CHAPTER - III

PROJECT DESCRIPTION

LOCATION AND ACCESS

1. The proposed site is located near Tundawand village in Mundra taluka of Kutch district of Gujarat. Coastal area (Gulf of Kutch) is located about 1.5 km away from the project site. The site is well connected with state Highway no. SH – 50 (via Anjar) and SH-6 (via Gandhidham) and would be near to proposed NH-8A (Delhi-Kandla). The nearest railway station is Adipur, which is 57 km away from the site. The railway station is well connected to multi-terminal Mundra port through broad gauge railway system owned by M/s. MSEZ Group. The nearest airport is Bhuj, which is about 60 km from site. The proposed project site is located at 25 kms from Mundra port.

BASIC REQUIREMENTS

Availability of Land

2. Land available for 4,000 MW (Nominal) coal based power plant is about 1242 Ha, which includes main plant, balance of plant, ash disposal area, green belt, roads, MGR and drains etc. This site is situated in coastal area at Tundawand village. Around 182 Ha of land is required for the power plant staff colony. General layout of the proposed power project is shown in Figure III.1. The main plant area comes in Tundawand village. Coal stockyard and ash pond area, which is about 341 Ha., will be located adjacent to western side of main power plant in Tunda and Kandagara village. The residential colony will be constructed near Nana Bhadia village.

3. The site is barren and generally plain with very little forest cultivation and no habitation. The site for the proposed project is fairly level with minimum undulation and would require nominal filling and grading to an extent of about 1 to 2 metre to grade the plant to the proposed level of 5 m w.r. to MSL. The plant is located more than 500m away from HTL meeting the stipulation of CRZ regulations. Location of intake and outfall channels is shown in Figure III.Ia. Typical process flow diagram for power generation from pulverized coal is shown in Figure III.2.

Project Cost

4. The total indicative cost of the project including cost of pollution control is estimated to be Rs. 18000 Crores (Rupees eighteen thousand crores only). This also includes the cost of once through condenser cooling water system and cost of rail network from Mundra to project site.

Requirement and Availability of Water

5. There is no source of water other than nearby sea. Seawater would be directly used for condenser cooling and the fresh water requirements would be met by installation of a thermal desalination plant . The daily sea water requirement of the proposed 4000 MW (Nominal) coal fired thermal power plant including fresh water requirement is estimated to be 14.26Mm^3/day. The above quantity of seawater would be drawn from nearby sea (Gulf of Kutch), located at a distance of about 2.5 km from the site. Location of intake and outfall channels w.r.t CRZ line is shown in Figure III.1a.

Figure III.1
Plot Plan

Figure III.1a

Location of Intake and Outfall channels

Figure III.2

Process Flow Diagram for Power generation from Pulverised Fuel

6. The seawater would be drawn to the plant boundary through an open channel excavated to a depth of about 3 m below lowest tide water level. The width of channel required would be about 100 m to draw an estimated cooling water flow of about 594,200 m^3/hr. channel will be designed for 620,000 m^3/hr. The intake channel would be routed through Kotdi Creek. An on shore pump house located within the plant boundary will house the cooling water pumps. Water balance scheme for once through cooling system is shown in Figure III.2a.

7. Once through or cooling tower system is indicated for the proposed UMPP to determine economics of power unit. However, developer has the freedom to choose the type of cooling water system based on least cost tariff.

PLANT WATER SYSTEM

8. Plant water requirement of 14.26Mm^3/day will be met from nearby sea (Gulf of Kutch). Seawater is used directly for condenser cooling and fresh water is generated from sea water through a desalination plant. Fresh water is used for other services such as Demineralization (DM) plant (for SG make-up), coal handling / ash handling system, potable water for plant / colony, air conditioning system makeup and plant service water. Seawater analysis of sample collected from Gulf of Kutch is furnished in Appendix-1.

9. For condenser cooling, a once through cooling system is proposed which would be economical as the site is located in coastal area close to sea. Seawater drawn from the sea is conveyed to the fore bay/sump in the plant area through a skimmer wall and open intake channel arrangement. Water from sump is pumped to the condenser by 2x50% capacity concrete volute pump for each unit. Hot water from condenser is led back to the sea through a seal well discharge channel arrangement.

