CESC LIMITED

PRE FEASIBILITY REPORT
FOR

2 X 660 MW THERMAL POWER STATION

AT BALAGARH, WEST BENGAL

MECON LIMITED
RANCHI-834002

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01. INTRODUCTION

CESC Limited, a 110 years old private sector utility engaged in generation and distribution of power in and around Kolkata, proposes to set up a 2x660 MW Thermal Power Plant at Balagarh, about 70 km from Kolkata.

The Balagarh Project was initially cleared by CEA and was granted Environmental Clearance by MoEF in the year 1992. The Project configuration was then 3x250 MW and was being pursued by WBPDCL. Later on, the Project was transferred to CESC Limited / BPCL (an SPV) for implementation with 2x250 MW configurations and the Environmental Clearance was transferred accordingly in 1995. All clearances were obtained by CESC / BPCL including 'NOC' from WBPCB.

CESC Limited started acquisition of land thereafter and presently has about 900 acres of land in its possession. This includes private, government as well as KoPT land. A lot of site enabling / infrastructure work has been done like construction of road bridge over the channel, construction power arrangement, test piling etc. About Rs. 70 Crores were spent in total.

CESC, however, could not pursue the project further due to various reasons. Instead a smaller project namely 250 MW Budge Budge Unit 3 was developed in the existing available space at that station.

Availability of suitable land and associated R&R issues are now the main bottlenecks in way of new power projects. In view of this and the fact that about 900 acres of land without any R&R implication is in possession of CESC at Balagarh, CESC has decided to utilize the land for setting up a super-critical power plant at this site.

Balagarh char being an island, Water and Power Consultancy Services (WAPCOS) was commissioned for the study of the stability of the island and need for necessary shore protection. They have submitted their report which concludes that the island is absolutely stable and recommended shore protection at strategic locations and an earthen embankment (level 10m above MSL) all around the site.

CESC now proposes to go ahead with the project with a revised configuration of 2x660 MW with super critical technology for its obvious environmental advantages.

M/s CESC Ltd has entrusted MECON limited vide LOI No. ED(P): BLR:683 for preparation of Pre-Feasibility Report (PFR) for 2x660 MW coal based thermal power plant at at Balagarh (Hoogly).The report is prepared to access the viability for the proposed power plant and addressing the following aspects-

- Promoter's Background
- Present power scenario and justification of the project with reference to state of West Bengal
- Various inputs required for the project
- Capacity and selection of technology for proposed power plant
- Description of major facilities and plant & equipments
- Environmental Aspect
- Clearances required
- Project implementation
- Block Capital cost

In addition to above, the report shall also highlight on preliminary plant layout, plant electrical distribution scheme etc.

02. PROMOTER'S BACKGROUND

M/s CESC Limited is a flagship company of RPG Enterprises, one of India's leading industrial houses. Starting as India's first fully integrated electrical utility, M/s CESC Limited have been generating and distributing electrical power in Kolkata and Howrah since 1897. They are the sole distributor of electricity within an area of 567 sq km of Kolkata and Howrah serving 2.3 million consumers which includes domestic, industrial and commercial users.

M/s CESC Limited own and operate four thermal power plants having total generating capacity of 1225 MW. These are Budge Budge Generating Station (750 MW), Southern Generating Station (135 MW), Titagarh Generating Station (240 MW) and New Cossipore Generating Station (100 MW). Almost 88% of the customers' electricity requirement is met from their own generating plants, rest 12% of electricity is purchased from third parties. More than 50% of the coal requirement is sourced from captive mines.

M/s CESC Limited also own and operate the Transmission & Distribution system through which they supply electricity to consumers.

M/s CESC is in process of setting up a number of power stations in the country. In view of this, M/s CESC Ltd has entrusted MECON limited to prepare pre-feasibility report for 2 x 660 MW Thermal Power Project at Balagarh in West Bengal.

03. PROJECT AT A GLANCE

An overall view of salient aspects and provision finally considered and adopted for the proposed plant are given in table-03.1.

Table – 03.1

Project at a Glance

Sl. No	Description of Facility	Facility Envisaged
1.	Installed capacity	1320 MW
2.	Configuration of the unit	2 x 660 MW Super-Critical PF Boilers with Steam Turbine and Generators
3.	Location and communication	The proposed site is located opposite to the confluence of Churni River and the River Hughli . It is close to Balagarh but separated from main landmass by a branch channel of River Hughli. The site is nearly 4.0 km from the Jirat railway station which is on Bandel –Barharawa section of Eastern Railway towards south of the proposed site. National Highway No. 2 (NH-2) is passing towards Western direction of site at a distance of 19 km from the site. Approximate latitude and longitude of the site is as follows: ▪ Latitude: 23°7' ▪ Longitude: 88° 30'
4.	**Land requirement**	
	Area of the proposed power plant (incl ash mound)	610
	Area for green belt	205
	c. Corridors	33 acres (Acquired by client for railway and road)
	d. Township	54 acres
5.	**Fuel Requirement**	
	a. Coal	6.56 Million Tonnes per annum at 85% plf for both units, considering GCV of coal as 3500 kCal/kg

Sl. No	Description of Facility	Facility Envisaged
	b. HFO/LSHS(for stabilization)	9200 KL/yr
	c. LDO (for start up)	625 KL/yr
6.	**Fuel Source**	
	a. Coal	As per long term coal linkage/coal block allocation from MOC, GOI
	b. Oil	From nearby Depots/ refinery.
7.	**Fuel Transportation**	
	a. Coal	By Railway wagon through MGR loop from coal mines to the plant.
	b. Oil	By Road tankers.
8.	**Fuel storage**	
	a. Coal	15 days storage for indigenous coal within plant boundary.
	b. HFO/LSHS	2 x 2000 KL capacity bulk storage tanks.
	c. LDO	2 x 500 KL capacity bulk storage tanks
9.	Fresh water	Requirement of fresh make-up water for two units has been estimated as 4325 m3/hr
9a.	Fresh water source	River Hoogly In order to meet requirement of make up water for the proposed plant, intake pump house, will be constructed at the intake point on river HOOGLI which is in the northern side of the proposed site.
9b.	Water transportation	Water from intake pump house shall be transported to site through pipelines.
9d.	Turbine condenser cooling system	Circulation system with induced draft cooling towers. Estimated requirement of water for condenser cooling of two units is 164000 m3/hr.
10.	**Ash collection & Disposal System**	
10a	Collection	Dry extraction and disposal with provision for wet disposal during exigency for fly ash. Bottom ash disposal in wet form has been envisaged.
10b	Annual Ash Generation	2.62 million tonnes at 85% plf and 40% ash in Coal for 2 units when firing worst coal.
11.	Chimney	One (1) no 275 m tall bi-flue R.C.C. chimney.
12.	Bulk Power Evacuation	Power is proposed to be evacuated to the 400kV grid by LILO of PGCIL Farakka- Jeerat Lines

Sl. No	Description of Facility	Facility Envisaged
13.	**Project Schedule**	
	Zero Date	Date of award of EPC contract
	Commercial operation of Unit – I	48 months
	Commercial operation of Unit – II	54 months
14.	Manpower	O&M personnel : Around 400
15.	Auxiliary power consumption	7.5%
16.	Tentative Project Cost	
a.	Indicative Project cost	Around Rs. 7000 Cr
b.	Indicative Cost of Generation	Depending on the allocation of coal block/linkage.

04. PROJECT NEED AND JUSTIFICATION

Inadequacy of available generation capacity has characterized power sector operation in India. From 2002-03 to 2008-09, power generation has grown from 543.4 billion units (BU) to 723.6 BU. India's per capita power consumption is quite low - around 700 kWh - compared to the world average of 2,600 kWh. However, in spite of the increased generation capacity and low per capita consumption, the country still faces an average peak demand shortfall of 12%. It is estimated that if the power shortfall needs to be made up, total investment of the order of US$ 200 billion would be needed during the next seven years.

Electricity Act 2003 has paved the way for faster capacity addition by encouraging the Private sector. CESC's decision to install a power station has given a new direction in the effort of Ministry of Power, Govt. of India to foster the Indian power sector.

CESC Limited is obliged to its consumers to provide uninterrupted power at all times to come, hence it is obvious that its generating capacity matches with the ever growing demand. Presently the peak demand is about 1600 MW and the installed capacity is 1225 MW. The rest has to be imported from various agencies and given the power scenario, it is at times difficult. To aggravate the situation, CESC has to close down one of its generating stations of 1947 vintage, for environmental considerations, which is still generating about 100 MW.

The peak demand of Kolkata is expected to gradually rise to about 2500 MW in the year 2016 – 2017. While 400 MW power will come into the system in 2013 from the upcoming Haldia Thermal Plant, the demand supply gap will continue to remain unless another base load station comes up.

In this context, the proposed 2x660 MW Power Plant at Balagarh will be the answer to the power situation in Kolkata as well as in the state of West Bengal in 2016 – 2017 and beyond.

Since, the 2 x 660 MW Thermal Power Project of M/s CESC shall be located in a region with nearby rich coal deposit state of Jharkhand, and nearness to water source, it will have an edge over other generating companies in establishment of new power generating units. In view of this it will be prudent to install a new power generating plant near Balagarh to meet the expected energy requirement and peak load demand of Kolkata and the State as a whole. Moreover the site is free from inhabitants and hence major issue of Rehabilitation and Resettlement does not exist. Considering all the above and the situation of West Bengal, it would be difficult to find a better site for a power plant in the State.

Requisite expertise and facility for installation and operation of coal based thermal units are available with M/s CESC. Also the infrastructure facilities like rail, road, water etc. exists near the proposed site and Govt. of West Bengal is committed to extend every kind of support for the power development in the state.

In conclusion, the factors justifying the installation of proposed project could be summarized as below:

1. Established power need at national level
2. Location of plant near coal rich state of Jharkhand for supply of indigenous coal for power plant.
3. Availability of acquired land by M/s CESC.
4. Availability of water near proposed plant.

5. Availability of infrastructure facilities like rail, road, construction power etc.
6. State Govt.'s entrepreneur friendly policies.
7. No Rehabilitation and Resettlement issues.
8. Minimum agricultural land.
9. M/s CESC's vast experience and in house capability to implement & operate thermal power plants.
10. Socio-economic contribution to the surroundings.

All the above facts justify and establish the installation of a thermal power plant of 2 x 660 MW capacity by establishing the proposed location i.e. Balagarh a potential site in West Bengal. Further details are provided in the following chapters.

05. SELECTION OF SITE

05.01 Availability of Resources

05.01.01 General

The basic requirement for setting up and operating a large green field thermal power station include availability of various resources and infrastructural facilities like land, water, fuel, construction materials, construction power & water, rail & roads, power evacuation & transmission network, and seismic condition, etc.

Relevant inputs required to assess the various infrastructural facilities as indicated above have been gathered through interaction with CESC officials, physical site visit, interaction with Govt. officials & local people at the proposed site and study of topo sheets.

