



REVIEW OF LAND REQUIREMENT FOR THERMAL POWER STATIONS



CENTRAL ELECTRICITY AUTHORITY
New Delhi – 110066

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GURDIAL SINGH
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FOREWORD

Land is increasingly becoming a scarce resource and availability of land is posing a big challenge for future as well as currently planned thermal power plants. Problems have been compounded due to demand from other competing sectors and certain objections on the part of local population. The optimum utilization of land has, therefore, gained significance so that maximum capacity of plants could be installed.

In view of the above, need was felt to review the earlier CEA report of December 2007 on land requirement of thermal power stations. The Committee consisting of representatives from CEA, NTPC, BHEL, Desein, Tata Consulting Engineers and L&T Sargent & Lundy was revived in October, 2009 to suggest further optimization of land. The Committee after detailed deliberations has recommended reduction in land for various categories of thermal power stations. The stipulations contained in MOE&F's notification dated 3.11.2009 for land requirement for ash dyke area have also been duly considered for optimization of land requirement in this review report. Ministry of Power has given its concurrence to go ahead with the reduced requirement of land recommended by the Committee.

I am sure that land requirement recommended in this report will serve as a useful guideline to Government agencies, utilities and power plant developers for meeting the objective of optimum utilization of land.

New Delhi
September, 2010


(GURDIAL SINGH)

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CONTENTS

Item No.	Description	Page No.
1.0	BACKGROUND	1
2.0	DELIBERATIONS HELD	1
3.0	REVIEW OF LAND REQUIREMENT	2
3.1	Land Requirement for facilities inside power plant boundary	4
	3.1.1 Main Plant Area	4
	3.1.2 Coal Storage & Handling System	5
	3.1.3 Station Water System and Raw Water Reservoir	6
	3.1.4 Switchyard	8
	3.1.5 Miscellaneous Balance of Plant facilities, stores, roads etc.	9
	3.1.6 Landscaping & Green Belt:	11
3.2	Land Requirement for facilities outside power plant boundary	12
	3.2.1 Ash Disposal Area	12
	3.2.2 Township	12
	3.2.3 Corridors for raw water intake, ash slurry pipeline & MGR/coal conveyors	12
4.0	SUMMARY OF LAND REQUIREMENT	14
	4.1 Pit head / Load center Stations based on indigenous coal	15
	4.2 Coastal Stations based on imported coal	16
5.0	COMPARISON OF PROPOSED LAND REQUIREMENT VS EARLIER REPORT.	19
6.0	RECOMMENDATIONS	23
Annexure	Land Requirement for 765 KV and 400 kV Switch Yard	26



REVIEW OF LAND REQUIREMENT FOR THERMAL POWER PROJECTS

1.0 BACKGROUND

A Committee comprising of members from CEA, NTPC, BHEL, Desein, Tata Consulting Engineers, L&T - Sargent & Lundy was constituted by CEA in April, 2007 to examine the land requirement of thermal power stations for various capacities. The Committee submitted a 'Report on the Land Requirement of Thermal Power Stations' in December, 2007 after detailed deliberations.

In view of large capacity envisaged in 12th Plan and beyond and challenges being faced in land acquisition, need was felt to examine if land requirement could be reduced further. This issue also came up in Power Ministers Conference held in June, 2009. Accordingly, the suggestions for further optimization of land were invited from major utilities including IPPs, BHEL and consultants in July, 2009. The Committee representing the organizations, which had brought out the report in December, 2007 was then asked to deliberate over the issues and suggest further optimization of land. The Committee comprised the following members:

- i) Shri Suresh Chander, Chief Engineer (TE & TD), CEA
- ii) Shri R. Baijal, DGM (PE-Civil), NTPC
- iii) Shri A. Joshi, AGM (PEM), BHEL
- iv) Shri K.S. Thimmaiah, GM, TCE
- v) Shri N.K. Gupta, L&T Sargent & Lundy Ltd.
- vi) Shri R. Sabharwal, Director(Engg.), Desein

2.0 DELIBERATIONS HELD

- 2.1 In response to CEA letter dated 27th July, 2009 inviting suggestions for optimization of land requirements, BHEL, Mahagenco, L&T-Sargent & Lundy, Tata Power, DCPL and Adani Power responded. The suggestions were discussed in the first meeting of the Committee held on 24.11.2009. Committee members were then requested to focus on different areas and send their analysis for optimization of land for respective areas.
- 2.2 Some utilities in public and private sector were requested to furnish data/drawings indicating the land requirement for various facilities of



their plants under construction. The layout drawings and other data received for following plants were studied:

- i) Coastal Gujarat Power Ltd. (5x800 MW) at Mundra, Gujarat of Tata Power
- ii) Sri Damodaram Sanjeevaiah Power Station Unit 1 & 2 (2x800 MW) at Krishnapatnam, Andhra Pradesh of APPDCL
- iii) OP Jindal Super Thermal Power Plant (4x600 MW) at Raigarh of Jindal Power Ltd.
- iv) Rihand Super Thermal Power Plant Stage II - Unit 3 & 4(2x500 MW) of NTPC
- v) North Chennai Super Thermal Power Plant Stage II Unit 1 & 2 (2x600 MW) of TNEB
- vi) Barh Super Thermal Power Plant Unit 4 & 5 (2x660 MW) of NTPC
- vii) Mundra Thermal Power Project – 4620 MW (2x330 MW, 2x330 MW, 2x660 MW, 3x660 MW) of Adani Power
- viii) Tiroda Thermal Power Project – 3300 MW (2x660 MW, 3x660 MW) of Adani Power
- ix) Hissar Thermal Power Project (2x600 MW) of HPGCL
- x) North Karanpura Power Project (3X660MW) of NTPC

- 2.3 Draft Report was prepared by CEA based on various inputs which was discussed in a meeting held on 25th May 2010 and report was finalized based on the discussions.

