV U-1,2,3	Bihar		UC	Coal	750	750		
53	Vallur (Ennore) JV U1,2	TN		UC	Coal	1000	1000	1000	
54	Tripura Gas ILFS JV	Tripura		UC	Gas/LNG	726	750		
55	Rampur HEP	HP		UC	Hydro	412	412		
56	Koteshwar U 1,2 HEP	Ut.Khand		Comnd	Hydro	200	200	200	200
57	Koteshwar U3-4 HEP	Ut.Khand		UC	Hydro	200	200	200	200
	Sub Total (Central Sector)						**36874**	**21222**	**16175**
	State Sector								
1	Jurala Priya U 1-6	AP		Comnd	Hydro	234	234	234	234
2	Rayalseema U4,5	AP		Comnd	Coal	420	420	420	420
3	Vijaywada TPP St-IV, U1	AP		Comnd	Coal	500	500	500	500
4	Kakatiya TPP	AP		Comnd	Coal	500	500	500	500
5	Kothagudem St-VI	AP		Comnd	Coal	500	500	500	500
6	Nagarjuna Sagar TR	AP		UC	Hydro	50	50	50	
7	Lower Jurala U1-6 HEP	AP		UC	Hydro	240	240		
8	Pulichintala HEP	AP		UC	Hydro	120	120		
9	Kakatiya Ext U1	AP		UC	Coal	500	500		
10	Lakwa Wh	Assam		UC	Gas/LNG	37.2	37.2	37.2	
11	Korba East Ext U2	Chattis		Comnd	Coal	250	250	250	250
12	Marwah TPP U 1,2	Chattis		UC	Coal	1000	1000		
13	Korba West Ext PH III	Chattis		UC	Coal	500	500		
14	Pragati-III (Bawana) GT-1,2	Delhi		Comnd	Gas/LNG	500	500	500	500
15	Pragati-III (Bawana) GT-3,4 & St-1,2	Delhi		UC	Gas/LNG	1000	1000	1000	500
16	Kutch Lign TPS	Gujarat		Comnd	Lignite	75	75	75	75
17	Dhuvran St	Gujarat		Comnd	Gas/LNG	40	40	40	40
18	Utran CCPP-GT+ST	Gujarat		Comnd	Gas/LNG	374	374	374	374
19	Surat Lignite Ext U3,4	Gujarat		Comnd	Lignite	250	250	250	250
20	Ukai Ext U6	Gujarat		UC	Coal	490	490	490	
21	GSEG Hazira Ext	Gujarat		UC	Gas/LNG	351	351	351	351
22	Pipavav JV Ccgt	Gujarat		UC	Gas/LNG	702	702	702	
23	Sikka TPP Ext	Gujarat		UC	Coal	500	500		
24	Yamuna Nagar U1,2	Haryana		Comnd	Coal	600	600	600	600
25	Rajiv Gandhi TPS (Hissar) U1,2	Haryana		Comnd	Coal	1200	1200	1200	1200
26	Uhl - III HEP	HP	HPJVVNL	UC	Hydro	100	100		
27	Sawara Kuddu HEP	HP	PVC	UC	Hydro	110	110		
28	Baglihar-I U1,2,3 HEP	J&K	JKPDC	Comnd	Hydro	450	450	450	450
29	Varahi Ext U1,2 HEP	Karntk	KPCL	Comnd	Hydro	230	230	230	230
30	Bellary TPP U 1	Karntk	KPCL	Comnd	Coal	500	500	500	500
31	Bellary TPP U 2	Karntk	KPCL	UC	Coal	500	500	500	500
32	Raichur U 8	Karntk	KPCL	Comnd	Coal	250	250	250	250
33	Kutiyadi Ext U1,2 HEP	Kerala	KSEB	Comnd	Hydro	100	100	100	100
34	Pallivasal HEP	Kerala	KSEB	UC	Hydro	60	60		
35	Ghatghar Pss U1,2	Maha	GOMID	Comnd	Hydro	250	250	250	250
36	Paras Ext U1,2	Maha	MSPGCL	Comnd	Coal	500	500	500	500
37	New Parli Ext U-2	Maha	MSPGCL	Comnd	Coal	250	250	250	250
38	Khaper Kheda Ext	Maha	MSPGCL	Comnd	Coal	500	500	500	500
39	Bhusawal TPP U4,5	Maha	MSPGCL	UC	Coal	1000	1000	1000	1000
40	Myntdu St-I HEP	Meghal	MESEB	UC	Hydro	84	84	84	84
41	Myntdu St-I Addl Unit	Meghal	MESEB	UC	Hydro	42		42	42
42	New Umtru HEP	Meghal	MESEB	UC	Hydro	40	40		
43	Birsinghpur Ext	MP	MPPGCL	Comnd	Coal	500	500	500	500

Sl.No.	Plant Name	State	Agency	Status	Fuel Type	Capacity (MW)	Capacity as per 78,700 MW	Capacity as per 62,374 MW	Capacity as per 52,063 MW
44	Amarkantak U-5	MP	MPGENCO	Comnd	Coal	210	210	210	210
45	Malwa TPP U1,2	MP	MPGENCO	UC	Coal	1000	1000		
46	Satpura Ext U-1,2	MP	MPPGCL	UC	Coal	500	500		
47	Balimela HEP St-II U7,8	Orissa	OHPC	Comnd	Hydro	150	150	150	150
48	GhTPP-II U-3,4	Punjab	PSEB	Comnd	Coal	500	500	500	500
49	Giral Lignite U-2	Rajas	RRVUNL	Comnd	Lignite	125	125	125	125
50	Chhabra TPS U-1,2	Rajas	RRVUNL	Comnd	Coal	500	500	500	500
51	Kota TPP U7	Rajas	RRVUNL	Comnd	Coal	195	195	195	195
52	Suratgarh Ext U6	Rajas	RRVUNL	Comnd	Coal	250	250	250	250
53	Dholpur GT2+ST	Rajas	RRVUNL	Comnd	Gas/LNG	220	220	220	220
54	Kalisindh TPS U1	Rajas	RRVUNL	UC	Coal	600	500		
55	Valuthur Ext	TN	TNEB	Comnd	Gas/LNG	92.2	92.2	92.2	92.2
56	Bhawani Barrage II & III	TN	TNEB	UC	Hydro	60	60	60	
57	Mettur Ext U1	TN	TNEB	UC	Coal	600	500	600	
58	North Chennai Ext U1,2	TN	TNEB	UC	Coal	1200	600	1200	
59	Baramura Gt	Tri		Comnd	Gas/LNG	21			21
60	Maneri Bhali HEP	Ut.Khand	UJVNL	Comnd	Hydro	304	304	304	304
61	Parichha Ext U-5,6	Up	UPRVUNL	UC	Coal	500	500	500	
62	Harduaganj Ext U-8	Up	UPRVUNL	Comnd	Coal	250	250	250	250
63	Harduaganj Ext U-9	Up	UPRVUNL	UC	Coal	250	250	250	250
64	Anpara-D U1,2	Up	UPRVUNL	UC	Coal	1000	1000		
65	Purlia Pss	WB	WBSEB	Comnd	Hydro	900	900	900	900
66	Sagardighi U 1,2	WB	WBPDCL	Comnd	Coal	600	600	600	600
67	Santaldih U5	WB	WBPDCL	Comnd	Coal	250	250	250	250
68	Santaldih Ext-U 6	WB	WBPDCL	Comnd	Coal	250	250	250	250
69	Bakreshwar U 4,5	WB	WBPDCL	Comnd	Coal	420	420	420	420
70	Durgapur Ext U 7	WB	DPL	Comnd	Coal	300	300	300	300
	Sub Total (State Sector)						**26783**	**21355**	**17237**
	Private Sector								
1	Konaseema Gt+St	AP	Konaseema Power	Comnd	Gas/LNG	445	445	445	445
2	Gautami	AP	Gautami Power	Comnd	Gas/LNG	464	464	464	464
3	Kondapalli CCPP Ph-II Gt+St	AP	LANCO	Comnd	Gas/LNG	366		366	366
4	Raigarh TPP Ph-I, U-1, 2; Ph II U 3,4	Chattis	Jindal Power	Comnd	Coal	1000	1000	1000	1000
5	Lanco Amarkantak U1,2	Chattis	LANCO	Comnd	Coal	600	600	600	600
6	Rithala CCPP (Gt1+Gt2+St)	Delhi	NDPL	Comnd	Gas/LNG	108.0		108.0	71.5
7	Sugen Torrent Block I, II & III	Gujarat	Torrent	Comnd	Gas/LNG	1147.5	1128	1147.5	1147.5
8	Mundra TPP Ph-I, U 1-4	Gujarat	Adani Power	Comnd	Coal	1320	1320	1320	1320
9	Mundra TPP Ph-II U1,2	Gujarat	Adani Power	Comnd	Coal	1320		1320	1320
10	Mundra TPP Ph-III U-1	Gujarat	Adani Power	UC	Coal	660		660	
11	Ultra Mega Mundra U1	Gujarat	Tata Power	UC	Coal	800		800	800
12	Allain Duhangan U1,2	HP	Adhpl	Comnd	Hydro	192	192	192	192
13	Karcham Wangtoo U1-4	HP	Jpkhcl	Comnd	Hydro	1000	1000	1000	1000
14	Malana HEP II U1,2	HP	Evrest Power	Comnd	Hydro	100	100	100	100
15	Budhil HEP	HP	LANCO	UC	Hydro	70	70	70	70
16	Sorang HEP	HP	Himachal Sorang Power	UC	Hydro	100	100		
17	Maithan RBC JV U1**	Jharknd	IPP	Comnd	Coal	525	0	525	525
18	Maithan RBC JV U2**	Jharknd	IPP	UC	Coal	525	0	525	525
19	Torangallu U1,2	Karntk	JSW Energy	Comnd	Coal	600	600	600	600
20	Udupi TPP (LANCO Nagarjuna) U1,2	Karntk	NPCL	Comnd	Coal	1200	1015	1015	1200

