

EXECUTIVE SUMMARY

1.0 DEMAND PROJECTION AND GENERATION PLANNING

1.1 REVIEW OF CAPACITY ADDITION DURING 11TH PLAN

The Planning Commission had set a capacity addition target of 78,700 MW for 11th Plan. This comprised of 15,627 MW Hydro, 59,693 MW Thermal and 3,380 MW Nuclear. Subsequently, as per the Mid Term Appraisal of Planning Commission, a revised target of 62,374 MW was set for 11th 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 and accordingly the likely capacity addition during 11th Plan is expected to be about 52,063 MW. 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.

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.

For the Generating Planning Studies, in the Base Case, 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, 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. A load factor of about 78% was considered while estimating the peak demand for 2016-17 & 76% for 2021-22.

Based on the above, in the Base Case, the demand to be adopted by 12th and 13th Plan end is as follows:

Table ES -1
DEMAND ADOPTED FOR GENERATION PLANNING STUDIES – BASE CASE

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

It is pertinent to mention that the above projections by 12th Plan end are very 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 for the 12th Plan, with 9% GDP growth rate and 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 during 12th Plan are as given below:

Table ES -2
DEMAND ADOPTED FOR GENERATION PLANNING STUDIES – SENSITIVITY STUDY
12TH PLAN

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

1.3 PLANNING NORMS

Availability of plant, Plant Load Factor (PLF), Auxiliary Power Consumption and Heat Rate of the generating units are key performance parameters of generating station. 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. LOLP of 0.2 % and ENS of 0.05 % have been adopted for planning purposes for 12th & 13th Plan periods.

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. While carrying out studies, the requirement of 5% Spinning reserve as stipulated in the National Electricity Policy, effect of up rating of hydro power plants and expected retirement of thermal units by 2012-17 have also been considered. A capacity of about 4,000 MW each from old and inefficient thermal units has been considered for retirement during 12th and 13th Plan.

1.4.1 Base Case - Based on the above studies, the capacity addition requirement 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 based, 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 this, 1200 MW import from Bhutan has also been considered. The 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 to yield benefits during 12th Plan. The capacity addition planned during the 12th Plan is detailed below:

Table ES -3
CAPACITY ADDITION REQUIREMENT DURING 12th PLAN (MW)- BASE CASE
(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

In addition, 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 Cogeneration and waste to energy put together and 3,800 MW Solar has been considered based on inputs provided by MNRE.

The tentative Sector-wise break-up of the capacity addition during 12th Plan is as follows:

Table ES -4
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

Broad details of Coal based capacity of 62,695 MW are as follows:

- (i) Technology type:
 - Super Critical - 23,940 MW (38%)
 - Sub-Critical - 38,755 MW (62%)
- (ii) Source of Coal:
 - Coal Linkage - 38,548 MW
 - Coal Block - 17,825 MW
 - Imported Coal - 6,292 MW
 - Requiring Coal Linkage - 30 MW
- (iii) Location:
 - Pithead - 25,995 MW
 - Load Centre - 25,160 MW
 - Coastal - 11,540 MW

The estimated fund requirement during 12th Plan for generation, including renewable, works out to about Rs 6,38,600 crs including Rs 2,72,582 crs for advance action for 13th Plan projects.

1.4.2 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 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.

1.4.3 Summary of Capacity Addition in Base Case and Sensitivity Analysis:

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

Table ES -5

(Figures in MW)

Type of Capacity	Capacity addition required during 12 th 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 ES -6

(Figures in MW)

Type of Capacity	Capacity addition required during 12 th 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

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
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

1.4.4 Capacity addition required during 13th Plan

The peak demand and energy requirement during the terminal year of 13th Plan (2021-22) is expected to be 2,89,667 MW and 1993 BU respectively. The capacity addition requirement during 13th Plan corresponding to this demand works out to 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 ES-7
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 has been considered as must run during 13th Plan while assessing generation capacity addition. 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.

1.5 COAL DEMAND AND AVAILABILITY DURING 12TH PLAN

Availability of coal for the coal based thermal power stations is a matter of serious concern. 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, 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 75,785MW). 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 be 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 of 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. 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 own requirement may be supplied to power stations.
- iii) Power Sector must be allocated 80% of total coal production by CIL.

1.6 POLICY TO INCENTIVISE RETIREMENT OF OLD PLANTS

Recommendations to incentivise generating agencies to retire the old and inefficient plants are:-

1. Regulatory frame work shall include provision that 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 provision for incentive in terms of interest subsidy etc. for these plants to be retired and new plants to be commissioned in place of old plant.

1.7 CAPTIVE GENERATION

The Installed Capacity of Captive Power Plants (1MW and above) by the end of FY 2010-11 is about 31,000 MW. A Capacity addition of around 12,000 MW is likely during 11th Plan. A capacity addition of approximately 13,000 MW is likely during 12th Plan (April 2012 to March 2017).

1.7 MAXIMISING 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

1.7.1 Life Extension (LE) and R&M of Thermal Units

72 units (16,532 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.

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. 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.

1.7.2 Uprating, LE and R&M of Hydro Plants

Up rating, LE and R&M of hydro power plant has to be strategically planned, keeping in view all the techno-economic considerations. During the 12th Plan, 5 numbers of projects totalling to 1,390 MW and 37 projects totalling to 3,859 MW are planned to be covered for R&M and LE/Uprating respectively. The programme for LE/Uprating is expected to yield benefits totalling to 4,064 MW.

1.7.3 Energy Efficiency Improvement through Energy Audit

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.

1.6.4 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 also provide a particularly attractive solution for meeting requirement of power at remote locations, where 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.

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 renewables 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. As on 31.03.2011, the grid interactive Installed Capacity from renewable is 19,975 MW.

During 12th Plan renewable capacity of 18,500 MW and during 13th Plan 30,500 MW has been envisaged to be added through Wind, Biomass, Small Hydro and Solar sources.

1.8 REQUIREMENT OF PEAKING POWER AND RESERVE PLANTS

1.8.1 PEAKING 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 of generating stations to respond dynamically and efficiently to the variation in demand within a short time. Since our system has wide variations in demand during peak and off peak period, there is need for peaking support with very high rampup rate. As such there is an urgent need for setting up peaking power plants during the 12th Plan with proper regulatory support.

Peaking power is ideally 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 gas based generation, in particular reciprocating engine based technology. 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.

Peaking Tariff

Operation of Combined Cycle Plants in peaking mode 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.

1.8.2 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

Primary reserves are those reserves that should be activated within 15 Seconds and the secondary reserves should be activated within 30 Seconds. 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.

1.8.3 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 peaking 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 peaking and intermediate loads with proper regulatory support.

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, 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

Super Critical thermal units of 660 MW (steam parameters of 247 kg/cm² and 535/565 °) and 800 MW (Temp 565/593 °) need to be promoted aggressively.

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.

All Power utilities and thermal plants are to plan and implement ash utilisation targets keeping view long term strategies on sustainable basis.

1.10 CONCLUSION AND RECOMMENDATIONS (GENERATION CAPACITY)

- (i) Based on capacity addition planned, 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.

- (ii) 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 (in the Business as Usual Scenario). 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. In the Optimistic scenario, the coal required to be imported is about 182 MT.
- (iii) MOC/ CIL needs to be impressed upon to formulate a contingency plan to meet the coal demand of the power sector. Sanctioning of additional coal blocks from MoE&F needs to be expedited by the Government.
- (iv) Captive Blocks allocated to various utilities may be advised to enhance their production through some incentive oriented strategy and surplus production may be supplied to power station.
- (v) 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. 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.
- (vi) 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.
- (vii) 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.
- (viii) The Group recommends that R&M schemes shall be continued during 12th and 13th Plans 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, improving its availability, meeting of environmental norms or are aimed at renovating obsolete equipment 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.
- (ix) 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.
- (x) 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. 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.

- (xi) Combined Heating and Cooling (CHP) plants which have a high efficiency must be promoted.

2.0 TRANSMISSION PLANNING INCLUDING NATIONAL GRID

2.1 REVIEW OF PROGRAMME AND ACHIEVEMENTS DURING 11TH PLAN

The details of the 11th Plan programme, achievements during the first four years of the 11th Plan and anticipated additions in 11th Plan for transmission lines and substations are furnished in Tables ES-4 and ES-5 below:

Table ES-8
Transmission Lines- 11th Plan Programme & Achievement

(Figures in circuit kms)

Voltage level	11th Plan programme	Achievement up to Mar 2011 during 11th Plan	Anticipated addition during 2011-12	Anticipated addition in 11 th Plan
765 kV	2773	1636	824	2460
± 500 kV HVDC	1600	1580	2000	3580
400 kV	40000	26856	12401	39257
220 kV	24300	19780	6567	26347
Total	68673	49852	21792	71644

Table ES-9
Sub Stations & HVDC Terminal capacity- 11th Plan Programme & Achievement

(Figures in MVA/MW)

Voltage level	11th Plan Programme	Achievement up to March 2011 during 11th Plan	Anticipated addition during 2011-12	Anticipated addition in 11 th Plan
765 kV	24500	4500	4000	8500
400 kV	51960	40920	8725	49645
220 kV	72731	50655	14655	65310
Total – AC Substation capacity in MVA	149191	96075	27380	123455
± 500 kV HVDC	8500	3000	2500	5500
Total- HVDC terminal capacity in MW	8500	3000	2500	5500

The total inter-regional transmission capacity at the beginning of 11th Plan was 14,050 MW which is now expected to grow to about 25,650 MW by the end of 11th Plan.

The achievement of transmission line addition in the first four years of the 11th Plan has been by and large satisfactory. The shortfall in addition of transformation capacity is mainly on account substations associated with the generation projects which have now slipped to 12th Plan. It is expected that in the terminal year of 11th Plan, the transmission line target would be fully met.

2.2 TRANSMISSION PLANNING KEEPING IN VIEW OPEN ACCESS

Based on application by a generator for Long Term Open Access, the transmission system is planned for evacuation of power from generating stations. However adequate intra-state transmission system is also required to absorb power injected from ISTS. During the planning process, some design margins get created in the network generally due to long term optimisation. These margins, along with operational and reliability margins, provide sufficient additional capacity in the system for trading and for States to buy power more than their long-term PPAs.

2.2.1 PROVISIONS IN ELECTRICITY ACT AND CERC REGULATION

Enactment of the Electricity Act, 2003 has opened up hitherto constrained electricity market, which was characterized by long term PPAs and inability of Distribution Companies and consumers to have a choice of suppliers. The provision regarding availability of non-discriminatory Open Access in transmission from the very beginning and distribution in a phased manner is an important feature of the Act. This creates enabling environment for competition among generators/traders to choose their customers and vice-versa.

Access to inter-State transmission system is governed by the regulations of the Central Regulatory Commission. The Central Transmission Utility (CTU) is the nodal agency for providing medium term (3 months to 3 years) and long term (12 to 25 years) access that are typically required by a generating station or a trader on its behalf. The nodal agency for grant of short term open access (up to three months) is the Regional Load Dispatch Centre. The nodal agency for providing transmission access to the power exchanges is the National Load Dispatch Centre.

2.2.2 LONG TERM OPEN ACCESS (LTA) IN INTER-STATE TRANSMISSION

Till March 2011, CTU has received about 187 Long Term Open Access (LTA) applications for transfer of power from their generation projects of capacity about 1,77,000 MW to various target regions. Based on the progress, LTA has been granted to 135 applicants with a capacity of about 1,17,000MW. Out of this, transmission system is already in place for about 43,500MW capacity and system strengthening identified for capacity of about 73,500MW. The progress of balance 52 applications with capacity of about 60,000MW was not up to the mark and was proposed to close/review the application based on subsequent progress.

The major challenge in processing Long Term Open Access application is that Distribution utilities are not inviting Case-1/ Case-2 bids to meet their long term requirement of power. In absence of firm beneficiaries, transmission is being developed based on target beneficiaries indicated by the generation project developers. Absence of firm beneficiaries may result into sub-optimal utilisation in one part of grid or congestion in another part. Further, the time schedule of commissioning of some of the generation projects is not certain. This puts a lot of risks on investment in transmission infrastructure and also, the time line for implementation of transmission system by CTU/ other transmission licensees becomes difficult to meet.

2.2.3 MEDIUM TERM OPEN ACCESS (MTOA)

Only two (2) applications were received for MTOA from UT DNH and UT DD in Western Region for transfer of 54MW from 500MW NSPCL generating station in Bhilai (Chhattisgarh). MTOA has been granted.

2.2.4 SHORT TERM OPEN ACCESS

The short term customers are eligible for short term open access over the surplus capacity available after use by long term customers and medium term customers due to inherent design margins available. Whenever the proposed bilateral transaction has a State utility or an intra state entity as buyer or seller, concurrence of the State Load Despatch centre shall be obtained in advance and submitted along with the application.

2.2.5 TRANSMISSION CONGESTION

Seasonal trading is done by the distribution utilities to meet their seasonal demand or sell their seasonal surplus. Short term trading on day-ahead basis is required for balancing the demand with supply. Short term trading is also required for meeting contingency requirement. However, in India the pattern of short term trading is erratic and depends on many extraneous factors particularly availability of funds with deficit Discoms etc. Sometimes a State may suddenly decide to reduce load shedding and resort to heavy short term purchase through trading. In such a situation, the drawl has to be restricted to the margins available in the planned transmission capacity. It is not possible to plan transmission system for catering to such a situation.

2.2.6 TRADING OF ELECTRICITY

Short term trading is an essential tool for optimization of resources and plays an important role in deficit scenario for harnessing additional / captive sources of generation for meeting the peak demand. Trading of electricity in India has picked up considerably after the advent of Electricity Act 2003 which recognizes trading as a distinct licensed activity. In future the quantum of electricity traded in the short term market is likely to grow considerably as the new generating capacity of many IPPs plants is not tied up in long term PPAs. The declining trend of prices in recent years is indication of more competition and increasing availability of supply.

2.2.7 POWER EXCHANGES

At present there are two power exchanges in the country, namely IEX and PXIL which separately operate Day-ahead Spot market for electricity. These two exchanges work on identical principle of price discovery as specified by CERC. The Day-ahead market operates on the principle of voluntary participation, double sided closed auctions, uniform price discovery and zonal market splitting in case of transmission constraint. The increasing volume and declining Price is indicative of improved liquidity of supply. The number of participants in the two exchanges has been growing rapidly due to the entry of bulk Open Access consumers particularly from the states of Punjab and Tamil Nadu.

2.3 12TH PLAN TRANSMISSION PROGRAMME

2.3.1 Evolving the Transmission System for 12th Plan

Identification of transmission expansion requirement for a Plan period is done based on power system studies corresponding to the generation expansion programme and forecasted demand scenario expected at the end of that Plan. The implementation programme is worked out keeping in view identification of projects, schemes and transmission elements that should be implemented matching with programme of generation capacity addition and load growth on yearly basis during the Plan.

2.3.2 Inter-Regional Transmission Capacity Programme

The Inter-regional transmission capacity of all-India grid at the end of 11th Plan is likely to be about 25,650 MW. During 12th Plan period considering about 76,000 MW capacity addition, the inter-regional transmission links of about 38,000 MW may be added during 12th Plan period. Thus inter-regional transmission capacity at the end of 12th Plan is expected to be of the order of 63,000 MW.

2.3.3 Growth in 765kV Transmission System up to 12th Plan / Early 13th Plan Period:

During 11th Plan, a number of 765kV lines and substations have been added and a few more are under-construction. A number of new 765kV lines and substations have been planned for evacuation of bulk power in the range of 3000 – 6000 MW over longer distances. The planned 765kV transmission systems are expected to be implemented during 12th Plan or early 13th Plan period.

2.3.4 Growth in HVDC Transmission System up to 12th Plan / Early 13th Plan Period:

During 11th Plan, Balia-Bhiwadi 2500 MW HVDC Bipole and upgradation of Talcher-Kolar Bipole by 500 MW has been completed. Another HVDC bipole as Dedicated Transmission line, i.e. Mundra-Mohindergarh 2500 MW is being constructed under private sector by Adani group during the 11th Plan period. Three more HVDC systems have been planned for completion during 12th Plan or early 13th Plan.

2.3.5 1200kV transmission system

The Aurangabad - Wardha 400 kV Quad D/C line which is part of the transmission system for evacuation of power from Mundra UMPP has been planned and designed in such a way that this line would be converted into a 1200kV S/C line at a later date.

2.3.6 Transmission Schemes Planned for 12th Plan Period

During 12th Plan period, a total of about 1,09,000 circuit kilometres (ckm) of transmission lines, 2,70,000 MVA of AC transformation capacity and 13,000 MW of HVDC systems are estimated to be added.