3.0 REVIEW OF LAND REQUIREMENT

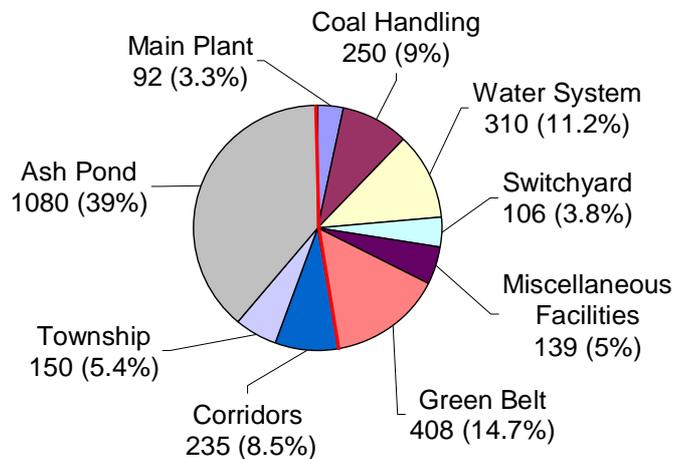
- i) Land requirement for thermal power projects depends on many factors viz. unit size and number of units; type of coal (indigenous or imported); location (pit-head or coastal) etc. Besides there are site specific issues which determine the land requirements. These include:
 - a) Coal storage capacity planned depending on the location of plant and certainty of coal receipts
 - b) Mode of coal receipt i.e rail (marshalling yard or MGR) or conveyor
 - c) Water storage capacity planned depending on source of water and its availability
 - d) Type of condenser cooling system: While cooling towers are must for inland stations, both options (once through or cooling tower) are possible in coastal stations
- ii) A review of the land recommended in CEA's Report in December, 2007 indicates following distribution of land requirement for various facilities for 5X800MW plant:



TABLE-1

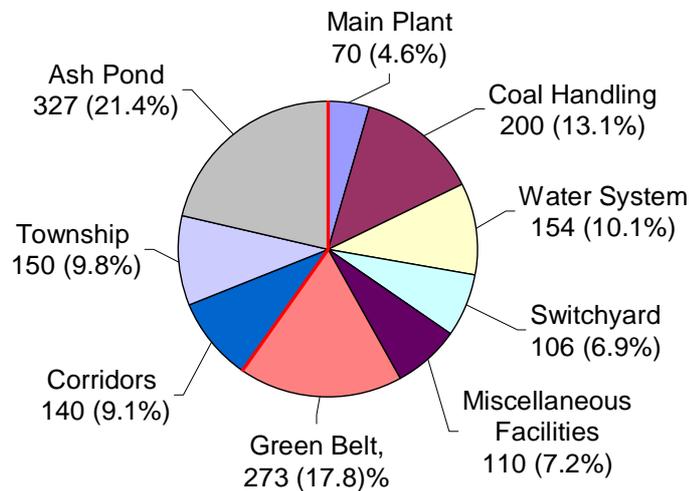
S. No.	Facility	Area in acres			
		Land requirement (indigenous coal)		Land requirement (imported coal)	
		Area	%	Area	%
<i>Facilities inside Power Plant Boundary</i>					
1	Main Plant (Boiler, Turbine-generator and auxiliaries) from transformer yard to chimney	92	3.3	70	4.6
2	Coal storage and handling system	250	9	200	13.1
3	Station water system and water reservoir	310	11.2	154	10.1
4	Switchyard	106	3.8	106	6.9
5	Miscellaneous balance of plant facilities, stores and roads	139	5	110	7.2
6	Green Belt	408	14.7	273	17.8
<i>Facilities outside Power Plant Boundary</i>					
7	Corridors for ash slurry disposal pipelines, MGR system and Raw Water pipeline	235	8.5	140	9.1
8	Township	150	5.4	150	9.8
9	Ash disposal area	1080	39	327	21.4
	Total	2770		1530	

Distribution of land requirement in a Thermal Power Plant (5 x 800 MW)
Based on Indigenous Coal





Distribution of land requirement in a Thermal Power Plant (5 x 800 MW)
Based on Imported Coal



From the above, it is seen that coal storage and handling system, station water system & water reservoir occupy most of the land space inside the power plant boundary whereas most of the land outside the plant boundary is used by ash disposal area. In the following paragraphs, the possibilities for reduction in land requirement has been discussed facility-wise.

