

PRE-FEASIBILITY REPORT

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CHAPTER – I

INTRODUCTION

1.0 GENERAL:

M/S. Chennai Power Generation Ltd, proposes to install a 2 x 515Mw Thermal Power plant to be fuelled by imported coal envisaged to be brought from Indonesia, Australia, etc. The proposed Plant will be located near **Kattupalli and Kalanji villages at Ponneri Taluk, Thiruvallur district, Tamil Nadu state.**

1.1 BACK GROUND OF THE PROJECT:

M/s General Mediterranean Holding through its subsidiary M/s Chennai Power Generation Limited (CPGL) have proposed to establish a 1000 Mw imported coal based power plant at Kattupalli and Kalanaji villages in Ponneri Taluk , Thiruvallur District Tamilnadu.

Background of the project is given below:

- This location was selected by Tamil Nadu Electricity board for setting up the Power plant and allotted through MOU route to CPGL. This Project was conceived by TNEB under MOU route and MOU was signed with TNEB on 18.2.95.
- Land is reserved vide GO No 47 dated 5-2-1998 for setting up of this power plant.
- Initially 1000 Mw Gas based plant was proposed based on LNG Terminal to be erected by TIDCO.
- Environmental Clearance from MOEF was obtained vide letter No. J 13011/11/96-1A11 (T) dated 19.3.97 using naphtha as fuel.
- Various other clearances like NOC from Tamilnadu Pollution Control Board, NOC obtained from District Forest Officer, Clearance from Airport Authority of India NAAI New Delhi, Clearance from Air, Clearance from Ministry of Defence, Clearance from Fisheries department, NOC from Madras Metro-water and Sewerage Board, In Principle Mega Power Project Status from Ministry of Power, etc., were obtained.
- Subsequently, TIDCO dropped the proposal to establish the LNG Terminal.
- Then the company had approached MOEF to give amendment for change of fuel from Naptha to Imported coal.(Ltr no 27/12/2007)
- MOEF asked for revised EIA/EMP report vide letter no J-13011/11/96-IA- II(7) dated 18/1/2007 for the proposed coal based thermal power-plant using imported coal.

- Subsequent to submission of fresh application to get Environmental Clearance to MOEF for the project during January 2009, based on the EAC Meeting held during 12th and 13th March 2009 and again on 15th and 16th April 2009, TOR was issued for the project in letter No. J-1301/11/96-iAII (T) dated 03.06.2009.
- During the presentation by our company to the Expert Committee, it was informed that there is overlapping of lands between our project site and the North Chennai Power Company Project site and we requested the Committee to impress upon North Chennai power to spare 70 acres of land for our project so that both the projects can come up in the same area.
- However, M/s North Chennai Power Company refused to spare and MOEF gave Environmental Clearance to North Chennai Power Company ignoring our objections and also impose two special conditions in our Terms of Reference namely
 - a) Clear ownership of the lands belonging to the company free of all encumbrances and
 - b) There should not be any overlapping of the lands belonging to any other company and we have to get a certificate from Revenue Authorities for the above two conditions.
- Even though we had completed studies as per TOR, we could not proceed further as Pollution Control Board, Tamil Nadu refused to conduct Public Hearing stating that overlap of land issue was not resolved.
- As our project could not proceed further and in order to get remedy we approached Hon'ble High Court, Madras in W.P. No. 25545 of 2010 and 25080 of 2010 for cancellation of environmental clearance issued to M/s North Chennai Power Company.
- In the counter filed by MOEF., they had stated that they had no objection for the two power projects co-existing in the areas in question with maintenance of environmental integrity of power project to come up vis-à-vis that of the base line environment. Further, during the arguments in the Court M/s North Chennai Power Company submitted that they have no objection for CPGL to acquire lands in the overlapping area and proceed with their project.
- Based on the assurance given by MOEF in the Counter that both projects can co-exist, the case pending in the High Court of Madras was disposed on 29.11.2011.

- During the litigation in the Court, the validity of TOR given to our project on 3.06.2009 had expired and we gave a representation to MOEF on 13.05 2015 for extension of .validity.
- However, MOEF in their letter NO. F.No. J/13011/11/1996/IAII(T) dated 18.06.2015 have requested us to apply for fresh TOR.

Based on the above direction of MOEF, we have now submitted our application for issue of fresh TOR.

This feasibility report is prepared for the 2 x 515 MW imported coal based Thermal Power Station towards obtaining Terms Of Reference for this project.

1.2 NEED FOR THE PROJECT:

Indian Power sector is witnessing major changes. Growth of power sector in India since Independence has been noteworthy. The present total installed capacity is 271722 Mw (as on 31/03/2015). However, the demand has been outstripping the growth of availability. Substantial peak and energy shortages prevail in the country. This is due to inadequacies in generation, transmission and distribution. As on 31.03.2015, the energy and peak demand shortages were 3.6% and 4.7% (CEA). This situation will only aggravate due to future demand in industrial, agricultural, service and rural sectors of the economy. Besides, the present GDP growth of 5 will put a heavy demand on power.

The National electricity Policy formulated by GOI envisages providing availability of over 1000 Units of percapita electricity by year 2012. As on 31.03.2015 per capita Electricity Consumption is 1010 Units.

The 18th Electrical Power Survey published by Planning Commission taking into account the various factors has projected a demand of 14174 MW at the end of 11th plan (2011-12) and at 20816 MW at end of 12th Plan (2016-17).

As per 18th Power survey capacity addition expected during the 12th Plan period upto 2016-17 is as below

Central Sector Share	- 2371 Mw
State Sector	- 1860 Mw
Private Sector	- 660 Mw
	=====
Total	4891 Mw
	=====

Even after considering the above addition, still there will be deficit by the end of 12th Plan Considering the long gestation period and huge investment in creating the above Capacity and considering the present financial position of the Govt. of Tamil Nadu, it is desirable to go for private participation for creating this capacity. In view of the above, TNEB desired promoting Private Sector in creating this required capacity.

1.2.2 JUSTIFICATION FOR THE PROJECT

As per the 18th Power Survey of CEA the energy requirement and Annual Peak demand by 2016-17 for the all India are 1354874 MU and 1,99,540 Mw as against the available as on 31.03.2015 of 1030800 MU and 141160 Mw. Therefore demand availability of about 60,000 Mw is to be created to meet the demand by the end of 12th Plan and about 1,00,000 Mw during the 13th Plan period i.e 2017-18 to 2021-22. To meet the additional demand, adequate installed capacity is to be added during the remaining years of 12th Plan and the entire 13th Plan.

Considering the above scenario of Power requirement in Tamil Nadu and also on All India basis and the persisting power shortage in Southern and Western region, the proposed 2x515 MW Thermal Power Project at Thiruvallur District in Tamil Nadu State is well justified.

* * * * *

CHAPTER – II

SITE DESCRIPTION

2.0 LOCATION & COMMUNICATION:

The 2x 515 MW Power plant is proposed to be located near Kattupalli village at Ponneri Taluk, Thiruvallur district, Tamil Nadu state. This site is a part of Survey of India Topo sheet No 66 C / 7, lying approximately at Latitude 13⁰ 19' 01.47" to 13⁰ 20' 06.89" North and Longitude 80⁰19' 37.2" - 80⁰ 20'41.43" East. The site is 4km north of Ennore Port, which is 22km north of Chennai. Chennai Airport is about 50Km from the site. Athipattu is the nearest railhead. The area is approachable from the North Chennai Power Plant (NCTP) – Ennore Port road, which branches off the Chennai – Manali – Minjur road near Vallur village.

The location plan is given in **Figure No 2.1**.

2.1 TOPOGRAPHY & DRAINAGE:

The plant area will cover about 319 acres including ash pond area outside the CRZ area. Besides, 23 acres within CRZ area will be used as corridor for sea water and coal conveying.

The project area is a typically plain coastal area with sandy soil and sparse vegetation. The general slope of the area is from Northwest to Southeast. The Bay of Bengal is near the eastern boundary of the site and the Buckingham canal is flowing in the west

2.2 CLIMATE:

Climate of the region can be considered as subtropical without any extreme variation in temperature profile.

Average annual rainfall is 1330 mm, out of which the maximum precipitation is during the North-East monsoon period of October to December, when nearly 70% of the annual rainfall occurs. Maximum rainfall invariably is in the month of November and minimum in the month of March.

The hottest months of the year are May to July, when the monthly average temperature ranges from 35°C to 37°C. Individual day maximum temperature during the summer months may go up to 40°C.

Feasibility Report for 2 x 515MW Imported Coal based Thermal Power Plant of M/s. Chennai Power Generation Limited in Kattupalli & Kalanji Villages, Ponneri Taluk, Thiruvallur District, TamilNadu State.

LOCATION PLAN

Figure No 2.1



Low temperature is recorded during the Winter months of December and January, the average monthly temperature ranging between 22°C & 23°C. However the minimum daily temperature does not go below 15°C.

Mean monthly wind velocity normally ranges from 10 km /hr to 15 km/hr. High velocity wind of 15 to 20 kms/hr occurs during the monsoon period. The wind direction is predominantly from SE & SW directions.

2.3 SITE SELECTION CRITERIA:

It is proposed to set up this power plant near Kattupalli village, Ponneri Taluk in Tiruvallur district, Tamil Nadu because of the following advantages.

- ❖ Proximity to the well developed Ennore Port and L & T Kattupalli Port for handling imported coal and has logistical advantages.
- ❖ Availability of sufficient vacant land in the area.
- ❖ Proximity to sea and availability of sea water as source of water without putting constraints on the existing water system of the locality.
- ❖ Proximity to load centre (i.e Chennai city)
- ❖ Absence of any ecologically sensitive features in the 10km region.

Besides, this location is selected by Tamil Nadu Electricity board for setting up the Power plant and allotted to CPGL through MOU route. This land is also reserved vide GO No 47 dated 5-2-1998 for setting up of this power plant.

2.2 OTHER REQUIREMENTS:

2.2.1 LAND REQUIREMENT:

The land requirement has been presented in Table 2.1 below:

Table – 2.1

Land Requirement		
Sl. No.	Details	Area (Acres)
1.	Power block including Switchyard area	60
2.	Coal handling Plant including blending facilities	45
3.	Cooling Tower and Water Facilities	35
4.	Ash Pond & Slurry disposal facilities	14
5.	Road and Open Space	45
6.	Infrastructures, Store etc.	10
7.	Green Belt	110
	Total Plant area Outside the CRZ area	319

Besides, 23 acres within CRZ area will be utilized as corridor for sea water pipeline and for coal conveying.

It has been proposed that the common corridor facilities for Intake sea water, sea water outfall pipeline and Coal Conveyor from the dedicated jetty to Plant site will be developed by CPGL.

2.2.2 FUEL REQUIREMENT:

The Steam Generator would be designed primarily for imported coal firing having about 7.5% of ash content with gross calorific value (GCV) of minimum 4100 k Cal / kg. Imported Coal for the project would be procured mostly from Indonesia.

The annual consumption of Coal for the proposed Power Plant is estimated as 4.05 million tonnes considering average GCV value of coal as 4100 kCal/ kg, plant heat rate 2300 kcal/ kwhr and annual plant load factor (PLF) of 80%.

The typical analysis of coal considered for the proposed power plant is as follows:

PROXIMATE ANALYSIS, AS RECEIVED basis

1.	Total moisture (as received basis) %	35
2.	Inherent moisture(air dried basis) %	10-13
3.	Ash (air dried basis) %	2-4
4.	Volatile matter %	38-42
5.	Total sulphur not exceeding %	0.5
6.	GCV (as received basis) Kcal/kg	4100
7.	Hardgrove index	45-50

The Coal from dedicated jetty/ nearby Port to Site shall be transported through conveyor belts. A Coal storage yard of 45 days has been proposed for the Power Plant.

2.2.3 WATER REQUIREMENT:

The total Estimated consumptive water requirement for the plant is about 10,650 m3/hr (=93.29 million m3/year) for 2 x 515 MW plant capacity, considering recirculation closed cooling water system with Induced Draft Cooling Towers. Sea water from Bay of Bengal will be brought to the Plant through construction of offshore booster pump house and pipe line.

In view of the closed recirculation cooling water system, the sea water will be required only for make up (~ 10650 m³/hr) considering COC 1.5, which will significantly

reduce the cost of sea water intake system.

Due to proximity to the sea and in order to avoid depletion of sweet water source in the proximity, it is proposed to use sea water after clarification for condenser cooling and sea water with appropriate treatment shall be used for the cycle make-up and other consumptive water requirements for the proposed Plant.