Sl.No.	Plant Name	State	Agency	Status	Fuel Type	Capacity (MW)	Capacity as per 78,700 MW	Capacity as per 62,374 MW	Capacity as per 52,063 MW
21	Trombay TPS	Maha	Tata Power	Comnd	Coal	250	250	250	250
22	JSW Energy, RaTNagiri U1-3	Maha	JSW	Comnd	Coal	900	900	900	900
23	JSW Energy, RaTNagiri U4	Maha	JSW	UC	Coal	300	300	300	300
24	TPS At Warora U1,2,3,4	Maha	Wardha Powerco	Comnd	Coal	540			540
25	Tiroda TPP Ph-I U1	Maha	Adani Power	UC	Coal	660		660	660
26	Maheshwar 1-10	MP	SMHPCL	UC	Hydro	400	400	400	
27	Sterlite TPP U 2,1	Orissa	Sterlite Energy	Comnd	Coal	1200	600	1200	1200
28	Sterlite TPP U3	Orissa	Sterlite Energy	Comnd	Coal	600			600
29	Jallipa Lignite U 1,2	Rajas	Raj West Power	Comnd	Lignite	270	270	270	270
30	Jallipa Lignite U 3-8	Rajas	Raj West Power	UC	Lignite	810	810	810	135
31	Teesta III	Sikkim	Teesta Urja	UC	Hydro	1200	1200	600	
32	Chujachen	Sikkim	GATI	UC	Hydro	99	99	99	
33	Srinagar	Ut.Khand	GVK	UC	Hydro	330	330		
34	Rosa St-I U1,2	UP	Reliance Power	Comnd	Coal	600	600	600	600
35	Anpara-C U1,2	UP	LANCO	UC	Coal	1200	1000	1200	1200
36	Budge-Budge Ext	WB	CESC	Comnd	Coal	250	250	250	250
	Sub Total (Private Sector)						**15043**	**19797**	**18651**
	Total (11th Plan)						**78700**	**62374**	**52063**

Note - UC: Under Construction

*considered in Private sector in 62,374 MW & 52,063 MW

****considered in Central sector in 78,700 MW

Appendix 1.4
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LIST OF PROJECTS SLIPPING FROM 78,700 MW viz-a-viz 62,374 MW

Sl.No.	PLANT NAME	STATE	AGENCY	CAPACITY (MW)	REASONS FOR SLIPPAGE
	HYDRO				
	CENTRAL SECTOR				
1	PARBATI - II	HP	NHPC	800	Slow progress of Head Race Tunnel works because of bad geology.
2	SUBANSIRI LOWER	AR.PR.	NHPC	2000	Poor geology and consequent change in design of surge shaft arrangement. Local issues.
3	RAMPUR	HP	SJVNL	412	Slow progress of Head Race Tunnel works because of bad geology.
4	KAMENG	AR.PR.	NEEPCO	600	Adverse geology resulting in slow progress in HRT. Flash flood.
5	LOHARI NAGPALA	UKND	NTPC	600	Work held up due to environmental concern.
6	TAPOVAN VISHNUGARH	UKND	NTPC	520	Slow progress in power house due to poor rock strata.
7	KOLDAM	HP	NTPC	800	Slow progress of work. Contractual issues.
	Sub-total (Central)			**5732**	
	STATE SECTOR				
8	LOWER JURALA U1-6	AP	APGENCO	240	Slow progress of civil work.
9	PULICHINTALA	AP	APID	120	Delay in civil works.
10	UHL - III	HP	HPJVVNL	100	Poor geology in HRT. Re-award of contract for HRT & Neri Khad works due to slow progress.
11	SAWARA KUDDU	HP	PVC	110	Initial delay due to MoEF clearance. Delay in award of civil and E&M package.
12	NEW UMTRU	MEGHALAYA	MeSEB	40	Slow progress of civil works.
13	PALLIVASAL	KERL	KSEB	60	Delay in land acquisition. Slow progress of civil works.
	Sub-total (State)			**670**	
14	SORANG	HP	HIMACHAL SORANG POWER	100	Difficult area, weather conditions & accessibility.
15	SRINAGAR	UKND	GVK	330	Concreting of dam. Local issues
16	TEESTA III	SIKKIM	TEESTA URJA	600	E&M works are critical.
	Sub-total (Private)			**1030**	
	SUB TOTAL (HYDRO)			**7432**	

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Sl.No.	PLANT NAME	STATE	AGENCY	CAPACITY (MW)	REASONS FOR SLIPPAGE
	THERMAL				
	CENTRAL SECTOR				
1	MAUDA TPP U1,2	MAH	NTPC	1000	Delay in placement of main plant order.
2	BARH I U 1,2,3	BIH	NTPC	1980	Contractual issues.
3	BARH II U1	BIH	NTPC	660	Delay in placement of main plant order.
4	SIPAT I U 1-3	CHG	NTPC	1980	Contractual issues.
5	NABINAGAR JV U-1,2,3	BIH	NTPC	750	Land to be acquired.
6	BONGAIGAON U3	ASSAM	NTPC	250	Law & order problem.
7	TUTICORIN JV	TN	NLC	1000	Delay in placement of main plant order.
8	BOKARO EXPANSION	JHAR	DVC	500	Delay in dismantling of CW channel for start of work of boiler foundation.
9	TRIPURA GAS ILFS JV	TRI	ONGC	750	Order for main plant civil works and logistics to be placed by BHEL. Forest clearance from MoEF for erection of transmission lines awaited.
	Sub-total (Central)			**8870**	
	STATE SECTOR				
10	KALISINDH TPS U1	RAJ	RRVUNL	500	Delay in placement of orders for main plant.Orders for BoPs to be placed.
11	MARWAH TPP U 1,2	CHG	CSEB	1000	Delay in placement of main plant order.
12	MALWA TPP U1,2	MP	MPGENCO	1000	Delay in placement of orders for main plant.Orders for BoPs to be placed.
13	SATPURA EXT U-1,2	MP	MPPGCL	500	Delay in placement of orders for main plant.Orders for BoPs to be placed.
14	SIKKA EXT	GUJ	GSECL	500	Environmental clearance by MoEF. Orders for BoPs to be placed.
15	KAKATIYA EXT U1	AP	APGENCO	500	Delay in placement of main plant order.
16	ANPARA-D U1,2	UP	UPRVUNL	1000	Delay in award of civil works.
17	KORBA WEST EXT PH III	CHG	CSEB	500	Delay in placement of main plant order.
	Sub-total (State)			**5500**	
	SUB TOTAL (THERMAL)			**14370**	
	TOTAL SLIPPAGE			**21802**	
	CENTRAL SECTOR			*14602*	
	STATE SECTOR			*6170*	
	PRIVATE SECTOR			*1030*	

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BREAK UP OF SLIPPED CAPACITY (REASON-WISE)

Delay in placement of orders for Main plant: 6,660 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	MAUDA TPP U1,2	MAHARASHTRA	NTPC	1000
2	BARH II U1	BIHAR	NTPC	660
3	TUTICORIN JV	TN	NLC	1000
4	KALISINDH TPS U1	RAJASTHAN	RRVUNL	500
5	MARWAH TPP U 1,2	CHHATTISGARH	CSEB	1000
6	MALWA TPP U1,2	MP	MPGENCO	1000
7	SATPURA EXT U1,2	MP	MPPGCL	500
8	KAKATIYA EXT U1	AP	APGENCO	500
9	KORBA WEST EXT PH III	CHHATTISGARH	CSEB	500
	Total			**6660**

Delay in placement of orders for Civil works: 1,860 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	TRIPURA GAS ILFS JV	TRIPURA	ONGC	750
2	ANPARA-D U1,2	UP	UPRVUNL	1000
3	SAWARA KUDDU	HP	PVC	110
	Total			**1860**

Slow progress of Civil works: 900 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	LOWER JURALA U1-6	AP	APGENCO	240
2	NEW UMTRU	MEGHALAYA	MeSEB	40
4	PULICHINTALA	AP	APID	120
5	BOKARO EXPANSION	JHARKHAND	DVC	500
	Total			**900**

Poor Geology: 4,432 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	PARBATI - II	HP	NHPC	800
2	SUBANSIRI LOWER	ARUNACHAL PRADESH	NHPC	2000
3	RAMPUR	HP	SJVNL	412
4	KAMENG	ARUNACHAL PRADESH	NEEPCO	600
5	TAPOVAN VISHNUGARH	UTTARAKHAND	NTPC	520
6	UHL - III	HP	HPJVVNL	100
	Total			**4432**

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Contractual dispute between project developer and contractor and their sub-vendors / sub-contractor: 4,760 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	BARH I U 1,2,3	BIHAR	NTPC	1980
2	SIPAT I U 1-3	CHHATTISGARH	NTPC	1980
3	KOLDAM	HP	NTPC	800
	Total			**4760**

Delay in Land Acquisition: 810 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	PALLIVASAL	KERALA	KSEB	60
2	NABINAGAR JV U-1,2,3	BIHAR	NTPC	750
	Total			**810**

Environmental Concern: 1100 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	LOHARI NAGPALA	UTTARAKHAND	NTPC	600
2	SIKKA EXT	GUJARAT	GSECL	500
	Total			**1100**

Law and Order Problem/Local Issues: 580 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	BONGAIGAON U3	ASSAM	NTPC	250
2	SRINAGAR	UTTARAKHAND	GVK	330
	Total			**580**

E&M work critical: 600 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	TEESTA III	SIKKIM	TEESTA URJA	600
	Total			**600**

Difficult area and accessibility: 100 MW

Sl. No.	Plant Name	State	Agency	Capacity (MW)
1	SORANG	HP	HIMACHAL SORANG POWER	100
	Total			**100**
	Total Capacity Slipping from 78,700 MW			**21802**

Appendix 1.5

LIST OF ADDITIONAL PROJECTS FOR BENEFITS DURING 11TH PLAN

Sl.No.	PLANT NAME	STATE	AGENCY	ULTIMATE CAPACITY (MW)	TYPE	BENEFITS 11TH PLAN (2007-12)
	STATE SECTOR					
1	MYNTDU St-I ADDL UNIT	MEGH	MeSEB	42	HYDRO	42
2	NORTH CHENNAI EXT U2	TN	TNEB	600	COAL	600
	SUB TOTAL					**642**
	PRIVATE SECTOR					
3	RITHALA CCPP	DELHI	NDPL	108	GAS/LNG	108
4	KONDAPALLI CCPP PH-II	AP	LANCO Kondapalli Power	366	GAS/LNG	366
5	TIRODA TPP PH-I, U1	MAH	Adani Power	660	660	660
6	MUNDRA TPP PH-II U1,2	GUJ	Adani Power	1320	COAL	1320
7	MUNDRA TPP PH-III U1	GUJ	Adani Power	660	COAL	660
8	STERLITE TPP U2	ORS	Sterlite Energy	2400	COAL	600
9	ULTRA MEGA MUNDRA U1	GUJ	TATA Power	800	COAL	800
	SUB TOTAL					**4514**
	TOTAL					**5156**

