

## Chapter 7

### KEY INPUTS

#### 7.0 INTRODUCTION

Government of India has made an action plan to provide power to all and has taken many initiatives in this direction. In order to bridge the existing gap between demand and supply and to meet the future requirements, there is a need of enhancing the installed capacity to about 275 GW by 2017. The capacity addition required during the 12<sup>th</sup> Plan is about 75,785 MW (excluding capacity addition through renewable sources) in the thermal, hydro & nuclear sector during 12th. Five year plan, details of tentative year-wise phasing are as shown at Table 7.1.

Table- 7.1

(figures in MW)

Capacity Addition - Projection for 12th plan *						
Type	2012-13	2013-14	2014-15	2015-16	2016-17	Total
Hydro	1370	1808	2077	2539	1419	9204
Coal	13685	12970	13555	12575	9910	62695
Gas	986	100	0	0	0	1086
Thermal	14671	13070	13555	12575	9910	63781
Nuclear	0	0	0	1400	1400	2800
<b>Total</b>	<b>16041</b>	<b>14878</b>	<b>15632</b>	<b>16505</b>	<b>12729</b>	<b>75785</b>

\* Year-wise capacity addition plan from 'Renewable' not included

A capacity addition of about 93,400 MW has been tentatively projected for the 13th Plan period.

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%.

Timely availability of key inputs such as equipment, material, fuel, land and water transport 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. This chapter gives details of Infrastructural support required for 12th and 13th Plan for the following:

- Fuel
- Transport
- Port facilities
- Construction & Manufacturing Capabilities

- Roads
- Steel, Cement, Aluminium and other material

## 7.1 FUEL - COAL, LIGNITE AND GAS

### 7.1.1 Coal

#### 7.1.1.1 Coal Requirement

##### (a) For 12<sup>th</sup> Plan

Coal is recognized as the most important fuel source for power generation in India, due to its abundant availability compared to other fuels. At present out of the total installed capacity of 1,82,689 MW, coal based generation constitutes 1,00,098 MW. Coal based electricity generation is almost 81% of total generation. Coal is likely to remain the main fuel source for the domestic energy market over the next few decades. As per the projection of CEA, coal-based capacity addition at the end of 12<sup>th</sup> Plan will be 1,66,724 MW, as detailed in Table- 7.2:

Table- 7.2

Coal-based Capacity Addition / Generation & Coal Requirement Projection					
DESCRIPTION	2012-13	2013-14	2014-15	2015-16	2016-17
Installed Capacity [Coal based]	108029	121714	134684	148239	160814
Additions (Coal Based)	13685	12970	13555	12575	9910
Retirements	0	0	0	0	4000
<b>Total Installed Capacity (MW) (coal based)</b>	<b>121714</b>	<b>134684</b>	<b>148239</b>	<b>160814</b>	<b>166724</b>
<b>Total Generation (BU)*</b>	<b>690</b>	<b>783</b>	<b>890</b>	<b>1010</b>	<b>1155</b>
<b>Total Coal Requirement (MT) **</b>	<b>515</b>	<b>572</b>	<b>650</b>	<b>737</b>	<b>842</b>

\* PLF considered as 82.5% for units above 200 MW and 80% below 200 MW.

\*\* Including coal requirement of imported coal based stations

Assumption: Sp. Coal Consumption of '0.73'

##### (b) For 13<sup>th</sup> Plan

The Capacity Addition target for 13th Plan has been tentatively envisaged as 93,400 MW out of which thermal capacity would be 63,400 MW. The coal required for the total capacity at the end of 13th Plan is estimated to be 1040 MT (against 842 MT at the end of 12th Plan).

#### 7.1.1.2 Coal Availability

During the last 5 years (2006-07 to 2011-12) coal-based generation capacity has increased at a CAGR of 8.72% while the domestic coal production has increased at a CAGR of only 5.10%. For the 12<sup>th</sup> Plan period, the corresponding CAGR for coal based Capacity addition is likely to be at 8.97% while domestic coal production is expected to grow at a CAGR of 6.04% only. This clearly indicates a continuing shortfall in availability of Domestic Coal and calls for major policy initiatives such as

opening up coal production to private sector and setting up an Independent Coal Regulator by the Ministry of Coal, besides adequate measures for substantially increasing coal production from domestic sources by CIL and its associate companies. It is also suggested that the new captive coal mines need to be allotted for competitive bidding by State Power Utilities at the lowest price of power generated instead of auctioning proposed by the Ministry of Coal.

**(a) For 12<sup>th</sup> Plan**

Coal availability from CIL, the major coal producer in India, is a major concern. During 2010-11, total non-coking coal production of CIL declined to 390 MT from 395 MT in the previous year. Production of Coal by CIL (Coal India Limited) and SCCL (Singareni Collieries Company Ltd.) during the last 5 years along with their projections for 12th. five-year plan period are as under :

**Table -7.3**

<b>Coal Availability Projection from CIL, SCCL &amp; Captive Blocks</b>											
<b>Sources</b>	<b>Coal Production [Last 5 yrs.] [MT]</b>					<b>2011 -12#</b>	<b>Coal Production [12th. Plan] [MT]</b>				
	<b>2006 -07</b>	<b>2007 -08</b>	<b>2008 -09</b>	<b>2009 -10</b>	<b>2010 -11</b>		<b>2012 -13</b>	<b>2013 -14</b>	<b>2014 -15</b>	<b>2015 -16</b>	<b>2016- 17</b>
<b>CIL</b>											
Total production	361	379	403	431	431	447	466	485	507	530	556\$
For power sector	262	280	295	298	304	347*	355	364	381	410	415
<b>SCCL</b>											
Total production	37	41	44	50	51	52	52	52	53	55	57
For power sector	27	29	30	34	33	33	34	34	34	35	35
<b>Captive Blocks @</b>											
Total production	18	21	30	35	35	39	42	50	59	71	97
For power sector	10	13	21	26	25	28	29	31	31	35	49

# Targeted @Data from Coal Controller \* Coal dispatch plan of CIL

\$ Target for coal production agreed by CIL under optimistic scenario is 615MT.

Based on the above projections given by Coal India Ltd. and SCCL, availability of coal from indigenous sources by the end of 12<sup>th</sup> Plan for Power Sector will be only 450 Million Tonnes against a total requirement of 842 Million Tonnes including requirement of imported coal based power plants. Considering an optimistic production of 100 Million Tonnes from captive coal mines the total domestic coal availability is projected to be 550 Million tonnes which still leaves a short fall of about 292 MT of coal from domestic sources. If 10 to 15% blending with imported coal is considered, about 55 to 82 MT imported coal eqvt to 83 to 115 MT domestic coal would be required. Considering another 54 MT of domestic coal equivalent required for imported coal based plants, there shall still be a shortfall of about 155 MT (for 10% blend) or 115 MT (for 15% blend) from domestic sources.

Thus CIL / SSCL will have to increase domestic coal production to ensure supply of at least 565 to 605 MT from their mines.

### (b) For 13<sup>th</sup> Plan

The coal availability from CIL & SSCL is expected to be about 553 MT considering 70% of CIL/SSCL production for the power sector. Additionally about 250 MT of coal is expected to be produced from captive coal blocks and about 80 MT will be imported by the developers of imported coal based plants. Thus there will be shortfall in coal availability to the extent of 160 MT which will have to be met through imports. This only emphasizes the need for a quantum increase in domestic coal production on a sustained basis in order to meet the country's Power Capacity addition targets in the 12th and 13th plan periods.

#### 7.1.1.3 Coal Reserves

Since coal is our major source of energy and would remain the mainstay of future energy requirement, coal production needs a boost. And, to facilitate enhancement of coal production, there is an urgent need to accelerate exploration activities for finding out coal reserves in our country. A total of 276.81 billion tonnes of Geological Resources of Coal have so far been estimated in the country as on 01.04.2010. Hard coal deposit spread over 27 major coalfields, are mainly confined to eastern and south central parts of the country. Over the past 5 years, coal consumption has grown by around 6% in a restricted supply scenario, whereas addition in coal reserves in the Indicated and Proven category has been still low of around 2.01 % & 2.58 % respectively (As shown in Table 7. 4).