3.1 LAND REQUIREMENT FOR FACILITIES INSIDE POWER PLANT BOUNDARY

3.1.1 Main Plant Area

As brought out in Table-1 above at para 3.0, area requirement for main plant (from transformer yard to chimney) is not the major candidate for land reduction. Besides, this area is the main hub of the power plant operation and maintenance activity and space reduction is not advisable at the cost of flexibility in maintenance. Nonetheless, the land requirement for main power plant has been reviewed based on the area actually used in recent plants under construction and the comparative area recommended in December, 2007 report and areas now proposed after discussions in the meetings are given below:



i) Pit head / Load Center Stations using indigenous coal

TABLE -2A

Plant size	Area in acres	
	Area recommended Earlier	Area proposed now
2x500 MW	29.7	20
3x660 MW	54.4	44
5x660 MW	81.5	72
6x660 MW	108.8	88
4x800 MW	76.1	82
5x800 MW	92.4	100

ii) Coastal stations using imported coal

TABLE -2B

Plant size	Area in acres	
	Area recommended Earlier	Area proposed now
3x660 MW	27.8	30
6x660 MW	84.38	60
5x800 MW	70	65

3.1.2 Coal Storage & Handling System

i) Land requirement for coal storage & handling system depends on the location of the power plant, quality of coal, type of coal unloading, storage requirement etc. Considering these issues, the following land requirement was recommended in December, 2007 report for various station capacities:

a) Pit head / Load Center Stations using indigenous coal

TABLE -3A

Description	Area in acres					
	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Pithead stations	220	240	240	250	250	250



b) Coastal stations using imported coal

TABLE -3B

Description	Area in acres		
	3x660 MW	6x660 MW	5x800 MW
With MGR	150	180	200
With Coal Conveyor	108	140	150

- ii) With respect to indigenous coal based stations, it is observed that land recommended for coal handling system is already quite optimal and no further land reduction is possible. As would be seen, land for coal handling system has been kept almost the same for all the station capacities. This has been possible by considering location of raw water storage within the loop area for 3000 MW capacity and above which would have otherwise gone unutilized.

However, land reduction is possible in pit-head plants to the extent of 50% of that indicated above in cases where sized coal is dispatched from the mine end by conveyors instead of rail.

- iii) For imported coal based stations, no reduction seems possible for stations with MGR except that same land requirement of 180 acres is recommended for 6x660 MW and 5x800 MW. However, land requirement is recommended to be reduced in cases where coal is transported up to the power plant by conveyors, and not by MGR, as indicated in the Table below .

TABLE -4

Description	Land in acres		
	3x660 MW	6x660 MW	5x800 MW
With MGR	150	180	180
With Coal Conveyor	60	70	70

3.1.3 Station Water System and Raw Water Reservoir

- i) The land requirement for station water systems has been reviewed and it was observed that no significant change in the land requirement indicated earlier for water system is possible and land requirement similar to that recommended earlier is proposed as given in the following tables:



a) Pit head / Load Center Stations using indigenous coal

TABLE -5A

Description	Land in acres					
	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Water system area with IDCTs	28	54	90	108	90	112
Water system area with NDCTs	45	90	135	150	135	150

b) Coastal stations using imported coal

TABLE -5B

Description	Land in acres		
	3x660 MW	6x660 MW	5x800 MW
Water system area with IDCTs	54	108	112
Water system area with NDCTs	90	150	150
Water system area without cooling tower	6	8	8

Since most of the stations are located at pit-head where IDCT is generally provided, area requirement based on IDCT has been considered for total land requirement.

ii) The area for raw water reservoir has been recalculated as shown in Table-6 below based on the following assumptions:

- a) Consumptive raw water requirement of 3.5 m³/MW/h
- b) Storage capacity of 10 days plant water requirement
- c) Reservoir depth of 8m

TABLE -6

Description		Land in acres					
		2 x 500 MW	3 x 660 MW	5 x 660 MW	6 x 660 MW	4 x 800 MW	5x 800 MW
Water Reservoir Area,	Recommended Earlier	40	80	140	160	130	160
	Recommended Now	30	60	100	120	100	120

It can be seen from the above table that a reduction in space to the tune of 30-40% in raw water reservoir area is achievable by the above



considerations. However, it may be stated that the storage capacity of reservoir depends entirely on the reliability of the water source and may be shorter or longer than 10 days. In some cases, the storage duration may vary up to 30 days due to canal closure period. Hence, the space requirement will also vary. Similarly the depth of the reservoir may vary from 5 to 12 m depending upon the soil strata and the water table of the area. The suggestion to consider depth of reservoir up to 12 m by considering the reservoir partly underground and partly over ground was not found feasible, in general, because of possibility of breach and may be considered only where there is acute shortage of space.

3.1.4 Switchyard

- i) It was observed that land for switchyard in the December, 2007 report is generally higher than that actually used for switchyard in some recent plants under implementation.
- ii) Land requirement for switchyard depends on type of scheme, voltage level and number of bays. In the report of December, 2007, space for switchyard was calculated both for 400kV and 765 kV switchyard and land for 765 kV switchyard was considered in the total estimation of land. Further the width of the switchyard was considered same as that of the main plant. Requirement of land for switchyard has been reviewed on the following basis:
 - a) The width of the switchyard, depends upon the no. of feeders/ bays. Certain number of feeders/ bays have been assumed, depending upon the station capacity and same are given in enclosed Annexure -A.
 - b) For projects of more than 2000 MW capacity, 765 kV switchyard has been envisaged. However, in 765 kV switchyard, usually there is also a requirement for one more switchyard at 400kV level. Hence for 765 kV switchyard, land for switchyard at both the voltage levels have been considered.
 - c) For projects up to 2000 MW capacity, only 400 kV switchyard has been envisaged. For 400 kV switchyard three alternatives viz. a) 1-½ breaker scheme (D-type), b) 1-½ breaker scheme (I-type) and c) 2 main & transfer bus have been considered and maximum land requirement taken for land estimation.