05.01.02 Land

Land for the proposed Thermal Power Station (TPS) has been identified on the relevant topo sheet and as per data made available by client.
M/s CESC Limited has already earmarked an area of about 902 acres approximately in the proposed location including Rail –Cum- Road Corridor. Terrain of the proposed site is sloping down from north west to south east whereas site contour varies generally from 4m to 15 m. The High flood level of the area is 9.25m.

05.01.03 Water

Thermal power station requires substantial quantity of water for process needs as well as for various services including fire fighting, etc. Requirement of fresh make-up water for the proposed TPS has been estimated as 4325 m3/hr. In order to meet requirement of make up water for the proposed plant, an intake pump house, will be constructed at the intake point on river HOOGLI which is in the northern side of the proposed site.

05.01.04 Fuel

a) Coal:

Coal is the main fuel for thermal power plant. Requirement of coal for the proposed TPS has been estimated as 6.56 Million Tonnes per Annum (at 85% plf) based on GCV of 3500 Kcal/kg and 40% ash. However, M/s CESC shall take initiative for allocation of suitable coal mines for supplying fuel for this project.

Transportation of coal will generally be by Railway wagons.

b) Oil:

The oil (HFO / LDO) requirement for Thermal Power Plant of this capacity will be considerably high. Hence, separate facilities to receive oil by road have been planned.

05.02 Availability of Infrastructure Facilities and material for construction

a) Road

National Highway No. 2 (NH-2) is passing towards Western direction of site at a distance of 19 km from the site. The SH-6 connecting Jeewdhara to Bandel runs at about 4 km away from the proposed plant site in its Western direction. An approach road connecting proposed site & taking off from the SH-6 is already existing. CESC has also invested and constructed a two lane road bridge to site over the branch channel of the river Hoogly..

b) Railway siding:

Jirat Railway station lies on Bandel –Barharawa section of Eastern Railway has been identified as serving station for the proposed plant. Jirat Railway station is located towards south of the proposed site at a distance of approximately 4.0 km. Detail feasibility study for establishing siding from Jirat railway station and augmentation of the station etc.

05.03 Environmental and Ecological Aspects

The proposed site is located on the right bank of river Hugli near the confluence with churni river. The land falls within Bhawanipur char area under Balagarh police station of Hugli district. The site area in an eye – shaped island with the Hugli river flowing along its northern side and a branch channel on its south.

Balagarh island, is presently being partly utilized for cultivation of various summer and winter vegetable. There is no declared forest land around 25 km of the proposed site. As there is no forest in this area, no known important wild life is recorded. There is no sanctuary, places of archaeological, historical, cultural, religions or tourist importance and deference establishment in near vicinity of the site.

The Balagarh Project was initially cleared by CEA and was granted Environmental Clearance by MoEF in the year 1992. The Project configuration was then 3x250 MW and was being pursued by WBPDCL. Later on, the Project was transferred to CESC Limited / BPCL (an SPV) for implementation with 2x250 MW configurations and the Environmental Clearance was transferred accordingly in 1995. All clearances were obtained by CESC / BPCL including 'NOC' from WBPCB.

05.04 Merits of the site and Reasons for selecting the site:

- Stability study of the site has been carried out by WAPCOS and found to be in order i.e. the island site is stable and not sinking

- The land is almost free from habitants, hence require very nominal or nil rehabilitation. Given the highest population density in the country, it is almost impossible to find out 1000 acres of land at a stretch free from habitation in West Bengal

- About 900 acres of land is under the possession of CESC. Also, the rail & road corridors are under their possession.

- MOE&F has cleared the site twice
- M/s CESC has already invested substantial amount for creating infrastructures.
- Raising the elevation of the plant proper and the roads may reduce cost of soil filling.
- The site is located very near to the load center, requiring less transmission losses.
- Rail & road connectivity of the site is very good.

05.05 Conclusion

The site consists of vast stretch of land which otherwise would have been wasted, unless any industrial set up is permitted in that land. Considering the above, this site deserves clearance for setting up of a power station of given capacity.

06. PLANT LOCATION

GENERAL

M/s CESC Limited has proposed to install a 2x660 MW Thermal Power Plant at Balagarh in Hoogly District of West Bengal State.

LOCATION

The proposed site is located opposite to the confluence of Churni River and the River Hoogly. It is close to Balagarh but separated from main landmass by a branch channel of River Hoogly. The site is nearly 4.0 km to the Jirat railway station which is on Bandel –Barharawa section of Eastern Railway towards south of the proposed site.

National Highway No. 2 (NH-2) is passing towards Western direction of site at a distance of 19 km from the site.

Approximate latitude and longitude of the site is as follows:

- Latitude: Around 23^0 7'
- Longitude: Around 88^0 30'

Location & regional plan of proposed site is shown on drawing no. MEC/11/14/Q6RP/FR/04

LAND & TERRAIN

M/s CESC Limited has already earmarked an area of about 902 acres in the proposed location including Rail –Cum- Road Corridor. Terrain of the proposed site is sloping down from North West to south east whereas site contour varies from 4m to 15 m. The High flood level of the area is 9.25m.

METEOROLOGICAL DATA

Due to non availability of metrological data of Balagarh, The available data of nearest metrological station at Krishnanagar has been used. Krishnanagar is situated about 80 kilometers from the proposed site by rail.

Air Temperature

- Maximum temperature : 46.1^{o}C
- Minimum temperature : 3.9 ^{o}C
- Daily Average temperature (Max) : 33.0 ^{o}C
- Daily Average temperature (Min) : 20.1 ^{o}C

Relative Humidity

- Minimum : 40 %.
- Maximum : 85 %.
- Annual Average : 68.5 %

Rainfall

- Average annual rainfall : 1372.80 mm
- Heaviest fall in 24 Hrs : 293.90 mm

Wind

- Predominant wind directions : From South,
- Speed : 1-19Km/Hr

Seismic Zone

- Zone : III

RAIL INFRASTRUCTURE

Jirat Railway station lies on Bandel –Barharawa section of Eastern Railway has been identified as serving station for the proposed plant. Jirat Railway station is located towards south of the

proposed site at a distance of approximately 4.0 km. Detail feasibility study for establishing siding from Jirat railway station and augmentation of the station etc.

ROAD INFRASTRUCTURE

The SH-6 connecting Jeewdhara to Bandel runs at about 4 km away from the proposed plant site in its Western direction. An approach road connecting proposed site & taking off from the SH-6 already exists. The road needs widening & strengthening.

WATER

Thermal power station requires substantial quantity of water for process needs as well as for various services including fire fighting, etc. Requirement of fresh make-up water for the proposed TPS has been estimated as 4325 m3/hr.

In order to meet requirement of make up water for the proposed plant, an intake pump house will be constructed at the intake point on river HOOGLI which is in the northern side of the proposed site.

The flow in the river appears to be sufficient as observed during visit in the month of March 2010 and subsequent discussions. HOOGLI is a perennial river and other small rivers are joining the same. Make up water for the power plant has been proposed to be drawn from Hoogli river. For which necessary studies for intake pump house has been done by M/s WAPCOS and tentative location has been proposed by them. Necessary permission for intake pump house shall be obtained from CWC by CESC. The raw water from the intake pump house will be pumped to the plant WTP. The outflow point will be planned upstream of the intake point of the river as per MOE&F guidelines.

POWER EVACUATION

Power is proposed to be evacuated at 400 KV by LILO of PGCIL Jeerat-Farakka Lines.

CONSTRUCTION POWER

Construction Power will be availed from 33 kV/11kV Balagarh substation, through a 33 kV feeder. A 33kV/11kV construction Power substation will be constructed within plant premises for the purpose.

07. CAPACITY, UNIT SIZE AND TECHNOLOGY SELECTION

07.01 Capacity Selection of the Project

M/s CESC Limited has planned to set up a coal based power plant at Balagarh in West Bengal. Based on available infrastructure, the proposed capacity of the power project is 1320 MW.

07.02 Selection of Unit Size

Different alternatives of proven unit size, available in India for the proposed coal fired 1320 MW power plant, could be 6 x 210 MW; 5 x 250 MW, 4 x 330 MW , 2 x 600 MW and 2 x 660 MW. 2 x 660 MW is a better option because of operational and environmental considerations.

07.03 Technology Selection:

The emission of Carbon Dioxide to atmosphere could be reduced in significant quantum by adopting advanced combustion technologies. The various technological options includes Sub-critical Technology; Supercritical Technology. The supercritical technology is a better option from the efficiency, part load operation and environmental performance point of view. Although with higher steam parameters, the investment cost goes up on account of increase in the cost of boiler and turbine island equipment; yet with higher plant efficiency, the incremental investment cost shall be recovered within initial years of operation.

07.04 CONCLUSION

- Capacity of the proposed thermal power plant has been limited to 1320 MW considering the following factors :

- Requirement as stated by M/s CESC.
- Availability of infrastructure facilities like land, water and railway connectivity, etc.
- Optimum utilization of the said infrastructure facilities.

- The proposed 1320 MW power plant will consist of 2 nos. of 660 MW units.
- The power plant will be based on super critical power generation technology utilizing domestic non coking coal with approx GCV 3500 kcal/kg and 40 % ash.
- Unit size and technology for the proposed power plant have been selected keeping in view of the faster capacity addition, economics, availability of state-of-the-art technology, environmental concerns, level of confidence of various operating plants around the world and the upcoming plants in the Country.

08. GENERAL LAYOUT AND TRANSPORTATION

RATIONALE FOR LAYOUT

The general layout of the proposed ultimate capacity of 2x660 MW power plant has been developed keeping in view of following major factors:

- Existing ground level of the proposed site & optimum earthwork
- Safety of plant from river bank erosion & Proposal of Bund wall
- Shape and size of the proposed site
- Predominant wind direction
- Smooth and uninterrupted flow of material with optimum lead of transportation
    - Optimum lead for service lines
    - Maximum utilization of the available land
    - Logistic approach in location of technological units as well as services.

LOCATION OF VARIOUS UNITS

Major units / facilities envisaged for the proposed complex are as follows:

- Coal storage yard
- Wagon tippler
- Track Hopper
- 2x660 MW power plant complex
- TG Hall
- Transformer yard
- Switchyard
- Compressed air station
- LDO Storage
- Ash Silos
- Repair shop
- Canteen

- Administrative building
- Rail weigh bridge
- Ash Dump

Respective location of all units are shown in general layout drawings no. MEC/11/14/Q6RP/PFR/04

For the proposed plant, the receipt of Coal will be carried out by rail. Storage and handling facilities have been planned towards east direction with smooth road entry from existing approach road with due consideration of predominant wind direction.

The Boiler building & Switch Yard have been planned suitably. Switch Yard has been located in the periphery & west direction of the plant for ease of power evacuation to the grid.
The main sub-station building, water supply and electrical facilities have been planned suitably to cater the needs of plant units. A well planned road network envisaged to cater the need of technological units and various auxiliary units.