**Table – 7. 4**  
**CATEGORY OF COAL RESERVES & ITS GROWTH**

*(MOC Coal statistics 2009-10)*

Reference date	CATEGORY OF COAL RESERVES							
	Proved		Indicated		Inferred		Total	
	Qty. [MT]	Y-to-Y Growth (%)	Qty. [MT]	Y-to-Y Growth (%)	Qty. [MT]	Y-to-Y Growth (%)	Qty. [MT]	Y-to-Y Growth (%)
1/1/2002	87320		109377		37417		234114	
1/1/2003	90085	3.17	112613	2.96	38050	1.69	240748	2.83
1/1/2004	91631	1.72	116174	3.16	37888	-0.43	245693	2.05
1/1/2005	92960	1.45	117090	0.79	37797	-0.24	247847	0.88
1/1/2006	95866	3.13	119769	2.29	37666	-0.35	253301	2.20
1/4/2007	99060	3.33	120177	0.34	38144	1.27	257381	1.61
1/4/2008	101829	2.80	124216	3.36	38490	0.91	264535	2.78
1/4/2009	105820	3.92	123470	-0.60	37920	-1.48	267210	1.01
1/4/2010	109798	3.76	130653	5.82	36358	-4.12	276809	3.59

Against the estimated coal requirement of 842 Million tonnes (as projected by CEA), the cumulative availability of coal for this sector from CIL, SCCL and from the captive mine blocks, already allotted to Power Utilities, is estimated at about 550 Million tonnes. The detailed year-wise coal requirement vis-à-vis capacity addition during 12th Plan period, as projected by CEA, and Demand-Supply Gap Analysis of two scenarios placed are shown in Table-7.5

**Table- 7.5**  
**Coal Demand-Supply Projection for Power Sector (12th Plan Period)**

<i>(As Projected By CEA)</i>					
DESCRIPTION	2012-13	2013-14	2014-15	2015-16	2016-17
Installed Capacity [Coal based]	108029	121714	134684	148239	160814
Additions	13685	12970	13555	12575	9910
Retirements	0	0	0	0	4000
<b>Total Installed Capacity (MW)</b>	<b>121714</b>	<b>134684</b>	<b>148239</b>	<b>160814</b>	<b>166724</b>
<b>Total Generation (BU)</b>	<b>690</b>	<b>783</b>	<b>890</b>	<b>1010</b>	<b>1155</b>
<b>Total Coal Requirement (MT) ^</b>	<b>515</b>	<b>572</b>	<b>650</b>	<b>737</b>	<b>842</b>
<b>Likely Coal Availability [MT]</b>					
- From CIL	355	364	381	410	415
- From SCCL	34	34	34	35	35
- From Captive Mines <i>[Coal Controller's estimate]</i>	29	31	31	35	49
- From Captive Mines <i>[CEA's estimate]</i>	27	38	56	76	100
<b>Total Coal Availability <i>[Coal Controller's estimate]</i></b>	<b>418</b>	<b>429</b>	<b>446</b>	<b>480</b>	<b>499</b>
<b>Total Coal Availability <i>[CEA's estimate]</i></b>	<b>416</b>	<b>436</b>	<b>471</b>	<b>521</b>	<b>550</b>
<b>Qty. (MT)</b>	<b>-97</b>	<b>-143</b>	<b>-204</b>	<b>-257</b>	<b>-343</b>
<b>Demand-Supply Gap <i>[Considering coal from captive blocks as per CEA's estimate]</i></b>					
<b>Qty. (MT)</b>	<b>-99</b>	<b>-136</b>	<b>-179</b>	<b>-216</b>	<b>-292</b>
<i>Coal requirement for imported coal-based Projects - to be arranged by Project Developers [MT]</i>	<i>-23</i>	<i>-44</i>	<i>-51</i>	<i>-53</i>	<i>-54</i>
<i>Additional imported coal required to meet the demand-Supply Gap [domestic equivalent] [MT]</i>	<i>-76</i>	<i>-92</i>	<i>-128</i>	<i>-163</i>	<i>-238</i>
<i>Additional eqvnt imported coal required [MT]</i>	<i>-51</i>	<i>-61</i>	<i>-85</i>	<i>-109</i>	<i>-159</i>
<b><i>Imported Coal Requirement for blending with domestic coal to meet the shortage[domestic equivalent] [MT]</i></b>					
<i>- at 10% blending</i>	<i>62</i>	<i>65</i>	<i>71</i>	<i>78</i>	<i>83</i>
<i>- at 15% blending</i>	<i>94</i>	<i>98</i>	<i>106</i>	<i>117</i>	<i>123</i>
<b><i>Demand supply gap after import of coal [domestic equivalent] [MT]</i></b>					
<i>- at 10% blending</i>	<i>-14</i>	<i>-27</i>	<i>-57</i>	<i>-85</i>	<i>-155</i>
<i>- at 15% blending</i>	<i>18</i>	<i>6</i>	<i>-22</i>	<i>-46</i>	<i>-115</i>

# Total coal based capacity expected at the end of 11-12 : 108029 MW

^ Including coal requirement of imported coal based stations, Sp. Coal Consumption of '0.73'

The total quantity of coal to be imported for power generation by utilities works out to about **91MT for 10 % blend and 118 MT for 15% blend**. Impact of additional burden due to cost of imported coal on Generation companies needs to be considered apart from development of necessary Port and Railway infrastructure to handle such large quantities of imported coal. The responsibility for importing coal to meet the gap in supply from domestic sources shall be entirely of CIL and the issue of coal price pooling also needs to be addressed by MoC/CIL, in line with provisions of National Coal Distribution Policy. With regard to washing of coal it has been suggested that cost of washed coal

should be based on actual cost of washing instead of import parity as proposed by CIL. The issue of utilisation of rejects from coal washing plants is also to be addressed.

#### 7.1.1.4 Strategies for improvement of domestic coal production

❖ **Use of State-of-the art technology for improvement in efficiency & productivity in coal mines and related Policy changes:**

To facilitate adoption of State-of-the-art International coal mining technology, high output – high efficiency HEMM, new technology in Mine Safety, etc., further liberalization of import policies by the Indian government is needed. In addition to it, Coal Sector may be given “Infrastructure Status” with ‘Tax Holiday’ & Duty exemptions. Alternatively, the concept of Mega Project may be introduced in the coal sector also by according Mega Status to Coal Mines of production level of 5 MTPA or above and providing benefits of tax / duty concessions.

❖ **R&R Policy for Coal Mining Industry:**

Resettlement and rehabilitation policy needs to be evolved to protect the livelihood of project-affected people. To bring in clarity and uniformity – Nationwide, a uniform R&R policy needs to be formulated which should be adopted by all coal producing companies in India. With increased use of state-of-the-art technology and sophistication, more automation & computer control in coal mining operation, less manpower deployment will be required in the new mines and thus there will be less job opportunities. So, while formulating National R&R policies for coal mining, this aspect may also be looked into and suitable alternatives, beneficial for upliftment of livelihood of the displaced persons, may be agreed upon. Moreover, in order to avoid erosion of land compensation amount by the land oustees in a short span, a suitable mechanism like Interest-carrying deposits of land compensation amount – part or full in a suitable fund created by the mine owner, issuance of Bonds, etc., may be explored.

Unlike other industries, coal mining industry does not require establishment of permanent fixtures over the entire acquired land, hence the some of the land, after mining, can be used for cultivation with proper development like earth-filling & putting in of fertilizers, etc. R&R Policy for Coal Mining may look into another dimension like taking of agricultural land from local people on term-lease & returning of land to the extent possible in an area where mining operation is completed after proper development of that land so that cultivation can again be done. The Agency/Organization, engaged in coal mining in a particular block, will remain responsible for development & return of the land.

❖ **Expedient clearances for development of Coal Mining Projects:**

Govt. support in terms of simplified procedures and single-window approach for granting of various clearances and permissions, including environmental clearance, faster investment decisions, closer coordination between the Centre and the State Govt. agencies etc. would be needed for speedier execution of coal mining projects.

❖ **Captive Coal Mining**

Coal production, modernization and efficiency improvement would depend on the level of competition in the industry. Mobilization of the requisite investment in coal mining also

reinforces the need to induct more players from both the public and private sectors. The introduction of new players in the coal sector would be beneficial to the sector as a whole and is considered essential. It would also be essential to gradually increase the production through captive mining of 40 to 50 % of the total production of the country. Reputed International Coal Mining Companies may be encouraged to come to India for development & operation of coal mines which will facilitate introduction of latest mining technology & mine safety measures

❖ **State Governments must become partners in development of coal**

- i. There is a need to incentivise states from mining operation.
- ii. Before the allocation of blocks, concerned State Govt. may be consulted with and made party to it, as mining of coal in their States would directly and indirectly benefit that particular state.
- iii. In mineral rich states, a separate cell may be made operational for land acquisition process, processing of proposal related to environment and forest clearance (Single window approach through MOU), etc.
- iv. Coal-bearing states, in addition to Royalty, are demanding additional benefits. This issue needs to be resolved early.

❖ **Special Task Force for monitoring the progress of project implementation**

A special Task Force may be in place for periodic review & monitoring of the progress of coal mining projects. It will prevent any slippage, help in clearances / approvals and ensure timely commencement of production of coal. Such monitoring & status reporting must be done in a transparent manner and in electronic form.

❖ **To ensure adequate exploration of coal mines and reliability of estimates of extractable reserves**

It is needed to speed up our efforts to accelerate the pace of regional surveys and drilling to complete the comprehensive coal resource assessment exercise. Therefore, there is a need to enrol more specialist agencies to conduct exploration of blocks and prepare GRs, so that production from blocks can start in a timely manner.

❖ **Commercial coal mining by private sector**

The need to provide adequate investments in coal mines, conserve coal reserves ensure mine safety and environmental protection and to assure decent living standard for the coal labour was the basic reason for nationalization of coal mines during 1971 and 1973.