10. Adequate measures would be provided to limit the hot water temperature as per MoEF requirement. Suitable travelling water screens and stop logs at CW sump, Debris filter with on load tube cleaning system for condenser, and chlorination system (through chlorine dioxide system) for dosing chlorine at CW sump for marine growth control are proposed.

11. For cooling of TG / SG auxiliaries and other plant auxiliaries, passivated DM water is used. Hot DM water from the auxiliaries is cooled in plate type heat exchangers (3 x 50% for each unit) by seawater tapped of from condenser cooling water system and recirculated to the auxiliaries. 3 x 50% capacity pumps for each unit are proposed for both primary (DM water) and secondary [seawater] circuit.

12. Sea water pumped by separate set of pumps from CW sump is passed through a thermal desalination plant (MED).The desalination water (Fresh water) is led to a desalinated water storage tank from where water is distribute to various services.

13. Demineralised water required for steam generator make up and auxiliary cooling water system makeup is generated from desalinated water through ion exchange type DM plant (33.33% capacity streams – Cation – Anion – Mixed bed unit or Mixed bed unit only depending up on quality of desalination water).

14. For potable water to plant and colony, water from desalination water storage tank, after suitable treatment is pumped to an overhead tank from where it is distributed to various consumer points.

Figure III.2a

Water Balance Diagram for Once Through Cooling System

15. Fresh water for other miscellaneous services in the plant is pumped from the desalinated water storage tank to service water overhead tank from where water is distributed to various services.

Fire Protection System

16. For controlling / extinguishing fire in the plant, portable fire extinguishers / hydrant system covering all areas of plant, high velocity water spray system covering transformers, turbine lube oil system and boiler burner front and medium velocity water spray water covering cable galleries and coal conveyors would be provided. Water for fire fighting purposes would be supplied from the desalination water storage tank through suitable pumping system.

Effluent Disposal

17. All plant process drains and plant surface drains (except rain water) after suitable treatment for oil removal will be led to a guard pond from where the effluent would be utilized for horticulture and coal / ash dust suppression.

18. The desalination plant reject water would be discharged to sea, through the CW discharge channel.

COAL HANDLING SYSTEM

General

19. This system covers proposed facilities for transport of coal from the exporting country to power plant by the sea cum rail route, unloading and conveying coal up to the bunkers of the steam generators (SGs) or to the stockyard.

Design Criteria and Assumptions

20. The design criteria is based on the following functional requirements and assumptions:

a) Coal for each 800 MW (Nominal) unit of the ultra mega power plant at maximum continuous rating (MCR) condition based on imported coal having an average gross calorific value (GCV) of 5700 kcal / kg would be about 295 t/hr. The coal consumption with worst coal having GCV of 5350 kcal/kg would be about 318.4 t/hr. The annual coal requirement would be 11-13 million tonnes that would be imported from countries like Indonesia, Australia and South Africa.

b) A coal stockyard for stacking of coal required for a minimum period 30 days has been considered to take care of any adverse eventualities.

c) Coal would be received by ships at Mundra Port and would be transported to plant site by rail by merry go round system with BOBR wagons.

d) Coal handling system would be designed for the proposed 5x800 MW (Nominal) Units.

e) Two streams of conveyors (2 x 50%) are proposed throughout the power plant except for the emergency reclaim conveyor.

System Capacity

21. Based on coal firing rate of 315 TPH and 16 hours of operation, the system capacity works out to 3500 TPH. Two stream of 2000 TPH each will be provided.

System Description

22. The system description is furnished in the following paras. Process flow diagram for power generation is shown in Figure III. 2.

<u>Coal Conveying to SG Bunkers</u>

23. Coal received by rail through BOBR wagons would be unloaded at the track hopper to be installed by the power project developer. The coal unloaded in to the track hopper would be conveyed either to the power plant bunkers or to the power plant stock yard by the in plant coal crushing, stacking, reclaiming, conveying and bunker feeding system of required capacity to be installed by the power developer.