Appendix 1.6
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LIST OF PROJECTS COMMISSIONED DURING 2007-08 (11th PLAN)

PROJECT NAME	Capacity (COMMISSIONING DATE/MONTH/ YEAR)	REGION	SECTOR	STATE	TYPE	TOTAL CAPACITY (MW)
THERMAL PROJECTS						
SIPAT-II UNIT-4	500 (27/05/2007)	WR	C.S.	CHAT	COAL	500.00
PARAS UNIT-1	250 (31/05/2007)	WR	S.S.	MAHA	COAL	250.00
DHOLPUR CCGT GT -2	110 (16/06/2007)	NR	S.S.	RAJ.	GAS	110.00
BIRSINGPUR UNIT-5	500 (18/06/2007)	WR	S.S.	M.P.	COAL	500.00
DHUVRAN ST	40 (13/08/2007)	WR	S.S.	GUJ.	GAS	40.00
RAIGARH (JINDAL) U-I	250 (02/09/2007)	WR	P.S.	CHAT	COAL	250.00
MEJIA UNIT-6	250 (01/10/2007)	ER	C.S.	DVC	COAL	250.00
RATNAGIRI GAS	740 (28/10/2007)	WR	C.S.	MAHA	GAS	740.00
YAMUNA NAGAR U-I	300 (01/11/2007)	NR	S.S.	HAR.	COAL	300.00
SANTALDIH UNIT-5	250 (07/11/2007)	ER	S.S.	W.B.	COAL	250.00
RAYALSEEMA U-4	210 (20/11/2007)	SR	S.S.	A.P.	COAL	210.00
DURGAPUR DPL U-7	300 (24/11/2007)	ER	S.S.	W.B.	COAL	300.00
BELLARY UNIT-I	500 (03/12/2007)	SR	S.S.	KAR.	COAL	500.00
KORBA EAST EXT. U-2	250 (11/12/2007)	WR	S.S.	CHAT	COAL	250.00
SAGARDIGHI U-1	300 (21/12/2007)	ER	S.S.	W.B.	COAL	300.00
BAKRESHWAR U-4	210 (24/12/2007)	ER	S.S.	W.B.	COAL	210.00
DHOLPUR ST	110 (27/12/2007)	NR	S.S.	RAJ.	GAS	110.00
GHGTPS-II (LEH MOH)	250 (03/01/2008)	NR	S.S.	PUN.	COAL	250.00
RAIGARH (JINDAL) U-3	250 (10/02/2008)	WR	P.S.	CHAT	COAL	250.00
RAIGARH (JINDAL) U-2	250 (06/03/2008)	WR	P.S.	CHAT	COAL	250.00
KAHALGAON UNIT-6	500 (16/03/2008)	ER	C.S.	BIH.	COAL	500.00
YAMUNA NAGAR U-2	300 (29/03/2008)	NR	S.S.	HAR.	COAL	300.00
SUB-TOTAL(THERMAL)						**6620.00**
HYDRO PROJECTS						
PURLIA PSS UNIT-4 (JV)	225 (18/07/2007)	ER	S.S.	W.B.	HYDRO	900.00
PURLIA PSS UNIT-3 (JV)	225 (27/08/2007)					
PURLIA PSS UNIT-2 (JV)	225 (23/11/2007)					
PURLIA PSS UNIT-1 (JV)	225 (20/01/2008)					
		WR	C.S.	M.P.	HYDRO	520.00
OMKARESWAR UNIT-1	65 (21/07/2007)					
OMKARESWAR UNIT-2	65 (09/08/2007)					
OMKARESWAR UNIT-3	65 (29/08/2007)					
OMKARESWAR UNIT-4	65 (13/09/2007)					
OMKARESWAR UNIT-5	65 (27/09/2007)					
OMKARESWAR UNIT-6	65 (18/10/2007)					
OMKARESWAR UNIT-7	65 (27/10/2007)					
OMKARESWAR UNIT-8	65 (04/11/2007)					
BALIMELA UNIT-7	75 (05/01/2008)	ER	S.S.	ORI.	HYDRO	150.00
BALIMELA UNIT-8	75 (27/03/2008)					
MANERI BHALI U-4	76 (16/01/2008)	NR	S.S.	UTTA	HYDRO	304.00
MANERI BHALI U-1	76 (21/01/2008)					
MANERI BHALI U-3	76 (25/01/2008)					
MANERI BHALI U-2	76 (10/03/2008)					

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PROJECT NAME	Capacity (COMMISSIONING DATE/MONTH/ YEAR)	REGION	SECTOR	STATE	TYPE	TOTAL CAPACITY (MW)
TEESTA -V UNIT - 2	170 (06/02/2008)	ER	C.S	SIKK	HYDRO	510.00
TEESTA -V UNIT – 3	170 (20/03/2008)					
TEESTA -V UNIT - 1	170 (28/03/2008)					
JURALA PRIYA U-1	39 (28/03/2008)	SR	S.S.	A.P.	HYDRO	39.00
SUB-TOTAL(HYDRO)						**2423.00**
NUCLEAR PROJECT						
KAIGA UNIT-3	220 (11/04/2007)	SR	C.S.	KAR.	NUCLEAR	220.00
SUB-TOTAL(NUCLEAR)						**220.00**
TOTAL(THERMAL+HYDRO+NUCLEAR):-(2007-2008)						**9263.00**

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LIST OF PROJECTS COMMISSIONED DURING 2008-2009 (11th PLAN)

PROJECT NAME	Capacity (COMMISSIONING DATE/MONTH/ YEAR)	REGION	SECTOR	STATE	TYPE	TOTAL CAPACITY (MW)
THERMAL PROJECTS						
BHILAIEXN.TPPUNIT-1	250 (20/04/2008)	WR	C.S.	CHAT	COAL	250.00
VALUTHUR PH-II GTPP	59.8 (6/02/2009)	SR	S.S.	TAM.	GAS	59.8
AMARKANTAK U-5	210 (15/06/2008)	WR	S.S.	M.P.	COAL	210.00
RAIGARH (JINDAL) U-4	250 (17/06/2008)	WR	P.S.	CHAT	COAL	250.00
SAGARDIGHI U-2	300 (20/07/2008)	ER	S.S.	W.B.	COAL	300.00
GHGTPP-II,LEHAR MOB.	250 (31/07/2008)	NR	S.S.	PUN.	COAL	250.00
SIPAT ST-II U-5	500 (13/08/2008	WR	C.S.	CHAT	COAL	500
VALUTHUR PH-II ST	32.4 (17/02//2009)	SR	S.S.	TAM.	GAS	32.4
SUGEN CCPP	382.5 (4/02/2009)	WR	P.S.	GUJ	GAS	382.5
TROMBAY Extn.	250 (26.03.2009)	WR	P.S.	MAH	COAL	250
SUB-TOTAL(THERMAL)						**2484.7**
HYDRO PROJECTS						
GHATGHAR PSS	125 (13/05/2008)	WR	S.S.	MAHA	HYDRO	125.00
GHATGHAR PSS	125 (01/07/2008)	WR	S.S.	MAHA	HYDRO	125.00
JURALA PRIYA U-2	39 (31/08/2008)	SR	S.S.	A.P.	HYDRO	39.00
BAGLIHAR UNIT-1	150 (19/09/2008)	NR	S.S.	J&K	HYDRO	150.00
BAGLIHAR UNIT-2	150 (26/10/2008)	NR	S.S.	J&K	HYDRO	150.00
BAGLIHAR UNIT-3	150 (14/11/2008)	NR	S.S.	J&K	HYDRO	150.00
VARAHI EXT.UNIT 1	115 (11/1/2009	SR	S.S.	KAR	HYDRO	115.00
VARAHI EXT.UNIT 2	115 (09/2/2009	SR	S.S.	KAR	HYDRO	115.00
SUB-TOTAL(HYDRO)						**969.00**
NUCLEAR PROJECT						
SUB-TOTAL(NUCLEAR)						**0.00**
TOTAL(THERMAL+HYDRO+NUCLEAR):-(2008-2009)						**3453.7**

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LIST OF PROJECTS COMMISSIONED DURING 2009-2010 (11TH PLAN)

PROJECT NAME	CAPACITY (COMMISSIONING DATE/MONTH/ YEAR)	REGION	SECTOR	STATE	TYPE	TOTAL CAPACITY (MW)
TORANGALLU U-1	(23.4.2009)	SR	P.S.	KAR	COAL	300
SUGEN –BLOCK-2	*(7.5.2009)*	*WR*	*P.S.*	*GUJ*	*GAS*	*382.5*
GAUTAMI	*(3.5.2009)*	*SR*	*P.S*	*A.P.*	*GAS*	*464*
KONASEEMA GT	*(3.5.2009)*	*SR*	*P.S.*	*A.P.*	*GAS*	*280*
SUGEN BLOCK-3	*(8.6.2009)*	*WR*	*P.S.*	*GUJ*	*GAS*	*382.5*
LANCO AMARKANTAK U-1	*(4.6.2009)*	*WR*	*P.S.*	*CHATT*	*COAL*	*300*
BAKRESHWAR U-5	*(7.6.2009)*	*ER*	*S.S*	*WB*	*COAL*	*210*
BHILAI U-2	*(12.07.2009)*	*WR*	*C.S*	*CHATT*	*COAL*	*250*
KAHALGAON-II U-7	*(31.07.2009)*	*ER*	*C.S*	*BIHAR*	*COAL*	*500*
MUNDRA PH-I, U-I	*(4.8.2009)*	*WR*	*P.S.*	*GUJ*	*COAL*	*330*
UTRAN GT	*(8.8.2009)*	*WR*	*S.S.*	*GUJ*	*GAS*	*240*
TORANGALLU U-2	*(24.8.2009)*	*SR*	*P.S.*	*KAR*	*COAL*	*300*
SURATGARH U-6	*(29.8.2009)*	*NR*	*S.S.*	*RAJ*	*COAL*	*250*
KOTA U-7	*(30.8.2009)*	*NR*	*S.S.*	*RAJ*	*COAL*	*195*
BUDGE-BUDGE-EX	*(29.9.2009)*	*ER*	*P.S.*	*WB*	*COAL*	*250*
KUTCH LIGNITE U-4	*(1.10.2009)*	*WR*	*S.S.*	*GUJ*	*LIGNITE*	*75*
VIJAYWADA ST.IV U-I	*(8.10.2009)*	*SR*	*S.S*	*A.P.*	*COAL*	*500*
UTRAN CCPP-II ST	*(10.10.2009)*	*WR*	*S.S.*	*GUJ*	*GAS*	*134*
JALIPA LIGNITE U-I	*(16.10.2009)*	*NR*	*P.S.*	*RAJ*	*LIGNITE*	*135*
CHABRA U-I	*(30.10.2009)*	*NR*	*S.S*	*RAJ*	*COAL*	*250*
CHANDRAPUR U-7	*(4.11.2009)*	*ER*	*C.S.*	*DVC*	*COAL*	*250*
Lanco Kondapalli St-II GT	*(5.12.2009)*	*SR*	*P.S.*	*A.P.*	*GAS*	*233*
NCTPP DADRI UNIT 5	*(29.01.2010)*	*NR*	*C.S.*	*UP*	*COAL*	*490*
NEW PARLI EXT U2	*(10.2.2010)*	*WR*	*S.S.*	*MAHA*	*COAL*	*250*
ROSA ST-I U1	*(10.2.2010)*	*NR*	*P.S.*	*UP*	*COAL*	*300*
MUNDRA TPP ,PH-I,U-2	*(17.03.2010)*	*WR*	*P.S.*	*GUJ*	*COAL*	*330*
LANCO AMARKANTAK TPS U-2	*(25.03.2010)*	*WR*	*P.S.*	*CHAT*	*COAL*	*300*
PARAS TPS EXT. U2	*(27.03.2010)*	*WR*	*S.S.*	*MAHA*	*COAL*	*250*
CHANDRUPURA U-8	*(31.03.2010)*	*ER*	*C.S.*	*DVC*	*COAL*	*250*
RAJIV GANDHI (HISSAR) U-1	*(31.03.2010)*	*NR*	*S.S.*	*HAR*	*COAL*	*600*
GIRAL LIGNITE U-2		*NR*	*S.S.*	*RAJ*	*LIGNITE*	*125*
TOTAL THERMAL						***9106***
HYDRO PROJECTS						
JURALA PRIYA U-3	*(27.06.2009)*	*SR*	*S.S.*	*A.P.*	*HYDRO*	*39.0*
TOTAL HYDRO						***39.0***
NUCLEAR PROJECT						
RAPP U-5	*(4.02.2010)*	*NR*	*C.S.*	*RAJ*	*NUCLEAR*	*220*
RAPP U-6	*(31.03.2010)*	*NR*	*C.S.*	*RAJ*	*NUCLEAR*	*220*
TOTAL NUCLEAR						***440***
TOTAL (THERMAL+HYDRO+NUCLEAR)(2009-10)						***9585***