Following Tables give development of the transmission system in India in 11th Plan period and expected to be added during 12th Plan period.

Table: ES-10
Transmission Lines

(values in ckm)

Transmission Lines (AC and HVDC)	As at the end of 10th Plan	Addition during first four years of 11 th Plan (2007-11)	Expected end of 11th Plan	Expected addition during 12th Plan	Expected by end of 12th Plan
<i>HVDC Bipole lines</i>	5872	1580	9452	9440	18892
765 kV	1704	1636	4164	27000	31164
400 kV	75722	26856	114979	38000	152979
220 kV	114629	19780	140976	35000	175976
Total Transmission Line, ckm	197927	49852	269571	109440	379011

Table: ES -11
Substation*(values in MVA / MW)*

Substations(AC and HVDC)	As at the end of 10th Plan	Addition during first four years of 11 th Plan (2007-11)	Expected at the end of 11th Plan	Expected addition during 12th Plan	Expected by end of 12th Plan
Total- HVDC Terminal Capacity, MW	8000	8500	13500	13000	26500
Total- AC Substation capacity, MVA	249439	96075	372894	270000	642894

2.3.7 Fund Requirement for development of transmission system during 12th Plan Period:

The total fund requirement for development of transmission system is estimated to be of the order of Rs 1,80,000 crore ((Rs 1,00,000 Cr in Central Sector, Rs. 55,000 Cr in State Sector and Rs. 25,000 Cr in Private Sector).

In the Central Sector, there is no problem of capital resources for setting up transmission facilities. However, in the State Sector some of the STUs require financial support, especially for building transmission system for renewable energy sources such as wind, solar and small hydro. It is proposed that viability gap funding may be provided on case to case basis for building intra-State transmission system for renewable generation and conventional hydro stations.

2.4 TRANSMISSION EXPANSION ASSESSMENT FOR 13TH PLAN

Transmission systems for a number of generation projects have been planned under the LTA process, majority of which are expected to materialize during 12th Plan and the rest would be implemented during 13th Plan depending upon actual progress of the generation project. Based on progress and development of generation projects and transmission system during 12th Plan, only a broad assessment of transmission capacity addition for 13th Plan can be made considering probable load growth and indicative generation capacity addition scenarios for 13th Plan. Accordingly, following assessment has been made for transmission capacity addition during 13th Plan period:

Table: ES-12
Transmission capacity addition for 13th Plan (220kV and above system)

1.	Transmission lines	130 Thousand ckm
2.	Substation (Transformation) Capacity	300 Thousand MVA
3.	Fund requirement	Rs 200,000 Crore

2.5 MEETING CHALLENGES IN TRANSMISSION SECTOR

Major challenges being faced in the transmission sector are as follows:

- ❖ *Right Of Way (ROW)*
- ❖ *Flexibility in Line Loading and Regulation of Power*
- ❖ *Improvement of Operational Efficiency*

Following measures are being implemented to meet above challenges:

- ❖ *Increase in transmission voltage*
- ❖ *Upgradation of transmission line*
- ❖ *Upgradation of HVDC Terminal*
- ❖ *High capacity 400kV multi-circuit/bundle conductor lines*
- ❖ *High Surge Impedance Loading (HSIL) Line.*
- ❖ *Compact towers.*
- ❖ *Increase in current High Temperature Low Sag (HTLS) conductor line*
- ❖ *Reduction of land for substation*
- ❖ *Regulation in Power Flow/ FACTS devices*
- ❖ *Improvement of operational efficiency with Condition Based Monitoring and Preventive Maintenance*
- ❖ *1200kV Test Station*

2.6 SMART TRANSMISSION GRID

2.6.1 Smart Transmission Grid Implementation in India

WAMS (Wide Area Measurement System) based technology is to be implemented as a part of the Smart Transmission Grid implementation. Full implementation of WAMS requires installation of Phasor Measurement Units (PMUs) at the substations and power plants in each region and reliable communication network with very high band width. Phasor data concentrators (PDC) are to be installed at National, Regional and major State Load Despatch Centre (in states having 400 kV transmission system). Availability of PMU at strategically located 400 kV/ 765kV sub-stations / power stations and a robust fiber optic communication network will facilitate situational awareness (especially dynamic state of the grid in terms of angular stability and voltage stability), control and regulation of power flow to maintain grid parameters, Remedial action scheme(RAS) and system integrated protection scheme(SIPS) and identifying corrective actions to be taken in the event of severe contingency to prevent grid disturbances.

2.6.2 Need for fibre optic based communication system:

With the restructuring & liberalization of power sector and the advent of new regulations, open access, power exchange etc, reliable voice & data communication has become critically important. The requirement of effective communication system has increased with the advent of special protection schemes, wide area measurement technology, SCADA system and remote operation. Getting real time data of various power system elements ie, substations, generating plants, HVDC links, Interstate transmission lines etc has become an essential prerequisite for successful operation of modern power system as a 'Smart Transmission Grid'. Communication requirements can be met by fiber optic based communication system.

Therefore it is considered desirable that an institutional arrangement be mandated for planning, implementation and maintenance of dedicated high band width, fiber optic communication network connecting the existing and new substations and power plants under central sector, IPPs, UMPP, Merchant Power Plants coming under the control area of Load Despatch Centres.

All new 400 kV and above substations, irrespective of ownership (state sector, private sector, central sector) and type (ISTS, dedicated, intra-state) should have optical fibre communication (OFC) facility, unless specifically exempted by CTU, as a requirement for smooth grid operation. A Standing

Committee comprising of CTU, POSOCO and CEA should be constituted to identify (i) strategic lines where OFC shall be mandated (ii) strategic locations in the grid where PMUs and PDCs need to be placed. As a first step, this committee should identify all such locations in the existing grid within six months. It should meet periodically at least once in a year to review and identify new locations. Presently, POWERGRID has built some optic fibre communication (OFC) network as part of telecom business and it is partly leased to RLDCs and NLDC for grid operation. Investment is not serviced by RLDCs. On the other hand POWERGRID has to give some normative revenue credit to its long term customers for using the RoW of transmission lines for telecom business. In future POWERGRID may be required to install optical fibre as per requirement of grid operation without assurance of telecom business. In such cases the investment should be serviced by the users/POSOCO as determined by CERC. Similar arrangements may be made for each STU/SLDC through their respective SERCs. Grid communication users should have priority over the telecom customers of POWERGRID mandated for the smart transmission grid.

2.7 TRANSMISSION PLANNING FOR RENEWABLE GENERATION

More than 80% of the renewable generation capacity is in the states of Tamil Nadu, Maharashtra, Karnataka, Gujarat and Rajasthan. As most of the renewable energy generation in terms of MW are smaller in size ranging from few MW to 25 MW or 50 MW, therefore their integration with the grid is normally done at 11kV, 22 kV, 33kV or 66 kV. The EHV transmission system beyond first connection point is either at 110 kV, 132 kV, 220 kV or 400 kV depending on the quantum of power being pooled at EHV substations. Generally the power would be absorbed within the DISCOM area or at the most within the state for meeting the states Renewable Purchase Obligation (RPO). As the RPO requirement of each state would be increasing on a yearly basis along with the increasing capacity addition of renewable energy generation, only a few Renewable Energy Sources rich states would have renewable energy additions beyond their RPO requirements. This would require augmentation of the State's transmission system and interconnection with inter-state transmission system in some cases. In case of large scale renewable generation, it is not possible to absorb the energy locally particularly during off peak hours and a transmission system is required to be planned integrating renewable generation with the state grid as well as with inter-state grid. Integrated planning approach would ensure that renewable generation does not have to back down during off peak hours and local load centres are provided with uninterrupted supply even when renewable generation is not available.

Grant needs to be made available for setting up transmission system for evacuation of power from renewable energy source.

There is a need to encourage RES rich states to build transmission over and above their RPO requirement by providing grant.

2.8 EXCHANGE OF POWER WITH NEIGHBOURING COUNTRIES

Integration of Indian Electricity Grid with countries such as Bhutan, Nepal would result in optimization of electricity resources on a large scale and provision of additional benefits and opportunities to the buying and selling countries. Cross border electricity transaction particularly with Nepal and Bhutan may be facilitated through Inter Governmental framework agreements. There is also a need to develop coordinated procedures for scheduling and dispatch of cross border power and for financial settlement of electricity transactions.

The benefits of power exchange with Nepal and Bhutan are enhanced energy security of South Asia, lesser dependence on fossile fuels, better hydro-thermal mix in generation, reduction in carbon emissions and carbon intensity and economic benefits to the countries of South Asia.

2.9 POWER SYSTEM OPERATION

2.9.1 Government of India's interventions to empower system operation

A committee headed by Shri Gireesh Pradhan was constituted by the Ministry of Power, Government of India in February 2008 to examine issues relating to manpower, certification and incentives for the personnel employed on System Operation at various levels and also for ring-fencing the load despatch centres to ensure their functional autonomy. The recommendations of the above Committee and Task Forces are being actively implemented at the Central level. A new organization, namely Power System Operation Corporation Limited (POSOCO) was formed as a 100% subsidiary of POWERGRID in March 2009 and was notified as the designated entity to operate RLDCs/NLDC wef 1st October 2010. A Forum of Load Despatchers (FOLD) has been constituted as approved by the Forum of Regulators (FOR) in January 2009 for harmonizing practices across the different LDCs. Likewise, the National Power Training Institute (NPTI) has been designated as the agency for training and certification of system operators.

2.9.2 Achievements on the market front

Empowerment of RLDCs/NLDC and their designation as nodal agency have led to the following significant developments on the electricity market front:

1. Successful implementation of Availability Based Tariff (ABT) in all the regions since 2002-03 at the inter-state level.
2. Successful implementation of inter state open access since May 2004 leading to choice for market players and promoting competition.
3. Successful operation of two Power Exchanges since June 2008 leading to a robust price discovery mechanism and investment signals.
4. Successful implementation of the Renewable Energy Certificates (REC) mechanism since October 2010 to fulfill Renewable Purchase Obligation (RPO) of DISCOMs.

2.9.3 Suggested measures to improve system operation

It is recommended that a separate Load Dispatch Centre for renewable energies shall be set up. The collated data from such sub-LDCs can be transferred to the respective SLDC and RLDC so that the grid can be operated in a secure manner as well as ensuring that the renewable generation is absorbed to the fullest extent. Such sub-LDCs may be set up in renewable energy rich States e.g Tamil Nadu, Gujarat and Rajasthan. These sub-LDCs may be set up with grant from clean energy fund. To start with such a sub-LDC may be set up in Tamil Nadu which has about 6000 MW of installed wind capacity.

2.10 ANCILLARY SERVICES

Creation of Reserve and Back Up Power in the System

The Optimal power system should have adequate reserves in order to meet the contingency of outage of certain operating generation capacity. Therefore, creation of adequate reserve and back up power in the system need to be planned along-with related evacuation networks.

Voltage Support Service

Presently there is no legal binding on the generator for providing voltage support facility and very often generators get away from this issue by citing contractual reasons for not commissioning this facility. There is an urgent need to operate large hydro plants as synchronous condensers when the

water inflows are low. Operation of such generators as synchronous condensers will help in supporting the voltage and keeping the transmission system intact. It is therefore recommended that the Grid Standards for Connectivity to the grid notified by CEA may be amended to make it mandatory for hydro power stations to commission the synchronous condenser facility and test it periodically as prescribed by the system operator. CERC shall come out with guidelines/regulation for compensating the generator for the energy consumed during synchronous condenser operation, MVARh generated or absorbed by the generator and the extra Operation and Maintenance (O & M) costs associated with synchronous condenser operation.

Black-start Service: The Grid Connectivity Standards notified by CEA must make black start capability mandatory for all new hydro generating units and gas turbine units.

2.11 RELIABILITY STANDARDS

The existing Grid Codes need to be complemented by Reliability Standards. These Reliability Standards are to be adhered to by all utilities for maintaining grid security of the grid. It is recommended that POSOCO may constitute a Standing Committee for formulation of 'Reliability Standards and their approval from CERC/regulators.

2.12 NEED FOR A SEPARATE MARKET OPERATOR (MO)

There would be an explosion in number of control areas at the regional level from the level of nearly one hundred (100) control areas today to over three fold in the coming years. The number of long term, medium term, and short term and Power Exchange transactions would grow manifold. Metering and settlement system would become more complex with the above explosion in control areas. With the explosion of control areas, Fund Administration and Pool Account operations would also become more voluminous. These developments bring out the need for a Market Operator (MO) to co-ordinate all the transactions and inform the System Operator (SO) a day in advance for physical delivery. Since the work load of RLDCs has become enormous and complex, it is desirable in the interest of efficient system operation that the work of RLDC may be segregated between a 'System Operator' and a 'Market Operator'. Therefore, the following steps are suggested:

- POSOCO, in consultation with CERC, CEA and CTU shall prepare a detailed organizational proposal for segregation of 'System Operation' and 'Market Operation' functions within six (6) months.
- The proposal shall be submitted to the Government for approval and issue of enabling orders.

2.13 CONCLUSIONS AND RECOMMENDATIONS (TRANSMISSION)

- (i) All new 400 kV and above substations, irrespective of ownership (state sector, private sector, central sector) and type (ISTS, dedicated, intra-state) should have optical fibre communication (OFC) facility, unless specifically exempted by CTU, as a requirement for smooth grid operation. A Standing Committee comprising of CTU, POSOCO and CEA should be constituted to identify (i) strategic lines where OFC shall be mandated (ii) strategic locations in the grid where PMUs and PDCs need to be placed. As a first step, this committee should identify all such locations in the existing grid within six months. It should meet periodically at least once in a year to review and identify new locations.
- (ii) In future POWERGRID may be required to install optical fibre as per requirement of grid operation without assurance of telecom business. In such cases the investment should be serviced by the users/POSOCO as determined by CERC. Similar arrangements may be

- made for each STU/SLDC through their respective SERCs. Grid communication users should have priority over the telecom customers of POWERGRID mandated for the smart transmission grid.
- (iii) Grant needs to be made available for setting up transmission system for evacuation of power from renewable energy source. There is a need to encourage RES rich states to build transmission over and above their RPO requirement by providing grant. It is proposed that viability gap funding may be provided on case to case basis for building intra-State transmission system for renewable generation and conventional hydro stations.
 - (iv) As the patch of land occupied by the transmission tower would have zero resale value, it stands to reason that compensation for diminution of value of land occupied under tower base should be the full value of the private land at prevailing market rate as determined by the revenue authorities. It is suggested that Central Government may issue a notification in this regard in consultation with the states.
 - (v) Transmission corridors needs to be identified and reserved in high density population areas like metros and other upcoming urban areas to meet the future growing demand.
 - (vi) While doing town planning for new suburban area and industrial centres, provision for laying of substation and transmission line should be kept in mind. To reduce the requirement of land for constructing substation use of Gas Insulated Substations (GIS) which requires about 30 % land compared to conventional substation is being increasingly adopted in metro, hilly and other urban areas.
 - (vii) It is recommended that a separate Load Dispatch Centre for renewable energies shall be set up. To start with such a sub-LDC may be set up in Tamil Nadu which has about 6,000 MW of installed wind capacity.
 - (viii) The Grid Standards for Connectivity to the grid notified by CEA may be amended to make it mandatory for hydro power stations to commission the synchronous condenser facility and test it periodically as prescribed by the system operator. CERC shall come out with guidelines/regulation for compensating the generator for the energy consumed during synchronous condenser operation, MVARh generated or absorbed by the generator and the extra Operation and Maintenance (O & M) costs associated with synchronous condenser operation.
 - (ix) POSOCO may constitute a Standing Committee for formulation of 'Reliability Standards and their approval from CERC/regulators.
 - (x) POSOCO, in consultation with CERC, CEA and CTU shall prepare a detailed organizational proposal for segregation of 'System Operation' and 'Market Operation' functions within six (6) months. The proposal shall be submitted to the Government for approval and issue of enabling orders.
 - (xi) During 12th Plan period, a total of about 1,09,000 circuit kilometres (ckm) of transmission lines, 2,70,000 MVA of AC transformation capacity and 13,000 MW of HVDC systems are estimated to be added.
 - (xii) The total fund requirement during 12th Plan for evacuation of power works out to about Rs.1,80,000 Cr.

3.0 DISTRIBUTION INCLUDING VILLAGE AND HOUSEHOLD ELECTRIFICATION

The Government is emphasising on an efficient and well performing distribution sector and focusing on the improvement of financial health of utilities towards providing reliable and quality power supply and universal access to power. Accessibility of Power in Rural Areas, AT&C loss reduction, financial viability of DISCOMs, Smart Grid, Demand Side Management (DSM), Private Sector Participation/Private Public Participation (PPP) etc. are also some initiatives taking centre stage today. There has been a growing concern over the financial health of Distribution Utilities. Urgent and immediate action for sustainable Distribution sector is therefore necessary.