Based on the above, land requirement has been worked out as given in the following Table:



TABLE-7

Description	Area in Acres					
	2x 500 MW	3x 660 MW	5x 660 MW	6x 660 MW	4x 800 MW	5x 800 MW
A) 400kV system 1½ breaker scheme (1) I- type (2) D-type	15.57 20.43	17.65 26.21	19.74 26.21	19.74 26.21	19.74 26.21	19.74 26.21
B) 400kV system 2 Main & Transfer bus	23.19	27.99	29.59	31.19	27.99	29.59
C) 765kV system 1½ breaker scheme (I- type)	NA	NA	58.56	64.99	58.56	64.99
D) Total (400 + 765kV)						
A(1) + C	15.57	17.65	78.30	84.72	78.30	84.72
A(2) + C	20.43	26.21	84.77	91.20	84.77	91.20
B + C	23.19	27.99	88.15	96.18	86.55	94.58
E) Recommended land reqd.	24	28	89	97	87	95
F) As per Report of 2007	37.5	68.8	103	137.5	87.5	106.3

- iii) Land requirement for switchyard can be further reduced to 30% in case Gas Insulated Switchgear Switchyard (GIS) is used. GIS option may be adopted in coastal areas or in areas where there is acute shortage of land.
- iv) Additional land may be required for other voltage levels such as 220 kV, 132 kV, 33 kV which may be required for specific project.

3.1.5 Miscellaneous Balance of Plant facilities, stores, roads etc.

Area requirement for balance of plant systems (other than coal handling systems and water systems) and other facilities listed below were reviewed but no significant area reduction could be possible. However, 'Laydown & pre-assembly yard area', 'steel storage yard' and 'construction store' have been considered to be converted into green belt after project completion while in earlier report only 'Laydown & pre-assembly yard area' was considered for conversion to green belt. Accordingly land proposed for these facilities is given below:



a) Pit head / Load Center Stations using indigenous coal

TABLE -8A

S. No	Description	Land in acres					
		2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
1.	Ash Handling System	6	11	16	22	14	21
2.	Fuel oil facilities	3	3	6	6	6	6
3.	F.G.D. system	7	14	20	27	17	21
4.	Miscellaneous facilities <ul style="list-style-type: none"> • Admn. Building • Service Building • Workshop • Comp. House • Fire Station • Canteen • Security office • Lab • Hydrogen plant • DG Sets • Auxiliary Boiler • Fire Pump house • Fire Water Tank 	10	10	11	11	11	11
5.	Permanent Store	20	20	20	20	20	20
6.	Laydown & Pre-assembly yard *	50	50	50	50	50	50
7.	Steel Storage yard*	10	10	10	10	10	10
8.	Construction Store*	10	10	10	10	10	10
9.	Roads	20	25	25	25	25	25
	Total	66	83	98	111	93	104

“*” Not considered in ‘Total’ area calculation since this area will be converted to green belt after project construction is completed.



b) Coastal stations using imported coal

TABLE -8B

Sl. No	Description	Land in acres		
		3x660 MW	6x660 MW	5x800 MW
1.	Ash Handling System	11	16	16
2.	Fuel oil facilities	3	6	6
3.	F.G.D. system	4	8	8
4.	Miscellaneous facilities <ul style="list-style-type: none"> • Admn. Building • Service Building • Workshop • Compressor House • Fire Station • Canteen • Security office • Lab • Hydrogen plant • DG Sets • Auxiliary Boiler • Fire Pump house • Fire Water Tanks 	8	11	11
5.	Permanent Store	20	20	20
6.	Laydown & pre-assembly yard *	45	50	50
7.	Steel storage yard*	10	10	10
8.	Construction Store*	10	10	10
9.	Roads	20	25	25
	Total	66	86	86

‘**’ Not considered in ‘Total’ area calculation since this area will be converted to green belt after project construction is completed.

3.1.6 Landscaping & Green Belt:

One third of area has been provided for green belt and landscaping as per requirements of MOE&F in the earlier report. No change is proposed. However, as mentioned at para 3.1.5 above, areas for lay down & pre-assembly, steel storage yard and construction store will be used for green belt after the project is commissioned.



3.2 LAND REQUIREMENT FOR FACILITIES OUTSIDE POWER PLANT BOUNDARY

3.2.1 Ash Disposal Area

The land requirement for the ash pond has been stipulated vide MOE&F notification dated 03.11.2009. As per the stipulations contained therein, the fly ash is required to be disposed off in dry form to the extent of 100% by the end of 4 years from the date of commissioning for new plants and accordingly the land requirement shall be up to 50 hectares (around 125 acres) for a 500 MW unit based on 45% ash content in the coal, or in the same proportion for units in other capacities taking into account the ash content in coal. Accordingly, land requirement for ash dyke has been worked out as below:

TABLE-9

S No:	Plant capacity	Coal Type	Area in acres	
			Land recommended earlier	Land now proposed
1	2x500	Indigenous	500	250
2	3x660	Indigenous	855	495
3	5x660	Indigenous	1370	825
4	6x660	Indigenous	1630	990
5	4x800	Indigenous	1000	800
6	5x800	Indigenous	1200	1000
7	3x660	Imported	240	110
8	5x800	Imported	390	220
9	6x660	Imported	400	220

Note: Ash content considered in coal: Indigenous (45%), imported (10%).