Separate welfare facilities like administrative building, canteen, security posts, rest shed and parking lot are envisaged for the proposed plant.

The salient features of the general layout are indicated below:

- Area of the proposed power plant (incl ash mound) : 610 Acre
- Area for green belt : 205 acres
- Are for corridors : 33 acres
- Area for township : 54 acres
- 11.0m wide road : 1.50 KM
- 7.0m wide road with 2m berm on either side : 11.0 KM
- 4.0m wide road with 2m berm on either side : 11.0 KM
- Length of Boundary wall/embankment : 8.0 KM
- Length of railway tracks inside plant boundary : 14.0 KM
- No. of watch towers : 13 nos

- No. of road gates : 2 nos.
- No. of rail gate : 1 no.

TRANSPORTATION

Coal for boiler will be generally transported by railway track. Fly ash in dry condition collected in over head Silos will be dispatched outside plant boundary in contractor's road vehicle i.e in road tankers or to ash mound by HCSD system.

09. DESCRIPTION OF PLANT & EQUIPMENT

09.01 STEAM GENERATORS AND AUXILIARIES

The steam generators will be vertical, once through, outdoor, assisted circulation, single reheat, dry bottom, balanced draft type designed to burn 100% pulverised Coal. For initial start-up LDO has been proposed to be used. Provision to fire HFO / LSHS for flame stabilization and low load operation has also been envisaged. The power plant will operate on unit concept basis i.e. one steam generator will be connected with one steam turbine.

Each Steam Generator will largely comprise of a wholly water cooled combustion chamber, steam separator vessel, super heater sections, re-heater section, plane tube economiser, soot blowers, forced draft fans, induced draft fans, regenerative air heaters, coal mills N +2 configuration (vertical pressurized type) each with one gravimetric feeder (no. of mills may be finalized after receipt of actual coal analysis), PA fans, seal air fans, coal burners, oil burners, igniters for burner light-up, steam coil air pre heaters etc. Each steam generator will be provided with electrostatic precipitator, designed to limit the outlet dust emissions to below 50 mg/Nm3 under normal operating conditions. Boilers shall be designed for low Nox emission.

The steam generators and auxiliaries will be designed for burning coal. Although, the composition of coal may vary, the average value has been adopted for the purpose of this report. Accordingly, coal with an average GCV of 3500 kcal/kg has been considered for working out the coal requirement, storage capacity, etc.

Each steam generator is sized to have a maximum continuous rating steam at super-heater outlet with steam parameters of pressure 252 bar and temperature 540^0C & 568^0C at SH and RH outlet respectively, when supplied with a feed water temperature of 258^0C. The steam generator will be capable of catering to

the requirement of the associated turbine with control valves wide open (VWO) condition, simultaneously meeting the auxiliary steam requirement of the steam generator. Indicative main parameters for the steam generator conditions are summarized below-

PARAMETER	UNIT	VALUE
Main Steam Flow at BMCR	Tones per hour	2240 (at VWO condition) minimum
Main Steam at SH outlet		
- Pressure	Kg/cm2	252
- Temperature	^{0}C	540 +/- 5 or higher
Main Steam at Turbine Inlet		
- Pressure	Kg/cm2 (g)	247
- Temperature	^{0}C	537 +/- 5 or higher
RH outlet		
- Temperature	^{0}C	568 +/- 5 or higher

The main steam, cold-reheat and hot reheat temperatures will be controlled within close tolerance without oil firing. The steam generators will be designed to operate with the HP heaters out condition to supply steam at TMCR condition.

09.02 TURBINE & AUXILIARIES

a) General

The steam turbine will be three cylinder, multi stage, tandem compounded, single reheat, condensing type with separate HP, IP or combined HP-IP and LP casings directly coupled with generator and suitable for indoor installation; and provision of uncontrolled extractions for regenerative feed heating. The turbine shall be of reaction type. The main steam parameters at turbine inlet will be 247 bar, 537°C and reheat temp. of 565°C. The T.G. set is designed for a maximum throttle steam flow at turbine valve wide open (VWO) condition of 105% of turbine MCR-conditions. The turbine will be designed for H.P. and L.P. bypass system of 60% boiler MCR capacity. The turbine design will cover adequate provision for quick start up and loading of units to full load at fast rate. Apart from constant pressure operation, the turbine will also have the facility for sliding pressure operation.

b) Turbine Lube-oil system

Each steam turbine generator unit will be equipped with electronic / electro hydraulic governing system. The turbine governing and lub oil system will comprise of the following:

i) One steam turbine shaft driven main oil pump.

ii) 2x100% capacity A.C. motor driven auxiliary oil pump.

iii) 1x100% capacity D.C. motor driven emergency oil pump.

iv) One A.C. motor driven jacking oil pump and one 100% capacity D.C. motor driven jacking oil pump.

v) 2x100% capacity oil coolers.

vi) Oil tanks.

vii) Lube oil purification equipment capable of treating 20% of oil change in the system on a continuous basis per hour.

c) Condenser

The condensers shall be of surface type, single shell, double pass with divided water box construction having two independent circulating water inlets and outlets. The tubes of the condenser will be of Stainless Steel suitable for the available cooling water. The condenser will have on-line tube cleaning system.

d) Condensate Extraction pumps

Three (3) x 50% capacity, vertical, multistage, centrifugal "condensate extraction" pumps will be provided for each unit to pump condensate from condenser hot well to the "deaerator" through the "gland steam condenser", “condensate polishing unit”, "drain cooler" and “low pressure heaters”.

e) Air extraction system

Two (2) x 100% capacity "vacuum pumps" along with all accessories and instrumentation are provided for each unit to create and maintain vacuum in the condenser by expelling the non-condensible gases. The pumps are capable of maintaining 0.1033ata pressure at the turbine exhaust at design cooling water temperature.

f) Condensate Polishing Plant

The condensate polishing plant (CPP) would be deep-bed ion exchange type and one 100% capacity plant would be provided for each 660 MW unit. Each unit will have 2x50% capacity service vessels. Both the plants will have a common external regeneration system.

g) Regenerative Feed Heating System

The regenerative feed water heating plant will comprise Low Pressure heaters, one drain cooler, one deaerating feed water heater and High

Pressure heaters. The number of LP and HP heaters shall be based on optimization of feed heating cycle.

Feed water shall be heated by uncontrolled turbine extraction steam from turbine inter stage tap offs and cold reheat line in feed water heaters depending upon optimization of cycle. The deaerator shall normally operate under variable pressure on extraction steam from IP turbine exhaust to LP turbine. Each feed water shall be capable of handling the drains from the preceding heater under operating condition of the unit.

h) Deaerator

The deaerator shall be of spray type designed to operate at variable pressure and to deliver the feed water with maximum oxygen content of 0.005cc/litre. Oxygenated water treatment (OWT) system has been envisaged to minimize tube corrosion.

i) Boiler Feed Pumps

Two (2) turbine driven boiler feed pumps of 50% capacity each and one (1) x 50% capacity motor driven feed pump (as stand-by) for each 660 MW unit have been envisaged to pump feed water from the deaerator, through the HP heaters to economiser. The parameters of each BFP shall be designed to suit the steam generator requirements such that two feed pumps shall be capable of meeting the full requirements of the boiler with the third pump as stand by.

9.03 COAL HANDLING SYSTEM

M/S CESC Limited intends to set up a 2x660 MW Coal based Thermal Power Plant at Balagarh, West Bengal. The coal handling system envisaged for two generating units of 660 MW each shall consume approximately 880 tonnes per hour (TPH) of coal (considering GCV of 3500 kcal/kg.) at 100% plf. Thus maximum 21120 tonnes of coal needs to be handled per day at 100% Plant Load Factor. Two-shift operation of twelve hours (12 hours) has been considered for the Coal Handling Plant.

Six (6) to Seven (7) rakes of coal of 59 wagons shall be required every day at plant premises for 21120 tonnes requirements of coal.

Unloading System

Full rake of wagons of coal (Max. lump size (-) 300 mm) is brought to the Track Hopper (capacity 6000 t of coal) by loco of the power plant premises.

Two (2) nos conveyors below the track hopper have been envisaged. Each conveyor will be provided with 2 nos paddle feeders each PF with reclaiming capacity of 1500 tph. One no.conveyor below track hopper shall be in working mode under normal conditions & will transport the coal to crusher house.

In case of non availability of BOBR (bottom discharge) wagons, the coal shall be transported to plant by wagons of type BOX-N, BOXNHA, BOY & BOX of other type as per IS:10095-1982. The same shall be discharged to underground hopper by wagon tippler and shall be conveyed to crusher house.

Crushing, stockpiling & feeding of crushed coal

Under normal operating condition, the crushed coal shall be conveyed directly to the boiler bunker by a series of conveyors. However, in case the Boiler Bunker

are not in a position to receive the materials, the coal shall be stacked with the help of three (3) nos. stacker-cum-reclaimer @ 1500 TPH each to form two (2) nos. triangular stockpiles of 30 m width and 10.5 m high & two (2) nos. trapezoidal stockpiles of 45m width and 8 m high. To maintain constant coal supply to the bunkers, crushed coal equivalent to 15 days consumption will be stored in the yard. In the event of non-availability of coal directly from the track hopper/wagon tippler and simultaneous requirement of coal in the boiler bunkers, stacked- crushed coal shall be reclaimed by one of the 3 nos. stacker cum reclaimer (@ 1500 tph) and will be transported to the boiler bunkers by a series of conveyors.

Auxiliary facilities

Suitable Dust Suppression system/ dust extraction system shall be provided in the Track Hopper Station, Wagon tippler building, Crusher house and at all transfer points and Bunker House. Plain water sprinkling system has been envisaged for the stock piles. Fire fighting facilities shall be provided in the stock yard and Fire detection & Alarm system shall be provided all along the conveyor route.

A ventilation system has been envisaged for the underground Track Hopper and tunnels. Automatic coal sampling unit has been envisaged in the crusher house for crushed coal.

09.04 FUEL OIL SYSTEM

The steam generator of power station will be designed for 100% coal firing. However, Fuel oil (HFO/LSHS/) will be required for flame stabilization at low load and for hot start-up, the Light Diesel Oil (LDO) will be used for cold start- up, warming up and commissioning of the units.

HFO will be required up to 30% of boiler MCR loading during very low load operation of steam generators. The maximum oil requirement during low load operation will be 46 t/h. per unit.

LDO requirement has been estimated based on four hours operation of maximum 10 % heat load during cold starting of the unit. The maximum oil requirement is 15t/h per unit.

For storage of HFO, it has been envisaged to provide 2 nos. of fabricated cylindrical vertical mild steel tanks each of capacity 2000 KL. The tanks will be designed as per IS:803-1976. Each tank will be provided with all standard accessories and fittings, thermal insulation, steam heated type floor coil heater and suction heater. The floor coil heater and outflow suction heater will be adequately designed to meet the temperature requirement of heavy fuel oil at desired conditions.