<u>Coal Storage</u>

24. For the proposed units, space provision has been made in the coal stockyard to store about 30 days requirement of coal for all the five 800 MW (Nominal) Units. As the coal would also be stocked in Mundra port by Adani group it is proposed to provide storage for 30 days in the power plant area to take care of any adverse eventualities. The necessary stacking and reclaiming system of required capacity would be provided by the power plant developer. The management of the stockpiles meant for the power plant in side the Mundra port would be by the power plant developer.

<u>ASH HANDLING SYSTEM</u>

General

25. The following data have been considered for design of ash handling system:

(a) Hourly coal firing rate at MCR condition per unit for imported coal : 342 TPH

(b) Ash content in coal considered for design of ash handling system : 15 %

(c) Distribution of total ash produced as

- Bottom ash : 20 %
- Fly ash : 80%

(However for design, fly ash content would be considered as 90%)

(d) Volume occupied by one tonne of ash in Storage area : 1 cu.m

(e) The system adopted for bottom ash removal would be jet pump system and for fly ash removal, dry type pneumatic system

(f) Fly ash disposal would be either in dry form or wet slurry form

Capacity and Time Cycle

26. The expected bottom ash handling system is 60 TPH per unit and that of fly ash handling system would be 50 TPH per unit (indicative) during continuous operation and 100 TPH based on evacuation of fly ash collected in eight (8) hours in four (4) hours time during emergency. However, these would be reviewed and finalized by power plant developer.

System Description

Bottom ash handling system:

27. Bottom ash collected in the bottom ash hopper below the boiler furnaces would be conveyed by jet pump up to the ash slurry sump for further disposal in wet form.

Fly ash (FA) handling system

28. The fly ash collected at various hoppers would be conveyed pneumatically to FA storage silos. The air would be vented out to atmosphere after passing the same through bag filters to mitigate the environmental pollution. The dry fly ash collected in fly ash silos would be either disposed off in dry or in wet form.

Power Evacuation

29. The following lines are proposed for power evacuation and additional four lines will be identified in due course.

a) Mundra- Limbdi 400 kV double circuit line
b) Mundra- Ranchodpur 400 kV double circuit line
c) Mundra-Jetpur 400KV double circuit line.

Site Topography and Grade Level

30. Site and its vicinity is characterized by presence of sand dunes on the south side close to the sea and practically small streams and small creeks. The land, identified for the project is fairly graded with minimum undulation and would require only nominal filling to grade the plant to the proposed level of about 5 m above MSL.

Soil Characteristics

31. As per the preliminary geotechnical investigations carried out, the soil is predominantly clayey sand in nature.

Foundations

32. Preliminary geo-tech investigation is carried out in the proposed power plant site to ascertain the soil profile and decide on the safe bearing capacity to be considered for the foundation design of major buildings/structures, major equipment. Based on the investigation carried out, pile foundation is envisaged for all the major structures.

Machine Foundations

33. The turbine-generator pedestal would be of reinforced concrete frame structure and would be isolated from the building foundations and super-structure.

PLANT LAYOUT

Station Building: General Arrangement (Illustrative)

34. The main plant along with all the auxiliary systems has been shown in Plot Plan Figure III.1. The station building would be a non-basement structure. The steam turbine generators and auxiliary equipment, feed cycle equipment and electrical equipment would be located in the building.

35. The turbine - generator bay would have three floors - ground floor at 0.00 M level, mezzanine floor at 9.5 M level and operating floor at 17.00 M level. The exact levels of these floors would be finalized during the detailed project report. Localised O&M platforms at required levels would be provided. The deaerator would be located at appropriate floor elevation over the boiler feed pump bay. Road access would be provided to the unloading and maintenance bays for unloading TG components and auxiliary equipment.

36. The superstructure will be of structural steel framing with RCC floor slabs. Brick work side cladding up to 3.0 m above operating floor level and metal sheet cladding above this level has been considered. The roof of the TG bay would be insulated metal sheet. Building will have crane girder at a suitable elevation to support the E.O.T cranes. Intermediate floors are supported with internal columns around TG foundation.

37. The turbine-generator pedestal would be of reinforced concrete frame structure and would be isolated from the building foundations and super-structure.