3.1 INITIATIVES OF THE GOVERNMENT

3.1.1 Rural Electrification

The total numbers of villages electrified till July,2011 is 5,39,127 which implies that 90.8 % village electrification has been achieved.

Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) in 10th and 11th Plan

Government of India, in April 2005, launched RGGVY – A comprehensive scheme of Rural Electricity Infrastructure and Household Electrification for providing access of electricity to all rural households. There is a provision of capital subsidy of 90% of the total project cost under the scheme and balance 10% of the project cost are being provided by REC as loan.

Under the scheme, projects have been financed with capital subsidy for provision of –

- A. Rural Electricity Distribution Backbone (REDB)
- B. Creation of Village Electrification Infrastructure (VEI)
- C. Decentralised Distributed Generation (DDG) and Supply
- D. Electrification of Below Poverty Line Households

3.1.2 Restructured Accelerated Power Development & Reforms Programme (R-APDRP)

Re-structured APDRP was approved as a Central Sector Scheme on 31.07.2008 with total outlay of Rs.51,577 Cr.

State Schemes

States have come out with specific schemes for Distribution and Rural Electrification. Some of the significant schemes are as follows:

Maharashtra - Akshay Prakash Yojana

Maharashtra State Electricity Distribution Company Ltd.(MSEDCL) had launched the Akshay Prakash Yojana (APY) in 2004. The objective is to ensure better availability of supply and other social benefits based on collective volunteer responsibility of the inhabitants of the village.

Orissa- Biju Gram Jyoti

Biju Gram Jyoti – Govt of Orissa launched the programme in 2007 with an objective to provide access to electricity to all the habitations having population of less than 100. Altogether 10,000 habitations were covered during the 11th five year plan with budget allocation of Rs.314 Cr.

Gujarat - Jyotigram Yojana (Rural Lighting Scheme)

Gujarat Government launched the scheme in September 2003 with an objective to segregate the agriculture load from residential, industrial and commercial loads. The pilot scheme covering eight districts was completed in October 2004 and later on it was extended to cover over 18000 villages and about 9700 hamlets with an total expenditure of Rs.1,100 Cr

Best Practices Adopted by DISCOMs:

Various good practices have been adopted across the country by public and private utilities and they are detailed in Chapter 3 of the Report.

3.2 REVIEW OF 11TH PLAN PROGRESS

During the 11th Plan, emphasis was on creation of capacity in Sub-transmission & Distribution system to strengthen the Distribution sector. Emphasis has been given to Metering, Consumer Indexing, adoption of IT facilities, GIS mapping, modern payment system, HVDS, Rural franchisees etc.

3.2.1 Access to Power for Population of India

As per Census 2001, 80% of the total inhabited villages were electrified and 44% of the rural households had access to electricity. As on 31st July 2011, total of 96% of the villages of the country have access to electricity.

3.2.2 Rural Electrification – RGGVY: Review of Achievements

(a) Sanction of Projects: Under the scheme, 576 projects in 546 districts covering 1,18,499 un-electrified villages, 3,54,967 already electrified villages and 246.45 Lakh BPL households with sanctioned project cost of Rs.26,514.14 Cr have been approved.

(b) Physical Progress : As on 31.07.2011, works in 98,612 Un-electrified villages has been reported complete. However, 83,820 Un-Electrified villages have been reported energized. The gap is primarily in the states of Bihar, Jharkhand, Orissa and Assam. By the end of 11th Plan, most of the projects are expected to be completed excepting NE region and areas involving difficult terrain. The Bharat Nirman target of electrification of 1 Lakh un-electrified villages and 175 Lakh BPL households by March 2012 is expected to be surpassed.

(c) Financial Progress

Against total allocation of capital subsidy of Rs.33,000 Cr (Rs.5,000 Cr under 10th Plan and Rs.28,000 Cr under 11th Plan), capital subsidy of Rs.23,913 Cr has been released as on 31.03.2011. The subsidy allocation for FY 2011-12 is Rs.6,000 Cr and accordingly the expected cumulative achievement at the end of 11th Plan would be about Rs.29,913 Cr. Thus, there would be spill over of about Rs.3,000 Cr. in the 12th Plan.

(d) Delay in Implementation of Projects

Although there have been no shortfalls in achievement of targets for RGGVY, time overrun has been observed in implementation of RGGVY projects. Even after completion of project and energization of newly connected habitations, it has been noticed that certain regions do not get power for sufficient duration of 6-8 hours per day due to overall shortages of power. Slow progress on deployment of franchisees by the states in rural areas is also contributing to delay in energisation as well as maintaining adequate power supply due to manpower constraints.

(e) Issues and Concerns

- Coverage and Scope of the scheme
- Revenue sustainability – Deployment of Franchisees
- Notification of RE plan and its implementation by states
- Benchmark costs
- Availability of 6-8 hours Power Supply
- Monitoring
- Decentralized Distributed Generation (DDG)
- Social-economic Evaluation of RGGVY

3.2.3 R-APDRP Scheme

Part-A of R-APDRP is currently under implementation and is in a stage of advanced progress in several States. Part A of the R-APDRP is to be completed by utilities after 3 years of sanctioning. As of now, there are no projects which have completed three years of time, post sanctioning. However, it has been observed that State Procurement Policy and procedures delayed the appointment of ITIA in some States.

Financial Health of SEBs

(a) AT&C Losses:

Accelerated Power Development and Reforms Programme (APDRP) was launched in 2002-03 as an Additional Central Assistance (ACA) to finance the modernization of sub-transmission & distribution networks with the main objectives to reduce AT&C losses to 15%. AT&C loss at national level have been reduced from 38.86% in 2001-02 to 27.15% during 2009-10. While some states have shown an improvement in AT&C Loss reduction, it is pertinent to note that the absolute loss levels are still at a higher level with respect to losses and require further efforts for loss reduction.

(b) Revenue Loss (ARR and ACS gap)

As per the PFC report on "Performance of State Power Utilities" for the year 2009-10 the cash losses (revenue and subsidy realized basis) of utilities selling power directly to consumers increased from Rs.17,620 Cr. in the FY 2007-08 to Rs.42,415 Cr. in the FY 2009-10. The cumulative book losses (accrual basis) of the state utilities have increased from Rs.79,339 Cr. as on 31.03.2009 to Rs.1,06,247 Cr. at the end of year 2009-10. Gap between Average Cost of Supply and Average Revenue Realised is widening and has increased to Rs.0.73 per unit in 2009-10 from Rs.0.37 per unit in 2007-08 on subsidy realized basis. While some states have shown improvement in the financial health, others are yet to demonstrate the impact of the policy initiatives. In order to restore the commercial viability of the distribution companies it is necessary to eliminate the gap between Average Revenue realised (ARR) and Average Cost of Supply (ACS). The tariff structure needs to be designed based on Multi Year Tariff with tariff revision in a time bound manner. The National Tariff Policy mandates the SERCs to notify roadmap with a target that latest by the end of year 2010-11 the tariffs are within $\pm 20\%$ of the average cost of supply. A Panel chaired by former Comptroller and Auditor General Sh. V. K Shunglu has been formed to look into the financial health of power distribution companies and to suggest ways to improve the financial condition. Recommendations of the panel are awaited.

(c) Mounting of Debt on Utilities

The total borrowings of state DISCOMs have touched Rs.1,77,602 Cr as on 31.03.2010 and total interest charged from state utilities in year 2009-10 is Rs.15,651 Cr. RBI has taken cognizance of the difficult financial situations of DISCOMs and their attempts to bridge cash losses by short term borrowings. In order to bridge the gap between revenue and expenditure and to service interest on borrowing States resort to short-term borrowing and even divert long-term loans to bridge cash losses.

The suggested measures to improve the financial health of DISCOMs are to formulate a roadmap for reducing the gap between ACS and ARR and cash losses. Conversion of existing Government loans to DISCOMs into Government equity will help cash flow of DISCOMs because now subsidy payable by State Government is adjusted against interest on loan. Many DISCOMs have negative net-worth and conversion of loan into equity may result into positive net-worth and enable DISCOMs to attract fresh funds.

(d) Cross-subsidy

There is a significant level of cross subsidy from Industrial consumers to Agricultural consumers.

(e) Distribution Franchisee

The Government of Maharashtra had taken the initiative to introduce an input-based franchisee for distribution in selected towns. Similarly franchisee has been appointed for Agra in Uttar Pradesh. As regards, Rural Franchisee, some states have demonstrated success in rural franchisee model. The states of Uttarakhand and West Bengal have deployed Self Help Groups as rural franchisees for management of rural distribution.

3.3 REFORMS AND POLICY IMPLEMENTATION STATUS**Open Access**

The Open Access at Inter-State level is fully operational. During the FY 2009-10, the total number of transactions under Open Access was 18,128 as against 778 in 2004-05. Further, Central Transmission Utility (CTU) is reported to have received 225 applications from private developers for Long Term Open Access. At State level, as per information available with Forum of Regulators secretariat, 24 SERCs have notified terms and conditions of Open Access Regulations, 21 SERCs have determined cross subsidy surcharge, 25 SERCs have allowed Open Access up to 1 MW and above, 21 SERCs have determined transmission charges and 18 SERCs have determined wheeling charges.

Tariff Rationalization

It is seen that the tariff is not appropriate to meet the cost of supply of electricity. This hinders the sustainability of distribution companies. Further, default in payment, non-metering of consumers, no proper energy accounting/ auditing, inadequate upgradation of the distribution system are issues that need to be addressed. State Governments may have to examine the possibility of increasing the tariff in respect of agriculture and domestic sector or providing adequate revenue subsidy. Comptroller and Auditor General of India (CAG) have also carried out a study of 24 utilities on issues impacting financial performance of Power Distribution Utilities in India and have mentioned the issues of cross subsidy and tariff not being rational. Unless the tariff are not made rational and higher losses are not contained, DISCOMs will reach at break down level due to financial imprudence.

3.4 PROGRAMME FOR 12TH PLAN

The key challenges to be addressed during the 12th Plan are providing access of power to all, Sustainability, Efficiency and Effectiveness of Distribution sector. Estimates of Physical and Financial programme for 12 Plan are given in Table below.

Table: ES-13**Estimates of physical & financial requirement for distribution during 12th Plan.**

Sl. No.	Name of Segment	Units	Physical		Financial (Rs. Cr)	
			2012-17	2012-17	2012-17	2012-17
I	New Lines					
(i)	33 KV O/H line	Ckt Kms	121500		9720	
	33 KV U/G Cable(30%)	Ckt Kms	13500		4050	
	Total 33 KV line	Ckt Kms	135000			
(ii)	11 KV O/H line	Ckt Kms	448000		22400	
	11 KV U/G cable	Ckt Kms	112000		22400	
	Total 11 KV line	Ckt Kms	560000			
(iii)	LV O/H	Ckt Kms	488000		24400	
	LV ABC	Ckt Kms	122000		9760	
	Total LV	Ckt Kms	610000			
II	Installation of new S/S					
	33/11 KV(2X10 MVA)	No	4400		22000	
	No of 10 MVA Transformers	No	8800			
	Transformation capacity	MVA	88000			
III	Installation of DTs including all accessories	MVA	105000			
	1000 KVA	No	10500		1260	
	630 KVA	No	33500		3350	
	315 KVA	No	67000		4020	
	200 KVA	No	105000		5250	
	100 KVA	No	210000		8400	
	25 KVA	No	424000		8480	
	Total No of DTs	No	850000			
III	Aug of Sub-Station					
	33/11 KV	MVA	50000		10000	
	11/0.4 KV	MVA	50000		10000	
IV	Capacitors	MVAR	16000		1280	
V	Service Connections		50000000		25000	
VI	Re conducting of lines					
(i)	33 KV	Ckt. Kms	100000		3000	
(ii)	11 KV	Ckt. Kms	500000		10000	
(iii)	LV	Ckt. Kms	1000000		20000	
	SUB TOTAL				224770	
	Productive Load Scheme				61940	
	Smart Grid				9500	
	IT facilities & SCADA including HRD				10000	
	R&D				25	
	TOTAL				306235	
Say Rs 3.06 Lakh Crores						

3.5 MAJOR INITIATIVES FOR SUSTAINABLE DISTRIBUTION SECTOR DURING 12TH PLAN

Achieving the MoP's vision of "Reliable, adequate and quality power for all at reasonable prices" will require financial assistance and incentivizing investment from the Government of India. Details of the

major initiatives proposed for 12th Plan along with details of outlay and Government subsidy proposed are as follows:

Table ES -14

S. No.	Scheme type	Total fund requirement (Rs. Cr.)	Gol Assistance (Subsidy) (Rs. Cr.)
1.	R-APDRP	15,870	9,924
1.(a)	Additional requirement of funds for the ongoing projects sanctioned during XI Plan (Details enclosed)	-	9,900
2.	Smart Grid	9,500	5,000
3.	Research & Development (Rs. 5 Cr annually)	25	25
4.	RGGVY		
	(i) For Electrification of remaining villages & habitations	63,490	57,141
	(ii) Providing LED lamps for BPL households	1500	1350
	(iii) DDG	1000	900
	Total (RGGVY)	65990	59391
5.	Inclusion of Productive Load Scheme	61,940	30,970
6.	Feeder separation Scheme	20,000	10,000
7.	National Electricity Fund	22,000	22,000
8.	Human Resources Development Plan	150	150
9.	Scheme for Replacement of Inefficient Pump Sets by Energy Efficient Pump Sets in Agriculture Sector	30,000	15,000
	Grand Total	2,25,475	1,62,360

3.5 CONCLUSIONS AND MAJOR RECOMMENDATIONS (DISTRIBUTION):

1. AT&C Loss reduction is a priority and is to be achieved through various administrative and technical measures.
2. Electrification of all villages and habitations for universal coverage by year 2017.
3. Payment of subsidy/outstanding dues by States shall be made upfront, as per section 65 of Electricity Act, 2003. Clearing of all the outstanding subsidies to the utilities. Release payments from the State budget directly;
4. Rationalization of tariff and timely filing of Tariff Revision Petition regularly;
5. Adoption of Multi Year Tariff with tariff revision in a time bound manner.
6. Timely finalization and computerisation of accounts;
7. Establishment of DDG projects in Grid connected areas also where adequate power supply is not available. Setting up of Decentralised Distribution Generation (DDG) projects based on Viability Gap Funding (VGF) through competitive bidding process.
8. Continuation of R-APDRP and RGGVY in 12th Plan.
9. Under National Electricity Fund assistance to be linked to states (for interest subsidy) based on process of reforms and other eligibility criteria.
10. 100% Metering of Consumers to be ensured.
11. Distribution Franchisee as a PPP model in electricity distribution to be promoted.

12. Funding for smart grid pilot projects, training initiatives, and for Research and Development are recommended to be as grants.
13. Distribution Sector R&D to be promoted. Setting-up of a Technical Cell of CEA, which will focus on - Best practices, R&D in terms of data collection and specific projects, Technical support to States for consultancy and implementation.
14. The distribution system planned for the 12th Plan includes setting up of new lines (13,05,000 kcm), installation of new substations(88,000 MVA), augmentation of substation etc. The total fund requirement is Rs 3,06,235 crs for distribution sector.

4.0 LEGISLATIVE & POLICY ISSUES- FORMULATION, IMPLEMENTATION & FEEDBACK

Government of India's Policy of "Power for All" is in pursuance of the objective of the Electricity Act 2003 to protect the interest of consumers and supply of electricity to all areas. Several programmes have been initiated to achieve this objective. This objective has also been stated in the National Tariff Policy and National Electricity Policy and after many years of the implementation of these schemes and programmes, a need has been felt to review these policies in order to make Government's stated objectives achievable, within the boundaries of institutional and financial viability and to bring the benefits of electrification to the entire population. The suggested policy changes seek to accomplish the objective of achieving inclusive growth by providing affordable, adequate and quality power for all consumers.