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LIST OF PROJECTS COMMISSIONED DURING 2010-2011 (11th PLAN)

PROJECT NAME	COMMISSIONING DATE	REGION	SECTOR	STATE	TYPE	TOTAL (MW)
SURAT LIGNITE EXP TPP U3	12.04.2010	NR	S.S	GUJ	LIGNITE	125
SURAT LIGNITE EXP TPP 4	12.04.2010	NR	S.S	GUJ	LIGNITE	125
CHHABRA TPS U-2	04.05.2010	NR	S.S.	RAJ.	COAL	250
KAKATIYA ST-I U-1	27.05.2010	SR	S.S.	A.P.	COAL	500
ROSA PH-I U-2	26.06.2010	NR	P.S.	U.P.	COAL	300
BARSINGSAR LIG. U-1	28.06.2010	NR	C.S.	RAJ.	LIGNITE	125
WARDHA WARORA TPP U-I	05.06.2010	WR	P.S.	MAHA.	COAL	135
RAICHUR TPS EXTN. U-8	26.06.2010	SR	S.S.	KARNATAKA	COAL	250
KONASEEMA ST	30.06.2010	SR	P.S.	A.P.	GAS/LNG	165
LANCO KONDAPALLI St-II ST	19.07.2010	SR	P.S.	AP	GAS	133
UDUPI U I	23.07.2010	SR	P.S.	KARNATAKA	COAL	600
DADRI U-6	30.07.2010	NR	C.S	U.P.	COAL	490
JALIPA LIGNITE U -2	8.07.2010	NR	P.S.	RAJ	LIGNITE	135
MUNDRA TPP PH-I,U-3	2.08.2010	WR	P.S.	GUJ	COAL	330
BARAMURA GT EXTN.	3.08.2010	NER	S.S	TRI	GAS	21
JSW ENERGY RATNAGIRI U-1	24.08.2010	WR	P.S.	MAHA	COAL	300
MEJIA PH II , U-7	30.09.2010	ER	C.S.	DVC	COAL	500
RAJIV GANDHI(HISSAR) U-2	1.10.2010	NR	S.S	HAR	COAL	600
STERLITE (JHARSUGUDA) U-2	14.10. 2010	ER	P.S.	ORI	COAL	600
WARDHA WARORA TPP U-2	10.10.2010	WR	P.S.	MAHA.	COAL	135
PRAGATI (BAWANA) ST-III GT-I	24.10.2010	NR	S.S	DEL	GAS	250
INDRA GANDHI (JHAJJAR) U-I	31.10.2010	NR	C.S.	HAR	COAL	500
JSW ENERGY RATNAGIRI U-2	09.12.2010	WR	P.S.	MAH	COAL	300
MUNDRA TPP PH-I,U-4	20.12.2010	WR	P.S.	GUJ	COAL	330
KORBA STPP ST III U-7	26.12.2010	WR	C.S.	CHATT	COAL	500
MUNDRA TPP PH-II U-I	26.12.2010	WR	P.S	GUJ	COAL	660
RAYALSEEMA TPP ST.III U5	31.01.2011	SR	S.S.	AP	COAL	210
STERLITE (JHARSUGUDA) U1	29.12.210	ER	P.S.	ORI	COAL	600
RITHALA CCPP GT-1	9.12.2010	NR	P.S.	DEL	GAS	35.75
RITHALA CCPP GT-2	4.10.2010	NR	P.S.	DEL	GAS	35.75
WARDHA WARORA TPP U-3	21.01.2011	WR	P.S.	MAHA.	COAL	135
BARSINGHSAR LIGNITE U-2	25.01.2011	NR	C.S.	RAJ	LIGNITE	125
PRAGATI (BAWANA) ST-IIIGT-2	16.02.2011	NR	S.S	DEL	GAS	250
FARAKKA ST III ,U-6	23.03.2011	ER	C.S.	W.B.	COAL	500
SIMHADRI U-3	31.03.2011	SR	C.S	A.P	COAL	500
MEJIA TPS ,PH II U-8	26.03.2011	ER	C.S.	DVC	COAL	500
TOTAL THERMAL						***11250.5***
HYDRO PROJECTS						
KUTTIYADI EXTN. H.E. U-1	*25.05.2010*	*SR*	*S.S.*	*KERALA*	*HYDRO*	*50*
SEWA II U-1	*22.06.2010*	*NR*	*C.S.*	*J&K*	*HYDRO*	*40*
SEWA II U-2	*23.07.2010*	*NR*	*C.S.*	*J&K*	*HYDRO*	*40*
SEWA-II U-3	*23.07.2010*	*NR*	*C.S.*	*J&K*	*HYDRO*	*40*
JURALA PRIYA U-4	*28.08.2010*	*SR*	*S.S*	*A.P.*	*HYDRO*	*39*
ALLAIN DUHANGAN U-I	*16.09.2010*	*NR*	*P.S.*	*H.P.*	*HYDRO*	*96*
ALLAIN DUHANGAN U-2	*18.09.2010*	*NR*	*P.S.*	*H.P.*	*HYDRO*	*96*
KUTIYADI EXT.H.E. U-2	*23.09.2010*	*SR*	*S.S.*	*KERALA*	*HYDRO*	*50*
JURALA PRIYA U-5	*09.11.2010*	*SR*	*S.S*	*A.P*	*HYDRO*	*39*
KOTESHWAR ,U-1,2	*28 & 31.03.2011*	*NR*	*C.S.*	*UTTA*	*HYDRO*	*200*
TOTAL HYDRO						***690***
NUCLEAR PROJECTS						
KAIGA U-4	*19.01.2011*	*SR*	*C.S.*	*KARNATAKA*	*NUCLEAR*	*220*
TOTAL NUCLEAR						***220***
TOTAL (THERMAL+HYDRO+NUCLEAR)(2010-11)						***12160.5***

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SUMMARY OF CAPACITY ADDITION TARGET DURING 2011-12

	Hydro	Thermal				Nuclear	Total
		Coal	Gas	Lignite	Total		
CENTRAL SECTOR	655	2820	0	250	3070	2000	5725
STATE SECTOR	165	3250	851	0	4101	0	4266
PRIVATE SECTOR	1170	6305	0	135	6440	0	7610
ALL-INDIA	1990	12375	851	385	13611	2000	17601

LIST OF PROJECTS (CAPACITY ADDITION TARGET) DURING 2011-12

Sl. No.	PLANT NAME	STATE	DEVELOPER	SECTOR	CATEGORY	FUEL	CAPACITY (MW)
	HYDRO						
1	CHUTAK	J&K	NHPC	C	UC	HYDRO	44
2	CHAMERA-III	HP	NHPC	C	UC	HYDRO	231
3	URI-II U1,2,3	J&K	NHPC	C	UC	HYDRO	180
4	KOTESHWAR U3-4	UKND	THDC	C	UC	HYDRO	200
5	JURALA PRIYA U 6	AP	APGENCO	S	COMND	HYDRO	39
6	MYNTDU St-I ADDL UNIT	MEGH	MeSEB	S	UC	HYDRO	84
7	MYNTDU St-I	MEGH	MeSEB	S	UC	HYDRO	42
8	MALANA II U1,2	HP	EVREST POWER	P	COMND	HYDRO	100
9	KARCHAM WANGTOO	HP	JPKHCL	P	COMND	HYDRO	1000
10	BUDHIL	HP	LANCO	P	UC	HYDRO	70
	TOTAL (HYDRO)						**1990**
	THERMAL						
1	KODARMA U1	JHAR	DVC	C	COMND	COAL	500
2	DURGAPUR STEEL U1	WB	DVC	C	COMND	COAL	500
3	INDIRA GANDHI TPP (JHAJJAR) JV U2	HAR	NTPC	C	UC	COAL	500
4	SIPAT-I U1	CHG	NTPC	C	COMND	COAL	660
4	SIPAT-I U2	CHG	NTPC	C	UC	COAL	660
5	NEYVELI - II LIG U1	TN	NLC	C	UC	LIGNITE	250
6	KOTHAGUDEM ST-VI	AP	APGENCO	S	COMND	COAL	500
7	BELLARY TPP U 2	KAR	KPCL	S	UC	COAL	500
8	KHAPER KHEDA EXT	MAH	MSPGCL	S	COMND	COAL	500
9	BHUSAWAL TPP U4,5	MAH	MSPGCL	S	UC	COAL	1000