The total plant water requirement is summarized below:

Plant Water Requirement

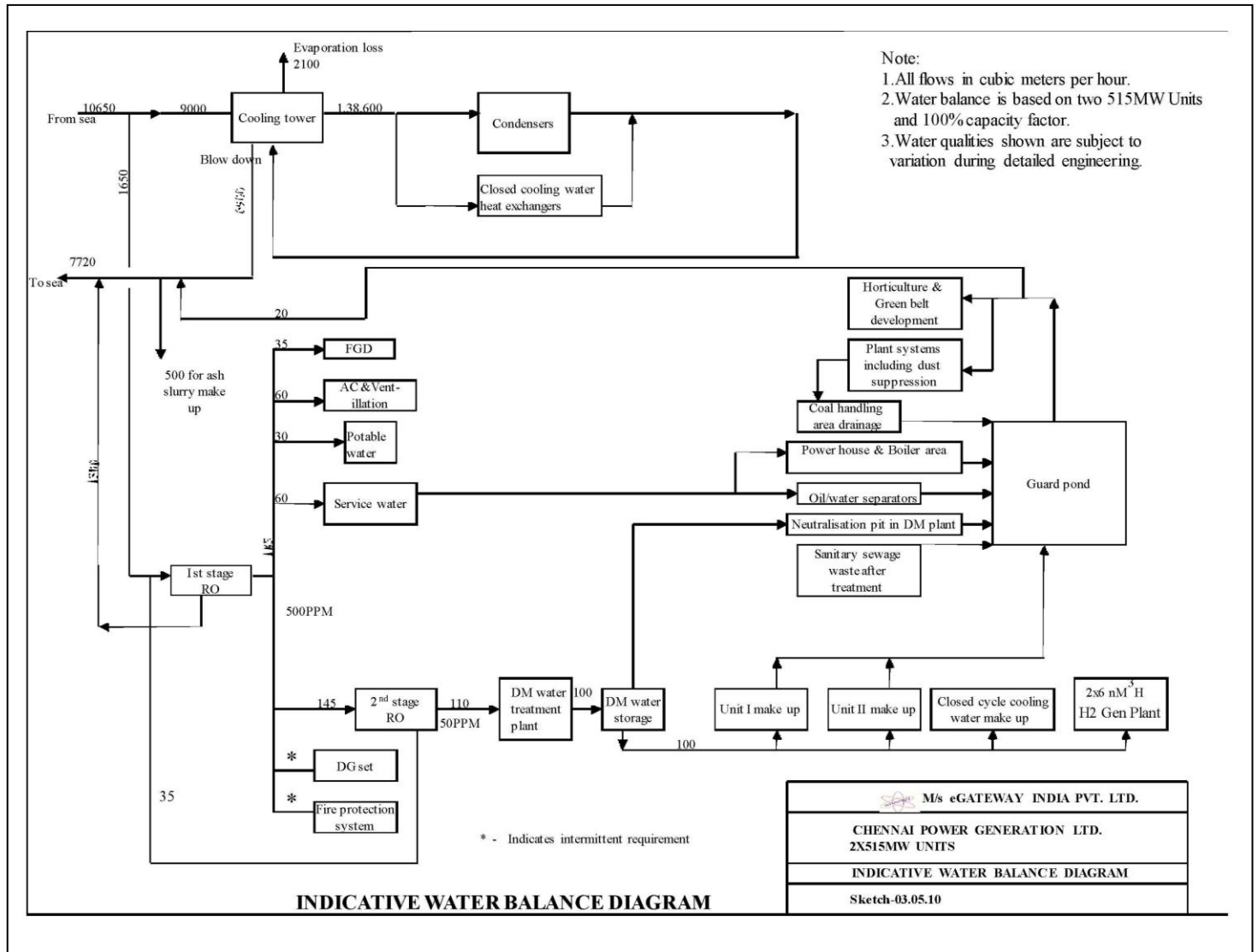
Item	m³/hr	m³/day	Quality
Make up for Cooling Tower	9000	2,16,000	Clarified Water
Service Water (Ash sealing + Coal dust suppression)	60	1440	RO Permeate
Potable water	30	720	RO Permeate
DM make up for Steam Generators	100	2400	DM Water
RO Plant Stage - I Blowdown	1300	31,200	Clarified Water
RO Plant Stage – II Blowdown	35	840	Filtered Water
DM Plant Regeneration	10	240	DM Regeneration
Make up for AC Plant & Ventilation System	60	1440	RO Permeate
Water for fire protection, DG set, FGD	55	1320	RO Permeate
Total Make up Water	10,650	2,55,600	

Note: From cooling tower blow down of 6900 m³/hr, 500 m³/hr will be used for Ash slurry and balance will be discharged to sea.

The water balance diagram is shown in **Figure No 2.2**.

Feasibility Report for 2 x 515MW Imported Coal based Thermal Power Plant of M/s. Chennai Power Generation Limited in Kattupalli & Kalanji Villages, Ponneri Taluk, Thiruvallur District, TamilNadu State.

Figure No 2.2.



2.5 PROJECT LAYOUT IN RELATION TO IMPORTANT NATURAL FEATURES:

Land are mostly sea side waste lands only. No agricultural land is involved. However, lots of industrial activities are happening in the area and there is good demand for the land.

Temporary accommodation facilities, temporary RMC unit, Kattupalli kuppam are located within the project area. Proper Rehabilitation & Resettlement scheme for Kattupalli kuppam is to be devised.

There is a road connecting Kalanji village passing through the project area. This is proposed to be diverted on the western side of the project boundary.

There are no declared biospheres, wild life sanctuaries, or tiger sanctuary or migrating corridor or Coastal zone in the core zone and 10 km buffer zone.

In the 10km buffer zone, the following features are observed:

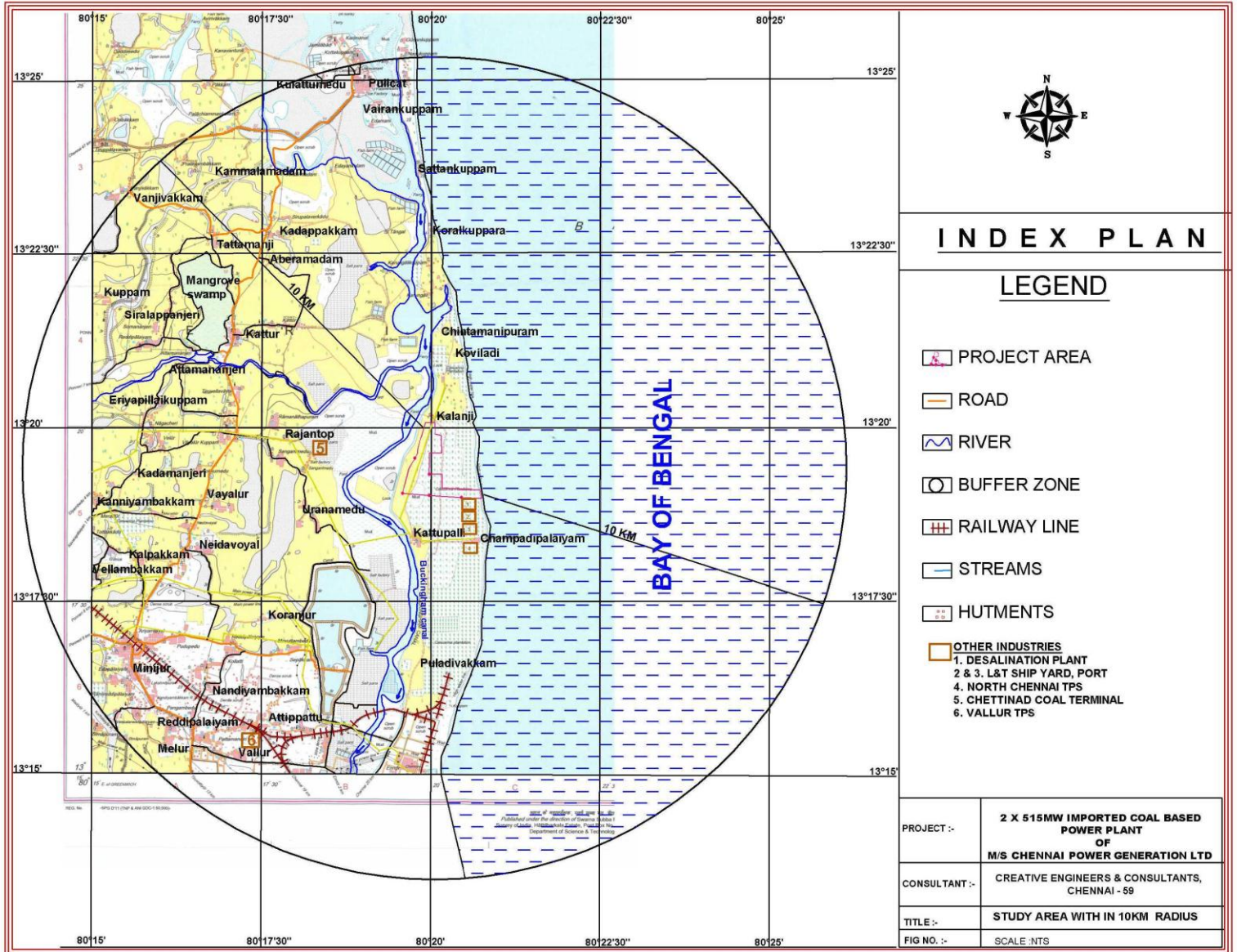
S.No	Particulars	Details
1.	Nearest villages	Kattupalli, Kalanji, Puzhudevakkam, Vallur etc
2.	Nearest Major water bodies	Buckingham canal – 100 m Bay of Bengal -0.5 Km
3.	Notified Archaeologically important places, Monuments	Nil within 10km radius
4.	Local Places of Historical and Tourism Interest	Nil within 10km radius
5.	Environmental sensitive areas, Protected areas as per Wildlife Protection Act, 1972 (Tiger reserve, Elephant reserve, Biospheres, National parks, Wildlife sanctuaries, community reserves and conservation reserves)	Pulicat Sanctuary – 12km
6.	Reserved / Protected Forests	Nil within 10km radius
7.	Defence Installations	Nil within 10km radius
8.	Seismic Zone	Zone – II (Least Active)
9.	Other Industries in the area	North Chennai TPS, Vallur TPS, Ennore port, L & T ship yard, L & T Port, Chettinad Coal Terminal, Chennai Metro Desalination plant, Vallur TPS, etc

Index plan showing the features within 10km radius is given as **Figure No – 2.3**

Feasibility Report for 2 x 515MW Imported Coal based Thermal Power Plant of M/s. Chennai Power Generation Limited in Kattupalli & Kalanji Villages, Ponneri Taluk, Thiruvallur District, TamilNadu State.

INDEX PLAN

Figure No – 2.3



CHAPTER – III

PLANT DESCRIPTION

3.0 PLANT DESCRIPTION:

3.1 PLANT SIZE AND ASSOCIATED ACTIVITIES:

The proposed Power Plant shall consist of two (2) nos. of Steam Turbine Generator (STG) sets, each of 515 MW capacity and two (2) nos. of Pulverized Coal Fired Subcritical Boilers and the Balance of Plant comprising of Coal & Ash Handling Plant, Water Treatment Plant, Desalination Plant, Compressed Air System, Electrical Controls, Instrumentation and Control, Chimney etc.

The total plant area will cover about 319 acres including ash pond area. Besides 23 acres within CRZ area will be utilized as corridor for sea water pipeline and for coal conveying.

3.2 TECHNICAL PROFILES:

It is proposed to install 2 X 515 MW sub critical units for this project. This configuration is adopted in view of the fact that proven technology is available within the country and a no. of sets of 500 MW capacity are working satisfactorily. This will also facilitate execution of these projects in a lesser time frame which will go a long way in mitigating prevailing the power shortages in the country.

The estimated Gross Station Heat rate for proposed 2X515 MW units is estimated about 2300 Kcal/KWh. However considering some OEM margin gross station heat rate of 2400Kcal/kWh is considered for the tariff purposes. As per CERC guidelines, Station Heat Rate of 2450 Kcal/Kwh is permitted for coal fired plants of 500 MW and above.