A Summary of Recommendations on 'Legislative and Policy Issues – Formulation, Implementation and feedback' is as follows:

1. Strengthening of institutions at the National/ Regional/State level such as NLDC/RLDCs/SLDCs is vital to the implementation of Open Access. The management of POSOCO should be separated from the Power Grid. There is a need for functional & financial separation in operation of SLDCs for ensuring their independence. The recommendations made by the Pradhan Committee need to be implemented for ensuring empowerment of SLDCs.
2. To give a clear timeline for States to expedite reassignment of the PPAs to DISCOMs and for winding up the single buyer model as early as possible, enabling provision may be made in this regard in the Policy.
3. SERCs should provide long term trajectory for Renewable Purchase Obligation. Forum of Regulators (FOR) should conduct studies in this regard and suggest possible trajectories for different States keeping in view availability of renewable sources in the country and impact of increasing level of Renewable Purchase Obligation (RPO) on the power purchase cost of the respective distribution licensee. FOR should strive to develop homogeneity in the RPO regulations of respective states and UTs.
4. The Principles & guidelines evolved through consensus by the Forum of Regulators for the Renewable Purchase Obligation (RPO) of Obligated entities and Renewable Energy Certificate (REC) mechanism should be followed up for timely adoption by corresponding Regulations of SERCs in keeping with Government Policies. A time limit of 3 to 6 months may be prescribed under the policy for respective SERCs to issue the relevant Regulation once it is adopted by the FOR with or without modification.
5. As the present definition of cogeneration plants as provided in the Act and as interpreted by Appellate Tribunal For Electricity (APTEL) does not prescribe the source of fuel (fossil or non-

- fossil), it is recommended to bring clarity in this regard through legislative changes, if required, in consultation with MNRE.
6. Empowering Regulatory Commissions for suo moto revision of tariff to consumers-Section 64 of Electricity Act 2003 may be amended by incorporating an additional provision for empowering the Regulatory Commissions for suo moto revision of tariff to consumers.
 7. The CGRF should be a multi-member setup with members from all stakeholders. FOR to play an important role in ensuring consonance of guidelines/regulations pertaining to CGRF & Ombudsman in respective States and UT's.
 8. The office of the Ombudsman should be funded by SERCs and a separate budgetary allocation could be made in the budget of SERCs for this purpose and should be recovered from distribution licensees.
 9. Consumer Advocacy Cells may be instituted by all the Commissions to provide the required legal advice, support, and assistance to Complainants for representing their case before the Ombudsman. Such a Cell could be funded by the Commission.
 10. Power procurement and allocation of power to be done in line with the tariff policy and the guidelines/ Standard Bid documents (SBD) issued by Govt. of India under the Electricity Act, by the State Government. The Working Group recommends that enabling provisions may be made in the NEP in this regard.
 11. A new Para in the policy may be added so that similar condition/ provision may be made on the lines of Works of Licensee Rules for conditions of construction of dedicated transmission lines and also any dispute is to be adjudicated and compensation decided by District Magistrate etc...
 12. 'Independent Monitoring Group' (IMG) for oversight on important programs / schemes such as RGGVY, NEF and R-APDRP may be constituted separately. To give effect to this mechanism, provision shall be made in the plan document / National Electricity Policy. These groups will consist of officials as well as independent experts and will review progress of policies/ programs / schemes periodically, say, every six months. IMGs will submit reports to Secretary (MoP) and these reports will be in the public domain."
 13. Alternative methods of calculating cross subsidy surcharge could be worked out to ensure that neither open access is throttled nor does the host DISCOM unduly suffer.
 14. SERCs may calculate Cross-Subsidy Surcharge based on the assumptions that the power available as a result of exit of open access consumer will be sold at the average revenue realization rate. This is the most practical scenario in a situation of shortage of power supply. The SERCs may assume certain percentage (say, 10%) of the total consumption by eligible open access consumers for the purpose of estimation of power available for sale at average realization rate. The wheeling charge (grossed up by the system loss at appropriate level) to be recovered from the open access consumers should also be factored into computation of surcharge. At the same time it should also be ensured that the formula incentivizes the distribution licensees to reduce their distribution losses.
 15. For a situation where there is no power cut, SERCs may calculate Cross-Subsidy Surcharge based on the estimation that the DISCOM will avoid purchase of the quantum of power for which open access has been sought. This principle of avoided cost method should be adopted in areas

where there are no power shortages. Other assumptions relating to quantum of power avoided and the wheeling charges could be on the same lines as above.

16. As envisaged under Sec. 61(g) of the Act, all SERCs/JERCs should specify through a regulation the roadmap for reduction of cross-subsidy between different consumer categories. The road map should also have intermediate milestones, based on the approach of a gradual reduction in cross subsidy.
17. SERCs should impose reasonable trading margin for the intra-state sale irrespective of the final destination of the electricity. SERC's should incentivize the intra-state trading in line with Act and Policy.
18. The concerned SERC should ensure automatic pass through for any increase in power purchase cost arising out of rise in cost of fuel
19. Two Power Exchanges (PX) are in operation leading to two spot prices today. Two PX, while facilitating competition, also leads to fragmentation of transmission service. It is suggested that while there could be multiple PX, a central price clearing algorithm could be adopted. A single spot price would lead to more certainty as far as investors are concerned. An alternative suggestion received was that as the Power Exchanges were still at a nascent stage, they should be allowed to mature before having a concept of a central price clearing algorithm. In the interim, there could be arbitrage opportunities between the two PX.
20. It is suggested that the ancillary active power market be developed. CERC shall come out with a framework for implementation of ancillary market.
21. The need for long term adequacy statement by DISCOMs was emphasized in order to reduce uncertainty to the end consumer. It is felt that a substantial part, say about 80-85% of the requirement needed to be sourced by DISCOMs through long/ medium term contracts so that the infrastructure is developed accordingly.
22. In view of the slow progress made by the distribution licensees for arranging long-term power purchase agreements through competitive bidding, it is recommended that a separate group may be set up to examine the impediments in this regard and suggest remedial measures required.
23. Short term procurements can be done three months in advance by the DISCOMs. Other products available in short term are First Come First Served (FCFS), day ahead and same day. A suggested model could be to source up to 98-102% of the requirements two days in advance and leaving only the last 2-3% for the day-ahead market. The day-ahead market might be taken recourse to only to account for load forecast errors and/or forced outage of some generating units.
24. The Act shall provide further clarification on the meaning of 'extraordinary circumstances' mentioned in Section 11, in case required. Further, the Appropriate Commissions might in line with the provisions of the Act clearly specify the compensation to be provided to Generating Companies whenever section 11 directive is issued to generating companies.
25. The provision under section 11 or 108 of electricity Act, 2003 should not be misused to deal with shortage of power in the State as this section was meant to be invoked in extra ordinary

circumstances like security of the State, public order or a natural calamity. This position may be clarified in the National Electrical Policy

26. To make open access happen, it is also important to evolve a uniform approach to operational level issues like metering, billing and settlement etc. and various charges for open access. FOR should evolve uniform principles on all such issues through the consensus evolved and follow up for timely implementation.
27. For all 1 MW and above consumers seeking open access, Stand by charges should apply only if the distribution licensees continue to have the universal service obligation for energy supply. In case the distribution companies do not have the universal service obligation, stand by charges may be decided by mutual agreement between the open access consumers and the distribution companies.
28. In order to have two different types of distribution licensees, the power granted to Appropriate Commission, under Section 14 to grant a distribution licence, will have to be amended to the effect that it can grant two different types of distribution licences.
29. The definition of minimum area of supply may be modified and it may be left to the discretion of the SERCs to decide the area, with due consideration to the fact that the grant of second/subsequent license does not lead to "cherry picking".
30. At the state level, DISCOMs also need to create Distribution Control Centres (DCCs) and empower them so that open access at the distribution level becomes a reality. The nodal agencies identified also need to be protected against taxation related issues with respect to single window clearance operation.
31. Single entity which takes care of wires and multiple suppliers of power which use the common network may be a vital step for operationalization of Open Access in Distribution Sector. A detailed study should be conducted by FOR in this regard based on international experience and implications should be assessed.
32. It may be desirable for the SERCs to encourage the distribution licensees to go for competitive bidding process. More clarity needs to be brought in this regard through suitable legislative changes.
33. Adequacy issues with respect to 'carriage' must be clearly understood and documented both at the inter-state and intra state transmission. Stakeholders must clearly understand the limitations of the network and the maximum possible power that can be transacted either way into and out of the network.
34. States may also consider setting up dedicated mobile courts and police stations for dealing with offences mentioned in Electricity Act.
35. States should ensure that the institution of Chief Electrical Inspectorate to Govt. of India (CEIG)/State Government is strengthened so that quick and timely approvals are given.
36. Taking into account the practical difficulties in view of the growing number of connections and the shortage of the staff, CEA should work out a scheme of delegation of authority of mandatory inspections, including self-certifications, which would be in consonance with liberalization of bureaucratic control without compromising system safety and suggest possible steps for

strengthening of Chief Electrical Inspector institutions which may be adopted by the State Governments.

37. Suitable incentives to those states who have adopted such measures viz., Time of Day (TOD) tariff should be given.
38. TOD for LT industries and Domestic consumers should be operationalized in phases
39. Pre – paid meters shall be promoted to High value consumers and to those categories of consumers who are chronic defaulters to avoid piling up of arrears.
40. 100% Spot billing, Spot collection, Semi / fully automated meter reading and Standardization of metering protocols shall be done for extensive usage of AMR.
41. Dedicated feeders may be extended to energy intensive consumer groups at their cost.
42. The State Governments should not only clear all the outstanding dues to the Utilities, but ensure payment of subsidies as per section 65 of EA 2003 in future. FOR shall evolve principles & methodologies in this regard through consensus and further follow up the progress.
43. There is an urgent need to align power/energy policies by the States with the Tariff Policy notified under the Electricity Act.
44. Regulatory Commissions (ERCs) could consider initiating investigation under Section 128 to investigate on any action with respect to procurement and/ or disposal of power by State Government in its capacity as a deemed licensee u/s 14 and give appropriate direction. ERCs could issue directions u/s 60 to State Govt (in its capacity as a deemed licensee u/s 14) to not force generating company to export surplus power only through SEB and thereby examine whether unfair conditions are being imposed on account of violation of Section 10(2) and / or whether unlawful actions are being taken by contravention of the Tariff Policy. ERCs could also take action if they feel that their tariff fixation powers are being encroached upon or being vitiate on account of the State Government policies.
45. Renewable purchase obligation for these sources have to be fixed in line with the expected generating capacities and for which the corresponding action plan/mission of on the lines of National Solar Mission which will look into all related steps like corresponding transmission evacuation capacity, the technical and commercial issues associated with it are considered in consultation with all stakeholders. Thereafter, RPOs should be distributed among the states in line with the targets set under the National Action Plan on Climate Change to be done through amendment in Electricity Act 2003 and/ or Tariff Policy.
46. Each state to have 5-10 years RPO for different renewable resources.
47. All states should take Renewable Purchase Obligation (RPO) in all renewable power resources. Percentage share of each resource may depend upon availability of resource in the state, e.g. Bihar with higher biomass resources may take higher PO for biomass and remaining from others-this will create market for each renewable resource.
48. All Generators who set up Power plants may be encouraged to set up corresponding renewable source power generation through suitable incentives by MNRE.
49. Long term procurement of power by the distribution licensee to be done through competitive bidding process (CBP) and Power Purchase Agreements (PPA). To start with, the provisions in

the Tariff Policy may be amended suitably for phase-wise introduction of competition for the different sources of renewable energy. Renewable Power procuring state will have the following procurement options:-

1. Long term procurement through competitive bidding.
 2. Short term procurement through Purchase of REC or at preferential tariffs.
50. For the procurement of renewable power individual demands of more than one distribution licensees/ States may be pooled at the regional level and procured through competitive bidding route under Section 63 (A) of EA 2003/ National Tariff Policy .
51. Spinning reserves need to be facilitated for grid stability at the regional level to accommodate the infirm renewable energy injection into the grid.
52. Suitable incentive for low cost transmission system linking the renewable energy generation sources, development of Smart Grid for evacuation and transmission of renewable power , creation of Spinning Reserves managed by the Regional Load Dispatch Centre needs to be developed may be done through the National Clean Energy Fund .
58. Through suitable legislative changes it is recommended that a Multi-disciplinary body shall be constituted comprising of representatives from Centre and States to review the performance of the Regulatory Commissions periodically on the basis of a performance evaluation matrix and report to the appropriate Government for necessary corrective action.
59. Through suitable legislative changes, to entrust CERC with the additional function of regulating coal prices and its transportation charges.

5.0 DEMAND SIDE MANAGEMENT ENERGY EFFICIENCY & ENERGY CONSERVATION

5.1 11TH FIVE YEAR PLAN – TARGETS & ACHIEVEMENTS

In the 11th Five Year Plan (2007–12), it was proposed to achieve energy saving of 5% of the anticipated energy consumption level in the beginning of the 11th Five Year Plan.

Various activities under different schemes of BEE and MoP have resulted in savings in avoided power capacity of 7415 MW (verified; till Dec 2010) and 250 MW (unverified for 4th Quarter of year 2010 – 11) and 3409 MW avoided power capacity savings is projected during the last year of the 11th Five Year Plan (2011-12).

5.2 UTILITY BASED DEMAND SIDE MANAGEMENT IN THE 12TH PLAN

BEE would provide the technical assistance for establishment of DSM cells in the DISCOMs and capacity building of personnel of DSM cells for enabling them to undertake the following strategies and schemes of DSM in 12th Five Year plan:

- (i) Load Survey
- (ii) Load Strategies
 - Demand Response
 - Load Management Programmes
 - Dynamic/Real Time Pricing
 - Time-of-Use Rates
 - Automated/Smart Metering
 - Web-based/Communication System

- (iii) Demonstration Studies
- (iv) Advanced Metering
- (v) DSM Financing

The total funds required for providing technical assistance for capacity building of DSM cells established by DISCOMs under 12th Five Year Plan is Rs. 300 crore.

5.3 ENERGY CONSERVATION STRATEGY IN THE 12TH PLAN

It is necessary to carry forward the existing schemes as well as further strengthen the activities to accelerate the process of implementation of energy efficiency measures to achieve the desired energy savings. The target of energy saving which may be achieved in the terminal year 2016-17 of 12th Five year Plan as a consequence of Demand Side Management (DSM), Energy Efficiency and Energy Conservation schemes as proposed in the plan is expected to be 44.85 BU (at consumer side) which is equivalent to 60.17 BU at the Bus bar side. Details of the various Schemes are as follows:

5.3.1 Strengthening State Designated Agencies (SDA)

The thrust of the SDA program during the 12th Plan will be on strengthening the 32 SDAs which would enable them to implement various programs and activities initiated by BEE or SDAs themselves.

In the 11th Plan, BEE supported State designated agencies (SDAs) in preparation of action plan, building institutional capacity of SDAs, to perform their regulatory, developmental and promotional functions in their respective states, by way of technical assistance, guidance and funding etc. Each SDA has been supported to develop a five year Energy Conservation Action Plan, customized to local needs aiming at and delivery of the EC act mandates. The proposed activities for the 12th Plan include sector specific interventions in areas like municipality (drinking water and sewage treatment), agriculture sector (pumping), street lighting, commercial buildings, government buildings and waste heat recovery in SMEs including demonstration projects.

The total funds requirement for proposed activities is Rs. 140 crore.

5.3.2 State Energy Conservation Funds (SECF)

The State Energy Conservation Funds (SECF) as mandated under the Energy Conservation Act, 2001, have already been constituted in 22 states and funds have been released to 20 states during the 11th Plan to operationalize the SECF for various energy efficiency initiatives. The state governments of Andhra Pradesh, Rajasthan, Chhattisgarh, Karnataka, Haryana, Gujarat and Mizoram have also contributed a matching grant to the SECF.

In the 12th Plan, it is proposed to set up the SECF in all the states and

- Pursue with SDAs for constitution of SECF in the states and matching contribution by the state governments to the SECF.
- Coordinate with SDAs to implement various energy conservation activities and utilization of fund under SECF.

Contribution of Rs. 70 crore to state energy conservation fund is proposed under the 12th Plan.

Total fund required for strengthening of SDAs and SECF is Rs. 210 crore.

5.3.3 Industrial Sector

The total commercial energy consumed by the industries and SMEs together stands at about 40-50% of the total commercial energy consumption in the country. In view of continuing growth of industry sector, the proportion of commercial energy consumed by industry is envisaged to be around 40-45% in the next five-year plan also.

(a) Large Industries (Designated Consumers)

The projected energy saving potential in the 12th Plan is 11.43 mtoe which consists of a saving of 6.2 mtoe from the seven energy intensive industries (DCs) and 5.23 mtoe from thermal power stations sector. The total energy saving per year during 2011-12 to 2016-17 for 7 DC sectors is calculated on the basis of 1.2% p.a. and at 1% p.a. for the Thermal Power Plant sector during 2015-16.

The instruments to achieve the projected savings in 12th Plan in DCs and other industries are:

- **Continuation of on-going Schemes/Programs by Bureau of Energy Efficiency and Ministry of Power**
 - National Energy Conservation Award
 - Notification of Energy Intensive Sectors as Designated Consumers (DC)
 - Enhanced Capacity Building of Energy Management Professionals (National Certification Examination for EA/EM)
 - Implementation of Perform, Achieve & Trade (PAT) Scheme

The following points describe the vision for PAT scheme during 2012-2017.