In this regard, Coal Mines (Nationalisation) Amendment Bill, 2000 is a step towards promoting liberalisation in the coal sector. It will also address the need for augmenting coal production in the country through wider participation of private coal mining companies. The proposed amendment bill is pending for long time to be expedited

### 7.1.1.5 Strategies for Mitigation of demand supply gap of coal

#### 7.1.1.5.1 Import of coal

Based on the demand-supply mismatch of domestic coal, as experienced in 11th Plan period, non-coking coal has to be imported to meet fuel requirement of existing coal based capacities and



capacity addition during 12<sup>th</sup> Plan. As per the demand-supply analysis of domestic coal, done above, import of non-coking coal equivalent to around 340 MTPA of domestic coal by the end of 12th Plan period is needed to meet the demand of power sector. The present port capacity can handle around 55 MT of thermal coal and would need to be augmented to meet the rising coal import forecasted. Further, imported coal can be used as a blend with the domestic coal to substitute requirement of washed coal, which is required for Power Stations to adhere with MoEF's stipulation. Such a situation would also ease the problem of handling washery rejects. However, high cost of imported coal will have adverse impact on the power tariff.

#### Impacts of high import of coal for power sector:

- **Impact on Power tariff:** The price of imported coal has witnessed a steep increase of around 75 percent in the last financial year. It has resulted in an increase in the price of electricity in the range of 30 to 80 paisa per KWh depending on percentage of blending carried out with domestic coal. Due to this fact, the variable charges of electricity touched more than Rs 3 in some of the stations. The Financial health of most of the DISCOMs / SEBs is not good and import of coal will be a further burden on them. DISCOMs / SEBs are in-fact reluctant to draw such costly power.
- **Impacts on boiler design efficiency:** It is not possible to blend more than 15 to 20% of imported coal as boilers are designed for Indian coal and this may lead to technical difficulties during the operations of power stations.
- **Logistic problems:** As the quantum of coal import are going to reach 120 Million Tonnes by 2016-17, but Ports and Railways are not equipped to handle such huge quantum of coal. Port Rail infrastructure will require to be augmented.
- **Impact on foreign exchange reserves:** There will be substantial outflow of the country's foreign exchange reserves. Based on present CIF price of coal, import of 120 million tonnes of coal will result in annual out flow of foreign exchange of Rs. 72,000 Crores.
- **Sustainable long term contract:** Most of the coal is imported from countries like Australia, Indonesia and their tax regimes are under review. This may lead to uncertainty in long term contract price.

Regarding imported coal, following are suggested:

- To enhance the import of coal, infrastructure at ports to be strengthened to receive large ships and to handle required imported coal quantity.
- Logistics, Railways in particular, needs to be augmented, for movement of imported coal from port to power stations.
- Power plants may be designed to operate with high blending of imported coal. CEA has already issued guidelines for designing all future plants for 30% blending.
- Construction of more costal power plants to operate on imported coal to be encouraged, however, required policy changes be made to address risks of sourcing countries.
- Making 15-20% blending with imported coal.



### 7.1.1.5.2 Coal price pooling:

The concept of pooling of price of domestic and imported coal is necessitated due to the fact that the production of domestic coal is not increasing commensurate with the requirement of coal for power stations which are existing and are being planned, based on domestic coal. Most of the new Power Utilities would be required to import coal to bridge the gap between their requirement and availability of domestic coal.

Coal for thermal power plants is predominantly being imported from countries like Australia and Indonesia which has a high Calorific Value ranging from 6000-6500 Kcal/ Kg with low ash content. Major ports for import are Mundra, Vizag, Gangavaram, Ennore, Tuticorin, Pipavav etc. Transportation cost from these ports to power plant site which are not in the coastal region or not in the state where these ports are located may be as high as Rs. 1500 per tonne.

Coal for the Power Utilities in the country is being transported by Indian Railways and most of their routes are already facing congestion due to heavy movement of traffic. There is cross movement of coal from port to Power Utilities located in Central India and from domestic coal mines to Power Utilities located in coastal or adjoining areas. This is causing duplicate movement of coal rakes and causing unnecessary expenditure on freight and avoidable overloading of Indian Railways network and creating other logistic problem. Transporting coal from such a long distance also increases transit loss thereby reflecting in the bottom line of generating utilities. Since the fuel price is generally pass through in the tariff, higher freight charges will certainly increase the tariff resulting in higher cost of electricity to the consumers. The situation thus needs to be rationalized to the extent feasible.

A solution to this problem could be the allocation of coal to Power Utilities from the nearby coal source to the extent possible to minimize transportation cost. Power Utilities located in coastal areas may be asked to use larger chunk of imported coal being nearest to the port subject to design limitations. Most of the coal mines of Coal India Ltd. are located in Central India giving almost an equal distance of coal transportation from coal mine to a majority of Power Stations. Therefore, the Power Utilities which are at a larger distance from ports may be allocated coal from the mines of Coal India only and be asked to use imported coal only in the case of shortfall to avoid unnecessary double movement of coal rakes.

It is accepted fact that the cost of imported coal is higher than domestic coal even after accounting for its higher GCV, at present rate it is almost two and half times costlier than domestic coal on heat value basis. This could be a deterrent to the Power Utilities at coastal areas which would be asked to use a higher chunk of imported coal as it will increase their cost of generation.

A case, therefore, exists for importing coal to bridge the gap between requirement and availability of domestic coal and the cost of the same to be equitably borne by all the power utilities. It may however be mentioned that the concept of pooling cost is to be applicable to power stations designed for domestic coal only. Imported coal based stations and stations linked to dedicated coal blocks are not to be considered in this pooling mechanism.

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Pooled price is to be evaluated based on the heat value(Rs/Kcal) of the coal. CIL shall be responsible for importing coal and levying the pooled price on the various power utilities. This is reasonable in view of the fact that the New Coal Distribution Policy stipulates that CIL is responsible for meeting 100% of the normative requirement of coal of the power utilities, and import of coal may be resorted to the extent required.

### **7.1.1.6 Other strategies recommended for sustainable fuel supply to power projects**

#### **7.1.1.6.1 Demand side management of Coal**

All the new units planned in 12th plan (excluding which are already under construction) thrust to be given for super critical technology, which will result in saving of about 5-8 % of fuel requirement and correspondingly less emission. As, coal is increasingly becoming a scarce resource, India's long term fuel security depends on its efficient utilization. In order to optimally utilize coal, efficient coal consumption (heat rate and auxiliary consumption) norms be used for according linkage (FSA).

#### **7.1.1.6.2 Coal Linkages needs a holistic review**

Coal supply sources & existing coal linkages for various Power Stations across the country need proper mapping & rationalization for easy transportation, quick movement, etc. While working out short-term linkages of coal to existing power stations as well as long-term linkages for future power projects, there is a need for broader review of all old Long Term Linkages by the representatives from Ministry of Coal, Power, Railways, Shipping and major Coal producing & Power generating companies, for evolving appropriate mechanism to correlate the coal production plan from mines of a particular zone with the zone where the Power Station / Project is located to ensure optimal coal movement and its utilization.

#### **7.1.1.6.3 Regular meeting of Standing Linkage Committee(Long Term)**

- The linkage of coal for 12th five-yr plan projects have not yet been granted so far, as such it will be difficult to achieve the generation target, as the project gestation period is not less than 4 years from the date of award of order for execution of the project, besides, the time required for getting environmental clearance after grant of coal linkage. Long term linkage of coal to all the projects of 12th Five Year Plan already recommended by the Ministry of Power, Government of India needs to be accorded. However, MOC may review the progress achieved by existing LoA awardees, thoroughly and may cancel LoAs where projects have failed to achieve requisite milestones.
- SLC(LT) meeting must be conducted regularly to address the grievances of coal consumers and resolution of dispute.
- This meeting should also review the implementation of decisions taken in the previous meetings.

#### 7.1.1.6.4 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 as with 50% coal availability, the generation will also be at around 50% thereby the Fixed Cost will get distributed on power generated at 50% PLF as against at the normative level of PLF as determined by the Electricity Regulatory Commission. Besides the operation of units at lower PLF will increase the Station Heat Rate & auxiliary power consumption. 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 paise per KWH.
- ACQ level be determined at 90% PLF level for all power plants. Uniform trigger level of 90% of ACQ be set across all power sector consumers such that coal is uniformly supplied to all the consumers and a level playing field is maintained among power sector generators.
- 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 13<sup>th</sup> Plan, new power plant based on sub-critical technology should be an exception.**
- The LOA along with milestones has been finalized without the involvement of consumers and LOA does not guarantee the supply of coal and there is no firm commitment for supply of coal by coal supplier.
- The 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 25 years, commensurate with useful life of power project.
- Consistent with stipulations of NCDP, subject to agreement by the buyer, CIL should import coal and meet its responsibility under FSAs.

#### **7.1.1.6.5 Augmenting crushing of coal at mine to facilitate evacuation of Pit head coal**

Due to inadequate crushing facilities almost about 50-60 million tone of coal is lying at Mine head. This Coal is getting deteriorated with time. Further loading of uncrushed coal also leads to unloading problems at plant and large rake detention time. To address this, crushing facilities needs to be augmented at mine end.