3.3 MAIN PLANT EQUIPMENT AND SYSTEMS

3.3.1 STEAM GENERATOR:

The steam generator (SG) would be designed for firing 100% pulverized coal and would be natural/ asserted circulation drum type, two pass design, radiant, single reheat, balanced draft, semi-outdoor type, rated to deliver 1700 t/ hr of superheated steam at 178 bar pressure with temperature 540 °C when supplied with feed water at a temperature around 246 °C at the economiser inlet. The reheat steam temperature would also be 540°C. The Boiler design shall be suitable both for Constant Pressure & Variable pressure operation from 30% to 100% BMCR. The main parameters at 100% BMCR will be as follows:

1.	Flow	1700 TPH
2.	Pressure at super heater outlet	178 bar
3.	Temperature at SH outlet (minimum)	540 °C
4.	Steam temperature at reheater outlet (minimum)	540 °C

3.3.2 Steam Turbine

Each TG unit of 515 MW shall broadly cover the Steam Turbine along with its integral systems and auxiliaries like lube oil system, control-fluid system, condensers, condenser air evacuation system, HP&LP Bypass system, complete regenerative feed heating system, condensate pumps along with their drives, boiler feed water pumps along with their drives, automatic turbine run-up system, instrumentation and control devices, turbine supervisory instruments, turbine protection and interlock system, automatic turbine testing system and turbine hall EOT cranes.

The steam turbine shall be tandem compound, single reheat, regenerative, condensing, multi cylinder design with separate or combined HP-IP and separate LP casings, nozzle / throttle governing and directly coupled with the generator suitable for indoor installation. The plant would be designed to operate as a base load station. However, continuous operation under two-shift and cyclic modes during certain periods of the year are also envisaged. The turbine design shall cover adequate provision for quick start-up and loading of the units to full load at a fast rate. The turbine shall be provided with suitable margins for VWO flow.

The steam turbine shall conform to the following design and duty conditions:

Output under Economic Maximum Continuous Rating (EMCR) (Guarantee output load) at Generator terminals with Cycle make up of 3% of throttle steam flow and design condenser pressure.	515 MW (In case of static excitation system, the EMCR output at generator terminals shall be 515MW plus excitation power requirement at EMCR).
Turbine throttle steam pressure	170 bar (abs)
Turbine throttle Main steam/ Reheat Steam temperature (minimum)	537 °C
Variations in rated Steam temperature & pressure	As per IEC-45.
Condenser pressure - Design/ Maximum	76 mm Hg abs
DM Water make up to thermal cycle under EMCR condition	3% of throttle steam flow.
Final feed water temperature for heat rate (HR) guarantee point (at 100 % TMCR condition)	246°C +/- 5 °C

Turbine protection against water induction	As per ASME-TDP-1 (latest)
No. of extractions for regenerative feed water heating	As per cycle optimization by the bidder

3.3.3 Electrostatic Precipitator

It is proposed to install high efficiency electrostatic precipitator having an efficiency that limits the outlet emission to 50 mg/Nm³. The electrostatic precipitators will have Four (4) parallel gas streams, isolated from each other on the electrical as well as gas side and will be provided with gas tight dampers at inlets and outlets of each stream, so as to allow maintenance to be carried out safely on the faulty stream, while the unit is working. Electrostatic precipitator will be provided with microprocessor based programmable type rapper control system and ESP management system to ensure safe and optimum operation of ESP.

ESP transformer rectifier sets will use high flash point oil as the cooling medium. The dust collection hoppers at all strategic locations will have a minimum storage capacity of eight (8) hours. The hoppers will have heating arrangements to prevent ash sticking to the sloping sides and down pipes. Level indicators to indicate ash levels in the hoppers and trip the ESP in case of high ash levels in the ash hoppers are also envisaged to ensure safety of ESP.

3.3.4 Flue Gas Desulphurising System (FGD)

Space provision for the FGD system, to be installed in future (if required), shall be kept behind the chimney. The design and layout of steam generator and its auxiliaries will be such that a wet/dry flue gas desulphurisation system can be installed in future, taking suction from duct after ID fan and feeding the desulphurised flue gases back to the chimney with provision for bypassing the FGD system.

3.3.5 Environmental and Efficiency Considerations

In order to meet the environment norms and maintain the sustained efficiency of ESP, it shall be adequately designed with sufficient margins for all operating conditions. The Electrostatic Precipitator Management System (EPMS) in conjunction with opacity monitor shall continuously monitor and maintain the optimum energy level to achieve higher efficiency of ESP. The steam generator shall be designed for low NO_x formation by adopting the appropriate burners. The boiler will meet the requirement of sustained high efficiency and availability, high efficiency at part load, flexibility to burn coal within the

range specified, and quick start-up and two shift operations. Furnace shall be sized for burning high ash coal and low flue gas velocities to minimize erosion.

3.3.6 Chimney

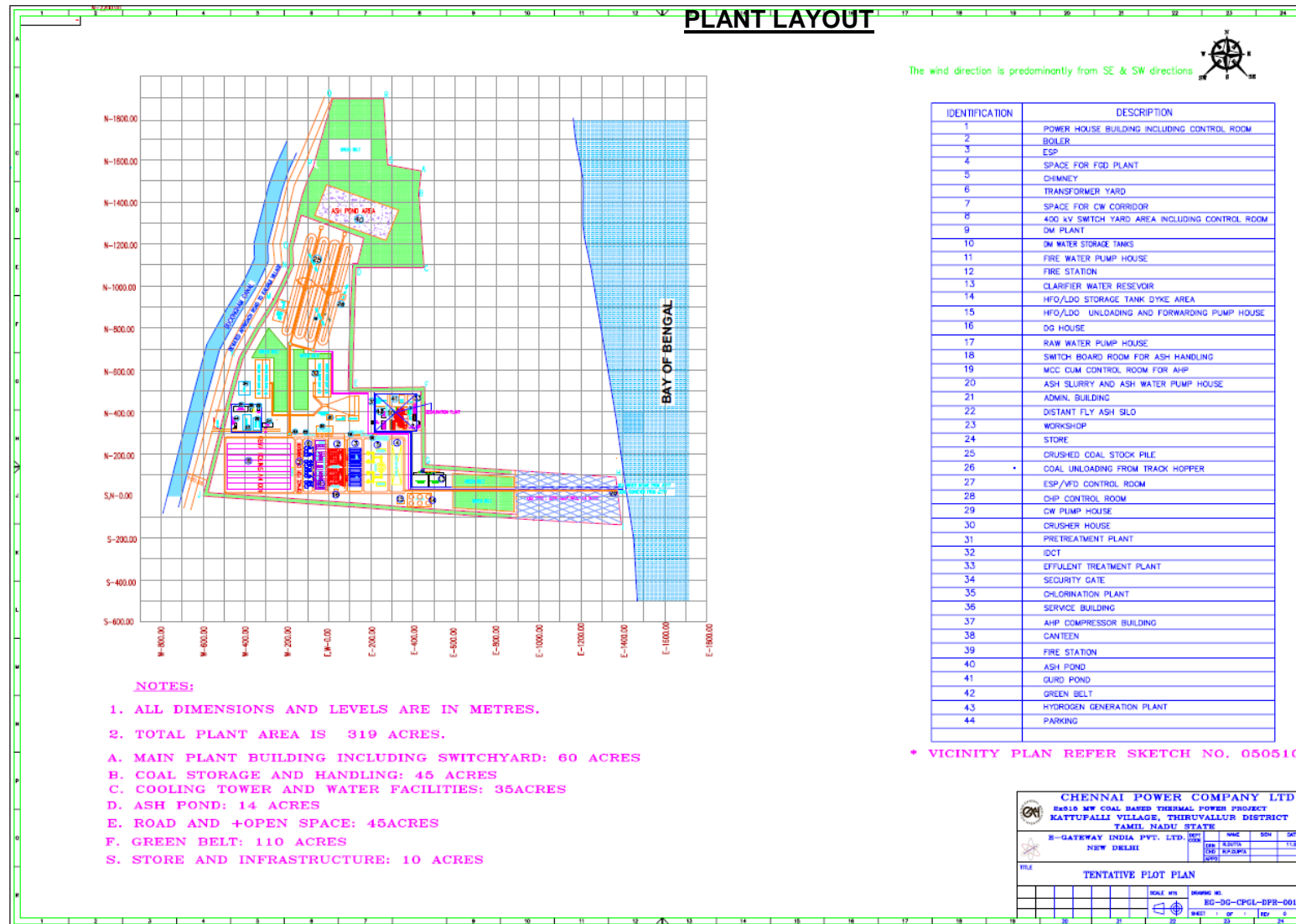
Single twin flue chimneys for both the units has been envisaged for the proposed thermal power plant. The total height of each reinforced concrete chimney is 275 m. This would meet the requirement of MOEF and PCB. The RCC for the chimney and other super structure shall be of M-35 grade and for foundation & grade level slab it shall be of M-30 grade. The flues will be of mild steel construction with glass wool insulation. The chimney windshield shall be of RCC slip form construction.

3.4 PLANT LAYOUT:

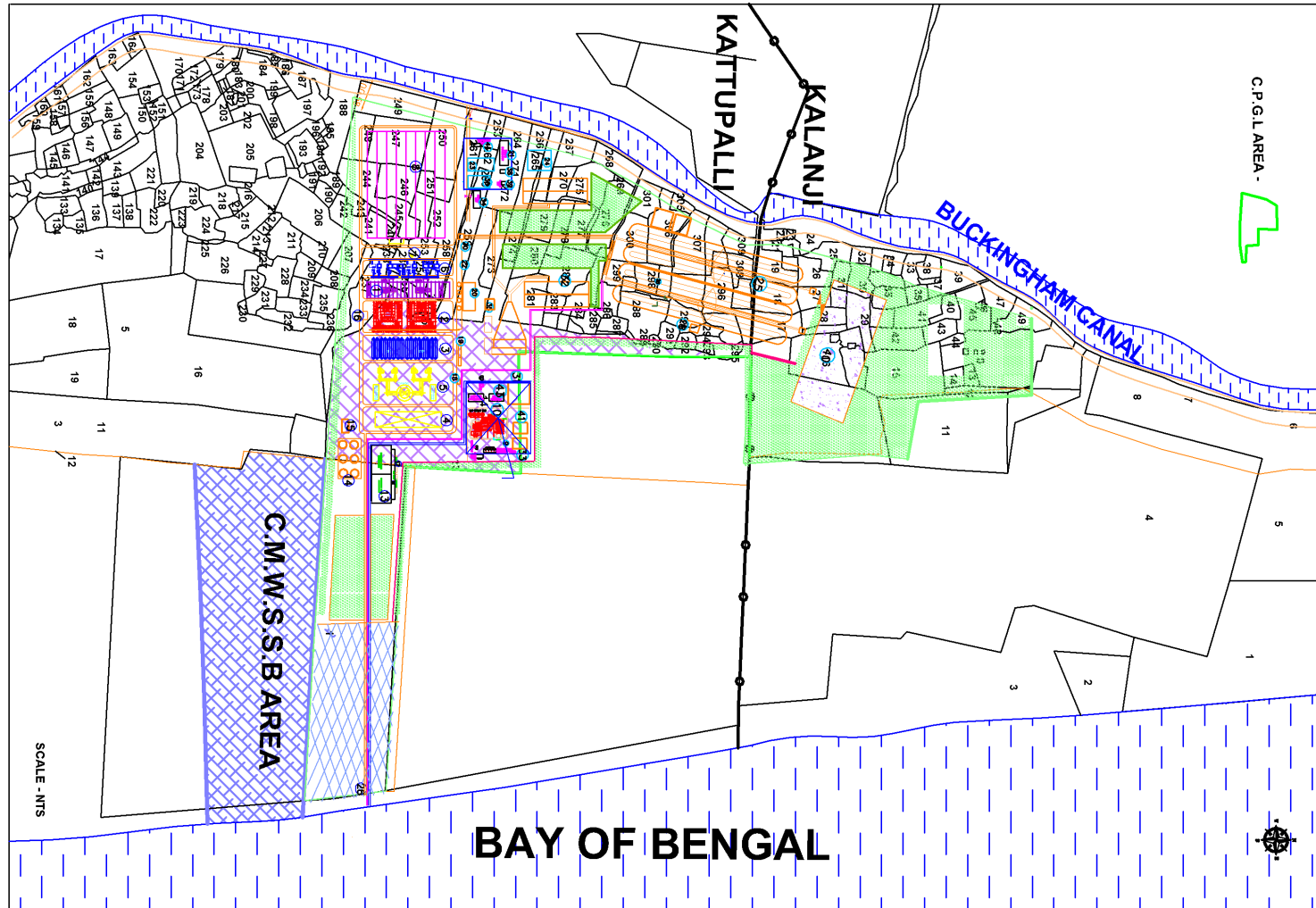
The layout of the main plant along with all the auxiliary systems for 2 x 515 MW units is shown in Plant layout **Figure No 3.1**. The Plant Layout super imposed with village map is shown in **Figure No – 3.2**.

Feasibility Report for 2 x 515MW Imported Coal based Thermal Power Plant of M/s. Chennai Power Generation Limited in Kattupalli & Kalanji Villages, Ponneri Taluk, Thiruvallur District, TamilNadu State.