- Implementation of 1st Cycle of PAT to achieve the set target of 6.6 mtoe by 2014-15
- Widening and Deepening the Scope of PAT during the 2nd Cycle of PAT
- Accelerate the Implementation of ISO 50001 to promote benchmarking of Energy Management system in Industries and facilities
- Implementation of Frame work for Energy Efficient Economic Development
- Getting support from National Clean Energy Fund (NCEF)
- Facilitation for Need for R&D in NMEEE / PAT

(b) Small & Medium Enterprises

The MSME sector plays a significant role in energy consumption which is about 5% of the total energy consumption by industrial sector. In the 12th Five Year Plan, BEE would target the SME sector for reduction in energy consumption by 6% of the energy used in the energy intensive manufacturing SMEs which is equivalent to 1.75 mtoe. The targeted goal is proposed to be achieved by introducing innovative business models and financial instruments (like Venture Capital Fund/Revolving Fund, Partial Risk Guarantee Fund). The proposed schemes/activities to be undertaken in 12th Plan are as mentioned below:

- Sector specific approach for energy efficiency and technology upgradation through facilitation of implementation of DPRs
- Energy mapping of the targeted SME Sector on all India basis
- Undertaking of Innovative Financial Schemes for adoption of EE Technologies in the SMEs
- Technical assistance and capacity building
- SMEs Product Labelling Promotion Scheme

5.3.4 Equipment and Appliances

(a) Standard & Labeling (S&L) Programme:

The proposed activities in 12th Five Year Plan under S&L for equipments and appliances include:

- Inclusion of 5 new equipment and appliances
- Awareness creation among all the stakeholders,
- Undertaking of check testing, monitoring, market impact assessment of appliances/ equipments covered under S&L

- Up-gradation of energy performance standards for equipment/ appliances covered during 11th Plan.

S&L for Transport Sector

There are total 13.3 million passenger cars (2010 – 11) in India which consume about 9 mtoe. The average annual sales of new passenger cars in the country are about 1.1 million. Under the labeling scheme, the following activities are proposed

- Introduction of fuel economy norms effective from 1st year of 12th Plan,
- Technical study for 2 & 3 wheelers and commercial vehicles (Truck & Buses) to finalise S&L programme

The targeted energy saving by the end of the 12th Five Year Plan is 4.3 mtoe.

(b) Super Efficient Equipment Program (SEEP)

SEEP is a part of Market Transformation for Energy Efficiency (MTEE) initiative, one of the four initiatives of the National Mission on Enhanced Energy Efficiency (NMEEE). The primary objective of MTEE is to accelerate the shift to energy efficient appliances through innovative measures to make the products more affordable. NMEEE seeks to achieve annual savings of 19,598 MW of power and 23 million tonnes of fuel and greenhouse gas emissions reduction of 98.55 million tonnes. is the mission implementing agency for NMEEE.

5.3.5 Commercial Sector

a) Energy Conservation Building Code & Energy Efficiency in Existing Buildings

The projected energy saving at the end of the 12th Five Year Plan is 10.77 BU with the financial budget requirements of Rs. 65 crore.

b) Residential Sector

Bachat Lamp Yojana

The projected electricity saving at the end of 12th Plan is about 10 BU with the financial budget requirement of Rs. 6 crore.

c) Agriculture Sector

Agriculture DSM (Ag DSM)

The projected electricity saving at the end of 12th Plan is about 0.7 BU with the financial budget requirement of Rs. 393 crore.

d) Municipal and Public Utility Sector

Municipal DSM (Mu DSM)

- Energy Efficiency in ULBs
- Energy Efficiency in Water pumping

The projected electricity saving at the end of 12th Plan is about 0.47 BU with the financial budget requirement of Rs. 45 crore.

5.3.6 Energy conservation awareness, awards and painting competition

It is proposed to strengthen all ongoing activities during the 12th Plan and introduce the following specific activities:

- Creation of data base and its analysis for EC Award participating units
- Compilation and dissemination of best-practices in industry and building sector
- Continuation of EC Awards and paintings competition on energy conservation
- Awareness creation on energy conservation through print, electronic and other media for general public

The projected saving at the end of 12th Plan is about 6.83 BU of electrical energy and 5 mtoe of thermal fuel saving with the financial budget requirement of Rs. 100 crore.

5.3.7 Human Resource Development Programmes

In addition to the HRD activities undertaken in each of the scheme of BEE and MoP, the following initiatives are also proposed to be undertaken in the 12th Five Year Plan:

- Student awareness programs
- Training, skill up gradation and refresher training of energy managers and energy auditors
- Training, skill upgradation and refresher training of operators handling fuel fired furnaces and boilers.
- Inter-institutional networking in energy efficiency training
- Training of Power plant personals

The HRD plan is developed for general public awareness and student groups as well as through special training packages for sector specific energy efficiency of operators, energy auditors and managers. It meets the need of most of the sectors such as the power sector, SME, North East, agricultural, buildings, etc.

The total budget proposed is Rs. 288 crores in the 12th Plan.

5.4 CONCLUSION & RECOMMENDATION

Following recommendations/new initiatives are suggested for 12th Plan.

- Continuation of on-going Schemes/Programs by Bureau of Energy Efficiency and Ministry of Power
- The target of energy saving which may be achieved in the terminal year 2016-17 of 12th Five year Plan as a consequence of Demand Side Management (DSM), Energy Efficiency and Energy Conservation schemes as proposed in the plan is expected to be 44.85 BU (at consumer side) which is equivalent to 60.17 BU at the Bus bar side.
- State designated agencies (SDAs) in different states need to play a very important role in terms of carrying forward various energy efficiency initiatives at the state level. The thrust of the SDA program during the 12th Plan will be on strengthening the 32 SDAs which would enable them to implement various programs and activities initiated by BEE or SDAs themselves.
- In the 12th Plan, it is proposed to set up State Energy Conservation Fund (SECF) in all the States and pursue with SDAs for constitution of SECF in the states to implement various energy conservation activities and utilization of fund under SECF. Matching contribution may be made by the state governments to the SECF.

The proposed activities in 12th Five Year Plan under Standard & Labelling Programme (S&L) for equipments and appliances include:

- Inclusion of at least 5 selected new equipment and appliances. Standby power loss reduction in few of the electrical appliances will also be focussed in the 12th Plan.
- Awareness creation among all the stakeholders,

- Undertaking of check testing, label verification, market impact assessment for appliances/equipments covered under S&L scheme and
- Up-gradation of energy performance standards for equipment/ appliances covered during 11th Plan.

Under the labelling scheme, the following activities are proposed

- Introduction of fuel economy norms effective from 1st year of 12th Plan,
- Technical study for 2 & 3 wheelers and commercial vehicles (Truck & Buses) to finalise S&L programme

6.0 RESEARCH AND DEVELOPMENT

6.1 REVIEW OF R&D ACTIVITIES DURING 11th PLAN

- Details of R&D activities by NTPC are in the following areas:

Development of IGCC Technology, Solar Thermal Platform & Solar Photovoltaic Research set ups, Waste heat recovery from flue gas for air conditioning, Development of aqueous-ammonia technology, Establishment of integrated biodiesel pilot plant, Development of robotic based inspection systems for boiler tubes, Set up of Solar thermal based HVAC system, Development of Water & Waste Treatment Technology, Set up of Pressure Swing Adsorption (PSA) based pilot plant for CO₂ capture, Studies on fixation of CO₂ through Microalgae, Studies on aqueous mineralization of fly ash by flue gases, Feasibility studies on Extraction of moisture from flue gas, Development of PDC-RVM instrument and expert system for moisture measurement in insulating papers of transformers, Retrofitting of VFD drives in existing cooling tower fans, Development & installation of artificial intelligence based software for plant performance improvement, Development & installation of online boiler water chemistry monitoring & advisory software, CFD modeling of flue gas ducts to improve temperature & velocity imbalances, etc

Scientific & technical support provided to all NTPC stations as well as many outside stations by NETRA plays a definite role in increasing the availability & reliability of stations in terms of failure investigations, corrosion analysis & control, water & waste water treatment, condition monitoring, health assessment, etc.

- Research projects taken up by BHEL during 11th plan under transmission sector are as follows:
 - 2.5 MVar STATCOM: This project has been taken up jointly with CPRI and the system was developed and successfully commissioned at BHILAI steel plant.
 - Development of IEC 61850 Compliant Substation Automation System. Under this project IEC 61850 client has been developed. Bay Control Unit (BCU) has been developed. Based on this, a 132 kV substation of AP TRANSCO at Chintal has been provided with BHEL developed SAS under a field trial project.
 - Based on the development of 33kV Phase Shifting Transformer (PST) with Thyristor controlled static tap changer, BHEL has made efforts to develop and manufacture PST suitable for transmission applications. In this regard, with the help of CEA and APGENCO, system studies were made and a proposal for the design, manufacture and commissioning of 400kV, 315 MVA +/- 15 degree PST was proposed at KTPS stage VI .

Based on the proposal, APGENCO has awarded a commercial order on BHEL. The project is under advanced stage of execution.

- d) BHEL is working on the development of 400kV GIS and all the systems have cleared required dielectric tests and the efforts for field trial of the developed GIS is proposed in 2012. The field trial may spill over to 12th plan.
- e) BHEL has developed IEC 61850 Process Bus requirements. In this regard, A Merging Unit (MU) has been developed and successfully tested at KEMA in the beginning of 2011. Field trial of full scale SAS along with process bus is contemplated in 2012 and the same is likely to come up in 12th plan.

iii. National Perspective Plan (NPP) –Initiative of MoP in R&D

R&D projects are executed through National Perspective Plan (NPP) Scheme of MoP in a collaborative mode. During the 11th plan period, thrust was given to new technologies such as: High temperature superconducting (HTS) systems, National Effort to Develop Custom Power Devices, Development of materials to address Silt erosion, Grid integration issues with renewable generation such as wind. These are addressed in a project mode.

The total fund spent so far in 11th Plan R&D works is 352 Crore only. Thus, MoP has initiated R&D Plan in new and emerging technologies, which need to be continued during the 12th plan.

6.2 PROPOSED R&D PLAN FOR 12TH PLAN

In the present scenario it is proposed to categorize the R&D initiatives into four different conventional sectors, viz. Generation, Transmission, Distribution and Environment. Under each Sector different technologies have been identified for development of prototypes and pilot plant demonstration. The different areas in these sectors are as below:

- a. **Generation Sector:** Thermal, Hydro Fuel, Renewable Energy and Distributed Generation
- b. **Transmission sector:** Design and development of equipment, real time simulators and controllers, Creation of data-bank, Automation, Pilot plant/Demonstration, Development of alternative materials, Equipment performance, Biological effects, Concept proving / Exploratory studies
- c. **Distribution sector:** Smart Grid, Distributed generation
- d. **Environment:** Clean Development Mechanism, Bulk utilization of fly ash, SO_x, NO_x, and mercury control.

The details of proposed R&D works are given in Chapter 6 of the Report.

6.3 ATTRACTING AND RETAINING OF YOUNG TALENT FOR R&D IN POWER SECTOR

First of all the young engineers should be trained in all aspects of Power Engineering. Training shall include:

- Field exposure
- System simulation for carrying out system studies
- Any other specialized areas in which they are supposed to work
- The problems faced in the Power sector shall be obtained from utilities Specific areas for R&D should be identified by experts; young talent can be used to solve the problems under the guidance of experts

- Incentives should be given for good R&D work.

(a) To retain engineers/ young talent they should be allowed to pursue higher studies such that the research work they are carrying out becomes their project work for their masters or doctoral work.

(b) Institute should go for campus interviews in IIT's /NITs/Universities, explain to them the importance of R&D, the facilities and avenues for research, so that they make a proper choice of their future work.

(c) The problems faced in power sector should be made known to the researchers so that they can appreciate and take up such research work.

(d) More job opportunities should be created to absorb engineers for a job placement who are successful/excel in R&D.

(g) Researchers should be rewarded suitably, and if the research works ends up in patent he should also be eligible for the royalty, awards and citations etc.

(h) Researchers should be sent to training programs on advanced topics for research.

(i) Curriculum at degree level should be revamped to make students to realize the importance of R&D in power sector, so that they can pursue R&D

(j) Educational institutions should provide motivation to students to take up research work.

(k) R&D jobs should be paid on par with IT professionals else there is every chance that power engineers also take up IT related work and there is no brain drain.

(l) There should be an increased emphasis on induction level and advanced training focusing on career development of individuals and organization.

The educational institutions in the order of IIT/NIT/ Universities where the staff of Electrical Engineering Department is active should be identified for carrying advanced research and identifying as centres of excellence in specific fields.

6.4 Institutional and funding framework for R&D

Government should fund the R&D programmes through various schemes such as National Perspective Plan (NPP), Research Scheme on Power (RSoP). Some of them can be in collaborative mode with participation from CPSU's, Industry and academic institutes and utilities.

With a view to take up R&D projects under major thrust areas, and to establish new facilities and augment existing facilities fund requirement amounting to Rs 2,668 crores is proposed. The financial requirements to execute the projects outlined through NPP R&D scheme of MoP are to the tune of Rs 1,500 Crores. Thus, total requirement of fund during 12th Plan for R&D works out to Rs. 4168 Crore.

Out of the Rs 1,500 crores proposed for R&D, direct government grant should be to the tune of Rs 750 crores and balance can be through participation from CPSUs, Utilities and industry.

Details of R&D projects proposed are given in Chapter 6.

6.5 PROMOTION OF R&D IN POWER SECTOR

The Standing Committee on Research and Development (SCRD), which is presently managing NPP R&D, should be strengthened and empowered to make policy document on R&D for the power sector and prioritize problems of National importance having short, medium and long term impact. This should be the apex committee for R&D of power sector. This committee should be well represented by senior executives of central R&D institutions, CPSUs, Utilities and industry.

- (a) Utilities should have collaboration with research institutes so that the problems faced by them can be taken up as research work and will also have immediate application.
- (b) Manufacturers should also participate and sponsor the research program relevant to power sector.
- (c) The successful R&D projects should be given a wide publicity within the power sector
- (d) The power sector should have joint collaboration with similar research institutes abroad to have exchange of know-how and latest methods.

The proposed 'POWER – ACADEMY' should be entrusted with complete research need of country, and shall work in coordination with SCR. All the manufacturing firms, utilities and all concerned even remotely with power sector should be reporting their problems, R & D requirement to this academy.

The recommendations can be implemented by R&D institutions which are financially and administratively autonomous. Such institutions can draw road map for R&D for the next decade.

6.6 CONCLUSION AND RECOMMENDATIONS

1. Power Sector, being highly technology intensive, there is need to promote extensive Research and Development (R&D) in the country, especially while considering introduction of new and advanced
2. Collaborative Research in a phased manner is needed to bridge the knowledge and technology gaps, build expertise, to find solutions for the problems existing in the system and also for problems that may arise in the future.
3. Technologies such as FACTS and HVDC transmission have played a crucial role in alleviating transmission system constraints. More R&D in these area need to be promoted.
4. Special attention is needed for the development of the eight States of the NE Region of the country through a separate R&D Programme on renewable energy.
5. It is proposed to institute Scholarship schemes in some of the Engineering colleges in North East, institute Cash incentive schemes for students and encourage students to take up Masters and Doctoral Programmes in Engineering.
6. Human Resource and Competence building Development for R&D in power sector would require creating a separate cadre for research in taking up application oriented research. The success of the R&D projects will largely depend upon quality of manpower, freedom for research and continuity. Keeping this in view, special schemes such as: attractive fellowships, provision to improve qualification and exposure will be introduced, for attracting young talent and to retain them in power sector.
7. With a view to strengthen the multi disciplinary collaborative research activity amongst CPSUs, utilities, industry and academic institutions, **Centres of Excellence (CoE)** need to be

created to take up application oriented research projects in strengthening the performance of power sector.

8. There is a need to establish '**Power – Academy**' in line with the 'CSIR-Academy', ISRO – Indian Institute of space science and Technology, to attract young engineers, and provide scope to build professional carrier in R&D.
9. With a view to take up R&D projects under major thrust areas, and to establish new facilities and augment existing facilities fund requirement amounting to Rs 2,668 crores is proposed. The financial requirements to execute the projects outlined through NPP R&D scheme of MoP are to the tune of Rs 1,500 Crores. Thus, total requirement of fund during 12th Plan for R&D works out to Rs. 4168 Crore.

7.0 KEY INPUTS

Timely availability of key inputs such as equipment, material, fuel, land and water transplanted etc., is crucial for the timely completion of power projects. Infrastructural support such as Port facility, construction & manufacturing capabilities specifically erection machinery and erection agencies including civil and BOP contractors are also of utmost importance.