#### **7.1.1.6.6 Use of washed coal**

Use of washed coal should be encouraged as far as possible. It will save in transportation cost by preventing hauling unnecessary ash and this will increase the carrying capacity of rakes. Use of washed coal also addresses the problems of oversize coal and quality, being faced by power producers. Consumer gets consistent quality of coal and increases generation of the plant and Environment gains due to reduced ash, particulates, CO<sub>2</sub> emission. Use of washed coal is beneficial in terms of less maintenance of plant, less coal handling, less ash handling, less ash dyke area requirement, etc.

In this direction, CIL has come out with a tender for setting up of 20 washeries with a capacity of 111.1 MTPA on Build-Own-Maintain (BOM) basis. With these efforts, the capacity of coking coal washeries of CIL will increase from the existing 22.18 MTPA to 43.28 MTPA and the capacity of non-coking coal washeries will increase from the existing 17.22 MTPA to 107.22 MTPA. CIL intends to

wash 90 per cent of the coal produced from new mines developed during the XII Five-Year Plan (2012-17).

MoEF has proposed an amendment to notification for use of beneficiated/ blended coal with less than 34% ash making it mandatory for projects located beyond 500 km from mines (presently it is beyond 1000 km). CIL will need to ensure adequate number of washeries to meet this stipulation before it is implemented. The cost of washed coal should be on the basis of actual cost and not on import price parity. For utilization of washery rejects, reject based power plants may be considered wherever techno-economically viable.

#### **7.1.1.6.7 e-Auction of coal**

As per NCDP, around 10% of total domestic coal production is allowed for e-Auction by CIL. It is to be ensured that before offering 10% quantity, FSA/MOU commitments are met with. The issue of rail connectivity to such mines from where coal for e-auction is sourced should be taken up immediately.

#### **7.1.1.7 Coal Regulator**

A need is being felt for long to institute an independent regulatory body to regulate the upstream allotment and exploitation of available coal blocks to yield coal, coal bed methane, coal-to-liquid and for in-situ coal gasification. The proposed Regulatory Body, as an interim measure, may approve coal price revisions, ensure supply of coal to the power sector under commercially driven long-term FSAs, facilitate the development of formulae/indices for resetting coal prices under long-term fuel supply agreements, monitor the functioning of the proposed e-auctions, ensure that the price discovery through e-auctions is free of distortions, regulate trading margins, develop a mechanism for adequate quantities of coal imports under long-term contracts to bridge the gap between supply and demand thereby assuring that the e-auctions and consequent price discovery does not take place in a supply constrained market and, finally, create the environment for a competitive coal market to operate.

Once a competitive market is developed, the role of Regulator in determining the prices would be to ensure a free and transparent market for coal. The Regulator must ensure that mines are planned, designed and developed in a scientific manner giving due importance to coal conservation thereby maximising percentage of coal recovery from geological blocks.

The Regulator must standardise norms of operation, establish benchmarks and ensure that coal companies raise their level of competence to be at par with international standards. The proposed Coal Regulator should also be entrusted with following aspects of coal mining:

- Coal Resources Management
- Safety, Health, and Employment in coal mines
- Prices, Taxes, Royalty, Value Added Tax, Property Tax, and Salary of Workers
- Environment Management
- Policy-Legal, Public Relations, Statistics, and Dispute Resolution
- Recommendation to CIL for issuance of LoAs

- Approval of mine plans including mine closure plans
- Optimization of current linkages to minimize Rail/Road transportation
- Oversight role on captive coal block auctions
- Dispute resolution - primary forum for :
  - dispute resolution among entities;
  - entities aggrieved due to decisions given by MOC/MOEF relating to mine closure, etc.

### 7.1.2 Lignite

Lignite reserves in the country have been estimated at around 40.9 Billion tonnes, most of which is found in the state of Tamil Nadu. About 82 % of the Lignite reserves are located in the State of Tamil Nadu & Pondicherry. At present only a small percentage of the total reserves of lignite have been exploited. Considerable scope remains for the exploitation of the lignite reserves and use of lignite in thermal power stations subject to cost-economics, particularly in the states of Tamil Nadu, Rajasthan and Gujarat having the limitations of transportation of coal to these regions. State-wise distribution of Lignite resources, Lignite Demand & Production Plan by M/s. Neyveli Lignite Corporation Ltd. (NLC) and Lignite Demand & Production Plan by State Electricity Board are shown in Table- 7.6 to 7.8

**Table– 7.6**  
**State-wise Lignite Reserves**

State	Total[MT]
Tamil Nadu	33309.53
Rajasthan	4835.29
Gujarat	2722.05
Jammu & Kashmir	27.55
Others (Kerala, West Bengal)	11.44
<b>Total</b>	<b>40905.86</b>

**Table -7.7**  
**Lignite Demand & Production Plan by M/s. Neyveli Lignite Corporation Ltd. (NLC)**

Item	2012-13	2013-14	2014-15	2015-16	2016-17	12th plan
<b>Demand(MT)</b>	25.60	26.12	25.91	25.37	27.26	<b>130.27</b>
<b>Production (MT)</b>	26.01	26.01	26.01	26.01	27.29	<b>131.33</b>
<b>Demand-Production Gap (MT)</b>	<b>0.41</b>	<b>-0.11</b>	<b>0.10</b>	<b>0.64</b>	<b>0.02</b>	<b>1.05</b>

Brief year-wise anticipated demand & production plan of Lignite by other State Electricity Boards and private companies (other than NLC) during 12th five year plan period are shown below (TABLE 7.8).

**Table 7.8**  
**Lignite Demand & Production Plan by State Electricity Board**

Item	2012-13	2013-14	2014-15	2015-16	2016-17	12th plan
<b>Rajasthan Rajya Vidyut Utpadan Nigam Limited</b>						
<b>Demand(MT)</b>	8.4	8.4	10.5	10.7	10.7	<b>48.7</b>
<b>Production (MT)</b>	5.4	6.1	10.6	13.1	13.1	<b>48.3</b>
<b>Demand-Production Gap (MT)</b>	-3	-2.3	0.1	2.4	2.4	<b>-0.4</b>
<b>Gujarat Industries Power Company Ltd.</b>						
<b>Demand (MT)</b>	3.6	3.6	3.6	8.1	8.1	<b>27.0</b>
<b>Production (MT)</b>	3.6	4.2	5	8.4	8.4	<b>29.6</b>
<b>Demand-Production Gap (MT)</b>	<b>0</b>	<b>0.6</b>	<b>1.4</b>	<b>0.3</b>	<b>0.3</b>	<b>1.4</b>

- 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.

### 7.1.3 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 to re-think. A gas-based power plant makes sense over a coal based plant if landed gas cost remains below or at US\$7 per mmbtu. If the gas prices rise above US\$ 10-US\$ 12, it leads to unviable economics for the power sector. In last one year, the spot natural gas prices have risen by 50%. This has turned power generation companies averse to the use of spot LNG. Unless new discoveries are made and exploration happens, new gas based capacities may not be considered.

- There is need for promotion of new gas based capacity in the country (at least 20,000 MW during 12<sup>th</sup> 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 11<sup>th</sup> Plan/early 12<sup>th</sup> Plan, if gas is made available.
- Gas supply to be made available for at least 20,000 MW new Capacity in the 12<sup>th</sup> Plan.

#### 7.1.3.1 Need For Capacity addition through Gas based stations

##### Load profile in the country and the role of gas based power in addressing the requirements reliably:

CERC has encouraged setting up of peaking capacities by prescribing peaking tariffs for different category of plants including pumped storage schemes. Hydel projects have taken much longer gestation period for development and construction and as a result hydro power share in the country's generation capacity mix has continuously slipped. It is in this context that gas-based generation can play an important role in meeting peak/intermediate load requirements far more reliably compared to other available options.



**Shorter construction periods**

Gas-based power plants can be constructed in a much shorter time-frame of 18-24 months relative to longer construction timelines involved in coal and hydel projects.

**Lesser strain on resources – land and water:**

Gas based plants require lesser land and water as compared to coal based plants or hydro capacities, where there is a possibility of large-scale people displacement.

**Considerable environmental benefits relative to coal-based power:**

Gas-based power is considerably cleaner when compared to coal-based power. CO<sub>2</sub> emissions from a modern combined cycle gas turbine (CCGT)/ combined cycle gas engines (CCGE) are only 0.35 kg/kwh in contrast with 0.83 kg/kwh from a 660 MW super critical unit.

**Diversification of fuel supply /energy security risks:**

Availability of domestic natural gas, though anticipated to increase substantially post commencement of production from KG-D6 gas finds, has declined in the recent months. However, a calibrated approach in gas-based capacity addition combined with the adoption of appropriate policies in the natural gas sector, still makes sense to diversify fuel supply risks resulting from excessive dependence on coal. Even if part of gas requirement is to be imported as LNG, it provides diversification of source countries from where energy is imported, thereby providing diversification of energy security risks.