Figure No 3.1



SITE PLAN SUPER IMPOSED IN VILLAGE MAP



In laying out the various facilities, consideration has been given to the following general principles:

- Predominant wind directions as given by the wind rose are duly taken into account with a view to minimize pollution, fire risk, etc.
- Power Evacuation corridor for connecting to PGCIL grid.
- Sea & fresh water facilities.
- Approach road to the Power Plant from the State Highway.
- All facilities are laid out in close proximity to each other to the extent practicable so as to accommodate all facilities within the Plant boundary.

The layout also facilitates communication of men and materials between the various facilities both during construction and also during subsequent operation and maintenance.

Availability of adequate space for fabrication / construction equipment beyond the Power Plant boundary which can be hired temporarily for the purpose.

Adequate space provision has been kept in the layout for lay-down and pre-assembly activities, open stores, Site Offices, contractor's offices and stores, green belt area etc. Construction offices and storage sheds are located close to the main Approach road to the plant.

3.5 PLANT WATER SYSTEM

3.5.1 Sea Water Intake System

Sea water required for the power plant will be drawn from Bay of Bengal by three (3) Nos. (2 working + 1 standby) Sea water intake pumps and conveyed to the plant for meeting the plant consumptive water system make up requirements. These pumps will be of vertical turbine type. Suitable trash rack, traveling water screens, coarse screen and stop log gates will be provided for the intake pump chamber. Make-up sea water will be brought to the plant area through pipes running along the jetty structure. The intake pump house will be located at a distance of about 0.5 km from the coast.

3.5.2 Raw Water System

Sea water drawn from Bay of Bengal will be used for supply of make up water to various plant requirements after the suitable treatment in Clarifier. The Clarified water will be further used in Cooling water make up. The clarified water will be treated in RO plant for further use in DM plant make up and other sweet water requirement.

3.5.3 Condenser Cooling Water System

Re-circulation type cooling water system with cooling tower is proposed for the CW system. The system will include Induced draught cooling towers (IDCT), CW pumps, CW conduits (with valves, expansion joints and instruments as required) and chlorination system. Make up for the system will be met from plant raw water system.

The system will be designed to operate at a cycle of concentration of 1.5. Debris filter with on load condenser tube cleaning system using rubber sponge balls will be provided for removing any scale formed and to maintain the condenser tubes in a clean condition.

3.5.4 Cooling Tower

It is proposed to install four (4) Induced draft cooling towers, two for each unit, of capacity 34,650 m³/hr for each unit. The cooling water will be collected in a RCC basin. The cooling tower will be designed for a cooling range of 8 °C and an approach of 4.5 °C. The design wet bulb temperature is about 28 °C. The design hot and cold water temperatures of the cooling towers will be 42 °C and 34 °C respectively. Tower construction will be of RCC with PVC splash type fill.

3.5.5 Auxiliary Cooling Water System

The ACW system will meet the cooling water requirements of all the auxiliary equipment of the TG and SG units such as turbine lube oil coolers, seal oil coolers, generator air coolers, ID/FD/PA fan bearing oil coolers, BFP auxiliaries such as lube oil coolers, working oil coolers, drive motors, condensate pump bearings, sample coolers and Instrument /service air compressors, fly ash compressor cooling etc.

A closed loop system using passivated DM water is proposed for the ACW system. The DM water will be circulated through the auxiliary coolers by three nos 50% capacity (2 working + 1 standby) Closed cycle cooling water (CCCW) pumps. The hot water from these auxiliaries will be cooled in the plate type ACW heat exchangers 2 Nos. (both working). Each 100% capacity ACW pump will be provided for each unit with one common stand by (3 working + 1 standby). These pumps shall be located in the CW pump house.

A CCCW overhead tank of 10 m³ capacity will be provided to ensure positive suction to the CCCW pumps and also serve as the source of make-up to the ACW system.

Normal make-up to the ACW overhead tank will be provided from the condensate extraction pump discharge. Initial fill for the tank will be provided from the boiler fill pumps discharge.

3.5.6 Water Treatment System

The water treatment system comprises of Water Pre-treatment Plant, RO Plant (Desalination Plant), DM Plant, Electro-chlorination Plant, Condensate Polishing Plant, CW Treatment Plant as described below.

3.5.7 Pre Treatment Plant

The makeup water pre-treatment plant (Electro-chlorination plant) shall be provided to avoid the growth of algae and bacteria within the well at Seawater makeup pump house with subsequent clarification in clarifier. Also necessary upstream chemical treatment and membrane protection systems for the in plant RO system will be provided. The first-stage desalinated water will be used for the fire protection system, service water system and ash handling systems. Second-stage desalinated water will be used for the potable water after suitable treatment and influent for DM Plant.

3.5.8 RO Water System

Treated seawater will be used to meet plant sweet water requirements. Sea water will be Desalinated by a two-stage Reverse Osmosis (RO) Plant. RO plant reject (second stage) will be reused within the plant and 1st stage reject discharge will be led to the sea. RO plant first stage product water will be used to meet service water requirement and second stage product water will be used for DM water feed and drinking water.

Storage tanks of 4 hours capacity each will be provided for first stage and 8 hrs for second stage product water of RO plant. A pipe network for distribution of potable water for plant will be provided from the overhead storage tanks. Required number of potable water pumps for plant area will be provided. A service water pipe network spread over the entire plant area would be provided for cleaning of main plant area and other buildings. Required number of service water pumps will be provided which will draw water from the service water tank.

In addition to the above, DM water make up system, boiler fill pumping system, Air pre-heater wash water system and HVAC make up system will also be provided as per requirement and required quantity of pumps for these services and their parameters will be

finalized as per final plant layout and requirements of the main plant equipment.

RO permeate water after stage -II will be stored in RO Permeate storage tank. Desalinated water storage tank capacity is adequate to meet 8 hrs make-up requirement for all the two Units. The two nos. (2x100%) DM plant supply pumps will be provided to transfer the RO Permeate from the RO Permeate storage tank to DM plant.

3.5.9 DM Plant

A DM plant of total 105 m³/hr capacity is envisaged to ensure make-up requirement of heat cycle at the rate of 3 % of the BMCR steam flow, make up to closed circuit auxiliary system, hydrogen generation plant (if applicable) and stator water-cooling system. The DM plant will consist of influent of RO - Plant second stage water, further treated with degasser and mixed bed polishers to produce DM water. Configuration of the DM Plant will be such that at least one stand by stream is available.

DM water will be stored in 2 x 1000 m³ of DM water storage tank. DM water storage tank capacity is adequate to meet 20 hrs make-up requirement for all the Units. The two nos. (2x100%) DM water Transfer pumps will be provided to transfer the DM Water from the DM plant storage tank to Condensate storage tanks of capacity 3 x 500 m³ for further heat cycle make up system.

The DM Water cycle make-up system will consist of 2x100% cycle make up pumps for feeding to condensate hotwell as well as feed water storage tank. Besides, there will be 2 x 100% SG fill pumps for direct filling of SG with Demineralised Water. These pumps will be located near Condensate storage tank.

33% hydrochloric acid and 48% sodium hydroxide would be used as regenerants for the purpose of regeneration of cation and anion resins respectively. The equipment of regeneration system shall comprise bulk acid and alkali storage tanks, acid / alkali transfer pumps, acid / alkali solution preparation and measuring etc. Two (2) nos., of bulk acid and alkali storage tanks each would be provided to meet the requirement of both the streams. Brine treatment system consisting of one brine preparation-cum-measuring tank with all associated pumps, valves, piping etc. would be provided to treat the SBA resin with brine as a measure to remove organics, if any, trapped in the resin.

The acidic and alkaline effluents from DM plant and the filter backwash would be led to the neutralizing pit which is in two (2) compartments to facilitate maintenance and

cleaning. Acid or alkali would be added to the neutralizing pit depending on nature of effluents from DM plant to neutralize the effluent collected in the neutralizing pit. Two (2) nos. of sump pumps, (one working + one standby) are proposed to recirculate the neutralized effluents to the guard pond.

3.5.10 Electro-Chlorination plant

Chlorination plant will be provided with Sodium hypochlorite dosing in the CW system and Seawater intake system to avoid the growth of algae and bacteria. The chlorination system will comprise of 3x50% (2 working and 1 Standby) streams of Hypochlorite generators using sea water along with 2x100% (1 working and 1 Standby) booster pump.

Two (2x100%) dosing pumps shall be provided for each dosing system. Total six (6) nos. dosing pump shall be provided. The transformer-rectifier and the hypochlorite tank will be located outdoor. The electrolyser cells will be located indoor.

3.5.11 Potable & Service Water System

Drinking water requirement for the plant will be met from the output of gravity filters after treatment. There will be 2x100% drinking water pumps, which will supply drinking water to various facility area overhead tanks. Plant service water requirement will be met from the Overhead Service water tank and 2x100% Service water pumps, which will supply service water to various facility area.

3.6.0 COAL HANDLING PLANT:

3.6.1 Coal Receipt & Unloading System

The envisaged mode of coal transportation from the proposed mines to the power plant is mainly by Sea Route. An offshore Jetty has been envisaged for receipt of imported coal and further conveying to site by 2X100% Cross country conveyors is envisaged. Possibility of Coal transportation from nearby Port shall be explored.

Coal received from the Jetty/Port is either directly sent to the crushers or to the stockpile from cross-country conveyor through a Transfer Point. CPGL will ensure that the cross-country conveyor system will consist of two parallel conveyors, each will be sized to transport 24 hours coal requirement of 2x 515 MW units in 16 hours.

Two (2) nos. Stacker cum reclaimers will be provided for stacking and reclaiming the un-crushed coal. Four (4) nos Coal Crushers, each of 50 % plant requirement capacity

(2W + 2S) will be provided to bring down the size of coal to that suitable for the Pulverisers.

3.6.2 Coal Storage

Coal storage and handling facilities have been located behind chimney. At present Crushed Coal stockpile for 45 days requirement of Uncrushed Coal has been envisaged within the plant, considering long distance of coal source.

3.6.3 Coal Conveying System

2x100% capacity streams of conveyers and equipment will be provided for conveying coal from stockyard to bunkers. Out of two streams, one will be normally operating and the second will be standby. During emergency, both the streams will be operating to meet the coal requirement at boiler bunkers of all the units. Individual bunkers will be provided for each mill. Bunkers will have a storage capacity of 12 hours. From the bunkers, the Coal will be fed to mills by raw coal feeders.

The rated capacity of each belt conveyors would be 1000 TPH. All conveyors would be provided with Nylon-Nylon belting with fire retardant (FR) grade covers of 5mm thickness at top and 3 mm thickness at bottom. The belt width would be 1400 mm with a troughing angle of 35°. The belt speed would be about 3.0 m / sec.

All above-ground conveyors would be provided with enclosed galleries with sheeting on sides and top. Seal plates at required locations like road and rail track crossings, above the building, etc. will be provided. The bottom run of conveyors near the station building area would be provided with seal plates to avoid coal falling on personnel walking in the area. Ventilation opening for a height of 250 mm at the top and bottom of side sheeting for the gallery would be provided for natural ventilation.

3.6.4 Salient features of Coal Handling Plant

The coal handling plant will be provided with the facility for recording the quantity and analysis of the raw coal received in the station and fed to the bunkers. In-line magnetic separators, bunker level indicators, flap gates in bifurcating chutes, chute vibrators, sump pumps (for underground areas) will be provided, where-ever necessary, to make the system efficient and trouble free.

Suitable pollution control measures like dust extraction and dust suppression systems shall be provided at different transfer points and crusher houses and ventilation

system to supply fresh air in underground tunnels will be provided. In addition, roof extraction fans will be provided in essential areas like crusher house and boiler bunker floors. Air conditioning for control room and pressurized ventilation with unitary air filter unit for MCC buildings of coal handling plant will be provided.

Stockpile areas shall be provided with automatic garden type sprinklers for dust suppression as well as to reduce spontaneous ignition of the coal stockpiles. RO plant 1st stage water is used in ash handling system for equipment sealing and cooling and the same will be reused for coal dust suppression system. Necessary water distribution network for drinking and service water with pumps, piping, tanks, valves etc. will be provided for distributing water at all transfer points, crusher house, control rooms etc.

A centralised control room with microprocessor based control system Programmable logic controller (PLC) has been envisaged for operation of the coal handling plant. Except locally controlled equipment like traveling tripper, dust extraction/ dust suppression / ventilation equipment, sump pumps, water distribution system etc., all other in-line equipment will be controlled from the centralised coal handling control room but will have provision for local control as well. All necessary interlocks, control panels, MCC's, mimic diagrams etc. will be provided for safe and reliable operation of the coal handling plant.