7.1 COAL

Coal-based generation is expected to continue to be the predominant source of electricity in the 12th plan period and beyond. Out of the total capacity addition of 75,785 MW envisaged during the 12th plan, coal-based capacity addition is expected to be about 62,695 MW i.e., about 82.73%. Hydro, Nuclear and Gas based generation is expected to constitute about 12.14%, 3.70% and 1.43%. The estimated coal requirement is 842 MT at the end of 12th Plan and 1040 MT at the end of 13th Plan.

Strategies for Mitigation of demand supply gap of coal are Import of coal, Coal price pooling, Demand side management of Coal and Coal Linkages to be reviewed.

7.1.1 Concerns Regarding New Coal Distribution Policy (NCDP)

- Coal India Limited is pursuing Power Utilities for signing of FSA for new units commissioned in year 2009-10 & after, with trigger value of 50% of ACQ quantities in stead of existing trigger value of 90% of ACQ. In this condition, the Fixed Cost Component of generation cost will increase with 50% coal availability and with the operation of units at lower PLF the Station Heat Rate & auxiliary power consumption will also increase. This will also increase the variable cost of generation. If the imported coal is used to maintain the PLF as specified by Regulatory Commission to recover 100% Fixed Cost, the Variable Cost of generation will be very high. The net impact in either case will be of the order of 60-70 paisa per KWH.
- ACQ level be determined at 90% PLF level for all power plants.
- Given the supply deficit scenario and monopolistic nature of domestic coal market, it is essential that CIL treats all the projects on the same platform, irrespective of vintage of the plant or ownership structure, while determining ACQ levels and agreeing on trigger levels for penalty for short-supply.
- Efficiency norms to be used for all plants and such norms to be reviewed by an independent expert body (CEA or CERC).

- New linkages to be given only to higher operating efficiency project- with super critical/ ultra super critical technology. It is recommended that during the 13th Plan, new power plant based on sub-critical technology should be an exception.
- Coal India has specified number of milestones for execution of the power projects for commencement of coal supply. The Coal India should restrict to the major milestone of commissioning of the unit on oil firing. The Coal India should also bind themselves with their milestones to give confidence to the power developer that they will get the assured supply of coal immediately after synchronization of their unit on oil to secure their investments.
- Difficulties in submission of documentary proof for achievement of milestones :
 - **Forest Clearance:** Coal Companies insist for NOC from State Forest Authority even when no forest land is involved for the project.
 - **Commitment of Equity Investment:** In some organisations, projects are financed in the equity: debt ratio of 30:70. No separate proposal for the equity investment is approved by the board, only investment decision is approved. Coal companies are not accepting extract of the annexure from the agenda.
 - **Financial Closure:** In some companies, the loans are tied up on the strength of balance sheet; project specific loans are not tied up. As such there is no financial closure of individual project, which is not acceptable to coal companies.
 - **Land Acquisition:** Coal companies accept only Land Registration/ Transfer Deed/ Land Lease Agreement as documentary proof for completion of Land acquisition milestone. The list of documents as proof for land acquisition must also include possession Certificates/ "dhekal dhakani" forms/ "khatoni"/final compensation award letters.
- The Coal India should delete the clause of operation of Commitment Guarantees in case the power developer fails to achieve milestones. If Coal India desires to retain the clause for encashment, then they should encash the Bank Guarantees of power developer only when Coal India is having sufficient coal with them. If Coal India is short of coal supply then they should not operate the Guarantee.
- No material changes should be made to the FSAs that existed at the time of announcement of NCDP. While there can be changes in the operational aspects, there cannot be changes in key risk parameters such as quantity, period of the agreement, quality, price, etc.
- A statement of cumulative contractual obligation of CIL, SCCL and their subsidiaries may be prepared. A framework may be developed for recommending issuance of a LoA. An essential input in this framework should be the existing cumulative contractual obligation of coal companies.
- FSA provisions may be revised in terms of:
 - **Quantity Obligation:** Minimum quantity obligation to be close to ~90% of the ACQ. Compensation for short supply/failure to lift the coal should be increased to 50% (from current 10%) of the base price of the coal.
 - **Term:** Term of FSA should be minimum 15 years, commensurate with typical project finance debt tenure.
- Consistent with stipulations of NCDP, subject to agreement by the buyer, CIL should import coal and meet its responsibility under FSAs.

7.2 GAS

As domestic gas is on the decline and international gas prices remain high and volatile, financial viability of gas-based power projects is a matter of concern. A gas-based power plant becomes unviable if the gas prices rise above US\$ 10-US\$ 12.

Need For Capacity addition through Gas based stations is on account of their suitability to function as peaking stations, Shorter construction periods, Lesser strain on resources such as land and water, considerable environmental benefits relative to coal-based power and Diversification of fuel supply /energy security risks.

7.3 LAND

Optimum utilization of land has gained significance and challenges are to be encountered in land usage practices.

As most of the 12th Plan Thermal Power Projects (62695 MW out of total 75785 MW) are already under construction, land has already been acquired and only about 1300 acres is still left. For Hydro Projects also, no serious issue is understood to have been raised by developers. Tentatively, land requirement for the 13th Plan projects is expected to be nearly 64000 acres.

Major Issues of concern regarding land are Lack of land Records, Issues related to compensation, Lack of clarity about the status of occupiers who are not owners, Right of way (ROW) for Ash/Water pipelines, coal conveyors and transmission lines, Resistance from local people, MOEF clearance and acquisition of forest land and Resettlement and rehabilitation of the project affected people (PAP).

7.4 WATER

Water is one of the key inputs to thermal power generation and off-late the availability of water has also become scarce. As much of the new generation capacity is envisaged near pit-head, difficulties are being faced in selection of suitable sites due to non-availability of water, particularly in coal bearing states such as Orissa, Jharkhand and Chhattisgarh. The Report highlights various technical measures for reducing water consumption including inter alia use of dry ash disposal/ high concentration disposal system, use of efficient cooling towers, dry cooling, water optimization during plant operation as well as additional measures for conserving water and mitigating water shortage for power plants. It is recommended that Ministry of Water Resource must take incentive for creation of new reservoir/dams on the potential rivers so as to tie-over the water shortage.

7.5 TRANSPORT

Transport sector plays a vital role in the growth of Power Sector. The development of different transport sectors like Railways, Highways & Roads, Ports, Inland Waterways and Gas pipelines are key to achieve the capacity addition targets in the 12th five year plan. On account of increase in Unit sizes to 660 MW, 800 MW and plus 1000 MW during 12th plan and beyond, Heavy Over Dimensional Consignments (ODC) will need to be transported from Ports (for imported equipment) and from sites of Indigenous Manufacturers to Project sites. This calls for bold initiatives, policy changes as well as adopting basic changes in load and handling specifications in Roads, Railways and Port sectors.

7.6 CONCLUSION AND RECOMMENDATIONS

FUEL

Since coal is our major source of energy and would remain the mainstay of future energy requirement, domestic coal production needs a boost as also acceleration of exploration activities for finding out new coal reserves in our country.

Domestic Coal Supplies:

1. To sustain the capacity addition proposed in the 12th Plan, coal availability to power sector must be increased by domestic coal companies to 688 million tons by the end of 12th Plan.
2. As per present projections of CIL/SCCL and expected coal production from captive coal blocks, the domestic coal availability is likely to be 550 million tonnes, thus indicating a huge gap in demand & supply. CIL/SCCL will need to step up its production as also to take action to arrange imported coal as per New Coal Distribution Policy of Ministry of Coal.
3. Coal sector needs to be immediately opened up for private sector investment
4. Coal Regulator needs to be in place to ensure higher coal productivity at least cost.
5. Need to upgrade coal mining equipment and practices in the already working mines for better productivity.
6. Concerns of developers regarding Fuel Supply Agreement (FSA) need to be addressed urgently. Coal companies need to guarantee 100% of the normative requirement and FSA for 90% of ACQ to be signed .
7. Coal crushing capacity to be augmented at mines.
8. MoEF has proposed an amendment to notification for mandatory use of beneficiated/ blended coal with less than 34% ash for projects located beyond 500 km from mines (presently it is beyond 1000 km). CIL to ensure adequate number of washeries to meet this stipulation before it is implemented.
9. The cost of washed coal should be on the basis of actual cost of washing instead of import price parity. Issue of coal rejects utilization also needs to be addressed sooner.
10. Coal should be sold through e-auction only after meeting the full demand of power sector. The issue of rail connectivity to such mines from where coal for e-auction is sourced should be taken up immediately.
11. Coal Price Pooling may be considered to optimize coal transportation and also to encourage acceptance of imported coal.

Captive Coal Blocks:

1. Coal blocks still falling in Category 'A' need to be immediately brought under Category 'B' including coal blocks in Hasdeo Arand coal field for UMPP and other ongoing power projects.
2. New captive coal mines need to be allocated for competitive bidding by state utilities at lowest price of power (Case-II) instead of auctioning proposed by Ministry of Coal.
3. Allocation as well as De-allocation of captive coal blocks should be by the Inter-Ministerial Committee as for coal linkages.
4. The issues of additional benefits requested by coal bearing states need to be addressed on urgent basis as some of the captive coal block developers are facing problems including, interalia, land acquisition.
5. The time lines prescribed for captive coal block development to be made more realistic.
6. In the draft Mines and Minerals (Development and Regulation) Bill 2011, the sharing of profits by local populace from the coal mines has been proposed. However in case of captive coal mines, since there is no sale of coal but only of power produced, the profit sharing

should be linked to royalty payable which could be adjusted from the pretax profits as any other revenue expenditure.

Lignite

1. Lignite reserves in the country have been estimated at around 40.9 billion tonnes, out of which about 82 % are located in the State of Tamil Nadu & Pondicherry. At present only a small percentage of the total reserves of lignite have been exploited. Immediate steps needed to augment lignite production considering large reserves of lignite in the country. The technology issues for efficient utilization of lignite resources need to be addressed.

Gas

- There is need for promotion of new gas based capacity in the country (at least 20,000 MW during 12th Plan) due to inherent advantages of gas power plants and also to reduce our carbon footprints.
- Presently gas based projects totaling to about 13,000 MW are already under construction. These projects can be commissioned during 11th Plan/early 12th Plan, if gas is made available.
- Gas supply to be made available for at least 20,000 MW new Capacity in the 12th Plan.

Policy changes to be adopted to encourage gas based capacity addition

1. Policy initiatives to incentivize gas based plants including Combined Heating & Cooling plants having high efficiency.
2. Priority for gas allocation to CCHP plants.
3. Constitution of Task force under CERC to address issues related to setting up of Peaking and Reserve Plants.
4. Standard Bidding Documents (SBDs)– need to be adapted for gas-based power.
5. Duration of PPA in case of gas based projects, which at present is 25 years, needs to be brought down to 15-18 years, keeping in mind economic life of gas-based power plants. Further, normally gas is allocated for 5 Year period, as such signing of PPA need to be facilitated for 5 year period, to be reviewed from time to time in line with extension of gas allocation period upto the economic life cycle of 15-18 year of the plant.
6. Fuel risks pass-through: Current domestic and international market environment for natural gas suggests that there are far too many uncertainties with regard to availability and/or price of natural gas. Developers are not ideally placed to take those risks. Therefore fuel availability and price risks need to be borne by the procurers.
7. Take-or-Pay risk pass-through: Gas supply contracts are characterized by high level of Take-or-Pay obligations on fuel buyer. PPA needs to be suitably amended to alter current level (relatively low) of minimum off-take guarantees to suitably higher levels. It also needs to be ensured that gas-based plants do not face dispatch risks during their intended hours of operation (peak/ intermediate load).
8. Capital cost and heat rate under competitive bidding scope: Bidding would therefore be primarily on competitively discovering capacity charges and conversion (net heat rate) efficiencies.
9. Gas based peaking power if integrated into the total electricity generation system can lead to carbon reduction efficiencies even higher than renewables like wind or solar power. Hence it is suggested to extend the fiscal benefits to gas based peaking power projects at par with the renewable energy projects or Ultra Mega Projects. Specifically, zero customs duties & taxes and interest rate subsidy.

LAND & WATER

Land

The Working Group recommends the following for Land use and acquisition:

1. Land to be acquired with a view of not only project development but also the livelihood issues of the original land owners.
2. Minimizing land requirement pressure for new projects by use of spare land within existing plants.
3. Review of MoEF procedures for expeditious project clearances.
4. Higher capacity units in place of older small size units
5. Adoption of higher size units.
6. Shelf of sites for projects i.e. land bank needs to be created.
7. New technology options to be adopted for minimizing land requirement.
8. CEA may undertake another exercise in consultation with various stakeholders to further optimize land requirement for Power projects.
9. Land acquisition by States need to be done expeditiously in a time bound manner, considering that a large percentage of Power is allocated / committed to the Home State from the Power project.

Water

Major recommendations regarding Water Requirement are as follows:

1. Technical measures for reducing water consumption may be adopted.
2. Creation of large reservoirs/ dams on potential rivers to retain flood waters.
3. Coastal power plants to be encouraged.

TRANSPORT

The development of Transport infrastructure in different transport sectors like Railways, Highways & Roads, Inland Waterways and Gas Pipelines is essential to achieve the capacity addition targets in 12th five year plan and beyond. The main recommendations on Transport sector are:

1. Railways to augment their capacity to evacuate coal from major coal fields namely North Karampura, Ib Valley, Talcher and Mand Raigarh.
2. For smooth and faster evacuation of coal, coal conveyors should be used to transport coal from mine to rail head with automatic loading in wagons.
3. Railway to expedite proposed Dedicated Freight Corridors to segregate freight and passenger traffic.
4. Railways to ensure rail connectivity to all ports having coal unloading facilities.
5. NTPC and Inland Water Ways Authority of India (IWAI) would be signing an agreement for transportation of 3 MT of imported coal to Farakka TPS. Other thermal projects located on the banks of Ganges in West Bengal and Bihar should also explore the same.
6. Roads and Highways need to be augmented for transportation of Over Dimensioned Consignments (ODC) for higher size units.
7. Amendment in Motor Vehicle Act to accommodate heavy consignments above 49 MT and inclusion of hydraulic axle trailers.

8. Review of load classification for Roads & Bridges by IRC/ MoRTH to accommodate ODCs beyond 100 MT.
9. Single window clearance and one time payment for ODC movement.
10. Proper design of Toll Plazas built on highways.
11. Changes in Road design in North Eastern & Hill states to minimise sharp curves/gradients in roads and have sufficient vertical clearance in underpasses.
12. Proper Approach Roads to be provided for Hydro Projects.

PORTS

Major recommendations for augmenting Ports and related infrastructure are:

1. Adequate coal unloading arrangement at Ports to be ensured to handle imported and domestic coal required for power stations .
2. On the East Coast, coal handling facilities to be augmented at Paradip and Vizag Ports. This will be necessary to evacuate coal from mines in Orissa as rail routes are congested.
3. All major and important minor ports should be mechanised by augmenting crane capacities, silos, conveyors & wagon tippers.
4. Draft at various ports to be increased to handle Panamax or Capsize vessels.
5. RO-RO berths should be created at least in two major ports namely Kandla on the west coast and Paradip on the east coast for unloading ODCs.
6. Road connectivity to ports to handle ODCs has to be ensured

MANUFACTURING CAPACITY AND CONSTRUCTION AGENCIES

Adequate manufacturing capacity of Main Plan Equipment including that for large super-critical thermal set shall be available indigenously to meet the capacity addition requirement of the Country during 12th Plan. As regards Balance of Plants (BOP), Construction Agencies and Construction equipment/ Construction techniques, the capacities and capabilities have to be further developed and enhanced.

Main Plant Equipment

1. An implementation mechanism for meeting the technical standards as notified by CEA needs to be devised for adherence by the Manufacturing agencies.
2. Standardization of technical specifications to the extent possible will enable batch production of equipments expediting their delivery.
3. Adequate Logistics & Road Connectivity
4. 12th Plan capacity addition proposes large size super critical sets. Therefore provision needs to be made for movement of heavy/ ODC consignments on domestic roads and bridges. The development of the project should also involve development of the roads/ bridges up to project site.
5. In order to reduce the transportation time and timely delivery at site, single window concept for clearances of consignments and hassle free movement of the goods at National/ State/ District/ Tehsil check nakas is recommended to be provided.
6. Government should encourage indigenous manufacturing of critical raw materials such as Special steels like CRGO & CRNGO, thicker boiler quality steel plates and high pressure tubes and pipes by providing incentives and policy support.

Balance of Plants (BOP)

1. Standardization

The variation in engineering practices delays the finalization of design of equipment and result in serious financial implications. Standardization of engineering / design practice in plant layout and equipment rating / selection is expected to reduce delays in project execution.