Steam-Generator Area and Mill Bay 5 X 800 MW (Nominal)

38. The mill bay would be located in between the TG building and the steam generators. The mill bay would be about 15m width and would have floors above the mills for the feeders and the trippers. Concrete paving would be provided in the steam generator and ESP area with necessary drains and trenches. Pipes and cables in this area would, in general, be routed on overhead pipe / cable racks.

Stack

39. Two multiflue stacks (one with 3 flues and the second one with 2 flues, each flue of 7.5 m inside diameter) of 275 m height will be provided for 5 x 800 MW (Nominal) steam generator units. This will meet the requirement of Indian Emission Regulations

Control Room

40. A common control room with unitized electronic cabinet rooms would be envisaged as required.

Sea Water Intake

41. The Mundra UMPP is located in the vicinity of Gulf of Kutch. The area experiences scanty rainfall and arid conditions persist in the region. Considering non-availability of fresh water and availability of sea water in abundance, it is proposed to use sea water for condenser cooling system. Sea water of about 620,000 m^3/hr would be drawn from the Gulf of Kutch through the Kotdi creek.. To draw the required flow, it would be necessary to have a channel with a base width of about 100m. In order to improve hydraulic conditions of the creek for drawing the flow, it is proposed to modify the creek, by widening and deepening suitably. The intake channel will

commence from a depth of 3m below Chart Datum or Lowest Tide Level. The length of the channel till the plant boundary would be about 6.5 km. The alignment of channels through creek (Ref. Fig. III.1a) is on tentative basis and will need to be finalized based on detailed bathymetric survey. On shore pump house located within the plant boundary will house the cooling water pumps (15 nos.). Analysis of sea water is given in Appendix-1.

Sea Water Outfall

42. The hot water will be discharged back to the sea through a discharge channel through the Mudhwa creek. The base width of the discharge channel within plant area will be about 60m . For a length of about 1.9 km outside the plant boundary upto the Mudhwa Creek, the channel is proposed to be designed as a pre-cooling channel, to ensure that at the creek location the temperature of the hot water is not more than 7°C above the ambient water temperature. A base width of about 200m is expected for the pre cooling channel based on the first order design. An end weir will be provided at the creek to ensure proper mixing of hot water with receiving water body. A channel will be provided beyond the creek upto an elevation of 1m below the lowest low tide level. The tentative location of discharge channel is indicated in Fig. III.1a.

43. The intake and discharge channels would be planned and designed based on the thermal dispersion study and hydraulic model study to be carried out by reputed agencies like the Central Water and Power Research Station (CWPRS).

Rain Water Collection

44. It is planned to provide a properly designed rainwater harvesting scheme. In order to conserve the rain water and use the available rainwater, a rainwater pond is planned in the plant layout. The collected water would be treated and used in the plant mainly for spraying for coal stockyard and gardening.

Ash Bund

45. The ash bund would be constructed in the land area of 241 Ha with homogeneous earth fill consisting of impervious core in the middle and semi impervious core for the balance area of bund. Side slope of 2.5 horizontal to 1 vertical would be provided on outer side of the bund and side slope of 2 horizontal to 1 vertical would be provided on inside of the bund. The ash bund would be lined suitably to avoid seepage of ash water into the ground. The minimum height of the ash bund would be about 5 m and this would be raised gradually at 3 m per raise. The raising of ash bund would be done using pond ash and impervious core as hearting with earth cover on outer surfaces.

Miscellaneous Buildings

46. Table- III.I indicates list of major buildings / structures planned in the power plant.

Table – III.I
Buildings / Structures 5 x 800 MW Units (Illustrative)