LDO will be stored in 2 nos. fabricated vertical cylindrical storage tanks of capacity 500 KL each. The capacity will be adequate to meet the total LDO requirement of one unit during start-up and commissioning. The tanks will be designed as per IS: 803-1976 and will be provided with all standard accessories and fittings.

A set of pressurizing pumps have been envisaged for pumping the oil to the steam generators.

09.05 PLANT WATER SYSTEM

General

Plant water system consists of raw water system & pre-treatment, condenser cooling water system, auxiliary cooling water system, filtration plant, demineralization plant and other system including fire hydrant & high velocity spray system.

The estimated water requirement for the proposed power plant is indicated in Table.

Table

Sl. No.	Description	Circulating Water (m^3/h)	DM Water Closed Circulation System (m^3/h)	Total Fresh Make-up Water (m^3/h)
1.	Turbine condenser cooling	156000	-	3410
2.	Cooling of Boiler & Turbine auxiliaries	8000 (Secondary Side)	8000 (Primary Side)	175
3.	DM water make-up for Boiler, ACW Primary System & H_2 Plant	-	-	250
4.	Ash flushing water	-	-	100
5.	Loss in water treatment plant, reservoir and transportation, drinking water.	-	-	290
6.	Drinking & other sanitation needs (plant and township)	-	-	100
	TOTAL	164000	8000	4325
	Total fresh water required from the source			**4325**

The fresh make-up water requirement from source will be to the order of 4325 m3/h in initial stage COC considered for calculating the water requirement is 4.

Source of water

River Hoogly is considered as the source of water for the project. Intake pump house on the river has been proposed. Water shall be drawn from the intake upto the plant. The flow in the river appears to be sufficient as observed during visit in the month of March 2010 and subsequent discussions. HOOGLI is a perennial river and other small rivers are joining the same. Necessary studies for intake pump house has been done by M/s WAPCOS and tentative location has been proposed by them. Necessary permission for intake pump house shall be obtained from CWC by CESC.

Make – up Water System

Since intake well from Hoogli river is adjacent to the proposed site no raw water reservoir has been considered. Raw water from intake pump house shall be pumped to the raw water treatment.

Raw water will be pumped from the intake pump house and will be treated in the pre-treatment plant. Pre treatment is provided to remove suspended solids and colloidal matter, etc. from the raw water. The pre treatment plant will broadly consist of

a) Chemical dosing facility
b) Chemical house
c) Clarifiers
d) Clarified water storage tank
e) Clarified water pump house
f) Sludge pump house

Clarified water will be stored in a clarified water storage tank. Separate group of pumps will be provided for pumping of clarified water as make – up water to common

pump house for condenser cooling and auxiliary cooling system and also to filtration plant and make up water to various consumers

Condenser cooling and auxiliaries cooling water re – circulation System

Total quantity of circulation water for the condenser cooling system and auxiliary cooling system for the proposed 2 units of 660MW power plant has been estimated as 164000 m^3/h.

A common pump house will be provided for condenser cooling and auxiliaries cooling system with arrangement of forebay and provision of vertical turbine pumps for supply of water to the condenser and steam turbine generator auxiliaries and other station auxiliaries. Two groups of pumps shall be provided – Group –1 for supply of water to Condenser cooling of Turbine Generators and Group – 2 for auxiliary cooling of turbine generators, boilers and other station auxiliaries.

Hot water from the condenser units and return hot water from auxiliary cooling system will be taken to the unitized cooling towers (with provision of spare cell).

Chlorination and chemical dosing system for scale inhibition are planned.

Filtration Plant

A filtration plant has been envisaged for rendering the influent clarified water to filtered water quality for meeting the plant filtered water requirement.

The filtered water will be stored in a filtered water storage tank. Requisite quantities of filtered water will be pumped from the storage tank to a) the drinking water overhead tank for the plant and b) make up water to the DM plant as well as to the backwash water over head tank respectively by means of separate group of pumps.

Demineralization Plant

A DM water plant of 3 streams (2 Working and 1 Standby) each of 125 Cum/hr normal capacity have been envisaged.

Other Services

a) Service Water System

The service water system will cover supply of blow-down water from condenser cooling water system and auxiliary cooling water system, required for the following:

1. CHP dust suppression
2. Booster pump sealing
3. AC & air wash make-up
4. Air pre-heater washing
5. Washing of boiler platform
6. Boiler access door & inspection door cooling
7. Plant washing and gardening
8. Horticulture

b) Fire fighting water system

In order to cater for any occurrence of fire, comprehensive fire fighting facility inside the plant shall be provided to meet the requirement of proposed 2 x 660MW power plant.

A network of underground hydrant mains and over ground wet risers with necessary hydrants and hydrant accessories at all strategic locations shall be provided.

c) Reuse of Blow down

The blow down water from the cooling towers will be stored in a sump and will be pumped to an overhead tank. From the overhead tank it will be reused for CHP dust suppression, plant washing, gardening, green belt development and boiler and auxiliaries.

09.06 HYDROGEN GENERATING PLANT

General

Hydrogen gas is required for cooling of rotor winding and stator core of generators. For the proposed power plant comprising 2x660 MW units, the requirements of hydrogen for initial filling and continuous makeup is proposed to be met by installation of a hydrogen generating plant within the power station area. The hydrogen generating plant will consist of 3 streams (2W+1S) of adequate capacity. The hydrogen gas produced will be stored in cylinder under pressure and can be used as when required in the power station.

09.07 COMPRESSED AIR SYSTEM

There will be a centralized Compressed Air station for 2x660 MW units. The compressed air system can be broadly classified into two categories i.e. Instrument Air system and Service Air system.

Instrument Air System

To meet the instrument air requirement of the 2 x 660 MW power plant four (4) nos. non-lubricated, multi-stage, horizontal reciprocating type or screw type air compressors shall be envisaged. Four (4) nos. Heat Of Compression (HOC) type air dryers of matching capacity have been envisaged for the plant, to obtain dry air having a dew point temperature of – 40^0C at atmospheric pressure. Four (4) nos. dedicated air receivers have also been envisaged.

Service Air System

To meet the service air requirement of the plant, Three (3) nos. multi-stage horizontal, reciprocating type or screw type air compressors each of adequate capacity have been envisaged for 2x660 MW units. Selection of service air compressors have been made matching with the capacity of instrument air compressor. Three (3) no. dedicated air receivers each of capacity have also been envisaged.

09.08 ASH HANDLING SYSTEM

The worst coal ash content is 40%. At 100% BMCR with design coal firing, the total ash generation will be around 150 tonnes/hour per boiler at 85% plf. The ash generated will be collected in the following forms:-

a) Bottom Ash
b) Economiser Ash
c) Fly Ash

Bottom Ash Removal System

Maximum 20% of the total ash produced in the boiler will be collected in a water impounded refractory lined furnace hopper as bottom ash. A set of clinker grinders and jet pumps will be mounted at the hopper outlet to crush the clinkers and finally the bottom ash will be disposed off to the Dewatering bin, settling and surge tanks and water will be recycled.

Economiser Ash Handling

Ash collected in economizer hoppers will drop continuously to the hoppers. The economizer ash will be pneumatically conveyed to ash silo from where it may be disposed of in dry form or in HCSD form, in case of emergency, to the ash mound through HCSD system.

Fly Ash Handling System

Dry Fly Ash Extraction and Transportation System

The dry fly ash handling system consists of ESP, & air-preheater removal system. Two stage fly ash conveying system has been envisaged. The first stage shall include extraction of dry fly ash from various ESP/APH/ hoppers to the

intermediate/buffer storage tanks located near the ESPs. In the second stage ash shall be conveyed/transported from the buffer hoppers to the storage silos.

Ash Disposal System

Normally fly ash will be collected in main silos and will be disposed dry as mentioned above to the prospective users. In case of any problem in normal operational mode of dry ash disposal either at power plant end or at consumer ends and/ or in case of any emergency/ unforeseen situations, ash will be disposed off in HCSD form fully or partly to the ash mound.

Water Facilities for Ash Handling System

For the purpose of water supply to the ash handling system, an over ground RCC tank has been envisaged which will be installed adjacent to the combined ash slurry & ash water pump house. Water supply to the tank/ ash handling system will be met from following sources:

a) CW System Blow down.
b) Return seal water.
c) Under flow from RW pre-treatment plant.
d) Balance – fresh water.

Ash Utilisation

Approximately 2.10 million tons/annum fly ash and 0.52 million tons/annum bottom ash will be generated from the proposed 2 x 660 MW Power Plant at 85% plf. Ash will be collected in dry form and will be utilized either for filling of low lands or for manufacturing bricks and cement or for road construction.

09.09 AIR CONDITIONING & VENTILATION FACILITIES

Air Conditioning

To ensure the proper working environment for men and machines and to maintain necessary environmental conditions, adequate air-conditioning facilities have been envisaged for various premises of the proposed Thermal Power Station. The various premises considered for air – conditioning systems / facilities are as follows :-

a) Unit control room, computer rooms SWAS (DRY) panel room & UPS room, equipment control rooms.
b) ESP control rooms.
c) Switchyard control room.
d) Service building – different rooms at different floors.
e) Coal handling yard control room.
f) Administration building – different rooms at different floors.
g) Control Room of CW Pump House.
h) DM plant control room.
i) Ash handling control room.

Ventilation Systems

To ensure the proper working environment for men & machines and to maintain necessary environmental conditions, adequate ventilation facilities have been envisaged for various premises of proposed Thermal Power Station of CSECL. The various premises considered for ventilation facilities / systems are as follows:-

01. Turbo Generator Hall.
02. Switch Gear Rooms.
03. MCC Rooms.

04. Cable Vaults.
05. Switch Gear cum MCC Rooms.
06. Battery Rooms and other Electrical Rooms.
07. Pump Houses.
08. Compressed Air Station.
09. Diesel Generator Station.
10. Chemical House.
11. Storage Rooms.
12. Hydrogen Plant.
13. Toilets etc.

09.10 INDUSTRIAL SAFETY AND FIRE FIGHTING

Safety of Personnel

All workmen employed in hazardous working conditions will be provided with adequate personnel safety appliances like:

- Industrial safety boots
- Industrial helmets
- Hand gloves - Ear muffs
- Welder's screens and aprons

Fire Fighting Facilities

Fire fighting water will be taken from CW pump house forebay.

Hydrant System

Internal hydrants will be provided in all major plant units at suitable locations and in different levels inside the plant buildings. Yard hydrants will be provided in the vicinity of each plant unit, normally along the road to meet the additional requirement of water to extinguish fire. The details of pumps are indicated in Water Supply Facilities chapter.

High Velocity Water Spray System

Automatic high velocity water spray (deluge) system is proposed for the protection of generator transformers, interconnecting transformers, unit auxiliary transformers, station transformers, turbine lube oil service tanks, boiler burner front and various transformers.