**7.1.3.2 Policy changes to be adopted to encourage gas based capacity addition**

- Policy initiatives to incentivize gas based plants including Combined Heating & Cooling plants having high efficiency.
  - Mandatory purchase of gas based power by DISCOMs and priority for gas allocation to CCHP plants.
  - Constitution of task force under CERC to address issues related to setting up of Peaking and Reserve Plants.
  - However, In the interest of consumers and in view of present financial health of DISCOMS, fixation of purchase obligation for gas based projects similar to RPO may not be tenable.
  - Standard Bidding Documents (SBDs)– need to be adapted for gas-based power.
- Duration of PPA: Duration of PPA is kept at 25 years, it 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.
  - 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.
  - 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).
- 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.
  - Technical requirements for intermittent or peaking application: Bid invitation should specify these requirements as the very nature of application would influence the choice of fuel and technology. These are –
    - Capable of number of stop / starts in a day in other words to operate on Load Follow Principle
    - No effect on maintenance due to multiple stop / starts
    - 5 to 10 minutes time from start up to full load
    - 5 to 10 minutes shut down time from full load to zero
    - Black start capability
    - No effect on efficiency due to part load operation of the plant
    - High availability - >94%

### 7.1.3.3 Fiscal benefits to Gas based peaking plants:

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.

## 7.2 LAND & WATER

### 7.2.1 Land

Land acquisition in recent times has become a critical issue for the project developers. Land is increasingly becoming a scarce resource and availability of land is posing a serious challenge for future power plants. Problems have been compounded due to demand from other competing sectors and resistance from local population/ land owners. The optimum utilization of land has therefore, gained significance and in coming times challenges are to be encountered in land usage practices.

As most of the 12<sup>th</sup> Plan Thermal Power Projects (62625 MW out of total 75715 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.

#### 7.2.1.1 Land Requirement for 13<sup>th</sup> Plan Thermal Power projects vs land availability

Tentatively, the capacity of thermal projects envisaged for 13th plan is expected to be of the same order as in the 12th plan for which nearly 64000 acres of land will be required.

### 7.2.1.2 Issues of concern

The issues that come in the way of land acquisition are mainly related to land records, forest clearances and R&R issues as listed below:

- i) *Lack of land Records*: The lack of updated land records is the most common problem that is encountered during land acquisition. The problem gets compounded due to low average holding per person and large number of claimants.
- ii) Issues related to compensation, price of land to be paid increases with scarcity.
- iii) *Lack of clarity about the status of occupiers who are not owners.*
- iv) *Right of way (ROW) for Ash/Water pipelines, coal conveyors and transmission lines*
- v) *Resistance from local people*
- vi) *MOEF clearance and acquisition of forest land coming in plant area and ROW.*
- vii) *Resettlement and rehabilitation of the project affected people (PAP).*

### 7.2.1.2 Hydro Power Projects

#### 7.2.1.2.1 Land Requirement for 12th plan Hydro Power Projects vs land availability

A total 83 number of schemes have been identified which may be developed to give benefits in 12th five year plan. Out of these, 17 numbers of schemes are under construction and no issues have so far understood to have been raised by the developers. The concurrence of CEA/State Govt. has been awarded to another 28 projects totaling to about 9298MW which may give benefit in the 12th plan.

#### 7.2.1.2.2 Land Requirement for 13th plan Hydro Power Projects vs land availability

Tentatively, the capacity of hydro projects envisaged for 13th plan is around 15000 MW, for which land will be required.

#### 7.2.1.2.3 Issues of concern

The general issues to be addressed are related to Resettlement and Rehabilitation, targeting solutions that provide relief to the asset-less rural poor, support the rehabilitation of displaced population. The resistance from local population and NGOs is also required to be addressed in specific cases.

### 7.2.1.3 Power Transmission Projects

Land is required for transmission towers and associated sub-stations in any transmission system. Many of such projects are getting delayed due to non availability of land and right of way. EHV transmission lines are normally few hundreds of kilometers long which pass through plain as well as hilly terrain involving forest land, National Parks, wild life sanctuaries and other ecological sensitive areas in some stretches. While carrying out survey for transmission lines these sensitive areas are avoided but in some cases it becomes unavoidable due to the location of power generating stations.

Forest clearance is a lengthy process which involves approval from State Government as well as Central Government which takes about one year time. Further, under the Scheduled Tribes and other traditional Dwellers (Recognition of Forest Rights) Act 2006, written consent of concerned Gram Sabha is necessary before the land is diverted for transmission project. Sometimes, matter is taken before the Courts by the environmental activists. The number of Gram Sabhas involved in such long lines will also be substantial and obtaining their consent under Forest Rights Act (FRA) and linking the same with forest proposal is likely to delay the forest clearance significantly. Pending the consent of all Gram Sabha's, the forest proposals are not recommended by the State Governments which delays the project start manifolds. The other requirement/ conditions for obtaining forest clearance are the payment of cost of Compensatory Afforestation on degraded forest land twice the area and payment of Net Present Value (NPV). This may affect project completion schedule. Transmission line projects may also affect wild life and its habitats for which an impact assessment is made for identifying possible corrective measures.

#### 7.2.1.3.1 Land Requirement for 12<sup>th</sup> plan

A tentative land requirement for 12th plan indicates a land requirement of around 9403 Hectares (23240 acres) for tower footings and around 21500 acres for sub stations.

There is a need for comprehensive National policy on land acquisition/ right of way for priority sector projects.

#### 7.2.1.4 Suggestions/ Recommendations

- a) *Comprehensive National Policy*: There is an urgent need for a comprehensive national policy on land acquisition/ right of way for priority sector projects and its thorough implementation at State level, focusing on the issues of latest land records, land bank system and a uniform mechanism for land compensation and R&R issues based on a realistic Social Impact Assessment. As per the Terms of Reference of Expert Appraisal Committee on Environment Impact Assessment of thermal power and coal mine projects, an action plan for identification of local employable youth for training in skills, relevant to the project for eventual employment in the project itself shall be formulated and numbers specified during construction and operation phases of the project. Such recommendation should be included in the R&R Bill
- b) *Spare land with existing plants*: Existing plants in state sector are quite old and have liberally acquired larger land. This land can be used for expansion projects by the utilities themselves or by an external agency. A rough estimate indicates a capacity addition of 8000-10000MW may be feasible through this route, with minimal land acquisition and/ or ROW issues.
- c) *Higher capacity units in place of older small size plants*: A large number of small capacity units are more than 30 years old and are inherently inefficient. These could be considered for retirement/ dismantling to unlock the land, which can be utilized for higher sized/ new technology efficient units. This exercise can be initiated in 12<sup>th</sup> plan and land thus freed can be utilized for projects in 13<sup>th</sup> plan period and beyond.

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- d) *Relaxing of MOEF Procedures:* Office Memorandum dated 31 March 2011 issued by MoEF stipulates requirement of obtaining stage-I forest clearance before obtaining environmental clearance. To avoid delays on this account MOEF may allow earlier procedure of having parallel clearance of the both.
- e) *Adoption of Higher size Units:* In view of higher efficiency and low per MW land requirement for the higher size units, it is recommended to have more number of such units in the 13<sup>th</sup> plan and beyond.
- f) *Shelf of site for projects:* Prospective sites should be identified beforehand so as to eliminate delays in obtaining clearances during execution of power projects. Shelf of prospective sites of more than 300,000 MW capacity as identified by CEA for faster execution of power projects could be given a review for implementation. States should earmark lands for power projects and State Energy Department should act as nodal agency for such activity.
- g) *Dissemination of project success stories to gain public acceptance:* Adequate mechanism should be developed at state/ project level to highlight the success stories related to project achievements in the field on increased economic activity of adjoining areas, innovative handling of R&R issues and the accrued positive social impact for greater acceptance.
- h) It is proposed that the compensation towards the land value may be paid on a market rate basis so that appropriate value/ compensation is paid to the landowners. It is also proposed that the compensation towards crops, trees and other structures may be made through a generous mechanism.
- i) Land selection in first instance shall preferably be government barren land even if its location is bit in remote and same be applied to private land. As far as feasible, emphasis should be on barren, undulated, low productivity land which may be acquired without much resistance.
- j) Timing of compensation after the damage/ digging of land is very important. If guidelines are issued regarding payment of part compensation in advance i.e. before executing the work on agriculture land with a promise that balance payment shall be paid after the assessment of revenue authorities will go a long way in reducing initial resistance at site.
- k) Since damages covered under the Electricity Act, 2003 and Indian Telegraph Act, 1885 has not been defined in any of the act and is open to interpretation by respective authorities based on their understanding of situation/circumstances. It is proposed to obtain opinion of Attorney General or Solicitor General of India and got it notified through MoP. Such definition of damages will be very helpful in solving the present ambiguity especially in case of Transmission lines.
- l) New Technology options and best practices should be adopted for minimizing land requirement, some suggested options are:
1. Transmission line with Steel Tubular Poles could be used in place of Steel Towers to reduce the right of way.

2. Right of Way could be optimized by adopting suitable alternative of multi-circuit or multi-voltage lines as applicable.
3. Due to Right of Way constraint in congested Metro cities XLPE cables could be used for short length.
4. Gas Insulated Substations / Compact Hybrid Substations could be adopted in place of conventional substations.
5. To maximize ash utilization for optimal land requirement
6. Develop compact layout for power plants for reducing the land required.