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Sl. No.	PLANT NAME	STATE	DEVELOPER	SECTOR	CATEGORY	FUEL	CAPACITY (MW)
10	HARDUAGANJ EXT U-8,9	UP	UPRVUNL	S	UC	COAL	500
11	SANTALDIH EXT-U 6	WB	WBPDCL	S	COMND	COAL	250
12	PRAGATI-III (BAWANA) GT-3, ST-1	DELHI	PPCL	S	UC	GAS/LNG	500
13	GSEG HAZIRA EXT	GUJ	GSECL	S	UC	GAS/LNG	351
14	MUNDRA TPP PH-II U 2	GUJ	ADANI POWER	P	COMND	COAL	660
15	ULTRA MEGA MUNDRA U1	GUJ	TATA POWER	P	UC	COAL	800
16	MAITHAN RBC JV U1	JHAR	IPP	P	COMND	COAL	525
16	MAITHAN RBC JV U2	JHAR	IPP	P	UC	COAL	525
17	UDUPI TPP (LANCO NAGARJUNA) U2	KAR	LANCO	P	COMND	COAL	600
18	TIRODA TPP PH-I, U1	MAH	ADANI POWER	P	UC	COAL	660
19	JSW ENERGY, RATNAGIRI U3	MAH	JSW ENERGY	P	COMND	COAL	300
20	JSW ENERGY, RATNAGIRI U4	MAH	JSW ENERGY	P	UC	COAL	300
21	TPS AT WARORA U4	MAH	WARDHA POWER CO.	P	COMND	COAL	135
22	STERLITE TPP U3	ORS	STERLITE ENERGY	P	COMND	COAL	600
23	ANPARA-C U1,2	UP	LANCO	P	UC	COAL	1200
24	JALIPA LIGNITE U 3	RAJ	RAJ WEST POWER	P	UC	LIGNITE	135
	TOTAL (THERMAL)						**13611**
	NUCLEAR						
1	KUDANKULAM U 1	TN	NPC	C	UC	NUCLEAR	2000
	TOTAL (NUCLEAR)						**2000**
	TOTAL						**17601**
	Capacity Commissioned during 2011-12 (till 30.09.2011)						**7155.5**

Appendix 1.8

DETAILS OF CAPACITY COMMISSIONED DURING 2011-12 UPTO 30.9.2011

	Hydro	Thermal				Nuclear	Total
		Coal	Gas	Lignite	Total		
CENTRAL SECTOR	**0**	**1660**	**0**	**0**	**1660**	**0**	**1660**
STATE SECTOR	**39**	**1500**	**0**	**0**	**1500**	**0**	**1539**
PRIVATE SECTOR	**1100**	**2820**	**36.5**	**0**	**2856.5**	**0**	**3956.5**
ALL-INDIA	**1139**	**5980**	**36.5**	**0**	**6016.5**	**0**	**7155.5**

LIST OF PROJECTS COMMISSIONED IN 2011-12 UPTO 30.9.2011

Sl. No.	PLANT NAME	STATE	DEVELOPER	SECTOR	FUEL	CAPACITY (MW)
	HYDRO					
1	Jurala Priya U 6	AP	APGENCO	S	HYDRO	39
2	Malana II U1,2	HP	EVREST POWER	P	HYDRO	100
3	Karcham Wangtoo	HP	JPKHCL	P	HYDRO	1000
	TOTAL (HYDRO)					**1139**
	THERMAL					
1	Kodarma U1	JHAR	DVC	C	COAL	500
2	Durgapur Steel U1	WB	DVC	C	COAL	500
3	Sipat-I U1	CHG	NTPC	C	COAL	660
4	Kothagudem St-VI	AP	APGENCO	S	COAL	500
5	Khaper Kheda Ext	MAH	MSPGCL	S	COAL	500
6	Santaldih Ext-U 6	WB	WBPDCL	S	COAL	250
7	Harduaganj U8	UP	UPPCL	S	COAL	250
8	Mundra TPP Ph-II U 2	GUJ	ADANI POWER	P	COAL	660
9	Maithan RBC JV U1	JHAR	IPP	P	COAL	525
10	Udupi TPP (Lanco Nagarjuna) U2	KAR	LANCO	P	COAL	600
11	JSW Energy, Ratnagiri U3	MAH	JSW ENERGY	P	COAL	300
12	TPS At Warora U4	MAH	WARDHA POWER CO.	P	COAL	135
13	Sterlite TPP U3	ORS	STERLITE ENERGY	P	COAL	600
14	Rithala ST (Not included in the capacity addition target of 17,601 MW during 2011-12)	Delhi	NDPL	P	GAS	36.5
	TOTAL (THERMAL)					**6016.5**
	TOTAL COMMISSIONED TILL 30.09.2011					**7155.5**

Appendix 1.9(a)

LIST OF PLANNED/ MOST FEASIBLE THERMAL PROJECTS FOR LIKELY BENEFITS DURING 12TH PLAN

Sl. No.	Project Name	State	Developer	Sector	Capacity (MW)
	Coal Based Projects				
1	Bongaigaon TPP U 3	Assam	NTPC	C	250
2	Muzaffarpur Ext. TPP U 1,2	Bihar	NTPC JV	C	390
3	Barh TPP-I U1-3	Bihar	NTPC	C	1980
4	Barh TPP-II U1-2	Bihar	NTPC	C	1320
5	Nabinagar TPP U 1-4	Bihar	NTPV JV	C	1000
6	Sipat TPP-I U 3	Chhattisgarh	NTPC	C	660
7	Bokaro TPP 'A' Exp U 1	Jharkhand	DVC	C	500
8	Vindhyachal TPP-IV U 11,12	MP	NTPC	C	1000
9	Mauda TPP U 1,2	Maharashtra	NTPC	C	1000
10	Vallur TPP -II U 3	TN	NTECL (NTPC/TNEB JV)	C	500
11	Tuticorin JV TPP U1,2	TN	NPTL (NLC JV)	C	1000
12	Rihand TPP-III U 5,6	UP	NTPC	C	1000
13	Kakatiya TPP Ext U 1	AP	APGENCO	S	600
14	Sri Damodaram Sanjeevaiah TPP (Krishnapattam TPP), U 1,2	AP	APPDCL	S	1600
15	Korba West TPP- III U5	Chhattisgarh	CSEB	S	500
16	Marwa TPP U 1,2	Chhattisgarh	CSEB	S	1000
17	Sikka TPP Ext. U 3,4	Gujarat	GSECL	S	500
18	Satpura TPP Ext U-10,11	MP	MPPGCL	S	500
19	Shree Singati (Malwa) TPP U 1,2	MP	MPGENCO	S	1200
20	Chandrapur TPP Ext U 8, 9	Maharashtra	MSPGCL	S	1000
21	Koradi TPP Ext U 8-10	Maharashtra	MSPGCL	S	1980
22	Parli TPP Ext U 8	Maharashtra	MSPGCL	S	250
23	Kalisindh TPP U 1,2	Rajasthan	RRVUNL	S	1200
24	Chhabra TPP Ext U 3,4	Rajasthan	RRVUNL	S	500
25	Anpara-D U 1,2	UP	UPRVUNL	S	1000
26	Durgapur TPS Ext U 8	WB	DPL	S	250
27	Thamminapatnam TPP -II U 3,4	AP	Meenakshi Energy Ltd.	P	600
28	Painampuram TPP U 1,2	AP	Thermal Powertech Corporation Ltd.	P	1320

Sl. No.	Project Name	State	Developer	Sector	Capacity (MW)
29	Simhapuri TPP-II U 3,4	AP	Madhucon Projects Ltd. (Simhapuri Energy Ltd)	P	300
30	Vandana Vidyut TPP U 2	Chhatisgarh	Vandana Vidyut	P	135
31	Darrampura TPP U 1-3	Chhatisgarh	SKS Power Generation (Chattisgarh) Ltd	P	900
32	Avantha Bhandar TPP U 1	Chhattisgarh	Korba West Power Company Ltd.	P	600
33	Maurti Clean Coal & Power TPP U 1	Chhattisgarh	Maurti Clean Coal & Power Ltd.	P	300
34	Lanco Amarkantak TPP- II U 3, 4	Chhattisgarh	LAP Pvt. Ltd.	P	1320
35	Uchpinda TPP U 1-3	Chhattisgarh	R.K.M. POWERGEN Pvt. Ltd.	P	1080
36	Akaltara (Nariyara) TPP U 1-4	Chhattisgarh	Wardha PCL (KSK)	P	2400
37	Mundra TPP- III U 2,3	Gujarat	Adani Power Ltd.	P	1320
38	Mundra UMPP U 2-5	Gujarat	Tata Power Company	P	3200
39	Jhajjar TPP (Mahatma Gandhi TPP) U 2	Haryana	CLPower India Pvt Ltd	P	660
40	Corporate Power Ltd (Maitrishi Usha)- I U 1,2	Jharkhand	Corporate Power Ltd.	P	540
41	Adhunik Power TPP U 1,2	Jharkhand	Adhunik Power & Natural Resources Ltd.	P	540
42	Anoppur TPP -I U 1,2	MP	MB Power (M P) Ltd.	P	1200
43	Bina TPP U 2	MP	Bina Power Supply Co. Ltd.	P	250
44	Sasan UMPP U 1-4	MP	Reliance Power Ltd.	P	2640
45	Nigri TPP U 1	MP	JP Power Ventures Ltd.	P	660
46	Mahan TPP U 1,2	MP	Essar Power MP Ltd.	P	1200
47	Amravati TPP -I U 1-5	Maharashtra	India Bulls	P	1350
48	Amravati TPP -II U 1-5	Maharashtra	India Bulls	P	1350
49	Nasik TPP-I U 1-5	Maharashtra	India Bulls	P	1350
50	Nasik TPP- II U 1-5	Maharashtra	India Bulls	P	1350
51	Dhariwal Infrastructure TPP U 1,2	Maharashtra	Dhariwal Infrastructure (P) Ltd.	P	600
52	EMCO Warora TPP U 1,2	Maharashtra	EMCO Energy Ltd. (GMR)	P	600
53	Butibori TPP -II U-1	Maharashtra	Vidarbha Industries Power Ltd	P	300
54	Lanco Vidarbha TPP U 1,2	Maharashtra	Lanco Vidarbha	P	1320