Automatic Fire Detection System

Unattended vulnerable premises like electrical control room, cable tunnels, oil cellars, etc. will be provided with automatic fire detection and alarm systems.

Portable Fire Extinguishers

All plant units, office buildings, stores, laboratories, etc. will be provided with adequate number of portable fire extinguishers to be used as first aid fire appliances. The distribution and selection of extinguishers will be done in accordance with the requirement of fire protection manual.

Fire Engine

The above fire protection systems will be supplemented by two nos. fire engines water tender. The fire engines will be equipped with all necessary accessories.

Fire Station

There will be one fire station with parking space for the above two fire tenders and to extend the necessary assistance required for fighting fire in any of the plant units and associate premises.

09.11 HANDLING & HOISTING FACILITIES

To handle various equipment of thermal power station, normally EOT cranes (Single Girder / Double Girder), Underslung cranes, electric hoists, manual hoists, mobile cranes, fork lift, sky-climbers, etc are used. For carrying operating personnel and materials, lifts are also provided at strategic locations. For maintenance of chimney rack & pinion type lift is used.

The following major handling & hoisting facilities have been envisaged for the proposed thermal power plant :

1. Two nos. E.O.T. crane of capacity 135/15t (each) for maintenance of TG(s).

2. Pendant push button operated cranes for pump houses, compressor building, DG station, etc.

3. Electric / manual hoists of various capacities for FD fans, ID fans, PA fans, air pre-heaters, fuel oil pumps, etc.

4. One no. VIP lifts in Turbine hall.

5. One no. passenger lift in service building.

6. Two no. goods cum passenger elevator for the boilers.

7. One no. rack and pinion type lift for the chimney.

09.12 ELECTRICAL SYSTEMS & EQUIPMENT

09.12.01 Electrical systems

The main electrical scheme is indicated in enclosed single line diagram (No MEC/11/S3/Q6RP/PFR/05). The proposed 2x660 MW turbo alternators will generate power at 21 kV. Each generator will be connected to Switchyard through 3Nos. 21/420kV,260 MVA single phase generator step up transformers.

Power Evacuation System

Power is proposed to be evacuated to the 400 kV grid by LILO of PGCIL Lines. Total Power to be evacuated and transmission lines required for evacuation are as follows.

Power to be Generated	1320 MW
Auxiliary Consumption	99 MW (7.5%)
Power to be evacuated	1221
No. of 400 kV Tr. Lines planned/proposed	4

So total Power to be evacuated is 1221 MW. For evacuating this Power 4 nos. 400 kV lines are considered.

Power Grid Corporation of India Limited will be approached for making necessary power evacuation studies/arrangements for the Project.

Construction Power

Construction Power will be availed from 33 kV/11kV Balagarh Substation, through a 33 kV feeder. A 33kV/11kV construction Power substation will be constructed within plant premises for the purpose.

Electrical Auxiliary Power Supply System:

The unit electrical auxiliary supplies for each unit will be derived from two nos. 21/6.9 kV, 35 MVA unit auxiliary transformers.

The station electrical auxiliary supply will be derived through two stages, at the primary stage through two nos.90 MVA, 400/11.5 kV station Transformers and further at the secondary stage through 11/6.9 kV station transformers. These transformers will feed 11kV and 6.6 kV station and unit boards

Boiler feed Pump motors will be fed from 11kV and other large fans/ pump motors like PA Fan, ID Fan,FD fan, CEP, Mills, CW pumps etc will be fed from 6.6 kV switch boards.

09.12.02 Brief Description of Main Electrical Equipment

a) Generator

Each generator shall be 660 MW/776 MVA, 0.85 (lagging) pf, 21 kV,3000 r.p.m, Class – F insulation. Generator will include auxiliary systems like stator water system, seal oil system, gas system complete with all accessories.

b) Generator Excitation System

A complete generator excitation and voltage regulation system shall be provided with the generator. The excitation shall be of static type or brushless type. The excitation system shall have two (2) 100% channels including independent AVRs, power converters and controls.

(c) Transformers

- **Generator transformer:**

Three (3) nos. 260MVA, 21/420kV single phase transformers per Unit shall be installed to evacuate power from the generator to switchyard. One no. of single phase

transformer will be kept as stand by / spare and it shall be kept in idle charge condition.

- **Unit Transformers (UTs)**

  Two (2) nos. 35 MVA, 21/6.9 kV unit transformers for each unit for meeting unit auxiliary loads.

- **Station Transformers (STs)**

  Two (2) nos. 90 MVA, 400 / 11.5 kV station transformers have been considered for meeting the station auxiliary load.

09.12.03 Emergency Power Supply System

In the event of a total failure of normal AC power supply in the plant, DG sets have been envisaged to supply AC power from an emergency source to facilitate safe shut down of units.

09.12.05 Electric Drives

Auxiliary Electric motors will be 3 phase 50 cycle squirrel cage induction motors operating at 6600 or 415 volts except BFP motor which is at 11000 volts. AC motors will have class of insulation F with temperature rise limited to class B.

09.12.06 400 kV Switchyard

Conventional outdoor switchyard with one and a half breaker switching scheme has been envisaged for power evacuation. Provision of 2 nos. of bays has been kept for future expansion.

Outdoor duty, 420 kV, SF6 type circuit breaker with electro-pneumatic/ electro-hydraulic operating mechanism; 420 kV isolators of pantograph design for bus connection and horizontal centre break type for others ; capacitor voltage type voltage transformer ; single phase, bar type oil immersed type current transformer and gapless type, heavy duty class 3 type Lightning Arresters have been envisaged.

09.13 CONTROL & INSTRUMENTATION

The proposed instrumentation & control system will provide for a centralized, automated and safe plant control to achieve maximum efficiency and better reliability and availability. This chapter covers the design criteria and concepts proposed for the following:

a. Distributed Digital Control, Monitoring & Information System (DDCMIS) including closed loop control system, open loop control system, Furnace Safeguard Supervisory System (FSSS) / Burner Management System (BMS), Soot Blower Control System, Furnace Protection System (FPS), Turbine Protection System (TPS), Turbine Control System (TCS), Measurement System, Human – Machine Interface & Plant Information System (HMIPIS), System Programming & Documentation Facility, Data Communication System, Sequence of Event Recording system, System Diagnostics, Performance Efficiency Calculation System and Master & Slave Clock System.

b. Conventional Alarm – Annunciation System

c. Steam & Water Analysis System (SWAS)

d. Continuous Emission Monitoring System (CEMS)

e. Instrument Laboratory Equipment

f. Power Supply Equipment

g. Air Supply for pneumatic equipment.

The latest microprocessor based control system is envisaged to provide a comprehensive integrated instrumentation and control system with a hierarchically distributed structure for the following advantages.

- Increased reliability
- Better availability

- Higher system security
- Increased flexibility
- Modularity & expandability
- Higher maintainability
- Increased capability
- Drift free control
- Lower power consumption
- Lower operating voltage
- Improved human machine communication with colour graphic CRT based control stations & large screen monitors.
- Faster response time.

The microprocessor based Distributed Digital Control, Monitoring & Information system (DDCMIS) will be provided for the safe and efficient operation of SG, TG, balance of plant and all auxiliaries in all regimes of operation. DDCMIS will basically consist of Furnace Protection System (FPS), Turbine Protection System (TPS), Turbine Control System (TCS), Closed Loop Control System (CLCS), Closed Loop Control System (OLCS) along with its measurement system; Human-machine Interface & Plant Information System (HMIPIS); System Programming & documentation facility; Data Communication System; Sequence of events recording system; System Diagnostics; Performance efficiency calculation system and master & slave clock system.

The following will be completely redundant:

- All the parallel and serial communication buses
- All the communication devices (processors, coupling devices etc.)
- All the process controllers including back-plane
- All serial communication channels versus automation subsystems
- All the power packs
- Critical drive related modules (drive or I/O modules)

A Sequence of Events Recording System (SERS) with a dedicated colour inkjet printer and colour SVGA CRT will be provided. SER will accept sequence of events (SOE) inputs in the form of potential free contacts. The number of SOE inputs will be on as required basis but not less than 500 points per unit. The SERS will be synchronized with master clock every one minute. The accuracy of the clock on the processors / controllers or input modules as well as the internal synchronization rate will be adequate to meet the resolution requirement given below.

A master & slave clock system will be provided for uniform timing throughout the various plant facilities. The system will be complete with receiving antennae (for receiving time from satellite & radio signal), receiver and associated electronics, Redundant master clocks, slave clocks, interconnecting cables, cubicles, power supplies & any other accessories. However, a provision will be kept for synchronisation of the master clock with other source.

Training course on DDCMIS will be provided in following areas :

- Operator training
- Hardware maintenance training
- Software training
- Any other specialized training as required for system operation and maintenance.

A latest state – of – the – Supervisory Control and Data Acquisition System (SCADA) will be provided at electrical switchyard control room for monitoring and control of the electrical parameters. SCADA will ensure safe, efficient and smooth operation of electrical equipment and its auxiliaries with minimum interface of the operating personnel.

The following close loop controls will be integrated in the DDCMIS and they will be operable from unit control room either from the CRT based OWS or conventional auto/manual stations in the back-up system:

(a) Co-ordinated master control
(b) Combustion control (fuel and air flow control)
(c) Furnace draft control
(d) Boiler feed pumps speed control
(e) Fuel oil temperature control
(f) Atomising Steam Header Pressure Control
(g) Air Heater Average Cold End Temperature Control
(h) Hotwell level control
(i) Condensate Extraction Pump Minimum Flow Recirculation control
(j) Deaerator level control
(k) Boiler Feed Pump Minimum Flow Recirculation Control
(l) SH/RH Steam Temperature control
(m) Coal Mill Primary Air Header Pressure Control
(n) Coal Mill Air Flow /Temperature Control
(o) Soot Blower Steam Pressure Control
(p) Gland Steam Pressure Control
(q) Wind Box Furnace Differential pressure control
(r) HP/LP Bypass pressure and temperature control
(s) Auxiliary steam pressure and Temperature control
(t) Deaerator Pegging Steam Pressure Control
(u) Feed Water Heater Drain Level Control
(v) Separator vessel drain Level control

Microprocessor based BMS / FSSS and SGCPLS / FPS will be designed for management and control of ignitors, fuel oil burning system and coal burning

system, in response to demand from operator and other integrated control systems.

Microprocessor based ATRS will be designed to control the steam turbine generator unit during start-up, loading and shut down. Control during start-up will include sequential operation of lube oil system, turning gear, control fluid system, HP/LP bypass system, gland seal system condenser evacuation system, turbine drain system, excitation and automatic synchronizing and loading up to 100% maximum continuous rating (MCR).

Rotor stress Evaluator (RSE) will be provided continuously computed permissible values for the desired changes in the operating conditions at all times and under all operating stages by displaying margins in the HP and IP rotor.