## 7.2.2 Water

Water is one of the key inputs to thermal power generation and of-late the availability of water has also become scarce. As much of the new generation capacity is envisaged near pit-heads, 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 dwells on 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. The sub-group recommends that Ministry of Water Resource must take initiative for creation of new reservoir/dams on the potential rivers so as to tie-over the water shortage.

### 7.2.2.1 Constraints/policy support required.

In planning, implementation and operation of a project, the preservation of the quality of environment and the ecological balance should be a primary consideration. The adverse impact on the environment, if any, should be minimized and should be offset by adequate compensatory measures. The project should, nevertheless, be sustainable. The resources should be conserved and the availability augmented by maximising retention, eliminating pollution and minimising losses. For this, measures like selective linings in the water conveyance system, modernisation and rehabilitation of existing systems including tanks, recycling and re-use of treated effluents and adoption of traditional techniques like mulching or pitcher irrigation and new techniques like drip and sprinkler may be promoted, wherever feasible. Efficiency of utilisation in all the diverse uses of water should be optimised and an awareness of water as a scarce resource should be fostered. Conservation consciousness should be promoted through education, regulation, incentives and disincentives.

### 7.2.2.2 Suggestions/ Recommendations

Technical measures for reducing water consumption may be adopted as below:

- i) Use of Dry ash disposal/ High concentration disposal system
- ii) Use of efficient cooling towers, and adoption of higher cycle of concentration (COC) / Monitoring performance of cooling towers during operation.
- iii) Dry cooling in cases where water is scarce.
- iv) Water optimization during plant operation.

- v) Use of municipal sewage water for thermal power station to the extent feasible.
- vi) Creating awareness programme for Water Foot print (consumptive water) for various modes of power generation.
  - Technical measures for reducing water consumption may be adopted.
  - Creation of large reservoirs/ dams on potential rivers to retain flood waters.
  - Coastal power plants to be encouraged.

### 7.3 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 XII five year plan. The total coal requirement for the power utilities by end of 12th Plan (2016-17) is estimated to be around 842 MMT (scenerio-1: 75% PLF) including domestic & Imported coal as also coal from the captive coal blocks. Apart from this, with the increase in Unit sizes to 660 MW, 800 MW and plus 1000 MW during 12th plan and beyond, heavy Over Dimensional Consignments (ODC) as never before will need to be transported from Ports (for imported equipment) and 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.

#### 7.3.1 Railways

The long-term strategy of Indian Railways is to segregate the freight and passenger movement through construction of Dedicated Freight Corridors (DFCs). At present two DFC projects i.e. Eastern DFC (Dankuni, WB - Ludhiana, Punjab) and Western DFC (JNPT, Mumbai- Dadri, UP) have been sanctioned. Apart from above Railways have also planned Gauge conversion, new railway lines, electrification of new routes and procurement of locomotives and wagons.

Broadly, Railways envisage the following targets for the medium and long-term goals (XII five year plan & beyond) towards creation of infrastructure and capacity build-up.

**Table 7.10**

Broad Category	Revised XI plan Targets	Vision 2020 Targets
<b>Doubling including DFC</b>	2500	<b>12,000 Kms.</b>
<b>Gauge Conversion</b>	6000	<b>12,000 Kms.</b>
<b>New Lines</b>	2000	<b>25,000 kms.</b>
<b>Electrification</b>	4500	<b>14,000 kms.</b>
<b>Procurement of Wagons</b>	62000	<b>289,136</b>
<b>Procurement of Diesel locomotives</b>	1019	<b>5334</b>
<b>Procurement of Electric locomotives</b>	<b>1205</b>	<b>4281</b>

To achieve, the projected high-growth targets, Railways need massive investments in capacity creation, network expansion and up-gradation and modernization. The existing trunk routes and



other coal carrying routes are heavily saturated. Railways needs to strengthen its net work speedily to achieve this high growth scenario. The tentative estimates of Investments required by the year 2020 to deal with higher levels of freight traffic would be as under:

**Table 7.11**

Description	Investment (Rs)
<b>Bottleneck removal –</b> Traffic facilities, freight bye-passes, logistic parks, etc.	23,000 cr
<b>Capacity augmentation-</b>	
New Line,	1,80,000 cr.
Doubling/Tripling/Quadrupling including DFC	1,30,000 cr.
Gauge conversion,	35,000 cr.
Electrification	12,600 cr.
<b>Rolling stock -</b>	
Freight wagons,	86,740 cr.
Diesel locomotives,	56,007 cr.
Electric locomotives	64,873 cr.
<b>Technological up- gradation -</b>	
Track renewal and 25 tonne axle load,	71,405 cr.
Bridges	8,000 cr.

The expansion plans detailed in the Vision 2020 documents of Railways gives a sense of confidence that to a large extent Railways will be able to meet Power Sector requirements for 12<sup>th</sup> Plan and beyond, provided of course that their expansion takes place as per their vision document.

### 7. 3.2 Inland Water Transport

Inland Waterways Authority of India (IWAI) has planned for the development, up-gradation, modernization and expansion of National Waterways / other Waterways during 12<sup>th</sup> plan period with an estimated investment of Rs. 10,460 Crores. Keeping this in view, there is a strong possibility of coal cargo movement through IWT becoming attractive to power companies especially if the contract of imported coal movement by IWT of 3.0 million tonnes per annum from Haldia to Farrakka Project of NTPC is a success. At present, ten thermal power stations are operational on the banks of Ganga and these are located in the States of West Bengal (7) and Bihar (3). Further eleven more Thermal Power Stations are proposed in Bihar and Uttar Pradesh with installed capacity of over 15000 MW. Their coal requirement is estimated to be around 70 million metric tonnes per annum, which can be met through IWT.

### 7. 3.3 National Highways

The National Highways comprise of only around 2% of the total Road Network in India but carry more than 40% of the Traffic. This makes route management of heavy Over Dimensional Consignments (ODCs) highly challenging and difficult. There are serious issues associated with ODC transportation

through roads / highways like interpretation of Motor Vehicle Act differently in different states, inadequate strength of roads and Bridges enroute to the project sites, insufficient road width / carriage width in state highways, improper design of Toll Plazas built on the Highways, sharp curves/bends/gradients on roads and inadequate vertical clearance in underpasses in North Eastern states etc. These need to be addressed urgently including necessary fundamental changes in loading specifications of roads, highways and bridges for which specific recommendations have been given in the Report.

### 7.3.4 Existing & Proposed Gas Pipelines / Grid

- Natural gas is the fastest growing primary energy source amongst fossil fuels, projected to grow around 3-4 times between 2002-2025 at current consumption level. We have come a long way from the time when oil and gas were first discovered in India in 1886 in Assam and subsequently when the famous Bombay High field was discovered in 1974 in the Western Offshore.
- With developing gas market, timely development of gas pipelines across the country for realization of social and economic benefits of natural gas usage has become a priority. Such trunk gas pipelines when integrated with the existing gas pipelines shall ultimately lead to the National Gas Grid. The indicative National Gas Grid shall consist of the existing pipelines, authorized / planned pipelines and their links to the remote and under-developed areas.
- EGOM (Empowered Group of Ministers) have formulated Gas Utilization Policy for distribution and utilization of domestic gas in the country and have allocated priority for KG D6 gas allocation to existing gas based / liquid based stations, connected with gas pipelines. For better utilization of generation capacities, presently running on liquid or under- utilized, it is necessary to connect them preferably as a part of trunk/ spur pipeline network.

#### 7.3.4.1 Existing Gas Pipelines

The present gas pipeline infrastructure in the county is around **12000 km** with design capacity of around **283 MMSCMD**. The existing main trunk pipelines are as under:

- **GAIL:** Owns and operates around 8000 km pipelines including spur lines (mainly HVJ-GREP-DVPL including DVPL-GREP up gradation and DUPL-DPPL) with design capacity around 150 mmscmd.
- **Reliance Gas Transportation Infrastructure Ltd. (RGITIL) :** Owns and operates around 1400 km long East - West Pipeline (EWPL) - (Kakinada-Hyderabad-Uran-Ahmedabad) with design capacity of 80 MMSCMD.
- **Other major regional players:**
- **Gujarat State Petronet Ltd (GSPL) :** Owns & operates ~ 1200 km pipelines with design capacity of 40 MMSCMD.
- **Assam Gas Company Ltd (AGCL) :** Owns & operates ~ 500 km pipelines with design capacity of 8 MMSCMD.

**7.3.4.2 Authorized Gas Pipelines:** Ministry of Petroleum and Natural Gas in 2007 authorized following nine new trunk pipelines with total length of approx. 8700 km with design capacity of about **209 MMSCMD**.

**(A) GAIL :**

- Dadri-Bawana-Nangal (600 ksm)
- Chainsa-Jhajjar-Hissar (400 kms)
- Jagdishpur-Haldia (2000 kms)
- Dabhol-Bangalore (1400 kms)
- Kochi-Kanjirakkod-Bangalore (1100 kms)

**(B) RGTIL :**

- Kakinada-Haldia (928 kms)
- Kakinada-Chennai (577 kms)
- Chennai-Bangalore-Mangalore (538 kms)
- Chennai-Tuticorin (585 kms)

These pipelines are under different stages of development.