3.7 ASH HANDLING SYSTEM:

For each unit, Bottom ash will be collected in wet form; while fly ash will be collected in dry form to facilitate utilization and the un-utilized fly ash will be disposed in wet form combined with bottom ash to the ash pond. Ash extraction system is unitised basis and ash disposal system will be common for both units. The ash handling system design is given below:

Ash Handling System Design

Sl. No.	Item		Value
1.	Hourly coal firing rate at MCR condition per unit for Imported coal	:	289 TPH
2.	Ash content in coal considered for the design of ash handling system	:	7.5 %
3.	Distribution of total ash produced as		21.67 TPH
4.	Bottom ash 80 %	:	17.34 TPH
5.	Fly ash 20 %	:	4.33 TPH
6.	Volume occupied by one tonne of ash in storage area	:	0.8 cu.m

For the design of the Ash Handling System, the following data has been considered for each Unit.

3.7.1 Bottom Ash system

Bottom ash will be collected in wet form and disposed to the ash pond. Ash extraction system is unitised basis and ash disposal will be common for all the units.

Bottom ash from boiler furnace shall be collected in 2 nos. of W type water impounded hoppers. Bottom ash slurry shall be discharged from the bottom ash hopper to ash slurry sump through a 2W+2S system of gates, clinker grinders and hydro ejectors/ jet pumps along with necessary piping, valves & fittings. Cooling tower blow down water will be used for hydro ejector water.

Ash from economiser and air preheater hoppers shall be collected in wet form by means of 2 x 100 % hydro-ejectors and sent to the above ash slurry sump.

3.7.2 Fly Ash system

Pneumatic conveying system (either vacuum system or pressurized system) will be employed for extraction of fly ash from the electrostatic precipitator hoppers in dry form. The conveying system will be sized such that ash collected in 8 hours will be evacuated in six hours. For this purpose, 2 x 100 % compressors / vacuum pumps for each unit will be provided. This dry ash will be taken to one (1) no. surge hopper of 12 hours storage capacity for each unit. The surge hoppers will be located adjacent to the ESP. Surge hoppers shall be of RCC/steel construction, with erosion resistant stainless steel inside lining. Surge hoppers will have facility to transport ash either in dry form to the main dry fly ash silos or in wet form to the common ash slurry sump. For dry ash conveying to storage silos, 4 x 100 % compressors will be provided common for all units. The conveying system will be sized for continuous evacuation of ash from surge silos. To facilitate easy flow of dry ash, 2 x 100 % fluidizing blowers will be provided, for each silo.

Dry ash from Intermediate surge hoppers will be transported to 2 nos. main storage silos of RCC construction having 24 hours capacity each, common for all the units, located near the plant boundary. Each shall be provided with ash unloading provision, in dry form, into truck to facilitate utilisation. To facilitate easy flow of dry ash, 2 x 100 % fluidizing blowers will be provided, common for both silos. Each silo shall be provided with two nos. of gates with rotary feeders/ dust conditioners units and telescopic chutes.

Silo area will be provided with fencing, office block, gate complex and passage for entry/exit of vehicles. The user industries will take the dry fly ash from these silos in closed tankers.

In the event of any emergency / malfunction of dry ash conveying system, fly ash shall be conveyed in slurry form from the surge silos thru 2x100% hydro ejectors/ wetting head units to ash slurry sump. From the surge hoppers the ash either will be conveyed in dry form to the main storage silos or to the wetting head below the surge hopper for converting in to slurry.

3.7.3 Ash Slurry Disposal (HCSD) System

High Concentration Slurry Disposal (HCSD) system has been envisaged for the disposal of bottom ash in slurry form. The disposal of fly ash in slurry form has been considered as stand by provision.

The bottom ash slurry and fly ash slurry will be led to the common slurry sump of the combined ash slurry disposal pump house. The three (3) nos (2W+1S) dense slurry disposal system streams constituting rotary feeders, conditioning unit, mixer, mixing tank, retention tank with agitator along with suction booster pumps as required and high pressure slurry pumps, shall be provided for. Ash to water ratio of 3:1 is envisaged for the HCSD system.

There will be a common ash slurry pump house. All the pumping streams will be provided with individual disposal pipes. Ash slurry sump shall have two (2) nos. compartments, each of holding capacity equivalent to slurry generated from one unit for 30 minutes. The ash slurry of fly ash and bottom ash from both units shall be pumped through two (2) nos. pumping streams from the ash slurry sumps to the ash disposal area. Each stream capacity will match with one unit slurry flow considering 100 % ash (i.e. no ash utilization). One of the series pump in each stream will be provided with variable speed drive arrangement, while other pumps in the series will be constant speed electric motor driven horizontal centrifugal type. The dense ash slurry pump will be positive displacement piston diaphragm type designed for continuous, heavy-duty operation in highly abrasive ash slurry service for a long distance pipeline disposal.

3 x 100% capacity HP water, LP water and seal water pumps each shall be provided. HP and LP ash water pumps shall draw the water from the ash water sump, while the seal

water pumps take their suction from the filtered water tank located near water treatment area.

3.7.4 Ash Pond

All efforts will be made to promote utilization of ash to the fullest extent. In view of the stringent restrictions from environmental authorities with respect to allocation of land for ash pond, the ash pond is envisaged to be around 14 acres. The fly ash will be collected in a dry form and pneumatically conveyed to the fly ash silo for disposal to cement plants through covered trucks and partly to ash pond.

The ash slurry will be discharged into the Ash Pond where the ash particles will settle and the decanted water will overflow into an overflow lagoon. This ash water is mixed with the cooling tower blowdown water and discharged back into the sea. Suitable geo-technical lining will be provided in the Ash pond to avoid seepage, contamination of soil etc

3.8 OTHER SYSTEM:

In addition to above facilities, other systems such as compressed air, air conditioning ventilation, communication, control and instrumentation, etc. will be provided commensurate with statutory requirements, with latest modern technological features

3.8.1 FIRE PROTECTION SYSTEM:

This system shall comprise of the following sub systems:

- Hydrant system covering all areas of the plant
- High velocity water spray (HVWS) system for the protection of generator transformers, turbine oil tanks, lube oil system equipment, unit auxiliary transformers
- Automatic deluge (medium velocity water spray) system for the protection of cable galleries and under ground conveyors, Coal handling system.
- Heavy duty portable or trolley mounted fire extinguishers for the protection of control rooms and portable fire extinguishers for different areas
- Foam sprinkler system for fuel oil tanks.
- Two (2) number Mobile fire tenders.

The system will be designed to conform to the rules and regulations of the Tariff Advisory Committee (TAC) of the Insurance Association of India. Three hydrant pumps (two motor-driven and one diesel engine-driven) of horizontal centrifugal type, each with 410 m³/hr capacity and head of 88 MWC will be provided for the hydrant system. Two (2) Spray system pumps (one motor-driven and one diesel engine-driven) of horizontal centrifugal type, each of 410 m³/hr and head 88 m WC will be provided and two jockey pumps (both motor-driven) of horizontal, centrifugal type, with 25 m³/hr capacity and head of 88 mWC will be provided to keep the system pressurized. All the above pumps will be located adjacent to the clarified water storage tank which will have a dead storage of water for the fire protection systems in line with the guidelines of the TAC/NFPA.

Portable extinguishers will be provided in all the buildings of plant premises. Portable trolley mounted CO₂ extinguisher of capacity 22.5 kg will be provided for control rooms

3.9 ENVIRONMENTAL PROTECTION FEATURES OF THE PROPOSED PLANT:

- As already mentioned the sub critical units will be installed in this power plant.

The following environmental management measures are inbuilt in the plant design itself: which will help in reducing emissions and effluents:

- Low NO_x burners have been envisaged to reduce the NO_x generation and consequent emission.
- High efficiency Electrostatic Precipitators have been envisaged to limit the particulate emissions to less than 50 mg/Nm³ as per the PCB norms.
- 275 M high tri-flue chimney has been envisaged for the plant, in line with the MoEF guidelines, which will help dispersion of air borne emissions over larger area and thus reducing the impact of the power plant on ground level concentrations.
- Space provision has been kept in the layout for retrofitting Flue Gas Desulphurisation (FGD) system, if required in future.
- Closed cooling water system with Cooling towers envisaged, thus reducing significantly the water requirement for the plant. Clarified sea water is envisaged for condenser cooling make up water.

- Dust extraction and dust suppression systems have been envisaged in the coal handling plant.
- It is proposed to use only closed trucks for fly ash transportation in order to avoid dust nuisance. To reduce the dust nuisance while loading the ash into the trucks from fly ash silos, the fly ash is conditioned with water spray.
- Water sprinkling system has been commissioned in the ash disposal area to restrain flying of fine ash to wind.
- The ash disposal area will be lined, if necessary, with impervious lining to prevent seepage of rain water from the disposal area into the ground and pollute ground water.
- It is proposed to utilise the power plant effluents for plant reuse as far as possible. It is envisaged to utilize cooling water blow down for ash handling purposes and treated wastewater from various sources for gardening. Rest of the waste water will be discharged into the sea after treatment. The discharge sea water will comply with MOEF and PCB requirement for marine environment.
- Streams of effluents emanating from the power station sources during operational phase will be treated individually based on the effluent quality. Treated effluents will be collected in a Central Monitoring Basin (CMB) for final monitoring. The treated effluent will be recycled for plant use and for green belt development. Therefore, there will be no impact on the ground and surface water resources.
- No discharge of liquid effluent to the other public boundaries other than sea is foreseen for the proposed power station.
- Sewage from various buildings in the power plant area will be conveyed through sewer lines to sewage treatment plant.
- All efforts will be made to utilize the fly ash for various purposes. Ash Management Plan will be developed for 100 % utilisation of fly ash within the time period prescribed by MoEF. The unused ash, till such time, would be disposed in the ash pond to be built within the plant premises.

- Extensive afforestation at plant area is planned which would not only act as lung space in the area but would also improve aesthetics and will be continued in all available space. Green belt of about 50 M width will be developed all around the plant periphery to minimize dust nuisance outside the plant boundary.

3.10 ELECTRICAL EQUIPMENTS & SYSTEM:

3.10.1 GENERAL PRINCIPLES OF DESIGN CONFIGURATIONS:

The design concepts of the electrical system are based on the necessity for safe and reliable performance of the steam turbine generator sets and the inter-connected allied electrical systems with provisions for easy maintenance and overhauling. Design standards adopted will fully comply with latest IEC / IS standards, and the relevant provisions of the Indian Electricity Rules, wherever applicable.

3.10.2 GENERAL DESCRIPTIONS:

The entire system will comprise of 2 steam turbine generators, each of 515 MW rating, with generation voltage from 16.5 to 21.0 kV. All of them will be connected to 400 kv switchyard through step up generator transformers and the power will be evacuated through 400 kv lines. Start up power will be drawn from the 400 kv switch yard through unit auxiliary transformer, supplemented by an additional unit to serve as a stand by.

Three voltage levels, 11 kv, 3.3 kv and 415 v are adopted for feeding plant auxiliaries.

3.10.3 RATING OF MAJOR EQUIPMENTS AND CONFIGURATION OF ALLIED SYSTEMS:

GENERATOR: Generators coupled with steam turbine will have the following salient technical features.

Type	:	Synchronous generator
Rated capacity	:	645 MVA to suit the turbine rating
Stator cooling	:	By water
Rotor cooling	:	By Hydrogen
Rated power factor	:	0.8 lag / 0.85 lead
Rated terminal voltage	:	16.5 to 21.0 kv
Insulation class	:	F (temperature rise limited to class "B")
Rated frequency	:	50 Hz
Frequency variation range	:	-5% to + 3% (47.5 Hz to 51.5 Hz)
No. of phase	:	3
Rated speed	:	3000 rpm

Line charging capability (MVAR) of generator will not be less than 40% rated MVA at zero p.f. leading. The generator winding will be star connected. All other provisions for surge diverters, protective capacitors, brushless excitation system, seal –oil system, stator water – cooling arrangement and CO₂ system will be built into the generator system as required for smooth system operation.

GENERATOR TRANSFORMERS:

The salient features of transformers will be as follows:

Type	:	oil filled, outdoor type
Voltage ratio	:	400 kv/16.5 –21 kv
Frequency	:	50 Hz
Vector group	:	YN.d1
Percentage impedance	:	14.5 % approx.
Capacity	:	3 X 215 MVA
Taps type	:	OFF CIRCUIT
Taps range	:	±10 % in steps of 2.5 %
Type of cooling	:	ONAN / ONAF

GENERATOR CIRCUIT BREAKER:

This shall be designed and manufactured for installation in the run of the isolated phase duct, between generator and step up transformer, for correct start-up of generator, switch-off of generator, separation of TG from the system etc. the design will ensure trouble free and safe operation of the system.