3.2.2 Township

Land requirement for township had been recommended in the earlier report as 100 acres for stations upto 2000 MW and 150 acres for stations upto 4000 MW. After deliberations, it was agreed that land requirement recommended for township in earlier report needs no further review.

3.2.3 Corridors for raw water intake, ash slurry pipeline & MGR/coal conveyors

The Committee deliberated on the land requirement for corridors for raw water intake, ash slurry pipeline and MGR/coal conveyors.



It was felt that area recommended in the earlier report, as indicated below, may be retained for corridors. However, corridors for coal conveyors for coastal stations has been revised based on inputs received.

a) Pit head / Load Center Stations using indigenous coal

TABLE-10A

S. No	Description	Land in acres					
		2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
1	Ash slurry disposal pipeline corridor	25	25	25	25	25	25
2	Corridors for MGR system	150	175	175	175	175	175
3	Corridor for Raw water pipe lines	35	35	35	35	35	35
4	Raw water pump house incl. desilting basin	10	10	15	15	15	15
	Total	220	245	250	250	250	250

Notes:

1. Area for ash slurry pipeline corridor is based on 10 km long pipeline and 10m wide corridor.
2. For MGR, rail distance of 20km with 30m wide corridor for single track has been considered for 2X500MW capacity station and MGR rail distance of 20km with 35m wide corridor for double track has been considered for other station capacities.
3. For raw water intake length of 10 km for raw water pipeline has been considered with 14 m width of corridor.



b) Coastal stations using imported coal

TABLE-10B

Land in acres

Sl. No	Description	3x660 MW	6x660 MW	5x800 MW
1	Ash slurry disposal pipeline corridor	25	25	25
2	Corridors for MGR system/ coal conveyors	75/ 60	75/ 60	75/ 60
3	Corridor for Raw water pipe lines	30	30	30
4	Raw water pump house incl. desilting basin	10	10	10
	Total	140/125	140/125	140/125

Notes:

1. Area for ash slurry pipeline corridor is based on 10 km long pipeline and 10m wide corridor.
2. For MGR, rail distance of 10 km with 30 m wide corridor has been considered. For conveyors distance of 10 km and 24 m wide corridor has been considered.
3. For raw water intake length of 10 km for raw water pipeline has been considered with 12 m width of corridor.

4.0 SUMMARY OF LAND REQUIREMENT

Based on the review of land requirement for various facilities/areas in thermal power stations, as above, the revised recommended land requirement has been worked out as under:



4.1 Pit head / Load Center Stations based on indigenous coal

Land requirement for different capacities of thermal power stations based on indigenous coal has been worked out in the following table:

TABLE-11

		Area in acres					
S. No	Description	2x500MW	3x660MW	5x660MW	6x660MW	4x800MW	5x800MW
<i>A. Facilities inside power plant boundary</i>							
1.	Main plant	20	44	72	88	82	100
2.	Coal Handling System	220	240	240	250	250	250
3.	Water system*	28 (45)	54 (90)	90 (135)	108 (150)	90 (135)	112 (150)
	Water reservoir [§]	30	60	100	120	100	120
4.	Switchyard	24	28	89	97	87	95
5.	Miscellaneous BOP facilities, stores, roads	66	83	98	111	93	104
6	Total (1 to 5 above)	388	509	689	774	702	781
7	Green belt	130	170	230	258	234	260
Sub-total		520	680	920	1030	940	1040
<i>B. Facilities outside power plant boundary</i>							
1	Ash disposal area	250	495	825	990	800	1000
2	Township	100	100	150	150	150	150
3	Corridors for ash slurry, raw water and coal [@]	220	245	250	250	250	250
GRAND TOTAL		1090	1520	2145	2420	2140	2440

Notes:

- *For Water system, the area indicated is with IDCT. In case NDCT is used the area will increase as indicated within brackets.
- [§]Water reservoir capacity has been arrived at considering depth of reservoir as 8m and storage requirement of 10 days.
- [@]Area for corridors may vary from station to station depending upon distance between the plant and ash dyke/raw water intake point and coal dispatch point.



4.2 Coastal Stations based on imported coal

Land requirement for coastal stations based on imported coal has been worked out in the following tables:

a) 3x660 MW

TABLE-12A

Area in acres

S. No	Description	3x660MW (With coal conveyor & without Cooling Tower)	3x660MW (With MGR & Cooling Tower)	3x660MW (With MGR & without Cooling Tower)	3x660MW (With coal conveyor & Cooling Tower)
A.	<i>Facilities inside power plant boundary</i>				
1	Main plant	30	30	30	30
2	Coal Handling system	60	150	150	60
3	Water system*	6	54 (90)	6	54 (90)
4	Switchyard	28	28	28	28
5	Miscellaneous BOP facilities, stores, roads	66	66	66	66
6	Total (1 to 5 above)	190	328	280	238
7	Green Belt	63	109	93	79
	Sub-total	255	435	375	320
B.	<i>Facilities outside power plant boundary</i>				
1	Ash disposal area	110	110	110	110
2	Township	100	100	100	100
3	Corridors for ash slurry, raw water and coal [@]	125	140	140	125
	GRAND TOTAL	590	785	725	655