An automatic Turbine Test system will be furnished to check the function of protective safety devices of the turbine and its stop cum control valves while the turbine is in operation without causing turbine trip.

A conventional alarm annunciation system in each unit control room will be provided in addition to the alarm functions being performed by DDCMIS. Any alternative of the following options for implementation of annunciation system will be provided.

The microprocessor based Steam & Water Analysis System (SWAS) will provide analytical instruments for continuous monitoring of condensate / feed water / demineralized water / steam.

A fully certified continuous Emission Monitoring System (CEMS) will be provided for each flue gas path to determine emissions of Opacity, SO_x, NO_x, CO, CO_2 etc

as per central / state Pollution Control Board requirements. A CEMS will be provided to measure stack emissions and produce all required data logging and reporting. The analyser system will include microprocessor based in-situ type analysers, a fully programmed controller, auto calibration accessories and mounting hardware for installation to provide a complete and operable system. The data logging and reporting system will store a data for a stipulated number of years and will be able to produce reports of required format.

09.14 CIVIL WORKS

General

The civil engineering work consists of providing main power plant building, buildings for auxiliary services, foundations for equipments, ware houses and other buildings which are necessary for installation of the plant.

Apart from the above, civil engineering works for administrative building, canteen, time and security office, parking shed and other service facilities such as roads, drainage and sewerage, site levelling etc. also have been considered.

Topographical Features of Site

The site of the proposed power plant is a river land with variable ground level. General site filling is envisaged to raise the topographical level of plant area.
An earthen bund having its top 0.75m above HFL is also envisaged to protect the proposed structures during flood time. The water side of the earthen embankment shall have suitable protection work against erosion due to water current.

Geo-technical Features of Site

The sub-soil investigation data of the proposed area is not available. As per available information regarding existing soil, Pile foundation is envisaged for major foundation for buildings, structures and equipments. However minor foundation/footings has been considered as open foundation. However the foundation design criteria shall be established based on actual geological report

Construction Materials Source

Most of the construction materials like course aggregate, fine aggregate, boulders, bricks etc as available from various sources within a reasonable distance shall be utilized for the proposed project.

Design Features

The plant area falls within zone having maximum basic wind speed of 55 m/sec. It also falls under seismic zone No. III. The buildings and structures will be designed for such wind and seismic load along with technological loading requirements.

Concrete of grade M-25 will generally be used except for RCC chimney, cooling towers, turbo-generator foundation etc. where higher grade of concrete will be used. Reinforcement will be of high strength deformed bars conforming to IS: 1786-1985.

All foundations and concrete structures shall be designed to resist full operating dead and live loads, with appropriate combination of wind and seismic forces and with due allowance for impact, vibration etc. as secondary effects of live loads, temperature variation etc. While designing structures and foundations, either the effect of seismic forces or wind loads, whichever produces the worst effect, shall be considered along with usual load conditions.

All roads will be of RCC/flexible type of construction with storm water drainage.

09.15 STEEL STRUCTURAL WORK

General

Steel structural work covers columns, beams, floors, roof trusses, crane girders, monorails, platforms, walkways, gratings, purlins, brackets, conveyor galleries, trestles, bridges, stairs, ladders, handrails, lift shafts, chimney structures, roof & wall sheeting, etc. complete in all respects, considered necessary for installation of the plant.

Design of steel structures

General

The different load combinations shall be taken as per IS:875 (Part-V) - 1987 and other relevant IS codes.

Wind and seismic forces shall not be considered to act simultaneously.

Design and fabrication shall be as per provisions of IS:800-1984 and other relevant standards.

All roofing will be rain tight and fixed to withstand maximum wind forces.

All walkways and stairs leading to working platform shall have minimum 1000 mm width and other walkways & stairs leading to areas of maintenance purpose or due to restriction of space shall have a minimum width of 800 mm. Generally staircase shall be designed with slope of approximately 37.5º with horizontal (in no case the angle should exceed 400). Rise of treads in staircases shall not exceed 200 mm.

Handrails to platforms will be of tubes or angles etc. The top rail will be 1.0 metre above platform level and there will also be intermediate and toe rails.

Building Structures

Buildings will generally be designed to meet the technological and general requirements.

For crane girder walkways a clearance of 500mm. will be provided between ends of all crane end carriages and any structural members alternatively a thorough passage shall be provided in the column shaft in which case the minimum clearance of 100mm. will be provided between the crane end carriage and the structural members.

Crane girder walkways (surge girder web) will be of Chequered plate.

Material of construction

- Chequered plates shall conform to IS:3502 .
- Pipes for hand rail shall conform to medium grade of IS: 1161.
- All gratings shall be pressure locked electro-forged.
- Steel sheets for use in toe guards will conform to IS:1079 - 1988.
- Galvanized corrugated steel sheets will conform to IS: 277-1985.
- Translucent sheets shall be of fiberglass/ poly-carbonate conform to IS: 12866-1989. The profile of translucent sheets shall match with that of GCS sheets as applicable.
- Crane rails shall conform to IS: 3443-1980.

09.16 TELECOMMUNICATION SYSTEM

For effective inter personnel communication in the plant area following two types of communication systems have been envisaged.

1. Telephone system
2. Loudspeaker talk back system

I. Telephone system

This system will be provided for general purpose communication among the plant personnel. This will consist of 200 lines Electronic Private Automatic Branch Exchange (EPABX)

The Telephone exchange system will broadly comprise of the following -

- Telephone exchange equipment and peripherals such as PC based maintenance console, printer etc.
- Main distribution frame with protection devices on the exchange side.
- Power supply equipment, including rectifier - cum - charger, back up battery set and interconnecting cables & wires.
- Auto-telephone instruments.
- Telephone cable network comprising cables, wires, and distribution & termination devices and associated erection accessories required for connecting the telephone instruments to the telephone exchange.

The exchange will have the following salient features :

1. Non-blocking speech path network employing TDM-PCM technique.
2. Modular expansion capability for future expansion possible by simply plugging in additional cards, modules, sub racks and racks.
3. In-built, on line diagnostic features with print out or display of faults through maintenance console.
4. Flexible extension numbering without changing cabling.

5. Distinct ringing for internal calls and trunk calls or operator calls.
6. Extension to extension dialing.
7. Direct outward dialing access to other exchanges.
8. Direct inward dialing.
9. Changing the subscriber facility through the maintenance console.
10. Facility of connecting up computer terminals, screens etc.
11. Facility for connecting Public address system.
12. Facility for connecting Radio Communication (VHF) system.
13. Remote maintenance facility.

The following facilities will be provided for subscribers of telephone exchange.

- Calling between subscriber
- Call transfer
- Executive/secretary facility
- Automatic call back
- Call pick up
- Emergency reporting
- Hotline facility
- Conference facility (4 party)
- Internal consultation
- Call forwarding
- Priority interrupt
- Paging access
- Last number re-dial
- Music on hold
- Other common features of the latest digital exchanges.

Operator console features

- Answering incoming calls
- Setting up external calls
- Operator call intercept
- Operator call transfer
- Consultation of calls on hold
- Automatic call distribution
- Trunk offering
- Call queuing
- Call waiting display
- Night service
- Last number re-dial
- Other common features of the latest digital exchanges.

II. Loudspeaker talk back system

Loudspeaker talk back system will be provided for facilitating reliable two-way intercommunication between various strategic points of the plant complex. The subscriber stations will be provided at locations having very high ambient noise level.

The system having the requisite number of subscribers will be provided in various units of the plant complex for smooth flow of information between process points.

10. ENVIRONMENTAL ASPECTS

The proposed 2 x 660 MW Power Plant of CESC has been planned to be located at Balagarh in state of West Bengal.

The proposed power station would be equipped with modern, sophisticated pollution control devices to bring down the emission of pollutants to limits within acceptable norms of the Country and the State.

Environmental Factors

A thermal power station utilizing coal as its prime fuel may create pollution involving the following:-

i) Particulate matters
ii) Toxic gases
iii) Thermal pollution
iv) Chemicals in liquid forms such as acids and alkalies.

The main pollutants from a super critical thermal power plant are discharged through the following sources: -

i) Stacks – emitting particulate matters, toxic gases (e.g. CO, SOx & NOx) and heat.
ii) Boiler drains
iii) Circulation water blow-down from condenser cooling circuit – discharging heat and water with higher salt concentrations and certain chemicals added for treatment of circulation water.
iv) Coal Handling Plant – Coal dust and particulate matters.
v) Effluents from the ion exchangers of DM Plant – discharging acidic and alkaline liquid through Effluent Treatment Plant.

Means to limit Pollution from a Thermal Power Station:

i) **Emission from Stack:**

Emissions from stack are particulate matters, toxic gases and heat carried over by flue gases.

For proper dispersion of emitting SPM and other acid gases, it is considered that one no 275 M high bi flue stack will be provided. A brief discussion on the nature of emission is given below:

a) **Particulate Matter**

Particulate matter would be generated by burning coal which contains about 40% ash. To limit the concentration of the Fly Ash content in the exit flue gases, very high efficiency electrostatic precipitator (ESP) will be installed to limit emission of particulate matter concentration in flue gases well below the permissible limit of 50 mg/Nm^3.

b) **Toxic Gases**

The fuel proposed to be used for this power plant is low sulphur content coal. Air pollution arising from SO_2 in the proposed plant is not apprehended and increase in ground level concentration would be well below the limit prescribed by the Ministry of Environment & Forest (MOEF)/ Central Pollution Control Board (CPCB).

Generation of nitrogen compounds (NOx) in a properly designed furnace with selection of appropriate burner system is very limited. The increase in GLC due to NOx emission from the proposed units will certainly be low and the resultant NOx level will be well within the permissible limit.

Carbon Monoxide as a source of pollution does not exit in the modern power station as design of combustion control equipment and the furnace eliminate almost completely, the possibility of incomplete combustion.

c) **Thermal or Heat Pollution**

Heat loss through the stack represents only about 6% to 8% of the total heat input to the furnace. The quantum of heat, so lost into the atmosphere, is insignificant considering the capacity of the atmosphere as the ultimate heat sink.

The effect of tall chimney, which takes care of the particulate and toxic gas dispersal, would also indirectly help in minimizing the thermal pollution, if any.

In view of the above conditions, chance of perceptible environmental pollution, arising from stack emission barely exists.

d) **Ground Level Concentration of Pollutants**

As per existing norms, the Ground Level Concentration (GLC) of the particulate matter, SO_2 and NOx will be within permissible limits, with proper selection of ESPs and with 275 Meter high stack.

ii) **Coal Handling Plant**

The coal handling in power plant is a source of particulate pollution under adverse wind-speed condition. In order to limit spreading of dust, water will be sprinkled in the stockyard. Adequate dust extraction equipment will be installed at specific locations of CHP.