UNIT AUXILIARY TRANSFORMER:

There will be 2 number of UAT per unit, with 100% rating, 3 phase 21kv / 11kv 2 winding, outdoor, oil-filled with “ONAN /ONAF” cooling. Other latest feature will be in-built into the system for efficient operation of the same.

VOLTAGE LEVELS FOR STATION AUXILIARIES:

The voltage levels required for the various auxiliaries of the plant for control, indication and instrumentation system are as follows

1. for motor load >1500 KW - 11KV 3phase
2. for motor load >250 KW <1500 KW - 3.3KV 3phase
3. for motor load <250 kw - 415 V 3 phase

4. 230 V DC, 2 wires (ungrounded) system for switch gear / control panel etc
5. 48V / 24V DC for PLCC control and instrumentation.

Required number of auxiliary transformers – 3 phase 11 KV / 433 V LT-transformer and 11 kv/3.3 KV - for supplying unit loads and station Lighting loads will be provided.

The power supply for the UAT will be tapped from the main run of the 21 KV isolated phase bus duct and it will be delta / star connected (Dyn). The neutral point of the 11 KV side will be grounded through resistance to limit the current to 300 A.

The ratings of the auxiliary transformers will be finalized during the detailed engineering design.

BUS DUCTS:

16.5-21 KV BUS DUCT

Bus duct of 16.5 to 21.0 KV will directly connect the generator to generator transformer. Necessary potential transformers and surge absorbers will be provided close to the generator. The static excitation transformers will also be connected to this bus duct, as necessary.

11 KV BUS DUCT

11 KV side of the UAT will be connected to the 11 KV feeder control panel through phase segregated bus duct or by 11 KV cable depending on detailed engineering design.

3.3 KV BUS SIDE

3.3 KV side of 11KV / 3.3 KV transformers will be connected to the 3.3KV feeder control panel through 3.3 KV cables.

LT SIDE OF 11KV / 415 V TRANSFORMER

LT transformers will be linked to individual 415 V power control centers through 415 v bus ducts.

BUS DUCT SUPPORTS AND ENCLOSURES

The supports and enclosures are designed to withstand the electro – mechanical and thermal stresses setup during short circuit condition without damage or deterioration of the material.

All bus duct supports and enclosures will be designed to withstand the electro-mechanical and thermal stresses likely to be arising in the system.

In addition 11 KV, 3.3 KV breakers and 415 V breakers will be provided in the system suitably for interruption at rated voltages and on standard operating duty.

MOTOR CONTROL CENTER AND POWER CONTROL CENTER:

These will be of sheet steel cubicle and fully draw out type construction with dust and vermin proof and free standing type, with accompanying control units with complements of switch fuse, contactors, relays, indicating lamps etc, as required.

EQUIPMENT FOR HAZARDOUS AREAS :

Electrical equipments such as Motors, push button stations, lighting fixtures , junction boxes, etc located in hazardous areas will have flame proof enclosures with adequate safety provisions as per relevant standards and area classification requirements.

GROUNDING AND LIGHTNING PROTECTION:

The plant grounding arrangements will be designed as per IEEE –80 / IEEE142/IS-3043 stipulations.

The earth mat of the station will be designed to ensure that ground impedance does not exceed 10.0 ohm, Earth mat and grounding of equipment will be made with MS rods or galvanized steel flats / GI wire.

Each building complex will have a ground loop around its perimeter. The ground loops around each structure will be connected to the ground grid. The power plant ground grid and switch yard ground grid will be suitably interconnected. All the metallic body of electrical as well as non-electrical will be connected to the ground grid at two distinct points. This will include metallic structures and towers.

The chimney and power house building will be equipped with lightning protection. Lightning protection device will be located on the top of the structures, suitably connected to the ground loop surrounding the structures with downcomers as per statutes laid down in Indian Electricity rules and IS 2309.

POWER AND CONTROL CABLES:

11 KV and 3.3 KV cables will be of stranded aluminum / copper conductor as well as on insulation, color coded, extruded bedding and extruded PVC sheathed, armoured and overall FRLS PVC sheathed.

LT power cables will be 1100 V grade with stranded aluminum / copper conductor XLPE / PVC insulated, color coded, extruded bedding and extruded PVC sheathed, armoured and overall FRLS PVC sheathed.

Control cables will be multi core 1100 V grade with stranded aluminum / copper conductor XLPE / PVC insulated, color coded, extruded bedding and extruded PVC sheathed, armoured and overall FRLS PVC sheathed with 2.5 mm stranded copper conductors.

- ❖ Oxygen index of the cable will not be less than 29 when tested in accordance with ASTM – D – 2863.
- ❖ Acid gas emission will be less than 20% as per the requirements of IEC – 754.
- ❖ Smoke generation will not be more than 60% when tested as per ASTM – D - 2843
- ❖ The cable will meet the flammability test as per IEEE – 383

ILLUMINATION SYSTEM:

This will comprise of normal AC lighting, emergency AC lighting and emergency DC lighting, the last in selected areas of the plant during emergencies. The emergency AC lighting will provide about 20% of total AC lighting and will be fed from DG set through emergency switch gear and lighting transformer, etc. Emergency DC lighting will be provided in specific areas such as control room, switch gear rooms, stair cases, other strategic areas etc.

PLANT COMMUNICATION SYSTEM:

This will comprise of page and party system; telephone system with EPABX, and P & T telephone system. The system will be arranged for effective communications at the plant and residential colony levels and for external contacts.

THE INSTRUMENT AND CONTROL SYSTEM :

This system will have a micro-processor based distributed control system (DCS) and a few other analog instruments and control devices. The system will be designed to fully cater to all monitoring requirements of the plant and for effective trouble free optimized performance of the plant through its three control levels, namely, unit control, sub level control and drive control. Alarm functions will be realized through CRT video

alarms. It will have full complements of safety and redundancy devices, such as color CRT, software, VDU equipment, printers, SCADA system for switchyard, turbine supervisory system etc.

3.11 OTHER PLANT UTILITIES:

3.11.1 COMPRESSED AIR SYSTEM

Function of compressed air system, consisting of instrument air and service air (IA/SA) systems will be:

- Provides filtered, regulated, clean, dry, compressed air at approximately in the range of 6 to 7 kg/cm² (g) to various pneumatically operated valves and instruments.
- Meets the demands of miscellaneous station needs like service air taps for pneumatically operated tools, equipment cleaning, etc. at approximately in the range of 6 to 7 kg/cm² (g).

The compressed air system will primarily consist of the following:

- Air compressors
- Air dryers
- Air receivers

Air compressors

The air compressors shall be non-lubricated, water-cooled, horizontal, balanced reciprocating type compressors and will be provided to meet the instrument air and service air requirements of the plant. Each compressor will be equipped with inlet air filter, silencer, inter-cooler, after cooler, moisture separator, interconnecting piping, anti-vibration pads, necessary instrumentation, controls and all other accessories.

The individual discharge from the service air compressors shall be connected to a common discharge header, which in turn will be connected to the service air receiver(s).

The individual discharge from the instrument air compressors shall be connected to a common discharge header, which in turn will be connected to the instrument air receiver(s).

Air dryers

The instrument air requirements will be met by passing the air from the instrument air receiver(s) through two (2) 100% dual tower, heat-less, regenerative desiccant type

fully automatic air dryers. The instrument air dryers will be provided with two (2) 100% pre-filters and two (2) 100% after filters along with necessary controls & instrumentation.

Air receivers

The common discharge header of the service air compressors shall connect to the Service air receiver and the common discharge header of the instrument air compressors shall connect to the Instrument air receivers. These receivers will dampen out pulsation and will act as intermediate storage.

3.11.2 AIR CONDITIONING SYSTEM

The air conditioning system will be provided in identified buildings/rooms in the plant to achieve inside design conditions in terms of space temperature, humidity, air quality & quantity and space pressurization. The system will provide safe, healthy and comfortable working conditions for personnel and a suitable range of operating environment for equipment located in the controlled space.

3.11.3 VENTILATION SYSTEM

The ventilation system will be designed to effectively remove the internal heat, fumes/ gases generated from the plant/equipment. Air will be uniformly distributed in the space to be ventilated eliminating stagnation and hot spot.

The ventilation system will comprise of air washer units, unitary air filtration units, supply and exhaust fans, roof exhausters, filters, louvers, ducting, etc. (as applicable) to meet the inside design conditions.

3.11.4 FUEL OIL SYSTEM

The fuel oil system envisaged for the plant consist of the facilities required for unloading of oil from the road tankers, transferring the oil to storage tanks and transferring this oil from the storage facility and supplying to boiler burners through the pressurizing units.

Fuel oil system will be designed to handle Light Diesel Oil (LDO) and Heavy Furnace oil (HFO). LDO shall be used for initial start up of the boiler and upto a load of 7.5% MCR of the boiler. HFO shall be used during the boiler start up and upto a load of 30% MCR of the boiler. HFO shall also be used for flame stabilization during low load conditions. The storage capacity for both LDO & HFO is envisaged for a period of one (1) month.

3.11.5 FIRE PROTECTION SYSTEM

The fire protection and detection system will be designed in compliance with the recommendations of Tariff Advisory Committee (TAC). The function of the fire protection system is to ensure reliable and efficient fire protection facility in order to combat an outbreak of fire, so as to reduce damage and consequential losses. The fire protection system will consist of

- Fire Hydrant system
- Water Spray system
- High Velocity Water Spray (HVWS) system
- Medium Velocity Water Spray (MVWS) system
- Foam Injection system
- Clean agent protection system
- Fire alarm & detection system
- Portable/mobile fire extinguishers

Different types of fire protection systems that are required for protecting the plant are briefly described below:

Fire Hydrant System

The hydrant system consists of pressurized piping network, both aboveground and underground (wherever aboveground network is not feasible and wherever the pipes are to be routed in the paved area same will be routed in the trench), which shall feed pressurized water to the external hydrants, fire escape hydrants, internal hydrants and water monitors located around the plant and buildings. Hydrants/Monitors served by the ring main will be positioned at strategic locations around the plant so as to ensure adequate protection of risk areas located in the plant.

The hydrant system shall be supplied with pressurized water by the electric motor driven hydrant pump(s) and the diesel engine driven pump(s) (including the common diesel engine driven pump for both hydrant & spray systems) located in the clarified water and fire water pump house. Hose pipes of suitable lengths along with standard accessories like branch pipes, nozzles, etc. will be provided in a central hose house for outdoor yard hydrants and in hose boxes for indoor hydrants / landing valves. The hydrant system shall be designed to meet the stipulations laid down by TAC considering thermal power plants

as “ordinary hazard occupancy”. In addition to hydrants, water monitors shall be provided for ESP area, fuel oil tank farm (foam monitors also to be provided) and the coal stockpile area.

Water Spray system

The system consists of electric motor driven spray pump and common diesel engine driven pump, located in the fire water pump house, with distribution pipe supplying water to high velocity and medium velocity water spray systems. The hydrant and spray pump discharge headers will be interconnected such that hydrant pump will be able to supply water to the spray system in case of additional spray water demand.

High Velocity Water Spray (HVWS) system

Automatic High Velocity Water Spray (HVWS) system consists of piping network tapped off from spray water mains with branch headers, isolation valves, deluge valve assembly, projectors and quartzoid bulb/heat detectors. The system will be completely automatic with hydraulically actuated deluge valve and quartzoid bulb detectors located on the pilot actuation pipeline around the equipment to be protected (In case of boiler burner fronts, the detection system shall be heat detectors. The signal from these detectors shall be used to actuate the deluge valve).

Projectors (spray nozzles) are located around the equipment to be protected. Water under pressure is directed to the projector network on actuation of deluge valve. The HVWS system for the burner platforms / fronts shall cover all the fuel oil / coal burner elevations and adjacent areas

Medium Velocity Water Spray (MVWS) system

Automatic Medium Velocity Water Spray (MVWS) system consists of piping network tapped off from spray water mains, risers and branch headers, deluge valve assembly, spray nozzle along with isolation valves. The system will be completely automatic with solenoid actuated deluge valve. The deluge valve shall be automatically actuated on fire alarm signal from fire alarm panel. Detection of fire will be either from linear heat sensing (LHS) cables and/or smoke detectors.