Notes:

- *For Water system, the area indicated is with IDCT. In case NDCT is used the area will increase as indicated within brackets.
- [@]Area for corridors may vary from station to station depending upon distance between the plant and ash dyke/raw water intake point and coal dispatch point.



b) 5x800 MW

TABLE-12B

Area in acres

S. No	Description	5x800MW (With coal conveyor & without Cooling Tower)	5x800MW (With MGR & Cooling Tower)	5x800MW (With MGR & without Cooling Tower)	5x800MW (With coal conveyor & Cooling Tower)
<i>A. Facilities inside power plant boundary</i>					
1	Main plant	65	65	65	65
2	Coal Handling system	70	180	180	70
3	Water system*	8	112 (150)	8	112 (150)
4	Switchyard	95	95	95	95
5	Miscellaneous BOP facilities, stores, roads	86	86	86	86
6	Total (1 to 5 above)	324	538	434	428
7	Green Belt	108	180	145	143
	Sub-total	430	720	580	570
<i>B. Facilities outside power plant boundary</i>					
1	Ash disposal area	220	220	220	220
2	Township	150	150	150	150
3	Corridors for ash slurry, raw water and coal [@]	125	140	140	125
	GRAND TOTAL	925	1230	1090	1065

Notes:

- *For Water system, the area indicated is with IDCT. In case NDCT is used the area will increase as indicated within brackets.
- [@]Area for corridors may vary from station to station depending upon distance between the plant and ash dyke/raw water intake point and coal dispatch point.



a) 6x660 MW

TABLE-12C

Area in acres

S. No	Description	6x660MW (With coal conveyor & without Cooling Tower)	6x660MW (With MGR & Cooling Tower)	6x660MW (With MGR & without Cooling Tower)	6x660MW (With coal conveyor & Cooling Tower)
<i>A. Facilities inside power plant boundary</i>					
1	Main plant	60	60	60	60
2	Coal Handling system	70	180	180	70
3	Water system*	8	108 (150)	8	108 (150)
4	Switchyard	97	97	97	97
5	Miscellaneous BOP facilities, stores, roads	86	86	86	86
6	Total (1 to 5 above)	321	531	431	421
7	Green Belt	107	177	144	140
	Sub-total	430	710	575	560
<i>B. Facilities outside power plant boundary</i>					
1	Ash disposal area	220	220	220	220
2	Township	150	150	150	150
3	Corridors for ash slurry, raw water and coal [@]	125	140	140	125
	GRAND TOTAL	925	1220	1085	1055

Notes:

- *For Water system, the area indicated is with IDCT. In case NDCT is used the area will increase as indicated within brackets.
- [@]Area for corridors may vary from station to station depending upon distance between the plant and ash dyke/raw water intake point and coal dispatch point.



5.0 COMPARISON OF PROPOSED LAND REQUIREMENT VS EARLIER REPORT.

Comparison of area proposed now v/s area recommended earlier vide report of December 2007 is given in following Tables 13, 14A, 14B, 14C. It would be seen that major area reduction has been effected in the land requirement for ash dyke as a result of MOE&F notification dated 3rd November, 2009. There is also significant area reduction in land requirement for power plant.

a) Pit head / Load Center Stations using indigenous coal

TABLE-13

		Area in acres					
S. No	Description	2x500MW	3x660MW	5x660MW	6x660MW	4x800MW	5x800MW
A. Area for Facilities inside power plant boundary							
1.	Area as per 2007 report	600	850	1090	1250	1050	1170
2.	Area now proposed	520	680	920	1030	940	1040
	Reduction in area	80 (13%)	170 (20%)	170 (16%)	220 (18%)	110 (10%)	130 (11%)
B. Area for Ash Dyke							
1	Area as per 2007 report	500	855	1370	1630	1000	1200
2	Area now proposed	250	495	825	990	800	1000
	Reduction in area	250 (50%)	360 (42%)	545 (40%)	640 (39%)	200 (20%)	200 (17%)
C. Total Area for power plant							
1	Area as per 2007 report	1420	2050	2860	3280	2450	2770
2	Area now proposed	1090	1520	2145	2420	2140	2440
	Reduction in area	330 (23%)	530 (26%)	715 (25%)	860 (26%)	310 (13%)	330 (12%)



b) Coastal stations using imported coal (3x660 MW)

TABLE-14A

Area in acres

S. No	Description	3x660MW (With coal conveyor & without Cooling Tower)	3x660MW (With MGR & Cooling Tower)	3x660MW (With MGR & without Cooling Tower)	3x660MW (With coal conveyor & Cooling Tower)
A. Area for Facilities inside power plant boundary					
1.	Area as per report 2007	400	570	450	520
2.	Area being proposed	255	435	375	320
	Reduction in area	145 (36%)	135 (24%)	75 (17%)	200 (38%)
B. Area for Ash Dyke					
1.	Area as per report 2007	240	240	240	240
2.	Area being proposed	110	110	110	110
	Reduction in area	130 (54%)	130 (54%)	130 (54%)	130 (54%)
C. Total Area for power plant					
1.	Area as per report 2007	840	1050	930	960
2.	Area being proposed	590	785	725	655
	Reduction in area	250 (30%)	265 (25%)	205 (22%)	305 (32%)



c) Coastal stations using imported coal (5x800 MW)