Sl. No.	Project Name	State	Developer	Sector	Capacity (MW)
55	Tiroda TPP -I U 2	Maharashtra	Adani Power Ltd.	P	660
56	Tiroda TPP- II U 1	Maharashtra	Adani Power Ltd.	P	660
57	Derang TPP U 1,2	Orissa	Jindal India Thermal Power Ltd	P	1200
58	Ind Bharat TPP U 1,2	Orissa	Ind. Bharat Power (Utkal) Ltd.	P	700
59	Lanco Babandh TPP U 1	Orissa	Lanco Babandh Power Ltd.	P	600
60	K.V.K. Nilanchal TPP U 1,2	Orissa	K.V.K. Nilanchal Power	P	1050
61	Kamalanga TPP U 1-3	Orissa	GMR Energy	P	1050
62	Talwandi Sabo TPP U 1,2	Punjab	Vedanta (Sterlite)	P	1320
63	Goindwal Sahib TPP U 1	Punjab	GVK Power	P	270
64	Melamaruthur TPP U 1,2	TN	Coastal Energen Pvt. Ltd.	P	1200
65	Bara TPP U 1,2	UP	Jaypee Power Ltd.	P	1320
66	Rosa TPP -II U 3.4	UP	Reliance Power Ltd.	P	600
	TOTAL (COAL BASED)				**62695**

Appendix 1.9 (b)
Sheet(1/2)

LIST OF UNDER CONSTRUCTION HYDRO PROJECTS FOR LIKELY BENEFITS DURING 12TH PLAN

Sl. No.	Project Name	State	Developer	Sector	Capacity (MW)	E&M equipment supplier
1	Pare	Ar. Pradesh	NEEPCO	C	110	Andritz
2	Kameng	Ar. Pradesh	NEEPCO	C	600	BHEL
3	Subansiri Lower	Ar. Pradesh	NHPC	C	2000	Alstom India
4	Parbati-II	H.P.	NHPC	C	800	BHEL
5	Rampur	H.P.	SJVNL	C	412	BHEL
6	Kol Dam	H.P.	NTPC	C	800	BHEL
7	Kishan Ganga	J & K	NHPC	C	330	BHEL
8	Tuirial	Mizoram	NEEPCO	C	60	BHEL
9	Tapovan Vishnugad	Uttarakhand	NTPC	C	520	BHEL
10	Lower Jurala	A.P.	APGENCO	S	240	Alstom India
11	Pulichintala	A.P.	APGENCO	S	120	BHEL
12	Kashang - I	H.P.	HPPCL	S	65	Andritz
13	Uhl-III	H.P.	BVPC	S	100	BHEL
14	Sawara Kuddu	H.P.	HPPCL	S	111	Andritz
15	Kashang II & III	H.P.	HPPCL	S	130	Andritz
16	Sainj	H.P.	HPPCL	S	100	
17	Baglihar-II	J & K	J&K State PDC	S	450	
18	Thottiar	Kerala	KSEB	S	40	M/s Chonging
19	Pallivasal	Kerala	KSEB	S	60	DEC China
20	New Umtru	Meghalaya	MeECL	S	40	Andritz
21	Tidong-I	H.P.	N S L Tidong Power Gen. Ltd	P	100	Alstom India
22	Sorang	H.P.	Himachal Sorang Power Pvt. Ltd	P	100	Voith Siemans
23	Tangnu Romai-I	H.P.	Tangnu Romai Power Gen.Ltd	P	44	
24	Bhasmey	Sikkim	Gati Infrastructure Ltd.	P	51	Voith Hydro
25	Jorethang Loop	Sikkim	DANS Pvt. Ltd	P	96	Alstom India
26	Rangit-IV	Sikkim	Jal Power Corp. Ltd.	P	120	Andritz
27	Teesta-VI	Sikkim	Lanco Energy Pvt. Ltd.	P	500	Alstom India
28	Teesta-III	Sikkim	Teesta Urja	P	600	VATech Hydro
29	Singoli Bhatwari	Uttarakhand	L & T	P	99	
30	Phata Byung	Uttarakhand	Lanco Energy Pvt. Ltd.	P	76	
31	Srinagar	Uttarakhand	AHP Co. Ltd. (GVK)	P	330	BHEL
	TOTAL (HYDRO)				**9204**	

Appendix 1.9 (b)
Sheet (2/2)

LIST OF UNDER CONSTRUCTION NUCLEAR PROJECTS FOR LIKELY BENEFITS DURING 12TH PLAN

Sl.No.	PLANT NAME	STATE	AGENCY	SECTOR	FUEL TYPE	CAPACITY (MW)
1	RAPP U 7 & 8	RAJ	NPC	C	NUCLEAR	1400
2	KAPP U-3 & 4	GUJARAT	NPC	C	NUCLEAR	1400
	TOTAL (NUCLEAR)					**2800**

LIST OF GAS BASED STATIONS
FOR WHICH GAS HAS BEEN TIED UP FROM LOCAL SOURCES

S.No.	Name of Power Station /Agency	Capacity (MW)	Located in State
	STATE SECTOR		
1	Ramgarh CCGT	160	Rajasthan
2	Namrup CCGT	100	Assam
	Sub Total (S.S.)	**260**	
	CENTRAL SECTOR		
1	Tripura Gas	726	Tripura
2	Monarchak	100	Tripura
	Sub Total (C.S.)	826	
	Total (All India)	**1086**	

LIST OF THERMAL UNITS PROGRAMMED FOR LIFE EXTENSION WORKS DURING 12TH PLAN

Appendix 1.10
(Sheet 1 of 5)

1. STATE SECTOR

Sl. No.	State	Name of Utility	Name of Station	Unit No.	Year of Comm.	Capacity (MW)	Make		LMZ / KWU	Remarks
							Boiler	TG		
Northern Region										
1	U.P.	UPRVUNL	Obra	11	1977	200	BHEL	BHEL	LMZ	Slip from 11th Plan
2	U.P.	UPRVUNL	Obra	12	1981	200	BHEL	BHEL	LMZ	Slip from 11th Plan
3	U.P.	UPRVUNL	Obra	12	1982	200	BHEL	BHEL	LMZ	Slip from 11th Plan
4	U.P.	UPRVUNL	Parichha	1	1984	110	BHEL	BHEL		Slip from 11th Plan
5	U.P.	UPRVUNL	Parichha	2	1985	110	BHEL	BHEL		Slip from 11th Plan
6	U.P.	UPRVUNL	Panki	3	1976	105	BHEL	BHEL		Slip from 11th Plan
7	U.P.	UPRVUNL	Panki	4	1977	105	BHEL	BHEL		Slip from 11th Plan
8	U.P.	UPRVUNL	Anpara"A"	1	1986	210	BHEL	BHEL	KWU	Slip from 11th Plan
9	U.P.	UPRVUNL	Anpara"A"	2	1986	210	BHEL	BHEL	KWU	Slip from 11th Plan
10	U.P.	UPRVUNL	Anpara"A"	3	1988	210	BHEL	BHEL	KWU	Slip from 11th Plan
	Sub Total			10		1660				
11	Punjab	PSPCL	Ropar	1	1984	210	BHEL	BHEL	KWU	Slip from 11th Plan
12	Punjab	PSPCL	Ropar	2	1985	210	BHEL	BHEL	KWU	Slip from 11th Plan
13	Punjab	PSPCL	Bathinda	4	1979	110	BHEL	BHEL		Slip from 11th Plan
	Sub Total			3		530				
14	Haryana	HPGCL	Panipat	3	1985	110	BHEL	BHEL		Being taken up under W.Bank EE R&M programme
15	Haryana	HPGCL	Panipat	4	1985	110	BHEL	BHEL		
	Sub Total			2		220				
							Boiler	TG		
16	Rajasthan	RRVUNL	Kota	1	1983	110	BHEL	BHEL		
17	Rajasthan	RRVUNL	Kota	2	1983	110	BHEL	BHEL		
	Sub Total			2		220				
	Sub Total Northern Region			**17**		**2630**				
Western Region										
18	Gujarat	GSECL	Ukai	3	1979	200	BHEL	BHEL	LMZ	
19	Gujarat	GSECL	Ukai	4	1979	200	BHEL	BHEL	LMZ	
20	Gujarat	GSECL	Wanakbori	1	1982	210	BHEL	BHEL	KWU	
21	Gujarat	GSECL	Wanakbori	2	1983	210	BHEL	BHEL	KWU	
	Sub Total			4		820				
22	Maharashtra	MAHAGENCO	Nashik	3	1979	210	BHEL	BHEL	LMZ	Taken up under KfW funded EER&M programme. Feasibility study report / DPR under preparation
23	Maharashtra	MAHAGENCO	Nashik	4	1980	210	BHEL	BHEL	LMZ	

Appendix 1.10
(Sheet 2 of 5)

Sl. No.	State	Name of Utility	Name of Station	Unit No.	Year of Comm.	Capacity (MW)	Make		LMZ / KWU	Remarks
							Boiler	TG		
24	Maharashtra	MAHAGENCO	Koradi	5	1978	210	BHEL	BHEL	LMZ	
25	Maharashtra	MAHAGENCO	Koradi	6	1982	200	BHEL	BHEL	LMZ	Being taken up under W.Bank EE R&M programme.
26	Maharashtra	MAHAGENCO	Bhusawal	2	1979	210	BHEL	BHEL	LMZ	
27	Maharashtra	MAHAGENCO	Bhusawal	3	1982	210	BHEL	BHEL	LMZ	
28	Maharashtra	MAHAGENCO	Chandrapur	1	1983	210	BHEL	BHEL	LMZ	
29	Maharashtra	MAHAGENCO	Chandrapur	2	1984	210	BHEL	BHEL	LMZ	
30	Maharashtra	MAHAGENCO	Parli	3	1980	210	BHEL	BHEL	LMZ	
	Sub Total			9		1880				
31	Chattisgarh	CSEB	Korba (West)	1	1983	210	BHEL	BHEL	KWU	
32	Chattisgarh	CSEB	Korba (West)	2	1984	210	BHEL	BHEL	KWU	
	Sub Total			2		420				
33	Madhya Pradesh	MPPGCL	Satpura	6	1979	200	BHEL	BHEL	LMZ	
34	Madhya Pradesh	MPPGCL	Satpura	7	1979	210	BHEL	BHEL	LMZ	
	Sub Total			2		410				
	Sub Total Western Region			**17**		**3530**				
Southern Region										
35	Tamil Nadu	TNEB	Tuticorin	1	1979	210	BHEL	BHEL	LMZ	
36	Tamil Nadu	TNEB	Tuticorin	2	1980	210	BHEL	BHEL	LMZ	
	Sub Total			2		420				
37	Andhra Pradesh	APGENCO	Dr. N.T. TPS (Vijaywada)	1	1979	210	BHEL	BHEL	LMZ	
38	Andhra Pradesh	APGENCO	Dr. N.T. TPS (Vijaywada)	2	1980	210	BHEL	BHEL	LMZ	
	Sub Total			2		420				
39	Karnataka	KPCL	Raichur	1	1985	210	BHEL	BHEL	KWU	
40	Karnataka	KPCL	Raichur	2	1986	210	BHEL	BHEL	KWU	
	Sub Total			2		420				
	Sub Total Southern Region			**6**		**1260**				
Eastern Region										
41	West Bengal	WBPDCL	Kolaghat	1	1990	210	AVB	BHEL	LMZ	
42	West Bengal	WBPDCL	Kolaghat	2	1985	210	AVB	BHEL	LMZ	
43	West Bengal	WBPDCL	Kolaghat	3	1984	210	AVB	BHEL	LMZ	Taken up under KfW funded EER&M programme.
44	West Bengal	WBPDCL	Bandel	5	1982	210	AVB	BHEL	LMZ	Slip from 11th Plan
	Sub Total			4		840				
45	Bihar	BSEB	Barauni	6	1983	110	BHEL	BHEL		Slip from 11th Plan
46	Bihar	KBUNL	Muzaffarpur	2	1986	110	BHEL	BHEL		Slip from 11th Plan
	Sub Total			2		220				