Liquid Effluent Management Plan

The major sources of liquid effluent are Ash mound overflow, Cooling Tower blow down, Boiler drains, Clariflocculator sludge and filtration backwash, DM degeneration waste, Miscellaneous effluent from power house & boiler area, Run off from coal yard & DS System, Colony sludge & sanitary sewage.

The effluents from boiler drains, clariflocculator sludge, ash mound overflow etc. are taken to the treatment pit. The decanted over-flow from the pit is treated in the treatment plant and water recovered is taken into the ash water sumps for re-use.

An Effluent Treatment Plant has been envisaged to treat water which will be reused and recycled.

Solid Waste Management Plant

Generation, storage and utilization of ash have already been covered in Chapter 09.08

Sludge

a) Solid sludge will be generated in the clariflocculator. These sludges will be sent to the ash mound for proper settlement of the suspended solids.

b) Other sludge (comprising coal particles) will be obtained from the settling tank meant for arresting suspended coal particles from coal pile area run-off from where it will be reused in environment friendly manner.

Size of ash mound will be decided based on the prevailing MOE&F guidelines at the time of implementation of the project.

Utilization Of Fly Ash Generated At The Power Station

Considering the maximum ash content of 40% (approx.) the generation of total ash from the power plant will be of 2.56 million t/y (considering 85% plf). Disposal of this huge quantum of ash is a problem for any pulverized coal fired power station. An ideal way to get rid of this problem will be to utilize the same for some useful purpose.

CESC to take initiative for ash utilization generated from proposed power plant for filling up of abandoned open cast coal mines or may be sold to prospective user of fly ash such as bricks industries, cement industries, road contractors, etc.

It has been observed that 100% ash utilization can be met through filling of abandoned mines. However, further efforts will be made to make arrangements for utilization of fly ash by nearby brick / cement manufacturers & road contractors. As such, meeting the requirement of 100% utilization of fly ash will be possible for the project.

Green Belt

Green belt has been planned around the plant boundary, around ash mound area and other available open space to meet the statutory norms requiring green belt in minimum 1/3rd of the total plant area.

Monitoring

Monitoring of various environmental aspects is necessary for a number of reasons.

- To keep watch on state of pollution
- To generate data for predictive and corrective purposes.

- To examine the efficiency of pollution control measures
- To quantify environmental impacts

The important factors to be monitored are stack emission, ambient air quality and disposed water quality.

No ecologically sensitive area exists within 10 km from the proposed site.

11. MANPOWER PLANNING AND TRAINING

Requirement of Manpower

Man power requirement for plant operation and maintenance depends on the following :

1. Different disciplines and sections of the plant
2. Services facilities
3. Number of operating shifts
4. Extent of mechanization
5. Extent / philosophy of automation and controls of various units.
6. Present pattern of manpower requirement for similar capacity power plants in the country
7. Personnel policy,
8. Labour productivity,
9. Working environment

Operation of utility power plant has been considered in 3 shift continuous basis. Sufficient leave reserve has also been considered in estimating the manpower.

It has been considered that the capital maintenance and statutory maintenance of the plant shall be carried out by outside agencies on contract basis or original equipment supplier. Further, it has also been assumed that staff for security, fire services, canteen works, etc. will be employed on contract basis.

Overall man power requirement has been considered as 400 persons including security personnel.

Training

Training aspect, particularly keeping in view the plant capacity, unit size and the sophistication provided thereof, has to be accorded the top most priority. The quantity, type and sequence of training has to be carefully and meticulously planned. The assessment of training needs for the personnel may be made at detailed engineering stage of the plant to suit the actual requirement. However there should not be any difficulty in this regard because there are already specialised training centres/institutions, where requisite training can be imparted. However, CESC authorities will plan and establish a full fledged HRD department to take care of entire manpower training aspects. By and large CESCL's existing facilities for training may be adequate but specialised training of a few identified personnel in similar plants or in institutions like PETS and also manufacturer's works for special plant and equipment may also help.

12.00 STATUTORY / NON-STATUTORY CLEARANCES

For setting up of any power project, certain clearances and approvals are required to obtain from different Government and Statutory Agencies at various stages of development and operation of the project. The following tentative list illustrates the major statutory and non-statutory clearances required for the project-

a) Statutory Clearances

S.No	Description	Concerned Authority
1.	Company registration	Registrar of Companies
2.	Sanctioning of Project	Ministry of Power, GOI to include the project in its five-year plan
3.	NOC for setting and operation of Facility	State Pollution Control Board
4.	Water availability & Water Supply Agreement	State Govt irrigation Dept.
5.	Pollution clearance (Water and Air)	State Pollution Control Board
6.	Environmental and forest clearance	Ministry of Environment & Forest, Govt. of India
7.	Forest clearance	Not applicable
8.	Civil aviation clearance for Chimney height	Airport Authority of India
9.	Rehabilitation and resettlement of displaced families by land acquisition	State Govt. MOEF, if necessary
10.	State / Central Govt clearance for Mega Power project.	State / Central Govt.
11.	Power Evacuation and Sale of Power	Ministry of Power/ PGCIL/WBEDCL/CEA etc

b) Non-Statutory Clearances

S.No	Description	Authority
1.	Land availability	State Government
2.	Coal Mine Allocation / Fuel Linkage	Ministry of Coal and Mines, Govt. of India
3.	Transportation of fuel	Ministry of Railways
4.	Foreign collaboration, Foreign currency loan and Foreign equity participation	Ministry of Industry, Ministry of Finance, Govt. of India, Income Tax Authorities
5.	Clearance from Archaeological department	Govt. of India
6.	Rights to access and use of site including right of way for all corridors to the Facility.	Sate Government / Concerned Agency

13. PROJECT IMPLEMENTATION SCHEDULE

Implementation Schedule

The project is proposed to be implemented within a time schedule of **54 months** from the "**zero-date**" which is reckoned as date of placement of order on EPC contractor for main plant package. The first unit will be commissioned in 48 months from zero date. The indicative implementation schedule showing major activities and considering the facilities proposed is given in **Drawing. No. MEC/Q6RP/11/PY/06.**

While preparing the implementation schedule, it has been assumed that pre-ordering activities for the major technological units will be completed before the zero-date.

Implementation Strategy

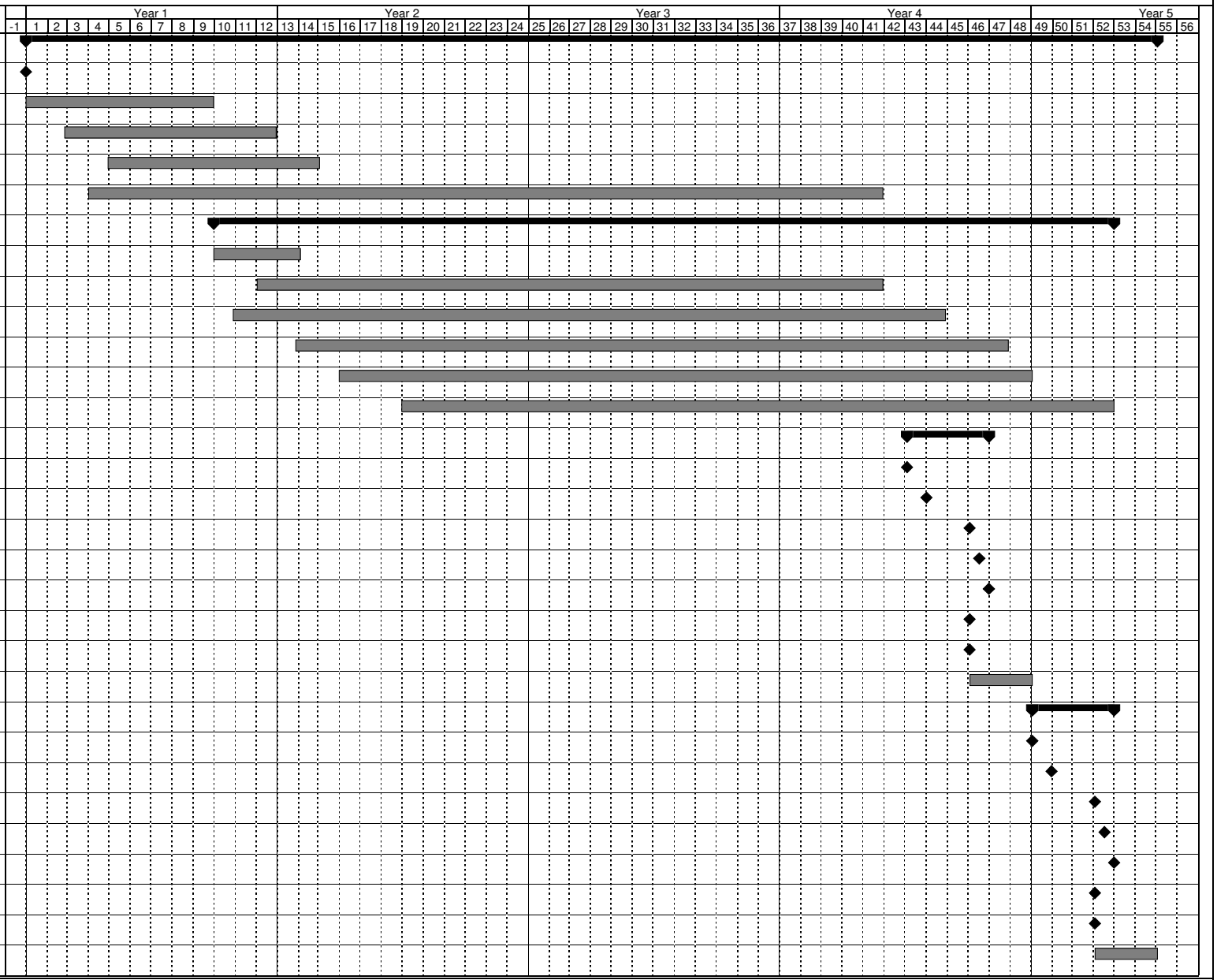
Implementation of the project is proposed to be carried out through a number of indigenous packages on turnkey basis. Auxiliary facilities are proposed to be implemented through separate indigenous packages under turnkey / semi-turnkey mode.

CESC LIMITED

2X660 MW COAL BASED T.P.P. AT BALAGARH (W.B.)