**7.3.4.3 Establishment of PNGRB:** The Petroleum and Natural Gas Regulatory Board (PNGRB) Act 2006 provides for the establishment of an independent regulatory board (PNGRB) as a downstream regulator to regulate the activities of companies related to refining, processing, storage, transportation, distribution, marketing and sale of petroleum, petroleum products and natural gas and City Gas Distribution (CGD). The board has been established and started functioning w.e.f. June 2007. The PNGRB have formulated several regulations pertaining to gas transportation. PNGRB is authorising entities for laying pipeline on basis of competitive bidding through EOI route. PNGRB has received 06 EOIs for setting up of additional gas pipelines. These are (as per PNGRB website):

- (i) Mallavaram (A.P.) – Vijapur (M.P.) – Bhilwara (Rajasthan)
- (ii) Mehasana (Gujarat) to Bhatinda (Punjab) via Jaipur (Rajasthan)
- (iii) Bhatinda (Punjab) to Srinagar (J & K)
- (iv) Surat to Paradip
- (v) Durgapur to Kolkata
- (vi) Kakinada to Srikakulam

## **7.4 PORTS**

Ports are critical part of transportation infrastructure of our country. India has about 6000 km. of natural peninsular coastline. There are 12 major and 176 minor ports in India.

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## Major Ports

The capacities of all the Major Ports are projected to rise from the existing level of 616.73 Million Tonnes (as on 31.03.2010) to 1328.265 million tonnes by the end of 12th Five Year Plan (2016-17) and to 1459.535 million tonnes in 2019-20. This capacity is excluding the capacities at the anchorage points of the Ports. In addition to above, Central Government plans to commission two more Major Ports, one each on Andhra Coast & West Coast, which will also entail additional capacity in Major Port segment.

## Non Major Ports

Recognising the critical importance of ports to cater to the future increase in maritime traffic, the maritime states initiated the process of development of ports in their States. The eight maritime States have estimated that the cargo traffic from non-major ports will increase from the existing 288.80 million tonnes in 2009-10 to 402.50 million tonnes in 2011-12, 987.81 million tonnes by the end of 12th Five Year Plan in 2016-17 and 1280.13 million tonnes by 2019-20. During 2009-10 to 2019-20, Cargo traffic in the maritime states (Non major ports) is projected to grow at Cumulative Annual Growth Rate (CAGR) of 16.06%.

Keeping in view the estimated capacity addition of 75,715 MW, the coal quantity to be imported by the end of 12th plan works out to about 121 MT for 15 % blend and including the requirement for power plants that would be operating completely on imported coal. Based on the Maritime Agenda for Ports, issued by the Ministry of Shipping, major and non major ports together are targeted to handle 476.04 Million Tonnes of Thermal and Coking coal combined by the end of 12<sup>th</sup> Plan. Moreover in order to augment the capacity and enhance productivity levels at major ports, several initiatives are being taken by the Ministry of Shipping including modernisation of port infrastructure, construction of new berths/ terminals, expansion/ up-gradation projects for berths and dredging, installation of new and modern equipment, mechanisation of cargo handling operations and automation through computer aided systems. However improving / augmenting rail and road connectivity especially last mile connectivity will need special attention particularly as it involves close coordination and interface between Roads, Railways and Port Authorities.

### 7.4.1 Suggestions/ Recommendations

- Adequate coal unloading arrangement at Ports to be ensured to handle imported and domestic coal required for power stations (approximately 150 MT).
- 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.
- All major and important minor ports should be mechanised by augmenting crane capacities, silos, conveyors & wagon tippers.
- Draft at various ports to be increased to handle Panamax or Capsize vessels.
- RO-RO berths should be created atleast in two major ports namely Kandla on the west coast and Paradip on the east coast for unloading ODCs.
- Road connectivity to ports to handle ODCs has to be ensured

## 7.5 MANUFACTURING CAPACITY AND CONSTRUCTION AGENCIES

Adequate domestic manufacturing capacities & capabilities for main plant equipment would be available to meet the demand of the 12<sup>th</sup> Plan capacity addition programme as a result of the push given by the Government for indigenous manufacturing of main plant equipment during the 11<sup>th</sup> Plan. To ensure energy security it is vital that the manufacturers give reliable services as well as spares during the life time operation of the Plant; accordingly it is essential that a level playing field is provided to manufacturers so that a healthy competition ensures competitive prices and quality equipment. A number of 11<sup>th</sup> Plan projects have not been able to achieve full load operation within stipulated time from synchronization due to non-readiness of the balance of plant.

### 7.4.1 Main Plant Equipment

In the category of coal based power plant, switch-over to super critical technology is envisaged for all the new capacities coming up in 13<sup>th</sup> Plan and beyond.

Based on the encouragement from Government of India for setting up domestic manufacturing facilities, a number of new manufacturers have come forward for setting up manufacturing facilities for Steam Generators and Turbine Generators. These include:

1. L&T-MHI
2. Toshiba-JSW
3. Alstom-Bharat Forge
4. Ansaldo-Gammon
5. BGR-Hitachi
6. Doosan
7. Thermax-Babcock
8. Cethar Vessel- Riley Power

In addition, BHEL has also augmented its capacity from 6,000 MW per annum in X Plan to 15,000 MW per annum and is in the process of augmenting its capacity further to 20,000 MW per annum by March 2012.

From the information provided by the manufacturers, it has emerged that following domestic capacities shall be available for steam generators and turbine generators.

	<b><u>By 2013-14</u></b>	<b><u>By 2014-15</u></b>
<b>SG (MW)</b>	26,500	40,500
<b>TG (MW)</b>	30,020	35,020

### 7.4.2 Balance of Plant (BoPs)

Balance of Plants such as Coal Handling Plant, Ash Handling Plant, Water Treatment / DM Plant, Cooling Towers, CW System, Chimney, Plant electrical and switchyard etc. have been identified as critical items for timely commissioning of thermal power projects. BoPs have been and continue to be a critical area for achieving capacity addition targets. To mitigate risk associated with BOP systems

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recommendations/ suggestions have been made in the report that include standardisation of BOP systems, reviewing the qualifying requirements to ensure quality vendors and large vendors for faster execution of projects, mandating a central organization to maintain a dynamic data base with regard to BOP orders and their liquidation.

Use of conventional technologies in civil works has been responsible to some extent for delays in completion. The latest methods of civil construction with mechanised equipment and man power mobilization need to be adopted. The vendors have to be encouraged to adopt new erection technologies to reduce the erection and commissioning cycle. An institutional mechanism to develop skilled man power for construction & execution of projects has also been stressed upon.

### 7.5.3 Suggestions/ Recommendations

The recommendations of the sub-group relating to manufacturing capacity and construction agencies are as follows;

- Developers may execute BOPs on EPC basis.
- A web based portal need to be designed and managed for all information relating to BOP vendors viz. orders at hand, their implementation status etc. so that developer of projects can take an informed decision.
- In second phase the BOP vendors and Construction agencies could be rated based on their performance.
- Work in hand / Bid Capacity etc. should find place in bid documents.
- MOP/CEA to suggest an 'implementation mechanism' to enforce technical standards notified by CEA.
- Training of Skilled/ Semi-skilled workers for Power project requirements to be taken by EPC Contractors, Developers as well as the Manufacturers.

## 7.6 MATERIALS

There are several inputs which are required for setting up of power projects which involves supply of Main Plant Equipment as well as Erection / Construction activity. Materials such as Steel, Cement, Copper, Aluminium etc. are the key inputs needed for power projects. The huge capacity addition plan requires that all key inputs are made available matching the schedule of implementation of the Power projects.

### 7.6.1 Material Requirements for Generating Stations

Following norms for Cement for Thermal Projects were considered keeping in view the norms developed by CEA and historical data for NTPC's Plants:

Table 7.12

MT per MW

Material	Thermal	
	Coal Based	Gas based
Cement	150	60
Structural Steel	85	29
Reinforcement Steel	45	24

Based on the projections and the data received from CEA the average requirement of materials per MW for the Hydro projects works out to be as under:

Table 7.13

MT per MW

Material	Hydro
Cement	956
Structural Steel	34
Reinforcement Steel	93

Based on the assessment of Nuclear Power Corporation (NPCIL), requirement of Steel, Cement and other materials for nuclear projects is considered at 130% of the requirement of coal based projects for planning purposes. Considering the above, the material requirement for Nuclear Projects as provided by CEA is as given under:

Table 7.14

Lakh MT

Material	12 <sup>th</sup> Plan	13 <sup>th</sup> Plan
	2800 MW	5600 MW
Cement	5.46	10.92
Structural Steel	3.09	6.19
Reinforcement Steel	1.64	3.28

The Norms for Cement and Reinforcement Steel for Power system network which have been considered based on historical data of PowerGrid are as follows:

Table 7.15

MT per ckt Km

Line	Cement	Reinforcement Steel
765 KV	56	11
HVDC	26	6
400 KV	21	9
220 KV	8	3
132 KV	5	1

As per the details provided by BHEL the average requirement of castings and forgings for a 500/660/800 MW sets is as given below:



**Table 7.16**  
MT per Set

Equipment	Weight of Castings	Weight of Forgings
Turbine	384	235
Generator	3	130
<b>Total</b>	<b>387</b>	<b>364</b>

Based on the norms given above, the requirement of various materials for the power sector during 12<sup>th</sup> Plan has been worked out as follows:

**Table 7.17**  
Lakh MT

Material	12 <sup>th</sup> Plan
	<b>75785 MW</b>
Cement**	217.39
Structural Steel**	102.48
Reinforcement Steel	46.85
CRGO Steel (as per IEEMA)	11.5
Castings*	0.36
Forgings*	0.34
Special Steel for Sub-Stations	5.0
Steel for Conductors in Transmission system Lines	4.9
Aluminium	15.75
Copper (as per IEEMA)	12.5
Zinc	2.6
Thermal Insulation#	2.37
Tubes & Pipes#	6.78
Thick Boiler Quality Plates (Imported)*	0.92

\*Excluding Nuclear & Hydro #Excluding Nuclear

\*\* Excluding Distribution system networks & power and distribution transformers

The consumption of cement for the power projects during the 12th Plan is going down as compared to 11th Plan due to fall in the planned share of Hydro Electric Power.