TABLE-14B

Area in acres

S. No	Description	5x800MW (With coal conveyor & without Cooling Tower)	5x800MW (With MGR & Cooling Tower)	5x800MW (With MGR & without Cooling Tower)	5x800MW (With coal conveyor & Cooling Tower)
A. Area for Facilities inside power plant boundary					
1.	Area as per report 2007	570	840	640	770
2.	Area being proposed	430	720	580	570
	Reduction in area	140 (25%)	120 (14%)	60 (9%)	200 (26%)
B. Area for Ash Dyke					
1.	Area as per report 2007	390	390	390	390
2.	Area being proposed	220	220	220	220
	Reduction in area	170 (44%)	170 (44%)	170 (44%)	170 (44%)
C. Total Area for power plant					
1.	Area as per report 2007	1220	1530	1330	1420
2.	Area being proposed	925	1230	1090	1065
	Reduction in area	295 (24%)	300 (20%)	240 (18%)	355 (25%)



d) Coastal stations using imported coal (6x660 MW)

TABLE-14C

Area in acres

S. No	Description	6X660MW (With coal conveyor & without Cooling Tower)	6X660MW (With MGR & Cooling Tower)	6X660MW (With MGR & without Cooling Tower)	6X660MW (With coal conveyor & Cooling Tower)
A.	Area for Facilities inside power plant boundary				
1.	Area as per report 2007	630	880	690	840
2.	Area being proposed	430	710	575	560
	Reduction in area	200 (32%)	170 (19%)	115 (17%)	280 (33%)
B.	Area for Ash Dyke				
1.	Area as per report 2007	400	400	400	400
2.	Area being proposed	220	220	220	220
	Reduction in area	180 (45%)	180 (45%)	180 (45%)	180 (45%)
C.	Total Area for power plant				
1.	Area as per report 2007	1290	1580	1390	1500
2.	Area being proposed	925	1220	1085	1055
	Reduction in area	365 (28%)	360 (23%)	305 (22%)	445 (30%)



6.0 RECOMMENDATIONS:

Based on the review of land requirements for various facilities of thermal power plant, following are the recommendations of committee for stations based on indigenous coal and coastal stations based on imported coal:

a) Pit head / Load Center Stations using indigenous coal

TABLE-15

Area in acres

S. No	Description	2x500MW	3x660MW	5x660MW	6x660MW	4x800MW	5x800MW
1	Power plant	520 (0.52)	680 (0.34)	920 (0.28)	1030 (0.26)	940 (0.29)	1040 (0.26)
2	Ash disposal area	250	495	825	990	800	1000
3	Township	100	100	150	150	150	150
4	Corridors for ash slurry, raw water and coal	220	245	250	250	250	250
	GRAND TOTAL	1090 (1.09)	1520 (0.77)	2145 (0.65)	2420 (0.61)	2140 (0.67)	2440 (0.61)

b) Coastal stations using imported coal (3x660 MW)

TABLE-16A

Area in acres

S. No	Description	3x660MW (With coal conveyor & without Cooling Tower)	3x660MW (With MGR & Cooling Tower)	3x660MW (With MGR & without Cooling Tower)	3x660MW (With coal conveyor & Cooling Tower)
1	Power plant	255 (0.13)	435 (0.22)	375 (0.19)	320 (0.16)
2	Ash disposal area	110	110	110	110
3	Township	100	100	100	100
4	Corridors for ash slurry, raw water and coal	125	140	140	125
	GRAND TOTAL	590 (0.3)	785 (0.4)	725 (0.37)	655 (0.33)



c) Coastal Stations using imported coal (5x800 MW)

TABLE-16B

S. No	Description	Area in acres			
		5x800MW (With coal conveyor & without Cooling Tower)	5x800MW (With MGR & Cooling Tower)	5x800MW (With MGR & without Cooling Tower)	5x800MW (With coal conveyor & Cooling Tower)
1	Power plant	430 (0.11)	720 (0.18)	580 (0.14)	570 (0.14)
2	Ash disposal area	220	220	220	220
3	Township	150	150	150	150
4	Corridors for ash slurry, raw water and coal	125	140	140	125
	GRAND TOTAL	925 (0.23)	1230 (0.31)	1090 (0.27)	1065 (0.27)

d) Coastal stations using imported coal (6x660 MW)

TABLE-16C

S. No	Description	Area in acres			
		6x660MW (With coal conveyor & without Cooling Tower)	6x660MW (With MGR & Cooling Tower)	6x660MW (With MGR & without Cooling Tower)	6x660MW (With coal conveyor & Cooling Tower)
1	Power plant	430 (0.11)	710 (0.18)	575 (0.15)	560 (0.14)
2	Ash disposal area	220	220	220	220
3	Township	150	150	150	150
4	Corridors for ash slurry, raw water and coal	125	140	140	125
	GRAND TOTAL	925 (0.23)	1220 (0.31)	1085 (0.27)	1055 (0.27)

Notes:

1. Figures shown within bracket in Table-15,16A,16B & 16C indicate land requirement per megawatt.
2. Land indicated above is based on provision of IDCT. In case NDCT is used the land requirement will increase as indicated within brackets in Tables 11, 12A, 12B, 12C.