	Sub Total Eastern Region		**6**		**1060**				
	SUB TOTAL STATE SECTOR		**46**		**8480**				

Appendix 1.10
(Sheet 3 of 5)

2. CENTRAL SECTOR

Sl. No.	Name of Utility	Name of Station	Unit No.	Year of Comm.	Capacity (MW)	Make		LMZ / KWU	Remarks
						Boiler	TG		
1	NLC	Neyveli M/C	1	1988	210	TE	FT	KWU	
2	NLC	Neyveli M/C	2	1987	210	TE	FT	KWU	
3	NLC	Neyveli M/C	3	1986	210	TE	FT	KWU	
	Sub Total		**3**		**630**				
4	DVC	Bokaro 'B'	1	1986	210	ABL	BHEL	LMZ	Taken up under KfW funded EER&M programme. Feasibility study report / DPR under preparation
5	DVC	Bokaro 'B'	2	1990	210	ABL	BHEL	LMZ	
6	DVC	Bokaro 'B'	3	1993	210	ABL	BHEL	LMZ	
7	DVC	Durgapur	4	1982	210	BHEL	BHEL	LMZ	
	Sub Total		**4**		**840**				
8	NTPC	Badarpur	4	1978	210	BHEL	BHEL	LMZ	Slip from 11th Plan
9	NTPC	Badarpur	5	1981	210	BHEL	BHEL	LMZ	Slip from 11th Plan
10	NTPC	Singrauli STPS	1	1982	200	BHEL	BHEL	LMZ	Slip from 11th Plan
11	NTPC	Singrauli STPS	2	1982	200	BHEL	BHEL	LMZ	Slip from 11th Plan
12	NTPC	Singrauli STPS	3	1983	200	BHEL	BHEL	LMZ	
13	NTPC	Singrauli STPS	4	1983	200	BHEL	BHEL	LMZ	
14	NTPC	Singrauli STPS	5	1984	200	BHEL	BHEL	LMZ	
15	NTPC	Singrauli STPS	6	1986	500	BHEL	BHEL	KWU	
16	NTPC	Singrauli STPS	7	1987	500	BHEL	BHEL	KWU	
17	NTPC	Korba STPS	1	1983	200	BHEL	BHEL	KWU	Slip from 11th Plan
18	NTPC	Korba STPS	2	1983	200	BHEL	BHEL	KWU	
19	NTPC	Korba STPS	3	1984	200	BHEL	BHEL	KWU	

Appendix 1.10
(Sheet 4 of 5)

Sl. No.	Name of Utility	Name of Station	Unit No.	Year of Comm.	Capacity (MW)	Make		LMZ / KWU	Remarks
						Boiler	TG		
20	NTPC	Korba STPS	4	1987	500	BHEL	BHEL	KWU	
21	NTPC	Korba STPS	5	1988	500	BHEL	BHEL	KWU	
22	NTPC	Korba STPS	6	1989	500	BHEL	BHEL	KWU	
23	NTPC	Ramagundam STPS	1	1984	200	Ansaldo	Ansaldo	KWU	Slip from 11th Plan
24	NTPC	Ramagundam STPS	2	1984	200	Ansaldo	Ansaldo	KWU	
25	NTPC	Ramagundam STPS	3	1984	200	Ansaldo	Ansaldo	KWU	
26	NTPC	Ramagundam STPS	4	1988	500	BHEL	BHEL	KWU	
27	NTPC	Ramagundam STPS	5	1989	500	BHEL	BHEL	KWU	
28	NTPC	Ramagundam STPS	6	1989	500	BHEL	BHEL	KWU	
29	NTPC	Farakka Stage-I	1	1986	200	BHEL	BHEL	KWU	
30	NTPC	Farakka Stage-I	2	1986	200	BHEL	BHEL	KWU	
31	NTPC	Farakka Stage-I	3	1987	200	BHEL	BHEL	KWU	
32	NTPC	Vindhyachal	1	1987	210	USSR	USSR	LMZ	
33	NTPC	Vindhyachal	2	1988	210	USSR	USSR	LMZ	
34	NTPC	Vindhyachal	4	1990	210	USSR	USSR	LMZ	
35	NTPC	Vindhyachal	5	1990	210	USSR	USSR	LMZ	
36	NTPC	Rihand	1	1988	500	ICL (UK)	GEC(UK)	KWU	
37	NTPC	Rihand	2	1989	500	ICL (UK)	GEC(UK)	KWU	

Appendix 1.10
(Sheet 5 of 5

Sl. No.	Name of Utility	Name of Station	Unit No.	Year of Comm.	Capacity (MW)	Make		LMZ / KWU	Remarks
						Boiler	TG		
38	NTPC	Dadri GT	GT-1	1992	131	SIEMENS			Slip from 11th Plan
39	NTPC	Dadri GT	GT-2	1992	131	SIEMENS			Slip from 11th Plan
40	NTPC	Dadri GT	GT-3	1992	131	SIEMENS			Slip from 11th Plan
41	NTPC	Dadri GT	GT-4	1992	131	SIEMENS			
42	NTPC	Auraiya GT	GT-1	1989	111.19	MHI, Japan			Slip from 11th Plan
43	NTPC	Auraiya GT	GT-2	1989	111.19	MHI, Japan			Slip from 11th Plan
44	NTPC	Auraiya GT	GT-3	1989	111.19	MHI, Japan			Slip from 11th Plan
45	NTPC	Auraiya GT	GT-4	1989	111.19	MHI, Japan			
46	NTPC	Kawas GT	GT-1	1992	106	GE			Slip from 11th Plan
47	NTPC	Kawas GT	GT-2	1992	106	GE			Slip from 11th Plan
48	NTPC	Kawas GT	GT-3	1992	106	GE			Slip from 11th Plan
49	NTPC	Kawas GT	GT-4	1992	106	GE			
50	NTPC	Gandhar GT	GT-1	1994	131	ABB			Slip from 11th Plan
51	NTPC	Gandhar GT	GT-2	1994	131	ABB			Slip from 11th Plan
52	NTPC	Gandhar GT	GT-3	1994	131	ABB			
53	NTPC	Faridabad CCPS	GT-1	1999	143	Siemens			
54	NTPC	Faridabad CCPS	GT-2	1999	143	BHEL			
55	NTPC	Rajiv Gandhi CCPS	GT-1	1998	115	GE			
56	NTPC	Rajiv Gandhi CCPS	GT-2	1999	115	BHEL			
57	NTPC	Anta GTPS	ST-1	1990	149	ABB			
58	NTPC	Auraiya CCPS	ST-1	1989	109	MHI, Japan			
59	NTPC	Auraiya CCPS	ST-2	1990	109	MHI, Japan			
	Sub Total		**52**		**11728.76**				
	SUB TOTAL CENTRAL SECTOR		**59**		**13198.76**				

TOTAL OF 12TH PLAN (LE) :

NUMBER OF UNITS : **105**
CAPACITY (MW) : **21679**

LIST OF THERMAL UNITS PROGRAMMED FOR R&M WORKS DURING 12TH PLAN.

Appendix 1.11
(Page 1 of 2)

1. STATE SECTOR

Sl. No.	State	Name of Utility	Name of Station	Unit No.	Year of Comm.	Capacity (MW)	Make	
							Boiler	TG
Northern Region								
1	U.P.	UPRVUNL	Anpara 'B'	4*	1993	500	BHEL	BHEL
2	U.P.	UPRVUNL	Obra	5*	1994	500	BHEL	BHEL
3	U.P.	UPRVUNL	Obra	7*	1974	100	BHEL	BHEL
4	U.P.	UPRVUNL	Obra	8*	1975	100	BHEL	BHEL
	Sub Total			4		1200		
5	Punjab	PSEB	Ropar	5	1992	210	BHEL	BHEL
6	Punjab	PSEB	Ropar	6	1993	210	BHEL	BHEL
	Sub total			2		420		
7	Haryana	HPGCL	Panipat	6	2001	210	BHEL	BHEL
Total Northern Region				**7**		**1830**		
Eastern Region								
8	Jharkhand	JSEB	Patratu	9*	1984	110	BHEL	BHEL
9	Jharkhand	JSEB	Patratu	10*	1986	110	BHEL	BHEL
	Sub-Total			2		220		
10	West Bengal	DPL	Durgapur	6*	1985	110	AVB	BHEL
Total Eaatern Region				**3**		**330**		
TOTAL STATE SECTOR				**10**		**2160**		
2. CENTRAL SECTOR								
1	NTPC		Unchahar	3	1999	210	BHEL	BHEL
2	NTPC		Unchahar	4	1999	210	BHEL	BHEL
3	NTPC		Vindhyachal	7	1999	210	BHEL	BHEL
4	NTPC		Vindhyachal	8	2000	210	BHEL	BHEL
5	NTPC		Simhadri	1	2002	500	BHEL	BHEL
6	NTPC		Simhadri	2	2002	500	BHEL	BHEL
7	NTPC		Kahalgaon	4	1996	210	BHEL	BHEL
8	NTPC		Talcher STPS	1	1995	500	BHEL	BHEL
9	NTPC		Talcher STPS	2	1996	500	BHEL	BHEL
10	NTPC		Talcher STPS	3	2003	500	BHEL	BHEL
11	NTPC		Talcher STPS	4	2003	500	BHEL	BHEL
	Sub Total			**11**		**4050**		