2. Faster Document Approval for BOP engineering

The delay in the finalization of engineering document and approval procedures in a BOP package has been affecting delivery schedules. The concept of e-documentation may be adopted using latest IT tools for speedier approval.

3. Ensure Availability / Development of skilled manpower

Both the developer and the contractor(s) have to jointly make efforts for providing training and necessary skill sets to local people to improve their employability.

4. Timely ordering for BOP packages - to minimize the delays in BOP supplies.

5. Review of Qualification Requirements

Qualification requirements for the BOP vendors may be reviewed from time to time, in order to align with the industry situations. This will ensure quality vendors and a larger vendor base for a faster execution of projects.

6. Concept of Functional Specification

The concept of functional specification to the extent feasible (say in respect of major components) may be adopted, keeping in view the commitment of vendor by way of guaranteed performance and liquidated damages clauses provided in the contract.

7. Ensuring clarity of inputs to vendors

Ambiguity in site inputs to the vendor delays the process of engineering and placement of orders. It is emphasized that clear site inputs / fronts shall be made available to the developers.

8. Adoption of latest techniques in project execution

Latest methods of civil construction with mechanized equipment and manpower mobilization needs to be adopted.

9. Technological up gradation of BOP

New design changes and materials may be adopted for an optimal functioning and reduced redundancies for a cost effective solution.

10. Mechanism for capacity assessment of BOP suppliers

There has been a bunching of orders with a few suppliers, with a result of delayed deliveries due to their limited capacities. There is an urgent need to develop mechanism for capacity assessment of BOP vendors.

11. Following EPC approach

EPC contracts have merits over the multiple package contracts. Multiple package poses problems of micro level monitoring and interfacing issues resulting in delays. The EPC packages are priced slightly higher, but the cost is compensated by the timely completion.

12. Proper interface between various vendors and consultants

The interface between various vendors has to be ensured to have proper matching equipment design and sequential supplies

Construction Agencies and Equipment

1. Latest methods of civil construction with mechanized equipment and manpower mobilization needs to be adopted. Vendors should be encouraged to adopt new erection technologies to reduce the erection and commissioning cycle.

2. New tools and tackles may be adopted for optimum functioning and reduce redundancies for a cost effective solution.

3. Industry is facing severe shortage of skilled manpower like welders (especially High Pressure welders), fitters, turners, masons, carpenters etc. Following is recommended:
- Creation of adequate number of new modern technical training institutions under government sector and facilitation in creation of the same under private sector.
 - PPE manufacturers and Developers to take a lead in Training and skill enhancement of manpower through encouragement and facilitation of plant visits, live projects, internship, guest lectures and other means of industry interaction with students and faculty of technical institutions.
 - An institutional mechanism for setting up Regional Skill Development Centers by pooling resources from Power Developers, Manufacturers and Contractors to enable a substantial increase in the availability of trained and skilled manpower.

MATERIALS

There is no shortage of key materials except CRGO Steel, higher grade CRNGO and thick boiler steel plates. The following measures should be taken:

- Need to set up plant for producing CRGO.
- Indigenous capacity for tubes and pipes to be augmented.
- Need to create short circuit testing facility for transformers.
- Indigenous manufacturing facility for gas insulated substation to be augmented.
- Indigenous capacity for thicker boiler quality plates needs to be created.
- Mandatory BIS Certification requirement may result in supply constraints of CRGO and thicker Boiler quality plates. This issue needs to be addressed.

8.0 FINANCIAL ISSUES IN POWER SECTOR FINANCING

8.1 FINANCIAL PERFORMANCE OF POWER SECTOR DURING 11TH PLAN

The 11th Plan fund requirement for the power sector was Rs. 10,31,600 crore. The All India Expenditure in Power for 11th Plan was Rs. 707,278 crore as mentioned in Table below.

Table: ES-15

Projected fund requirement v/s likely expenditure during 11th Plan

S. No.	Segment	Fund Requirement (Rs. crore)	Likely Expenditure (Rs. crore)*	Achievement (%)
1.	Generation (including Nuclear [#] , NCES, Merchant and Captive)	566,396	479,620	84.68%
2.	Transmission	140,000	122,991	87.85%
3.	Distribution (including DDG)	307,000	100,000	32.57%
4.	R&M	15,875	3,564	22.45%
5.	HRD	462	83	17.97%
6.	R&D	1,214	352	29.00%
7.	DSM	653	668	102.30%
Total		1,031,600	707,278	68.56%

Source: CEA & Working Group report of 11th Plan

[#]Source: Department of Atomic Energy Annual Accounts

*Generation includes nuclear, NCES, merchant and captive power projects

* Transmission includes 33 kV and above inter and intra state transmission lines

* Distribution is inclusive of sub-transmission lines upto 33 kV levels and DDG

*includes actual and projected expenditure up to FY 2011-12

8.2 FUND REQUIREMENT FOR 12TH PLAN

The fund requirement for 12th Plan has been estimated to be Rs. 12,37,480 as mentioned in Table below:

Table: ES 16

Capacity Addition & Fund Requirement for 12th Plan projects

S. No.	Capacity Addition	Allocation of cost towards 12th Plan (Rs. Crore)			
		Centre	State	Private	Total
1.	11th Plan (2011-12)				
a)	Generation –capacity addition	5,174	1,485	5,100	11,759
A	Sub-Total 11th Plan	5,174	1,485	5,100	11,759
2.	Generation – 12th Plan capacity addition				
a)	Thermal	48,650	55,734	1,73,117	2,77,500
b)	Hydro	35,183	8,024	6,952	50,159
c)	Nuclear	26,600	-	-	26,600
B	Sub-Total 12th Plan	1,10,433	63,758	1,80,069	3,54,260
3.	Advance action for 13th Plan				
a)	Thermal	40,440	14,805	80,577	1,35,822
b)	Hydro	28,132	612	11,216	39,960
c)	Nuclear	96,800	-	-	96,800
C	Sub-Total 13th Plan	1,65,372	15,417	91,793	2,72,582
4.	Sub-Total generation (A+B+C)	2,80,979	80,660	2,76,961	6,38,600
5.	Captive Power Projects			65,000	65,000
6.	R&M of Power Plants	19,847	12,040		31,887
7.	Transmission	1,00,000	55,000	25,000	1,80,000
8.	Distribution	48,191	2,38,082	19,963	3,06,235
9.	Research & Development	4,168			4,168
10.	DSM & EE	7,482			7,482
11.	Human Resources Development (Training Infrastructure)	4,108			4,108
	Fund Outlay (4 to 11)	4,64,774	3,85,782	3,86,924	12,37,480

Fund requirement Renewable Energy (RE) projects in 12th Plan have been computed on the basis of per MW cost of different types of RE projects which are based on the FY 2011-12 price. The total fund requirement for RE projects in 12th Plan is as below:

Table ES 17**Fund requirement for RE projects in 12th Plan**

S. No.	Type	Total cost (Rs. crore)
1.	Biomass	10,500
2.	SHP	8,000
3.	Solar	49,400
4.	Wind	67,200
Total		1,35,100

Hence, the total fund outlay for 12th Plan has been calculated as below:

Table: ES 18

Particulars	Total cost (Rs. crore)
Total fund outlay except RE projects	12,37,480
Fund outlay for RE projects	1,35,100
Total fund outlay for 12th Plan	13,72,580

The year wise fund requirement during 12th Plan is given in the table below:

Table: ES 19**Year wise fund requirement during 12th Plan***(Figures in Rs. Crore)*

Financial Year	2012-13	2013-14	2014-15	2015-16	2016-17	Total
Fund requirement	2,36,996	2,42,335	2,72,042	3,02,770	3,18,436	13,72,580

8.3 FUND AVAILABILITY

Debt: Equity (D/E) ratios for central, state and private sector have been taken based on the current lending norms for funding of power sector. The details are as given below:

Table: ES 20**Debt equity ratios**

Sector	Debt	Equity
Centre	70%	30%
State	80%	20%
Private	75%	25%

The possible sources of funding are commercial banks, public financial institutions, dedicated infrastructure/power finance institutions, insurance companies, overseas markets, bilateral/multilateral credit, bond markets and equity markets.

8.3.1 Estimated Funds Mobilization

The details of the major sources of financing and estimated quantum of funds are mentioned in subsequent sections.

Table: ES 21

Major sources of financing and funds mobilization

(Figures in Rs. Crore)

Sources of Funds	12th Plan estimations
Equity	
By promoters for IPPs, IPTCs	80,481
By promoters for NCES & Captive	56,780
Internal Resources	126,226
Total Sources of Equity (A)	263,487
Debt	
Scheduled Commercial Banks (SCBs)	270,455
PFC	178,259
REC	175,950
Other IFC	36,427
Bonds/Debentures	140,541
Multilateral/Bilateral Credits/ECBs	90,755
Insurance companies	28,899
Total Sources of Debt (B)	921,286
Total Sources of Debt and Equity (C=A+B)	1,184,773

8.4 SOURCES OF EQUITY

8.4.1 Internal Resources

Internal resource, mobilization by Public Sector Enterprises (PSEs) in 12th Plan have been estimated at Rs.1,26,226 crore. The estimate has been made on the basis of the Internal & Extra Budgetary Resources (I&EBR) data. For IPPs, IPTCs, NCES and Captive power projects it has been assumed that the required equity has been/ will be tied up to the satisfaction of lenders as these projects will achieve Financial Closure on non-recourse basis.

8.4.2 Gross Budgetary Support (GBS)

GBS to Central Sector power PSEs has been estimated at Rs. 2,473.26 crore during 12th Plan. In addition fund infusion through GBS under planned schemes has been estimated at Rs. 177,368 crore. Funds under NEF scheme amounting to around Rs. 22,000 crore will be provided as interest subsidy and thus have been excluded for estimation of fund availability.

8.5 SOURCES OF DEBT

8.5.1 Banks

The funds available from banks during 12th Plan have been estimated at Rs. 2,70,455 crore.

8.5.2 PFC

The funds available from PFC for 12th Plan have been estimated at Rs. 1,78,259 crore.

8.5.3 REC

The funds available from REC for 12th Plan have been estimated to be Rs. 1,75,950 crore.

8.5.4 Other IFC

The major IFCs other than PFC and REC are Infrastructure Development Finance Company Limited (IDFC), Larsen and Tubro Finance and PTC India Financial Services Ltd. The projected funding by IDFC for 12th Plan power projects is Rs. 30,000 crore which is about 80% of its incremental loan book in 12th Plan. Assuming similar ratios for the other two companies, the total funds available from the IFCs for 12th Plan power projects has been calculated as Rs. 36,427 crore.

8.5.5 Bonds/Debentures

Bond and Non-Convertible Debenture (NCD) issuances grew at a CAGR of 18% from Rs. 99,222 crore in FY 2007 to Rs. 1,94,948 crore in FY 2011. During the same period, bond issuances by Power sector companies (excluding IFC) increased at a CAGR of 38% from Rs. 5,275 crores to Rs. 19,025 crores. While the year on year growth rates for bond issuances has been volatile due to the impact of economic crisis, the percentage of bond issuances by Power sector companies to the overall bond issuances has been in the range of 7-10%.

Going forward, the growth rate of bond and NCD issuances during 12th Plan has been assumed at a conservative rate of 9% p.a., while the growth rate of bond issuances by Power sector companies is expected to moderate to around 10% p.a. Based on these assumptions, the total bond and NCD issuances in the terminal year of 12th Plan are expected to be around Rs. 3,27,000 crore with bond issuances by Power sector companies at around Rs. 33,704 crore i.e. around 10% of total bond and NCD issuances. The funds available from Bond issuances during 12th Plan have been estimated at around Rs. 1,40,541 crore..

8.5.6 Multilateral/ Bilateral Credits/ ECBs

The total outstanding amount of multilateral credits, bilateral credits and ECBs increased from Rs. 303,800 crore in March 2004 to Rs 412,076 crore in March 2007 (*Source: RBI*). The CAGR of the same has been computed as 10.7%. Assuming the same trend to continue, the total inflow of funds through these routes has been calculated to be Rs. 4,53,777 crore.

Based on the industry reports (*Source: McKinsey*), 24% of the total external borrowings have been assumed to be channelled towards infrastructure investments, out of which, 20% (83% of external borrowing to infrastructure) are assumed to be channelized to power sector. Hence, the total funds available through these routes have been calculated to be Rs. 90,755 crore.

8.5.7 Insurance companies

The following assumptions have been used to estimate fund availability from life and non-life insurance companies

- **Life insurance companies:**
 - The total investments of life insurance companies grew from Rs. 743,602 crore in March 2009 to Rs. 873,536 crore in March 2010 which is a growth of about 17.5%. The growth rate of these investments has been assumed to be 15% per annum till FY 2017.
 - In FY 2009 and FY 2010, about 9% of total investments of life insurance companies have been in housing and infrastructure sector. The same trend has been assumed to continue till FY 2017
 - 25% of the total investments of housing and infrastructure sector have been assumed to be allocated to power sector

- **Non-life insurance companies:**
 - The total investments of non-life insurance companies grew from 58,893 in March 2009 to 66,372 in March 2010 which is a growth of about 12.7%. The growth rate of these investments has been assumed to be 12.5% per annum till FY 2017.
 - In FY 2009 and FY 2010, about 15.5% of total investments of non-life insurance companies have been in housing and infrastructure sector. The same trend has been assumed to continue till FY 2017
 - 25% of the total investments of housing and infrastructure sector have been assumed to be allocated to power sector

On the basis of the above assumption, fund availability for power sector during 12th plan from life and non-life insurance companies has been estimated at rs. 28,899 crore.

8.6 ADEQUACY OF FUNDS

On the basis of the fund requirement and availability estimated in previous sections, the debt shortfall has been computed at around Rs. 97,444 crore and the equity shortfall has been computed at around Rs. 90,363 crore, implying a total funding shortfall of Rs. 1,87,807 crore.

After incorporating funds available from GBS and special schemes, the total funding available is detailed below:

Table: ES 22

Assessment of adequacy of funds during 12th Plan

(Figures in Rs. crore)

Particulars	Amount
Funds Required	13,72,580
Equity Required	3,53,850
Total sources of Equity	2,63,487
Equity available / (shortfall) (A)	(90,363)
Debt Required	10,18,730
Total sources of Debt	9,21,286

Particulars	Amount
Debt available /(shortfall) (B)	(97,444)
Total Funds available /(shortfall) before considering impact of Special Schemes (A+B)	(187,807)
Funding by GBS	
GBS to CPSEs	2,473
GBS to plan schemes	155,368*
Sub-Total (C)	1,57,841
Funding from other Sources	
Credit Enhancement Scheme	10,000
Infrastructure Debt Fund	25,000
Sub-Total (D)	35,000
Total funds available /(shortfall) (E=A+B+C+D)	5,034

* Funds under NEF scheme amounting to around Rs. 22,000 crore will be provided as interest subsidy and thus have been excluded for estimation of fund availability.

8.7 POLICY INTERVENTIONS & FINANCIAL MEASURES FOR REDUCING FUNDING GAP

8.7.1 Tax incentives on investments

A higher economic growth can only be sustained through investment in the infrastructure sector. For garnering additional funds for the sector, there is a need to introduce additional investment limit of Rs. 50,000 per year for infrastructure bonds under Section 80C of the Income Tax Act, 1961 over and above existing limit of Rs. 1,00,000. Assuming a subscriber base of 13 million (approx. 33% of the total tax payer base of 40 million), the amount mobilized is estimated as Rs. 39,000 crore p.a. Assuming a 50% flow to the power sector out of the above, the mobilization over 5 years is estimated at Rs. 97,500 crore. The loss of tax revenue from this step would be compensated by higher tax revenue in future due to higher GDP growth rate. Such a step can be supported at this junction as we expect higher tax collection as a result of a growing economy.

8.7.2 Institutional / Regulatory Interventions

- Payment security mechanism
 - a. Commitment of escrow upfront as in case of successful UMPPs to be provided
 - b. Alternatively, to provide access to large industrial consumers on payment of wheeling charges, in case of default, as adequate security in lieu of ESCROW.
- Uniform rules for cross subsidy and additional surcharges to be levied by SEB on sale of power by an IPP in that state to a third party
- In line with the National Electricity Policy, states should be encouraged to follow Intra – State ABT regime such that they are eligible for 14% return on equity. This would encourage better discipline even within the states and shall enhance internal resources for deployment in R&M/capacity expansion.