The main inputs for manufacturing power plant equipment are castings & forgings, steel plates, structural steel, copper, CRGO/CRNGO etc. While Steel, Cement, Copper, Aluminum etc. are the key inputs needed for erection & commissioning and transmission & distribution networks. Consumption norms have been worked out based on consumption pattern for the completed projects during the past and also for projects under execution. Prima facie there is no likely shortage of key materials except for CRGO, and thicker steel plates. Further, there is an inadequate indigenous manufacturing capacity in the country for Tubes & Pipes especially for alloy steel tubes & Pipes (T91/P91, T92/P92 grades), which needs to be augmented. Some indigenous capacity for heavy castings & forgings

which are critical for power generating equipments, are being planned by a major private sector manufacturer and are expected to come up in near future. Presently no facility exists in the country for short circuit testing facility for transformers. The recommendations of the sub-group relating to key materials are as follows:

There is no shortage of key materials except CRGO Steel, higher grade CRNGO and thick boiler steel plates.

However 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 CONCLUSION AND RECOMMENDATIONS

Based on various inputs given different teams, the Conclusion and Recommendations in terms of Key inputs are summarized as follows:

### 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:**

- To sustain the capacity addition proposed in the 12<sup>th</sup> Plan, coal availability to power sector must be increased by domestic coal companies to 688 million tons by the end of 12<sup>th</sup> Plan.
- 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.
- Coal sector needs to be immediately opened up for private sector investment also, to ensure that the coal production rate is matched with the rate of growth in thermal power generation.
- Coal Regulator needs to be in place to ensure higher coal productivity at least cost.
- Need to upgrade coal mining equipment and practices in the already working mines for better productivity.
- 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 be signed without delay.

- Coal crushing capacity to be augmented at mines.
- 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.
- 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.
- 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.
- **Coal Price Pooling may be considered to optimize coal transportation and also to encourage acceptance of imported coal.**

#### Captive Coal Blocks:

- 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.
- 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.
- Allocation as well as De-allocation of captive coal blocks should be by the Inter-Ministerial Committee as for coal linkages.
- 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.
- The time lines prescribed for captive coal block development to be made more realistic.
- 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

- 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

- New gas based projects totaling about 12204 MW are under construction out of which 8782 MW have been recommended for gas allocation in the 11<sup>th</sup> Plan. These projects would require about 47 MMSCMD gas at 75% PLF. The gas supply to these projects needs to be ensured.
- Gas supply is also to be made available to atleast 10,000 MW additional Capacity in the 12<sup>th</sup> Plan not only to ease pressure on domestic coal but also to encourage Green Power.

## LAND & WATER

### **Land**

Land is increasingly becoming a scarce resource and availability of land is posing a serious challenge for future power plants. The optimum utilization of land has therefore, gained significance and in coming times challenges are to be encountered in land usage practices. Sub Group 7 recommends the following for Land use and acquisition:

- Land to be acquired with a view of not only project development but also the livelihood issues of the original land owners.
- Minimizing land requirement pressure for new projects by use of spare land within existing plants.
- Review of MoEF procedures for expeditious project clearances.
- Higher capacity units in place of older small size units
- Adoption of higher size units.
- Shelf of sites for projects i.e. land bank needs to be created.
- New technology options to be adopted for minimizing land requirement.
- CEA may undertake another exercise in consultation with various stakeholders to further optimize land requirement for Power projects.
- 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**

With all round development in the country and vast growth of thermal power stations, the availability of water has become scarce. As drinking and irrigation water uses have got priority in allocation of water over industrial use and power generation, the thermal power plants are facing constraints in availability of adequate fresh water. Following are the main recommendations of the Sub Group regarding Water Requirement.

- Technical measures for reducing water consumption may be adopted.
- Creation of large reservoirs/ dams on potential rivers to retain flood waters.
- 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 12<sup>th</sup> five year plan and beyond. The main recommendations on Transport sector are:

- Railways are transporting about 60% of the total off-take of domestic coal.
- The percentage share will remain the same during the 12th plan.
- Railways to confirm their coal evacuation capacity from each coal field.
- Railways to augment their capacity to evacuate coal from major coal fields namely North Karampura, Ib Valley, Talcher and Mand Raigarh.

- 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.
- Railway to expedite proposed Dedicated Freight Corridors to segregate freight and passenger traffic.
- Railways to ensure rail connectivity to all ports having coal unloading facilities.
- 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.
- Roads and Highways need to be augmented for transportation of Over Dimensioned Consignments (ODC) for supercritical units.
  - Amendment in Motor Vehicle Act to accommodate heavy consignments above 49 MT and inclusion of hydraulic axle trailers.
  - Review of load classification for Roads & Bridges by IRC/ MoRTH to accommodate ODCs beyond 100 MT.
  - Single window clearance and one time payment for ODC movement.
  - Proper design of Toll Plazas built on highways.
- Changes in Road design in North Eastern & Hill states to minimise sharp curves/gradients in roads and have sufficient vertical clearance in underpasses.
- Proper Approach Roads to be provided for Hydro Projects.

## **PORTS**

Ports are critical part of transportation infrastructure of our country. India has about 6000 km. of natural peninsular coastline. There are 12 major and 176 minor ports in India.

The main recommendations for augmenting Ports and related infrastructure are:

- Adequate coal unloading arrangement at Ports to be ensured to handle imported and domestic coal required for power stations (approximately 150 MT).
- 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.
- All major and important minor ports should be mechanised by augmenting crane capacities, silos, conveyors & wagon tippers.
- Draft at various ports to be increased to handle Panamax or Capsize vessels.
- RO-RO berths should be created atleast in two major ports namely Kandla on the west coast and Paradip on the east coast for unloading ODCs.
- 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 12<sup>th</sup> Plan as projected by CEA. 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) Implementation of Technical standards**

An implementation mechanism for meeting the technical standards as notified by CEA needs to be devised for adherence by the Manufacturing agencies.

**2) Centralised agency to coordinate for various clearances/ availability of inputs**

The Committee recommends formation of a centralized agency with representatives from nodal Ministries/ Departments responsible for these inputs to expeditiously resolve the issue.

**3) Demand projection for development of key inputs**

In order to attract these vendors, Govt. has to encourage them to develop their capacities and capabilities for power sector, for which they should have optimistic projections of the demand.

**4) Standardisation**

Standardization of technical specifications i.e. design basis, equipment parameters, material specification, Quality plans etc., to the extent will enable batch production of equipments expediting their delivery.

**5) Logistics & Road Connectivity**

12<sup>th</sup> Plan capacity addition is mainly based on large size super critical sets. This large size super critical plant equipment involves movement of heavy/ ODC consignments on domestic roads and bridges. In order to meet the tight project schedules, smooth and uninterrupted movement of the equipment from manufacturer's works/ port to the project site is very critical. The development of the project should also involve development of the roads/ bridges up to project site.

**6) Single window for granting permits/ clearances for movement of the consignments across the States.**

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.

**7) Availability of raw material domestically**

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.

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**8) Lower rating sets for remote Sites**

Considering the logistics constraints, large size super critical sets may not be feasible for all locations. As such, lower rating / sub critical sets should also continue for which coal allocation may be made available.

**Balance of Plants (BOP)****1) Standardization**

The variations in engineering practices delay 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**

The availability of skilled and semi-skilled manpower for project execution has been an area of concern. 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**

Timely placement of orders for BOP by utilities and also the bought out items by the BOP vendors will 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**

There have been no significant technological changes in the BOP equipment and designs for a long time. 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) Construction Techniques**

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) Tools and Plants**

New tools and tackles may be adopted for optimum functioning and reduce redundancies for a cost effective solution.
- 3) Bridging skill gaps**

Industry is facing severe shortage of skilled manpower like welders (especially High Pressure welders), fitters, turners, masons, carpenters etc. Following is recommended:

  - (i) Creation of adequate number of new modern technical training institutions under government sector and facilitation in creation of the same under private sector.
  - (ii) PPE manufacturers and Developers will have 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.

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- (iii) 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.

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