IMPLEMENTATION SCHEDULE

ID	Activity	Dur(w)
1	2X660 MW UNITS POWER PLANT	235 w
2	Placement of order on EPC Contractor (Ze	0 w
3	Basic Engineering & Approval	39 w
4	Prepration & issue of T.S. for Auxiliaries	44 w
5	Tendering & Ordering for Auxiliaries	44 w
6	Detailed Design & Engineering	165 w
7	Execution at site	187 w
8	Moblisation for Civil Works	18 w
9	Civil Works	130 w
10	Fabrication Delivery of steel structures	148 w
11	Erection of steel structures	148 w
12	Delivery of Equipment	144 w
13	Erection of Equipment	148 w
14	Erection Completion of Unit-1	17 w
15	Erection of Condenser	0 w
16	Drum Lifting	0 w
17	Erection of Boiler Including Elect &	0 w
18	Hydrulic Testing of Boiler	0 w
19	Acid Cleaning of Boiler	0 w
20	Erection of Turbo-Generator includ	0 w
21	Complection of Auxiliaries	0 w
22	Test,Trial Run & Integrated Commissioning	13 w
23	Erection Completion of Unit-2	17 w
24	Erection of Condenser	0 w
25	Drum Lifting	0 w
26	Erection of Boiler Including Elect & ins	0 w
27	Hydrulic Testing of Boiler	0 w
28	Acid Cleaning of Boiler	0 w
29	Erection of Turbo-Generator including	0 w
30	Complection of Auxiliaries	0 w
31	Test,Trial Run & Integrated Commissioning	13 w



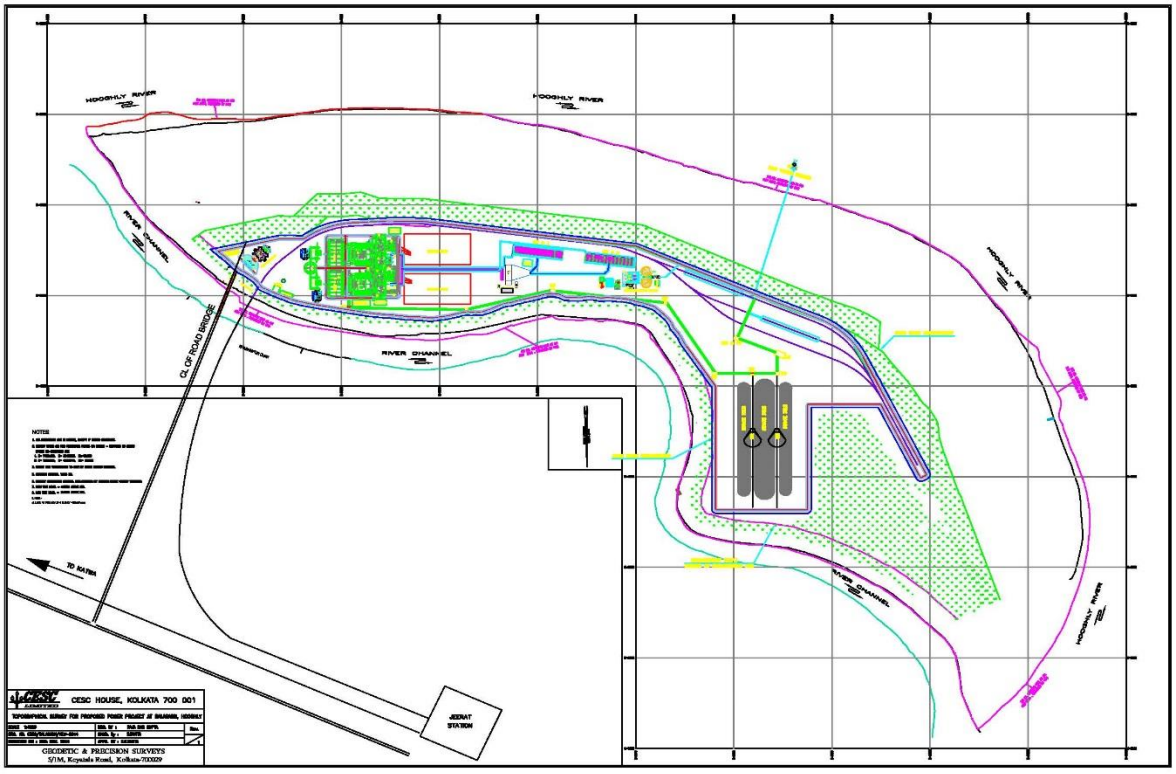
File: CESC_Q6RP_19th Apr'10

Task | Milestone | Summary

DRG.NO. MEC/11/S3/Q6RP/01(R-0)

14. COST ESTIMATES

As per preliminary cost estimates, total project cost of the proposed 2 x 660 MW thermal power plant at Balagarh shall be to the tune of Rs 7000 Cr. Cost of generation per unit shall depend on allocation of coal bock/linkage.



Total Area (in possession) : 902 acres

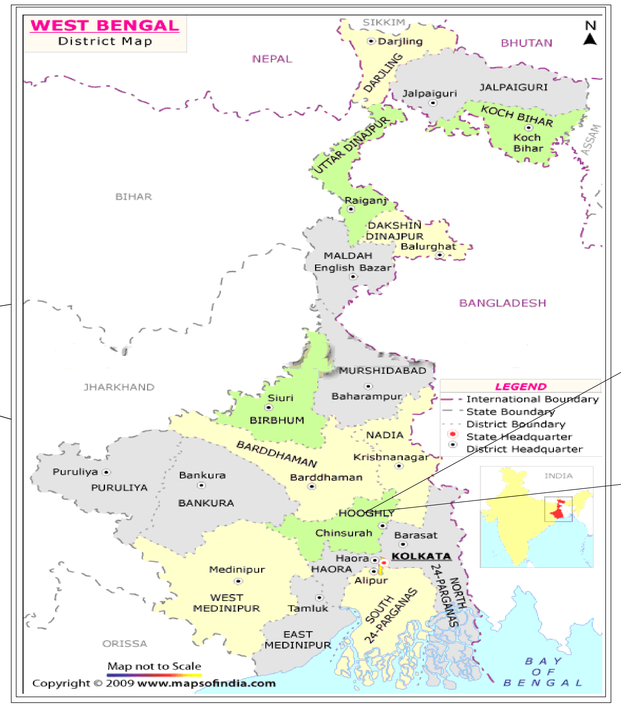
<u>Land required for the Project:</u>

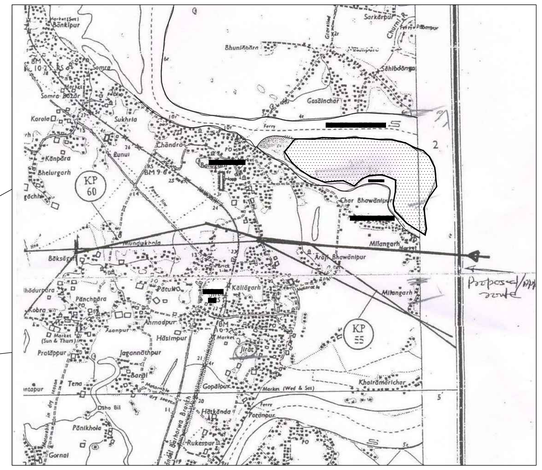
- ✓ **Plant Area : 410 acres**
- ✓ **Green Belt : 140 acres**
- ✓ **Emergency Ash Disposal Area : 115 acres (Outside the Island)**

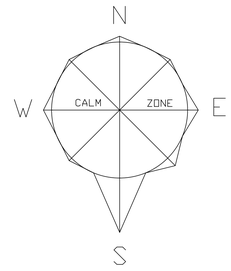
DRG.No.MEC/11/14/Q6RP/FR/04

MAP OF INDIA

WEST BENGAL DISTRICT MAP







SYMBOL LEGEND

PROPOSED SITE

REV.NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED

REFERENCES | DRG. NO.

CESC LIMITED

मेकॉन लिमिटेड

MECON LIMITED

SECTION	GL&T
LOCATION	RANCHI
DESIGNED	RISHI BABU
DRAWN	RISHI BABU
CHECKED AND VERIFIED	USR
APPROVED	

2X660 MW THERMAL POWER PLANT, BALAGARH, WEST BENGAL

LOCATION MAP

SCALE – NTS | SHEET 1 OF 1 | Rev. 0

DRG. No. MEC/11/14/Q6RP/FR/04

DRG.No.MEC/11/40/Q6RP/PFR/05

15

400 | 30 | 70 | 300

FILTERED WATER STORAGE TANK

PLANT DRINKING WATER O.H. STORAGE TANK

TOWNSHIP DRINKING WATER U/G STORAGE TANK

D.M. WATER PLANT

250

1. THERMAL CYCLE MAKEUP
2. ACW Py.CIRCUIT MAKE-UP
3. HYDROGEN PLANT
4. CHEMICAL FEED PREPERATION
5. AC SYSTEM MAKE UP.

UNDERFLOW

BACKWASH

15

400

PRESSURE FILTERS

225

415

SOLID CONTACT CLARIFIERS

4000

CLARIFIED WATER STORAGE TANK

4225

4325

100

ASH MOUND

–

HIGH CONC SLURRY DISPOSAL SYSTEM

ASH

40

SEAL WATER FOR HCSD BOOSTER PUMPS

182

40

ASH WATER RESERVOIR & ASH WATER PUMP HOUSE

SLUDGE

OIL SEPARATOR

POWER HOUSE & BOILER AREA SERVICE WASTE

BOILER BLOWDOWN

3586

MAKE-UP WATER FOR CONDENSER COOLING

MAKE-UP WATER FOR SECONDARY COOLING

3410

176

RIVER WATER PUMPING STATION

RIVER

75

A/C & AIR WASH MAKE-UP

40 | 30

BOILER & AUXILIARIES

PLANT WASHING & GARDENING

GREEN BELT DEVELOPMENT

200

COAL HANDLING DUST SUPPRESSION

567

BLOWDOWN WATER O. H. STORAGE TANK CAPACITY = 1000/1200 m3

567

BLOWDOWN WATER SUMP

DRAIN TO FIRE FIGHTING SYSTEM

C.T. BLOWDOWN = 539 M3/HR

C.T. EVAPORATION & DRIFT LOSS = 2871 m3/hr

CONDENSER COOLING SYSTEM CIRCULATING WATER= 156000 m3/hr

C.T. BLOWDOWN = 28 M3/HR

C.T. EVAPORATION & DRIFT LOSS = 148m3/hr

SECONDARY COOLING SYSTEM CIRCULATING WATER =8000m3/hr

COOLING TOWER DRAIN (OCCASIONAL)

COOLING TOWER DRAIN (OCCASIONAL)

PRELIMINARY

NOTES :

1. FIGURES SHOWN ARE IN m3/hr AVERAGE FLOW
2. THIS DRAWING FORMS PART OF THE PRE FEASIBILITY REPORT.

REV.NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISIONS		

REFERENCES | DRG. NO.

REV / SEC | CONCURRED BY

2X660MW THERMAL POWER PLANT AT BALAGARH (WB)

मैकॉन लिमिटेड

MECON LIMITED

SECTION	FS&PD
LOCATION	RANCHI
DESIGNED	S.Y. WAHID
DRAWN	S.Y. WAHID
CHECKED AND VERIFIED	K.GUPTA
APPROVED	
SIG.	
DATE–28/03/2010	

SCHEMATIC WATER FLOW DIAGRAM

SCALE– NTS | SHEET 1 OF 1 | REV 0

DRG.No.MEC/11/40/Q6RP/PFR/06