8.7.3 Fiscal and other Measures to enable cheaper power

- The effective tax rate for the business of lending to infrastructure sector after the likely advent of Direct tax code from FY12 is projected to go up from about 27% to 30% due to withdrawal of exemptions under 36(1)(viii) and 36(1)(vii)(c) of Income Tax, 1961. Hence infrastructure lending would be subjected to maximum tax rate. Though concessions for developers in infrastructure space would continue, all benefits for infrastructure lending are proposed to be removed. This would force lenders to pass this additional tax burden in the lending rates which would enhance the cost of borrowing for infrastructure projects.

Since the need of the hour is to arrange low-cost funds for infrastructure sector, there is a strong case for levying MAT for infra lending rather than the normal corporate tax or to restore the tax concession already available to these financial institutions.

- Excise duty on power generation, transmission & distribution equipment (which is currently at 14%) should be reduced and gradually phased out for generation projects with an installed capacity of more than 1,000 MW and for inter-state transmission lines. This is required, as power sector has no advantage of “cenvat” credit as there is no excise on power, which increases the cost of power.
- The import duty relaxation presently available for generation equipments may also be extended to include all equipment related to power transmission, distribution metering and energy conservation so that the supply of equipments at reasonable cost is available to continue with Distribution reforms which are being supported by schemes like APDRP etc.
- Existing Income tax exemption for power sector projects under section 80IA expiring in March 2012 to be extended till March 2017, i.e. end of 12th Plan period.
- Additional depreciation of 20% (WDV) under IT Act is available for investments in plant and machinery in industries other than power. Same depreciation should be made available to power industry also.
- Technology transfer for developing and enhancing existing manufacturing facilities in India needs to incorporate in equipment procurement contracts. As a first step, the domestic manufacturing obligations on the line of bulk-tendering carried out by NTPC for 800 MW and 660 MW sets could be stipulated for the power projects being awarded for the benefit of 13th Plan. Such a step will ensure that indigenous vendor development is facilitated for high-tech supplies in future.

8.7.4 National Electricity Fund (NEF)

The poor state of distribution sector requires investment for replacement of obsolete equipment and technology upgradation. During budget speech of 2008-09, Government of India (GoI) had announced the creation of NEF. Under this scheme, it was proposed that interest subsidy would be

extended to the Distribution Utilities which would be linked to reforms. This is expected to reduce the burden of servicing the interest on the utilities.

The proposed scheme is envisaged to provide interest subsidy for over 15 years with an estimated outlay of Rs. 63,750 crore. The amount of Rs. 22,000 crore has been estimated for 12th Plan under NEF, assuming an average interest subsidy of 5% per annum which is expected to be provided from the funds allocated for distribution.

8.7.5 Dedicated fund for financing Power projects in NE sector

Power projects in NE sector could be financed through a dedicated NE fund. Since the benefits of optimal utilization of mineral and water resources of NE would accrue to the whole country, establishing such a fund could channelize the funds collected from the country as a whole and release capital resources of banks/ GoI grants for community level developmental work in NE region.

Further, project developers could be further incentivised to set up projects in the NER through fiscal incentives like waiver on Minimum Alternate Tax (MAT). It may be emphasised that MAT credits are utilized by a project developer between 5th and 10th year of the project cycle. Hence, MAT waiver would not impact the total tax payments but would only increase upfront equity returns to the project developer.

8.8 CONCLUSION & RECOMMENDATIONS

1. On the basis of envisaged capacity mix, proposed capacity addition schedule and associated project cost, the total funds required during 12th Plan have been estimated at Rs. 13,72,580 crores with a Debt requirement of Rs. 10,18,730 crore and Equity requirement of Rs. 3,53,850 crore.
2. The availability of Debt and Equity during the same period have been estimated at Rs. 9,21,286 crores and 2,63,487 crores respectively implying a total funding shortfall of Rs. 1,87,807 crore.
3. After incorporating funds available from GBS and special schemes, the shortfall in availability of funds in low economic growth scenario has been computed to be Rs. 140,528 crore vis.a.vis fund surplus of 5,034 crore in the base case scenario.
4. While most of the 12th Plan power projects have achieved financial closure, fuel related issues viz. lack of binding FSA, high cost of imported coal and delays in according statutory clearances to captive coal blocks are expected to impact financial closure of 13th Plan power projects.
5. Further, appropriate steps are required to be taken to curtail the financial losses of the utilities and improve the investment climate in the power sector.
6. Due to the above reasons, mobilization of debt to power sector projects will continue to be challenge that needs to be addressed with suitable measures.
7. Further various policy measures like Hydro Power viability fund, measures for financing RE projects and take-out financing for ECB lenders have been suggested so as to improve fund availability for the sector.

9.0 HUMAN RESOURCE DEVELOPMENT (HRD)

The HRD/Training needs of Technical, Non-Technical and Supporting Staff should be addressed keeping in view the National Training Policy for the Power Sector.

9.1 REVIEW OF HRD PROGRAMME & ACHIEVEMENTS DURING 11th PLAN

Some of the major achievements pertaining to capacity building during 11th Plan are:

- (a) Distance Learning Certificate Programs on Power Distribution Management for JEs/ AEs level
- (b) Certificate of Competency in Power Distribution (CCPD)
- (c) Adoption of 69 ITIs by CPSUs/Private organizations
- (d) Training under Distribution Reforms, Upgrades and Management (DRUM)
- (e) C&D Employees Training
- (f) Franchisee Training
- (g) Training under R-APDRP etc.

9.2 ASSESSMENT OF REQUIREMENT OF MANPOWER

9.2.1 Manpower requirement in 12th Plan & 13th Plans

For a capacity addition of 94,215 MW(including renewable) in the 12th Plan, the additional manpower requirement shall be of the order of 407.67 thousands out of which 312.92 thousands will be technical and 94.75 thousands will be non-technical. The total manpower by the end of 12th Plan shall be 1425.79 thousands, out of which 1083.88 thousands (76%) will be technical and 341.91 thousands (24%) will be non-technical.

For a capacity addition of 1,23,900 MW(including renewable) in the 13th Plan, the additional manpower requirement shall be of the order of 547.78 thousands out of which 419.04 thousands will be technical and 128.74 thousands will be non-technical. The total manpower by the end of 13th Plan shall be 1795.34 thousands, out of which 1367.43 thousands (76%) will be technical and 427.91 thousands (24%) will be non-technical.

A summary of likely manpower at the end of 11th, 12th & 13th Plan is furnished in the following table.

Table: ES 23
Manpower under various Plans

Capacity in MW and Man Power in Thousands									
S No	Plan	Capacity at the beginning of Plan	Capacity addition during Plan*	Capacity at the end of Plan	Manpower at the beginning of Plan	Reduced Manpower due to retirement etc.	Manpower required for Capacity addition of Plan	Manpower at the end of Plan	Man/MW at the end of Plan
C 1	C 2	C 3	C 4	C 5 = C 3 + C 4	C 6	C 7 = 87.5% * C 6	C 8	C 9 = C 7 + C 8	C 10
1	11 th	132330	74374	206704	950.47	831.66	331.90	1163.56	5.63
2	12 th	206704	94215	300919	1163.56	1018.12	407.67	1425.79	4.74
3	13 th	300919	123900	424819	1425.79	1247.56	547.78	1795.34	4.23

* Includes Capacity addition from Renewable Energy
Man/MW ratio

The Man/MW ratio during various plans, based on above projections of capacity addition and corresponding requirement of manpower during 11th, 12th & 13th Plan is given below:

Table: ES 24
Man/MW Ratio at the end of various Plan Periods

End of Plan Period	Thermal	Hydro	Nuclear	Transmission & Distribution	Overall
9th	1.78	2.20	3.97	7.50	9.42
10th	1.44	1.95	2.96	5.41	7.00
11th	1.08	1.74	2.27	4.37	5.63
12th	0.85	1.56	1.87	3.73	4.74
13th	0.72	1.43	1.59	3.34	4.23

9.2.2 Manpower Availability

On the basis of the total number of technical institutions operational, it can be seen that at all the three levels i.e. Graduation, diploma and ITI, there are sufficient number of students passing out each year. However the skill set required for the power sector in few areas does not match the needs of the industry. Our ITIs and other vocational training institutions have to be augmented for providing certain skill sets like High Pressure Welders, Fabricators, Fitters, Binders, Drillers, Plumbers, Electricians, Linemen, Heavy Machine Operators, Operators-Crane, Dozer, Dumper, Excavation, Bar Benders, Piling Rig Operators etc. who would be required in huge number for the Erection & Commissioning Activities for the Thermal, Hydro, Nuclear Plants and Transmission & Distribution areas. The quality and range of their training will keep pace with the changing needs of the economy and opportunities for self-development.

9.3 TRAINING NEED ASSESSMENT

9.3.1 Training Strategy

To fulfil the above needs, training to the power sector personnel is provided in the following categories:

- i) O&M Training to all existing employees engaged in O&M of generating projects and Transmission & Distribution System as per statutory requirements under the Gazette Notification of September 2010 issued by CEA ranging from 4 Weeks to 30 Weeks.
- ii) Induction level training for new recruits for 1 month (Technical & Non-Technical) is considered a must in the power sector
- iii) Refresher/Advanced training of 5 Days in a year to all existing personnel of varying degrees in various specializations in line with National Training Policy for Power Sector.
- iv) Management training of 5 Days in a year to the senior Executives/Managers in India/Abroad in line with National Training Policy for Power Sector.

9.4 TRAINING FACILITIES

9.4.1 Training Institutes Recognized by CEA

During the 10th Plan, there were, 51 training institutes recognized by CEA under various power utilities. About 20 new institutes were recognized by CEA during the 11th Plan. A total of 72 training institutes under various power utilities have been recognised by CEA.

Various Organizations which have provided training in 11th Plan in Power Sector are:

- (i) National Power Training Institute
- (ii) Power Management Institutes (PMI) & Various training Institutes of NTPC
- (iii) Various training Institutes of NHPC, SJVNL, THDC etc.
- (iv) Various training Institutes of Power Grid
- (v) Various training Institutes of State/Private Generating Utilities
- (vi) Various training Institutes of State Transmission Utilities
- (vii) Various training Institutes of State/Private Distribution Utilities

Various Schemes under the 11th Plan towards Training were operative like Training under Distribution Reforms, Upgrades and Management (DRUM), C&D Employees Training, Franchisee Training, Training under R-APDRP etc. Short-term programs with multiple program themes Course Curriculum centrally developed under DRUM were delivered through institutional spread of 20 Training Institutions. Structured Training for C&D Level Distribution employees and Franchise development programs were initiated under RGGVY.

9.4.2 National Power Training Institute

NPTI has trained over 1,80,000 Power Professionals in regular Programs over the last 4 decades. NPTI operates on an all India basis through its nine Institutes in different zones of the country. NPTI conducts various Manpower Training and Academic Programs. NPTI has one 500 MW Thermal Training Simulator, Two Nos of 210 MW Thermal training Simulators, one 430 MW (2x143 MW Gas Turbine and 1 x 144 MW Steam Turbine) Combined Cycle Gas Turbine Simulator, one No of Hydel Simulator and one No of Load Dispatch Simulator. NPTI has a Training Infrastructure to provide Training of 29,356 Man-Months per Year.

9.4.3 Power Management Institute (PMI) & other training institutes of NTPC

The Power Management Institute (PMI), NTPC's apex training and development centre has been imparting training in the fields of management development, construction and O&M of power plants and information technology . NTPC has 11 No of training institutes at its Project Sites spread all across the country. NTPC has a Training Infrastructure to provide Training of 18,856 Man-Months per Year.

9.4.4. Training Institutes of NHPC

NHPC has Training Institutes at its Project Sites with a training infrastructure to provide training of 720 Man-Months per Year.

9.4.5 Training Institutes of PowerGrid

PowerGrid has Training Institutes at its Regional locations/Project Sites. They have a training infrastructure to provide training of 1917 Man-Months per Year.

9.4.6 Neyveli Lignite Corporation

Neyveli Lignite Corporation has a Training Institute at Neyveli. They have a Training Infrastructure to provide Training of 2407 Man-Months per Year.

9.4.7 Other Training Institutes

Names of some other leading Training Institutes which are providing training in Power Sector are Reliance Energy Management Institute, Mumbai, Jindal Institute of Power Technology, Raigarh, Chattisgarh, Evonik (Steag), Noida, Gujarat Energy Training & Research Institute, Vadodara

9.4.8 Distance Learning Certificate Programs on Power Distribution Management for JEs/ AEs level

Advanced Certificate in Power Distribution Management (ACPDM) - Course was developed by IGNOU in association with NPTI and delivered by IGNOU through multiple regional centres spread across the country. The course is meant for Graduate Engineers/Diploma holders, or Science/Commerce/Art Graduates or Equivalent with two years experience in Power Utilities or the Electricity Sector.

9.4.9 Certificate of Competency in Power Distribution (CCPD)

The course is meant for Technicians/Equivalent Trade or manpower working in Power Sector (sponsored candidates) or General Candidates or Private electricians at least 8th Pass (non-sponsored). The course started in August, 2009 and is presently being conducted at Durgapur, Nagpur & Guwahati Institutes of NPTI.

9.4.10 Adoption of ITIs

During the Power Sector conclave held during July 2007, the recommendations were included are Adoption of ITIs by Power Industry and Integration of ITIs by power industry to enhance the basic skills of workforce

9.5 CAPACITY BUILDING DURING 12TH PLAN

Training may be given to personnel in the power sector as detailed below:

- ❖ O&M Training
- ❖ On-job Training Facility
- ❖ Induction Training
- ❖ Refresher/Advanced Training
- ❖ Management Training
- ❖ Simulator Training
- ❖ Training in Renewable Sources of Energy
- ❖ Training in Demand Side Management, Energy Efficiency and Energy Conservation
- ❖ Power System Operators Training & Certification
- ❖ Capacity Building under R-APDRP
- ❖ National Training Program for Electricity Distribution Franchisee and C&D Employees under RGGVY
- ❖ HRD and Technical Competence Building due to Technology Advancement and R & D
- ❖ Introduction of Training on Attitudinal Changes / Behavioural Sciences
- ❖ Training in Information Technology
- ❖ Opportunities for Higher Studies
- ❖ Training of Non-Technical Officers and Staff
- ❖ HRD and Capacity Building for Power Generating Stations
- ❖ Training for Nuclear Power Personnel
- ❖ Training Abroad
- ❖ Hot Line Maintenance Training
- ❖ Vocational Training for Youths & Project Affected Persons (PAPs) near Project sites
- ❖ Training through Distance learning education & Web based Training

9.5.1 Training Infrastructure Requirements vis-à-vis Availability during 12th Plan.

Overall training load during 12th Plan is estimated as 2473.41 thousand man-weeks/year. The available training infrastructure is 1945.69 thousand man-weeks/year. Thus, there is a deficit of training infrastructure for 527.72 thousand man-weeks/years.

9.5.2 Conclusion & Recommendations

It is proposed that all Central Sector Utilities, all state Sector Utilities and all IPPs should create sufficient Training Infrastructure for providing O&M training as per the norms stipulated in notification of September 2010 issued by CEA. Additional training Infrastructure should also be created by Organizations like NPTI & Training Institutes of other Utilities and they should also augment their existing Training Institutes for meeting the increased training requirements of the Power Sector. It is also proposed that all existing nine Institutes of NPTI should be augmented for which estimated cost for augmentation per Institute is Rs. 50.00 crore and for nine institutes it works out to Rs. 450 crore, for which necessary Plan funding may be provided by Ministry of Power.

The following options are available for meeting the funding arrangements

- i) As per National Training Policy each organization should allocate training budget between 1.5% to 5% of annual salary budget.
- ii) Each utility engaged in generation and transmission could set aside 0.25% of profit annually for meeting the training expenses.
- iii) Training infrastructure for distribution could be funded through R-APDRP.
- iv) Funds could be sought under the National Skill Development Program of Ministry of Human Resource Development for meeting the Training requirements.

10.0 DEVELOPMENT OF POWER SECTOR IN NORTH-EASTERN REGION

Major recommendations towards development of the North eastern Region are as follows:

- i) A clear, coherent and sustainable power policy may be made specially for the NER which will take into account the special characteristics and needs of the Region. High capacity hydro & thermal power projects with associated transmission lines should be developed in the NE region for - First meeting the demand of the North-Eastern Region, and thereafter for other parts of the country.
- ii) CIL should take up development of new coal mines particularly in Assam and Meghalaya to meet the coal requirement for new thermal power projects being proposed in the NE region.
- i) The issue of gas availability and pricing may be appropriately addressed for exploiting the substantial gas reserves in the Region for power generation.
- iv) In planning road networks particular attention should be given to roads, bridges and underpasses with adequate design capacity considering transportation of heavy ODCs to power projects.
- v) More attention should be given to inland water routes as a method of connectivity within the region, the existing potential of which is largely untapped.