HFO & LDO tanks will be provided cooling by tapping the water from the hydrant pumps with quartzoid bulb detection network

Foam Protection system

The fixed foam system shall consist of foam concentrate tanks with foam concentrate, foam discharge pumps, ratio proportioners, foam makers with discharge outlets, interconnecting piping, valves, fittings, instrumentation, etc. In addition to fixed foam system foam hydrants / foam monitors shall also be provided to take care of fire due to oil spills in dyke. Foam concentrate shall be AFFF (Aqueous Film Forming Foam) type and shall be provided in 2x100% capacity foam concentrate tanks. It shall be discharged to the tanks through foam ejectors. Automatic solenoid valve shall be provided in the foam supply line, to each of the fuel oil tank. The operation of the fixed foam system shall be automatic with the aid of fire detection system provided inside the tanks. Water for the foam system shall be tapped from the hydrant system. A design margin of at least 10% shall be taken / considered over the calculated foam capacity, tank capacity and discharge capacity of foam concentrate discharge pumps.

Clean Agent Gas Extinguishing System

The system shall conform to NFPA 2001 and shall be provided for the following zones (Each area shall be treated as separate zone and suitable partitions shall be provided):

- Electronic Equipment room and computer room
- Common control room
- UPS room

Inert gas system shall be provided with 100% standby reserve supply of containers filled with agent and duly connected to the piping manifold. The system shall consist of INERGEN/ARGONITE gas cylinders filled with agent, cylinder mounting accessories, cylinder manifold, pressure reducing devices, cylinder valves, directional valves, discharge piping, nozzles, automatic opening devices, manual actuation devices/abort switches, associated fire detection/alarm system, audio visual safety warning devices, instrumentation, associated control system, panels, etc. The minimum design concentration of inert gas extinguishing system will be 37.5% at 70 deg.F by volume.

Analogue addressable Fire Alarm & Detection Systems

The fire detection, alarm & control system shall consist of various types of fire detectors, control cabling, fire alarm panels, control monitoring station, repeater station, annunciation/ control panel, local panels, etc.

The fire detection and alarm system shall be of analogue addressable type, to monitor various loops located at different strategic points as per the requirement with CPU, video display unit, control module and monitor module. System consists of various types of fire detectors (viz. Ionization smoke detectors, photoelectric smoke detectors, Heat detectors, LHS cables, Infra red heat detectors, Hooters, Manual call points and Response indicators). These detectors are located strategically in the power plant to detect outbreak of fire at the incipient stage and to provide an early warning to plant operators so that remedial action can be taken before any serious damage to the vital equipment of the plant. Analogue addressable fire alarm panel (Main Fire panel) shall be located in control room. Display of system status of fire pumps and clean agent gas extinguishing system actuation by audiovisual signal in the fire alarm panel located in control room shall be provided.

Fire Annunciation (Repeater) panel shall be located in Fire station to indicate system status. Control & Annunciation panel shall be located in the clarified water and fire water pump house. Fire alarm panels shall be provided with battery and battery charges. Battery shall be capable of 24 hours backup supply including hooter for 4 minutes in case of power failure.

In addition to the automatic fire detection system, a manual mode of the fire alarm system shall also be provided to give audio and visual indication in case of fire in any area of the plant. Addressable manual call points of “break glass push button station type” shall be provided throughout the plant. The system shall also initiate control functions like stoppage of coal conveyors, shut down of air-conditioning system, etc.

Portable/mobile Fire extinguishers

Portable/Mobile fire extinguishers of Dry chemical powder type, foam type, CO₂ type and water (CO₂ gas cartridge type) as per relevant IS codes/standards shall be provided for various areas / equipment covered by the fire protection system.

The type of fire protection systems depends on the mandatory/statutory requirements, class of hazard, nature of risk. The electric power generating station is covered under “Ordinary hazard” occupancy as per TAC. The systems shall be designed in general, as per TAC rules. Following fire protection systems for different plant areas have been envisaged.

FIRE PROTECTION SYSTEM

AREAS

- Hydrant system TG and Boiler areas of the power plant
- Transformer yard
- Water pre-treatment plant buildings/areas
- Water de-mineralising plant buildings/area
- Fuel oil storage tanks area dyke area
- Auxiliary plant buildings like CW pump house, raw water pump house
- Coal handling plant area including all conveyors, bunker floors, transfer towers, coal storage yards and crusher house
- Water Monitors ESP area
- Coal stockpile area
- Fuel oil dyke area
- Automatic HVWS All transformers oil filled transformers having rating 10 MVA and above
- Turbine lube oil tanks and purifier units
- Central lube oil tanks (both dirty and clean oil units) and central lube oil purifier
- Boiler feed pumps, lube oil tanks, coolers, consoles etc
- Generator seal oil system tanks, cooler assembly etc
- Turbine oil canal pipelines in main plant
- Boiler burner fronts
- Automatic MVWS
- All cable galleries/cable vault/cable spreader room in control building and auxiliary buildings i.e., ESP control building, CHP control building, Ash handling plant building etc
- All conveyors, conveyor galleries/ conveyor tunnels, crusher house and transfer towers of coal handling plant.
- The un-insulated shell surfaces of fuel oil tanks

FIRE DETECTION & ALARM SYSTEM

The plant will be provided with microprocessor based analogue addressable fire alarm and detection system, which shall include detectors, manual call points, panels, etc. The fire alarm & detection system shall be designed generally as per TAC's recommendations. The detector spacing shall be as per IS 2189.

HVAC Fire Provisions

The HVAC system of an area shall be isolated by tripping of fire dampers and running plant equipment (wherever applicable) in the event of fire.

Fire Water Storage

The clarified water storage tank shall be sized taking into account the exclusive fire water requirement of two (2) hours of hydrant pump capacity (in line with TAC's recommendations for ordinary hazard areas) and 90 minutes of spray pump capacity (in line with TAC's recommendations for spray system). The tank shall be divided equally by a partition.

Fire Water & Jockey Pumps

Hydrant Pumps

The hydrant pump capacity shall be determined based on number of hydrants as per TAC recommendations for ordinary hazard classification. Considering the number of hydrants and also fuel tanks cooling, two nos electric motor driven and one diesel engine driven pump of 410cu.m/hr capacity are envisaged. The capacity of hydrant pumps is kept same as the spray pump for operational flexibility and inventory of spares.

Spray Pumps

Spray pump capacity shall be selected based on the water requirement for single largest risk. HVWS system for transformers, lube oil systems, etc. shall be designed for a water density of 10.2 litres/min./m² of projected surface area in accordance with TAC's 'Rules for Water Spray Systems'. A minimum pressure of 3.5 bars & maximum pressure of 5 bars shall be maintained at the nozzle.

MVWS system for cable galleries shall be designed for a water density of 12.2 litre/min/m² of the exposed area as per TAC's "Rules for Water Spray Systems". A minimum pressure of 2.8 bars shall be maintained at the remotest nozzle. In case of coal conveyors the water density shall be 10.2 lpm/m² and the minimum pressure to be maintained shall be 1.4 bars.

The single largest risk under the spray system is 'generator transformer' and the estimated capacity of the spray pump for this purpose is 410cu.m/hr. One electric motor driven spray pump along with one diesel engine driven standby pump are envisaged. The diesel engine driven standby pump will be common standby for both hydrant and spray systems.

Jockey pumps

As per the recommendations of TAC, the jockey pumps capacity shall be selected between 3 -5% of installed fire water pumping capacity. The system will be designed in compliance with the recommendations of Tariff Advisory Committee (TAC).

System Control, Interlock and Protection Philosophy:

Hydrant System

In the event of fire, when any hydrant valve is opened in any part of the network, the resultant fall in header pressure will bring the electric motor driven hydrant pump into operation automatically to supply water to the hydrant system. Failure to start pump on demand will result in further fall in header pressure or if the header pressure still falls even when one pump is running then the signal from pressure switch will start the pumps and will start sequentially in auto mode. If the pressure falls even after that, the common standby diesel engine driven pump will start automatically. Thus, an automatic sequential starting of pumps will be provided with a status indication in the control panel. Pumps can be started manually in case of emergency. However pumps can be stopped only manually.

HVWS and MVWS System

Normally both spray system and hydrant system headers will remain charged with water at the desired pressure. On detection of fire, the automatic actuation of deluge valve decreases pressure in spray pipeline. This will cause the electric motor driven spray pump to come into operation. Failure to start the pump on demand will result in further fall of header pressure or if the header pressure still falls when spray pump is running then the signal from pressure switch will actuate the stand-by diesel engine driven pump to start automatically. In the event of failure of common stand-by diesel engine driven pump to start or the diesel engine pump is unable to maintain the system pressure, the header pressure will fall further and the hydrant system pumps will start automatically to supply water to the water spray system.

Pressurization System

The hydro-pneumatic tank shall be connected to the hydrant and spray system headers, maintaining the system water pressure. The tank will be kept charged

automatically through a common pressurizing system comprising of jockey pumps (2 x 100%) and air compressor (2x100%).

Jockey pumps and air compressor will start and stop automatically by means of level & pressure switches respectively mounted on the hydropneumatic tank. The necessary controls required for the operation of this system is provided in the Control & Annunciation panel located in the fire water pump house.

Fire water pumps

Operation of all the fire water pumps shall be controlled from the Control & Annunciation panel provided in the fire water pump house. Status of pumps and alarms will be repeated to the Main fire alarm panel in the Central Control Room. Each drive is provided with one stop push button (PB) at field (near to drive), which will be lockable in stop position. This PB shall be treated as 'Emergency Stop' and shall trip the drive whenever this PB is activated.

Foam Injection system

Water for the foam system will be tapped from the pressurized hydrant system header. Once fire is detected in any of the tanks the automatic valve of that particular tank opens and the foam is discharged to the tank through ejectors and proportioners. The operation shall be displayed on the Main fire alarm panel.

Fire Detection & Alarm system

Microprocessor based addressable analogue type fire alarm and detection system is provided for various buildings/areas to detect and provide alarm signal in the fire alarm panel in the Central Control Room. Fire alarm shall be repeated in a repeater fire alarm panel in the fire station. Break glass type manual call points will be provided at various locations within the plant for raising fire alarm in the event of emergency.

Clean agent protection system

In event of fire in the protected area, the detection system shall detect the fire and a signal given to the Clean agent control panel. The designated clean agent cylinder valve will be opened automatically through a signal from the control panel and the clean agent will get discharged through nozzles.

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CHAPTER – IV

ENVIRONMENTAL ASPECTS

4.0 GENERAL:

The proposed 2 x 515Mw coal fired thermal power plant may cause impact on the following Environmental Parameters:

- Air Environment
- Water Environment
- Noise Environment
- Solid Waste

The details are given below:

4.1 AIR ENVIRONMENT:

Impact on the air quality due to the power plant operation shall be due to :

- ❖ Particulate matter in the form of fly ash discharged with the flue gas from the stack
- ❖ Oxides of Sulphur (SO_x) and Nitrogen (NO_x) in the flue gas discharged from the stack
- ❖ Dust generation from the Coal handling operations
- ❖ Thermal pollution from the stack
- ❖ Work zone air quality due to movement of transport vehicle, coal handling and other operations.

In order to control air pollution from the above sources, adequate control systems have been planned in the plant design stage itself to take care of the pollution at the source of pollution itself. They are:

- Providing High efficient Electro Static Precipitator (ESP) for the boiler for arresting the fly ash before the flue gas is discharged to the atmosphere through stack.
- Providing stack of 275m height for effective plume dispersion
- Low NO_x burners for controlling NO_x emission.
- Providing dust suppression system by way of water spray/sprinklers to control fugitive dust emission during coal handling operations

- Providing cyclones and/ or bag filters with proper suction arrangements in the crusher house to prevent propagation of dust outside.
- Lower combustion temperature to minimize thermal pollution.
- Enclosing the belt conveyor in the coal handling plant to arrest dust.
- Unloading of coal in to the properly designed underground hoppers
- Storing of coal in the closed shed
- Developing extensive green belt of 50 to 100 m width all along the boundary of the plant covering 33% of the total project area with thick canopy cover.
- Proper and adequate training for employees towards maintenance and operation of these systems.
- Effective working of pollution control equipments through frequent maintenance, checks to ensure conformity with TNPCB limits.
- Good house keeping practices to control spills, heaps and waste within the plant premises, so that the plant and its premises present a clean and neat outlook.

4.2 WATER ENVIRONMENT:

The source of effluent water from the Power plant are:

- ❑ Oily waste water from various Transformers, DG & Compressor building drain, Workshop Building drain, HFO/LDO dyke area drain
- ❑ Regeneration waste of DM Plant
- ❑ Boiler blow down
- ❑ Chemical Laboratory waste
- ❑ Cooling Tower blow down
- ❑ Waste water from ash pond

Floor wash from Power house building, DG building and Work shop building will be collected in the respective oily effluent collection pits, from where it will be pumped to the oil water separator. The treated water from the oil water separator will be taken in to the centralised effluent monitoring basin (CMB) / Guard Pond.

Floor wash from water treatment plant area, clarified and fire water pump house, raw water pump house, CW pump house, chlorination building will also be

collected in the local sumps from where it will be pumped to the centralized effluent monitoring basin.