Appendix 1.11
(Page 2 of 2)

Sl. No.	Name of Utility	Name of Station	Unit No.	Year of Comm.	Capacity (MW)	Make
12	NEEPCO	Kathalguri CCGT	GT-1	1995	33.50	Mitsubishi, Japan
13	NEEPCO	Kathalguri CCGT	GT-2	1995	33.50	Mitsubishi, Japan
14	NEEPCO	Kathalguri CCGT	GT-3	1995	33.50	Mitsubishi, Japan
15	NEEPCO	Kathalguri CCGT	GT-4	1995	33.50	Mitsubishi, Japan
16	NEEPCO	Kathalguri CCGT	GT-5	1996	33.50	Mitsubishi, Japan
17	NEEPCO	Kathalguri CCGT	GT-6	1996	33.50	Mitsubishi, Japan
18	NEEPCO	Kathalguri CCGT	ST-1	1998	30.00	BHEL
19	NEEPCO	Kathalguri CCGT	ST-2	1998	30.00	BHEL
20	NEEPCO	Kathalguri CCGT	ST-3	1998	30.00	BHEL
	Sub Total		**9**		**291.00**	
TOTAL CENTRAL SECTOR			**20**		**4341.00**	

Notre:* Slip from 11th Plan
TOTAL OF 12TH PLAN (R&M) :
NUMBER OF UNITS : 30
CAPACITY (MW) : 6501
Total of 12th Plan (LE+R&M) 135

Capacity (MW) 28180

Appendix 1.12

STATE WISE LIST OF HYDRO R&M, LIFE EXTENSION & UPRATING SCHEMES PROGRAMMED FOR COMPLETION DURING THE 12TH PLAN

As on 31.03.2011

S. No	Project, Agency	CS/ SS	Installed Capacity (MW)	Estimated Cost (Rs. in Crs.)	Actual Expenditure (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
Ongoing Schemes – Under implementation								
Himachal Pradesh								
1	Bhakra LB, BBMB	CS	5x108	489.77	170.92 (as on 31.12.10)	540.00 (LE) + 90.00 (U)	RMU&LE	2012-13
Jammu & Kashmir								
2	Chenani, J&KPDC	SS	5x4.66	39.14	3.49 (as on 31.12.10)	23.30 (LE)	RM&LE	2012-13
3	Sumbal Sindh, J&KPDC	SS	2x11.3	25.60	13.10 (as on 31.12.10)	-	R&M	2012-13
4	Lower Jhelum, J&KPDC	SS	3x35	101.30	68.45 (as on 31.12.10)	15.00 (Res.)	R&M+ Res.	2012-13
Uttar Pradesh								
5	Obra, UPJVNL	SS	3x33	31.70	11.454 (as on 31.12.10)	99.00 (LE)	RM&LE	2013-14
6	Rihand, UPJVNL	SS	6x50	132.20	46.325 (as on 31.12.10)	300.00 (LE)	RM&LE	2012-13
Uttarakhand								
7	Pathri, UJVNL	SS	3x6.8	71.59	-	20.40 (LE)	RM&LE	2013-14
Andhra Pradesh								
8	Srisailam RB, APGENCO	SS	7x110	16.70	13.36 (as on 28.02.10)	-	R&M	2012-13
Kerala								
9	Sabirigiri, KSEB	SS	6x50	104.36	96.95 (as on 31.12.10)	300.00 (LE) + 35.00(U)	RMU&LE	2012-13
10	Idamalayar, KSEB	SS	2x37.5	11.70	5.45 (as on 31.12.10)	-	R&M	2012-13
Tamil Nadu								
11	Periyar,TNEB	SS	4x35	161.18	82.43 (as on 28.02.11)	140.00 (LE) + 28.00(U)	RMU&LE	2013-14
West Bengal								
12	Maithon, U-1&3, DVC	CS	2x20	49.05	3.76 (as on 31.03.10)	40.00 (LE)	RM&LE	2013-14

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S. No	Project, Agency	CS/ SS	Installed Capacity (MW)	Estimated Cost	Actual Expenditure	Benefits (MW)	Category	Year of Completion
				(Rs. in Crs.)				
13	Jaldhaka St.I, WBSEB	SS	3x9	88.62	59.80 (as on 31.12.10)	27.00(LE)	RM&LE	2012-13
Maharashtra								
14	Koyna St.III, MSPGCL	SS	4x80	16.65	5.79 (as on 30.6.10)	320 (LE)	RM&LE	2012-13
Orissa								
15	Rengali OHPC	SS	1x50	47.50	3.40 (as on 31.12.10)	50(LE)	RM&LE	2012-13
16	Hirakud-II, OHPC	SS	3x24	125.52	58.73 (as on 31.03.10)	72.00 (LE)	RM&LE	2013-14
Assam								
17	Kopili, NEEPCO	CS	2x50 + 2x50	66.42	0.218 (as on 30.09.10)	-	R&M & Refurbishment of Units 1 & 2	2013-14
18	Khandong, NEEPCO	CS	2x25	20.57	0.213 (as on 30.09.10)	50.00 (LE)	RM&LE	2013-14
Meghalaya								
19	UmiumSt.II , MeSEB	SS	2x9	90.46	19.00 (as on 31.12.10)	2(U)+ 18.00 (LE)	RM&LE	2012-13
	Sub Total(A)		**3172.30**	**1690.03**	**662.84**	**2169.70**		
Ongoing Schemes – Under Tendering								
Jammu & Kashmir								
20	Ganderbal, J&KPDC	SS	2x3+ 2x4.5	39.30	6.24 (as on 31.12.10)	15.00 (LE)	RM&LE	XII Plan
Uttar Pradesh								
21	Matatila, UPJVNL	SS	3x10.2	10.29	1.00 (as on 31.12.10)	30.6 (LE)	RM&LE	XII Plan
Uttarakhand								
22	Khatima, UJVNL	SS	3x13.8	140.24	-	41.40 (LE)	RM&LE	XII Plan
23	Chilla(Ph-B), UJVNL	SS	4x36	472.00	-	22(U) + 144(LE)	RMU&LE	XII Plan
24	Dhakrani, UJVNL	SS	3x11.25	70.00	-	33.75 (LE)	RM&LE	XII Plan

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S. No	Project, Agency	CS/ SS	Installed Capacity (MW)	Estimated Cost	Actual Expenditure	Benefits (MW)	Category	Year of Completion
				(Rs. in Crs.)				
25	Dhalipur, UJVNL	SS	3x17	101.25	-	51.00 (LE)	RM&LE	XII Plan
26	Tiloth, UJVNL	SS	3x30	163.75	-	90 (LE)	RM&LE	XII Plan
27	Kulhal, UJVNL	SS	3x10	38.75	-	30(LE)	RM&LE	XII Plan
28	Chibro, UJVNL	SS	4x60	201.25	-	240(LE)	RM&LE	XII Plan
29	Khodri(Ph-B), UJVNL	SS	4x30	120.00	-	120(LE)	RM&LE	XII Plan
Tamil Nadu								
30	Sholayar-I, TNEB	SS	2x35	40.681	-	14.00(U) + 70.00(LE)	RMU&LE	XII Plan
Kerala								
31	Poringal-kuthu,KSEB	SS	4x8	9.55	2.34 (as on 31.12.10)	32.00 (LE)	RM&LE	XII Plan
Jharkhand								
32	Panchet, U-1, DVC	CS	1x40	58.22	1.99 (as on 31.03.10)	40.00 (LE)	RM&LE	XII Plan
Orissa								
33	Hirakud-I U5&6, OHPC	SS	2x37.5	92.37	0.25 (as on 31.12.10)	75.00 (LE)	RM&LE	XII Plan
34	Balimela, OHPC	SS	6x60	160	-	360(LE)	RM&LE	XII Plan
	Sub Total(B)		**1372.75**	**1717.65**	**11.82**	**1408.75**		
Ongoing Schemes – Under DPR Preparation/Finalisation								
Himachal Pradesh								
35	Giri, HPSEB	SS	2x30	48.48	-	60.00 (LE)	RM&LE	XII Plan
Andhra Pradesh								
36	Machkund , APGENCO	SS	3x17 (St.I) & 3x21.25 (St.II)	124.45	-	15.25 (U) + 114.75 (LE)	RMU&LE	XII Plan
Kerala								
37	Sholayar, KSEB	SS	3x18	54.00	0.044 (as on 31.12.10)	54.00 (LE)	RM&LE	XII Plan
38	Kuttiadi, KSEB	SS	3x25	25.00	-	75.00 (LE)	RM&LE	XII Plan

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S. No	Project, Agency	CS/ SS	Installed Capacity (MW)	Estimated Cost	Actual Expenditure	Benefits (MW)	Category	Year of Completion
				(Rs. in Crs.)				
Meghalaya								
39	Kyrdemkulai, MeSEB	SS	2x30	168.00	-	60.00 (LE) 6.00 (U)	RMU & LE	XII Plan
	Sub Total(C)		**363.75**	**419.93**	**0.044**	**385.00**		
Ongoing Schemes – Under RLA Studies								
Andhra Pradesh								
40	Upper Sileru, APGENCO	SS	4x60	10.00	-	-	R&M	XII Plan
Tamil Nadu								
41	Kodayar Ph.I, TNEB	SS	1x60	30.00	-	60.00 (LE)	RM&LE	XII Plan
42	Kodayar PH-II, TNEB	SS	1x40	19.94	-	40.0(LE)	RM&LE	XII Plan
	Sub Total(D)		**340.00**	**59.94**	**-**	**100.00**		
	Total (A+B+C+D)		**5248.80**	**3887.55**	**674.70**	**4063.45 [212.25(U) + 3836.20(LE) + 15.0 (Res.)]**		

Abbreviations:
R&M – Renovation & Modernisation;
RM&U – Renovation, Modernisation & Uprating,
RM&LE – Renovation, Modernisation & Life Extension
RMU&LE – Renovation, Modernisation, Uprating & Life Extension;
R&M+Res.-Renovation & Modernisation + Restoration;
RM&LE+Res.- Renovation, Modernisation & Life Extension + Restoration;
RM&U+Res. – Renovation, Modernisation & Uprating + Restoration.
MW – Mega Watt; Res – Restoration; U – Uprating; LE – Life Extension