3. Space requirement is based on water reservoir capacity considering depth of reservoir as 8m and storage requirement of 10 days. Requirement will change from project to project depending on required storage capacity and depth of reservoir.
4. Area for corridors may vary from station to station depending upon distance between the plant and ash dyke/ raw water intake point/ coal dispatch point.
5. Additional land may be required for switchyard if other voltage levels such as 220 kV, 132 kV, 33 kV are required for specific projects.
6. Land requirement for switchyard can be further reduced to 30% in case Gas Insulated Switchgear Switchyard (GIS) is used. GIS option could be adopted in coastal areas or in areas where there is acute shortage of land.
7. Land requirement for coal storage & handling facilities can be reduced by about 50% in pit-head plants in cases where sized coal is dispatched from the mine end by conveyors instead of rail.

LAND REQUIREMENT FOR 765kV AND 400kV SWITCHYARD (1 ACRE = 4047 SQ. METER)

Description				2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW			
A	400kV system 1½ bkr. scheme	(1) I-type	Feeders/ Bays considered	2GT+2ST+4Line+2Line(F)+Bus Reactor (with line reactors) (Total 6 Is)	3GT+3ST+5Line+2Line(F)+Bus Reactor (with line reactors) (Total 7 Is)	5ST+3ICT+4Line+2Line(F)+Bus Reactor (with line reactors) (Total 8 Is)	6ST+3ICT+4Line+2Line(F)+Bus Reactor (with line reactors) (Total 8 Is)	4ST+3ICT+4Line+2Line(F)+Bus Reactor (with line reactors) (Total 8 Is)	5ST+3ICT+4Line+2Line(F)+Bus Reactor (with line reactors) (Total 8 Is)			
			W (mtr.)	202	229	256	256	256	256			
			D (mtr.)	312	312	312	312	312	312			
			A (acres)	15.57	17.65	19.74	19.74	19.74	19.74			
		(2) D-type	Feeders/ Bays considered	2GT+2ST+4Line+2Line(F)+Bus Reactor (with line reactors) (3 Ds on both side)	3GT+3ST+5Line+2Line(F)+Bus Reactor (with line reactors) (4 Ds on both side)	5ST+3ICT+4Line+2Line(F)+Bus Reactor (with line reactors) (4 Ds on both side)	6ST+3ICT+4Line+2Line(F)+Bus Reactor (with line reactors) (4 Ds on both side)	4ST+3ICT+4Line+2Line(F)+Bus Reactor (with line reactors) (4 Ds on both side)	5ST+3ICT+4Line+2Line(F)+Bus Reactor (with line reactors) (4 Ds on both side)			
			W (mtr.)	265	340	340	340	340	340			
			D (mtr.)	312	312	312	312	312	312			
			A (acres)	20.43	26.21	26.21	26.21	26.21	26.21			
			B	400kV system 2Main & Transfer bus scheme	I - type	Feeders/ Bays considered	2GT+2ST+4Line+2Line(F)+BC+BT+Bus Reactor (with line reactors) (Total 13 bays)	3GT+3ST+5Line+2Line(F)+BC+BT+Bus Reactor (with line reactors) (Total 16 bays)	5ST+3ICT+4Line+2Line(F)+BC+BT+Bus Reactor (with line reactors) (Total 17 bays)	6ST+3ICT+4Line+2Line(F)+BC+BT+Bus Reactor (with line reactors) (Total 18 bays)	4ST+3ICT+4Line+2Line(F)+BC+BT+Bus Reactor (with line reactors) (Total 16 bays)	5ST+3ICT+4Line+2Line(F)+BC+BT+Bus Reactor (with line reactors) (Total 17 bays)
						W (mtr.)	391	472	499	526	472	499
D (mtr.)	240	240				240	240	240	240			
A (acres)	23.19	27.99				29.59	31.19	27.99	29.59			
C	765kV system 1½ bkr. scheme	I - type	Feeders/ Bays considered	---	---	5GT+3ICT+3Line+2Line(F)+Bus Reactor (with line reactors) (Total 7 Is)	6GT+3ICT+3Line+2Line(F)+Bus Reactor (with line reactors) (Total 8 Is)	4GT+3ICT+3Line+2Line(F)+Bus Reactor (with line reactors) (Total 7 Is)	5GT+3ICT+3Line+2Line(F)+Bus Reactor (with line reactors) (Total 8 Is)			
			W (mtr.)	---	---	474	526	474	526			
			D (mtr.)	---	---	500	500	500	500			
			A (acres)	---	---	58.56	64.99	58.56	64.99			
D	Total	A(1)+C		15.57	17.65	78.30	84.72	78.30	84.72			
		A(2)+C		20.43	26.21	84.77	91.20	84.77	91.20			
		B+C		23.19	27.99	88.15	96.18	86.55	94.58			

Notes :

- 1) 90M width has been considered for switchable reactors (same shall be 80M for non-switchable reactors)
- 2) 70M width has been considered additionally for inter-connection between switchyards
- 3) 40M (20M on each side) has been considered for road and fencing
- 4) In case any other intermediate voltage level (132kV, 220kV etc.) is envisaged for any particular project, the land requirement for the same shall also be considered.