4.2.1 TREATMENT SCHEME ENVISAGED

Oily Wastewater

The oily water effluent from transformer yard of generator transformers, station transformer and UAT will be collected in a common pit located near transformer yard and will be pumped to the oil water separator for separation of oil. The oily water effluent from the auxiliary/service transformers area located near ESP control room, ash handling area, coal handling area, CT area and water treatment plant will be collected in the local pits in individual areas and will be pumped by sump pumps to oil water separator for separation of free oil.

The oily waste water from Power house building, DG building, HFO/LDO dyke area and Workshop, will be collected suitably in local pits and will also be pumped by sump pumps to the above mentioned oil water separator.

In the oil-water separator, the oil will be separated. The heavier suspended solids will also settle at the bottom of this separator. The treated effluent from this oil water separator conforming to applicable norms and standards will be led to the central effluent monitoring station for final discharge. The separated oil from the oil water separator will be collected in drums /barrels and will be sent for final disposal / will be sold out. The capacity of oil water separator will be selected considering the maximum expected simultaneous inflow. The sludge settled at the bottom of oil water separator will be properly disposed.

DM Plant Regeneration Waste

Regeneration waste from DM plant will be led through acid/alkali resistant tile lined trenches and collected in neutralization pit. After necessary pH correction, it will be pumped to central effluent monitoring station by horizontal centrifugal neutralized effluent disposal pump. Drain and overflow of DM water storage tank, various chemical tanks and service water waste due to floor wash of water treatment facility area will also be drained through the same drain trenches to the neutralization pit. Neutralisation pit will be sized for regeneration effluent generated from one complete chain in one day plus 20% margin.

Chemical Lab Waste

Waste generated from the chemical laboratory of DM plant building will be conveyed to the DM plant neutralization pit and the same will be pumped to central effluent monitoring station along with the DM plant regeneration waste after necessary pH correction by dosing acid or alkali in the neutralisation pit.

Cooling Tower Discharge

Part of cooling tower discharge will be used in the desalination plant and for ash sluicing. Remaining water, confirming limits, will be diffused back into the sea.

Boiler Blowdown

Boiler blowdown after quenching will be collected in a common pit from where it will be pumped to the central effluent monitoring station.

Waste Water From Ash Pond

Waste water from ash pond will be collected in ash water recycle sump and from there the same will be pumped to ash water recycle clarifier. From the clarifier, clear water will be pumped to ash water tank. The clarifier sludge collected in the sludge sump/pit will be pumped back to the ash pond.

Treated effluents from various sources like DM plant effluent, boiler blow downs, service water drains etc will be collected in a Central Monitoring Basin (CMB) or Guard pond. From this pond, some portion will be reutilized for various purpose like dust suppression in coal stockpile, ash sluicing, green belt development, etc. The remaining water conforming to statutory limits will be disposed in the sea through diffuser ports outfall system, which will be designed to have mixing in order to attain ambient temperature and salinity within a short distance. A mathematical model will determine the form, type, distribution and attack angle, as well as the expulsion speed of the brine in the diffusers at the end of the underwater discharge/outlet pipe in order not to harm marine life.

4.3 NOISE ENVIRONMENT:

In the proposed Thermal Power Plant, high pressure boilers, exhausters, turbines and leaking air/steam pipelines are the primary sources of noise pollution.

Noise control measures will be inbuilt to restrict the noise level within acceptable limits in and around the plant. The system design and equipment selection will restrict

exposure of personnel to noise levels conforming to OSHA (Occupational Safety and Health Administration), norms indicated in the table given below:

PERMISSIBLE NOISE LEVELS FOR OCCUPATIONAL NOISE EXPOSURE

DURATION PER DAY (HRS)	SOUND LEVEL IN dB(A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25	115

Various measures adopted for noise control measures are as below:

- ✓ Providing acoustic enclosures/barriers for the turbines.
- ✓ Continuous vigilance in high pressure air/steam pipelines for leakages and once noticed, immediate plugging of the leakage thus reducing the noise at the source.
- ✓ Providing silencers at inlet/outlet of the high pressure equipment like DG set, compressors, fans etc
- ✓ Providing sound proof cabins for the operators of turbine, compressed air station and other noise prone areas.
- ✓ Development of thick green belt along the plant boundary and around work centers as possible, which will act as an acoustic barrier.

Presently advanced silencers are available to reduce the noise level to as low as 48 dB(A) at about 125m of exhaust of turbine. Also acoustic barriers are available to effectively reduce noise from generators, compressors, pumps, fans etc. By selecting latest equipments, noise level outside the project site is not expected to be higher than the acceptable limit.

4.4 SOLID WASTE:

Ash is the main solid waste from the Power Plant. The ash generation with maximum 7.5% ash in coal, is expected to be 0.30MTPA of which 0.24MTPA is fly ash and the remaining 0.06 MTPA is bottom ash.

The proposed plant will be provided with a well designed ash handling system to prevent any pollution.

Bottom ash will be removed continuously from the furnace after proper cooling. Ash will be cooled using air coolers. The cooled bottom ash will be collected in the bottom ash silo and from the silo, ash will be conveyed to ash disposal area in a slurry form using high pressure pumps.

Nearly 80% of the total pulverized fuel ash is collected in the ESP zone as fly ash. The fly ash will be collected in a dry form and pneumatically conveyed to the fly ash silo for disposal to cement plants through covered trucks and partly to ash pond.

The plan includes utilization of 50% of ash upto 3rd year of operation, which will be increased to 100% utilization after 3 years of plant operation.

In south India, especially in Tamilnadu, due to expansion and capacity addition of various cement plants of Madras cements, India cements etc, there is considerable demand for fly ash and the entire fly ash generated is likely to be consumed from the initial stage itself. However, for ash pond designing, progressive fly ash utilisation as mentioned above is considered.

About 14 acres of ash pond area is earmarked for this project.

4.5 RISK ASSESSMENT & DISASTER MANAGEMENT PLAN

4.5.1 Risk Assessment

Environmental risks are inherent in design and operation of any power plant. Risk involves the occurrence or potential occurrence of an accident consisting of an event or sequence of events.

The main objectives of risk assessment are as follows:

- i. Identification of hazard prone area and estimation of damage distance for the maximum credible accident scenario visualized for storage.
- ii. Computation of frequency of occurrence of hazards and evaluation of risks
- iii. Recommendation of risk mitigation measures and arriving at a Disaster Management and Emergency Preparedness Plan.

Identification of hazards in a power plant is of primary significance in the analysis, quantification and cost effective control of accidents involving chemicals and process.

Hence, all the components of a process/system/plant need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident.

As coal is subject to spontaneous combustion it may catch fire given the slightest opportunity. This fire hazard is greatly influenced by the amount of airflow through the mass of coal.

Thus, storage of coal will be designed in such a way that the air content in the coal pile is minimized. Dimension of the coal stack, particularly the height, is a very important parameter for making storage of coal safe.

Fuel oils (LDO/HFO) will be used in small quantity for initial start-up. Chlorine and other chemicals are used in the water treatment & DM Plant. The hazards associated with the use of these materials need careful consideration and it is necessary to take due precaution for safe handling at various stages of usage.

4.5.2 Disaster Management Plan

A major emergency in a plant is one that has the potential to cause serious injury or loss of life. It may cause damage to property and serious disruption, both inside and outside of the plant. The disasters identified as most likely to occur in the power plant are:

- i. Fire at oil storage area
- ii. Fire at coal storage area
- iii. Toxic release of chemical

Hazard analysis has revealed that the damage distance is mainly confined to plant boundary only.

The main objective of the disaster management plan is to prevent or at least reduce the risk of accidents through design, operation, maintenance and inspection. An important element of accident mitigation is emergency planning, which would consist of:

- i. Recognising the possibilities and probabilities of each kind of accident
- ii. Assessing the on-site and off-site implications of such incidents and deciding the emergency procedures that would need to be carried out.

A number of elements make-up a good and workable disaster management plan.

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CHAPTER – V

REHABILITATION & RESETTLEMENT

The total land requirement for the plant area outside CRZ is estimated to be 319 acres. Besides, 23 acres within CRZ area will be utilized as corridor for sea water pipeline and for coal conveying.

Land are mostly sea side waste lands only. No agricultural land is involved. However, lot of industrial activities are happening in the area and there is good demand for the land.

Temporary accomodation facilities, temporary RMC unit, Kattupalli kuppam are located in the project area. Proper Rehabilitation & Resettlement scheme for Kattupalli kuppam is to be devised.

CHAPTER – VI

PROJECT IMPLEMENTATION SCHEDULE

6.0 GENERAL:

This being a major Power Plant of 2 x 515Mw capacity, accurate and realistic planning, scheduling and monitoring programmes are imperative, so as to complete the project on time without cost and time overruns. As such, various steps, listed below, should be initiated well in time, to adhere to strict time limits in project commissioning:

1) PRELIMINARY WORKS:

These involve the initial steps to be carried out in the project schedule to ensure successful off take of the project. The different components in this respect will be as below:

- Land acquisition
- Topographic survey
- Soil investigation and geo technical tests
- Obtaining various clearances like Environmental clearance from Ministry Of Environment & Forests (MOEF), State Pollution Control Board, Airport Authority clearance, Clearance from Ground water authorities etc

All most all the works in this connection have been completed / initiated. Approvals from statutory authorities are being sought and will be completed soon.

2) APPOINTMENT OF OWNERS ENGINEER:

Appointments of owners consultant to prepare DPR, tender documents etc and also to oversee proper implementation schedule during construction.

3) APPOINTMENT OF EPC CONTRACTOR:

A competent EPC contractor shall be appointed, through public tenders, to carry out the work assignment in respect of Design, Engineering, manufacture, supply, procurement, erection, testing and commissioning of the entire power plant. The EPC contractor will be fully responsible for timely completion of the project and successful performance of the plant in tune with the guarantees provided. EPC contractor will also be responsible for overall management of EPC contract including contract scheduling, planning, monitoring, expediting etc to ensure timely overall scheduling of the project.

They will also prepare overall integrated operation and maintenance instruction manual for the complement power plant.

4) NON EPC CONTRACTING:

Certain works like construction of compound wall/ fencing around the project area, construction of colony, establishment of laboratories, etc, will not be in the purview of the EPC contractor and has to be undertaken through non EPC contractors.

5) OPERATION AND MAINTENANCE CONTRACT:

For efficient operation and maintenance of power plant and maintenance needs of same, an O & M contractor will be appointed, through tender process, for an initial period of about 5 years or so, after commissioning of the project. Outsourcing of O & M initially is advisable to ensure successful performance schedules for the project with full responsibility and accountability of the O & M contractor. After 5 or 10 years, as suitable, the company can employ its own O & M staff.

6) FUEL SUPPLY SCHEDULING:

The plant will be fuelled with imported coal. Long term fuel supply agreement is to be made

7) FUEL HANDLING AND TRANSPORT SCHEDULE:

Imported coal will be handled in the nearby Ennore port. Necessary clearance for handling and transport of coal to this plant is to be made.

8) POWER PURCHASE AGREEMENT:

The power produced from this plant after meeting the requirement for auxiliaries will be sold to Power Trading Corporation (PTC), with whom necessary agreements are being entered into.

9) PROJECT SCHEDULE:

Zero date will be the date of achieving financial closure. The first unit of 515MW will be synchronized within 36 months from the zero date, which will be 3 months ahead of the Commercial Operation Date (COD). The second 515MW unit will be synchronized in 39 months time, (COD of unit 1 takes place by this time). The COD of unit 2 will takes place in 42 months time.

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CHAPTER – VII

PROJECT COST ESTIMATE

The actual cost of the project can be evaluated only after obtaining EPC Contract bids, obtaining firm prices for different equipments, jobs and finalization of the contract.

However, based on quotations obtained for other similar projects, probable project cost for this proposed 2 x 515 MW Power plant is estimated and it works out to be 52964.73 Millions including Interest during Construction prevailing taxes and duties.

The details are as below:-

Sl.No.	PARTICULARS	AMOUNT (Rupees in Millions
1	Land and Land Development	1850
2.	Pre Operatitve expenses	2000
3.	Civil and Structural;	42,941
4.	Boiler and TG	
5.	BOP – Mechanical	
6.	Electrical, Instrument and Control	
7.	Erection & Commissioning	
8.	Taxes and Duties	
	Total Plant & Equipment	46,791
	Interest during construction	6173
	Total Project Cost	52964 Million

The plant specific cost works out to Rs. 5.142 Crores/MW

CONCLUSION:

Considering the increasing Power demand, installation of plants of similar technology in various parts of the country and the cost economics, this project is techno economically viable for implementation.

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