Sl. no	Buildings / Structures	Type of Construction
1.	Cooling water pump house (CW Pump House)	RC sump with steel superstructure with sheet cladding with EOT crane
2.	CW pumps MCC room	Single storeyed RC framing with brick cladding
3	Desalinated water storage tank and filtered water storage tank	RC construction
4.	Filtered water pump house and desalinated water pump house with MCC rooms	Single storeyed RC framing with brick cladding with EOT crane
5.	Pre-treatment – clarification plant	RC construction
6.	Filtration plant with chemical house & MCC room	RC framing with brick cladding with EOT crane
7	Desalination plant with associated demineralizer plant and MCC room	Single storeyed RC framing with brick cladding
8.	ESP control room	Two storeyed steel / RC framing with brick cladding
9	Fuel oil dyke	Open area
10.	Fuel oil pump house	Single storeyed, steel / RC framing with brick cladding
11.	Coal handling switch gear & control room	Single storeyed, steel / RC framing with brick cladding
12.	Administration building	RC framing with brick cladding
13.	Canteen	Single storeyed, RC framing with brick cladding
14.	Ware houses	Structural steel framing, metal cladding & roofing
15.	Gate/security house	Single storeyed, RC framing with brick cladding
16.	Ash slurry pumps, compr. +MCC+ control room	Single storeyed, steel / RC framing with brick cladding, with monorail

Sl. no	Buildings / Structures	Type of Construction
17.	Hydrogen plant	Single storeyed, RC framing with brick cladding, monorail with 5 T lifting capacity
18.	Diesel Generator house	Single storeyed, RC framing with brick cladding, monorail with 5 T lifting capacity
19.	Air washer block	Single / two storeyed, steel framed building with brick cladding
20.	Service building	Two storeyed, steel framing with brick cladding
21.	Workshop	Single storeyed, steel framing with metal cladding with EOT Crane.
22.	Fire station	Single storeyed, RC framing with brick cladding
23.	Switchyard control room	Single storeyed, RC framing with brick cladding
24.	Electro chlorination plant	Single storeyed, RC framing with brick cladding

<u>Roads And Fences / Compound Wall</u>

47. The roads would initially be of wet mud macadam type with shoulders on either side of carriage width. After major construction activities are completed, these would be surfaced with bituminous carpet. The width of the double lane road would be 7.5 m excluding shoulders and the single lane road would be 4 m. Extra width would be provided on either side, for road side tree plantation, for all internal roads in the plant site. Storm water drains would be provided on either side of the roads. It is also considered to provide RCC roads around boilers and transformers. The proposed compound wall would be of concrete block masonry construction with barbed wire fixed to MS angles on the top.

<u>Drainage</u>

48. Suitable storm water drainage system would be provided to dispose off storm water efficiently from the plant site. The surface water run-off from the main plant area would be discharged into a nalla located on the eastern side of the plant boundary. The surface water run-off from the coal handling plant would be led to a sump for settling and the over flow would be discharged to guard pond located suitably within the plant boundary for treatment and recycling.

Sewage Disposal

49. Sewage from various group of buildings would be led to sewage treatment plant, by means of CI/SW/RCC pipes laid underground.

Landscaping

50. The various services / utility areas within the plant would be suitably graded to different elevations. Natural features of the plant site would be retained as far as possible to integrate with the buildings to form a harmonious / pleasant environment. Areas in front of various buildings and the entrance of power plant would be landscaped with ground cover, plants, trees based on factors like climate, adaptability, etc. The green belt would consist of native perennial green and fast growing trees. Trees would also be planted around the coal stockpile area and ash disposal area to minimize the dust pollution.

Staff Housing

51. The staff housing colony will be located at a distance of within 5 to 10 km from the proposed power plant. Power plant staff are proposed to be accommodated in the colony.

SALIENT FEATURES OF MAIN PLANT EQUIPMENT

Steam Generator

52. The steam generator (SG) would be once through type.

53 The steam generators (SG) would be designed for firing 100% imported coal. The SG would be of two pass design, radiant, single reheat, balanced draft and semi outdoor type.

54 The SGs would be dry bottom type. The water walls would be either of spiral wound plain tubes with vertical tubes over the spiral water walls or vertical with riffled tubes type.

55 The SGs would be of corner fired. The furnace would be appropriately sized to avoid slagging in the pedant / platen super heaters and reheaters and in the heat transfer surfaces in convection pass.

56 The coal burners would be of proven advanced design to reduce NO_x production and the furnace would be provided with over fire air ports to further reduce the NO_x production.

57. The SGs would be provided with circulation system, comprising steam separators and circulation pumps to remove the water moisture from the evaporator outlet and recirculate into economizer inlet, for use during start up and shut down.

58. The steam generator would consist of water cooled furnace, radiant and convection super-heaters, re-heaters, economizer, regenerative air heaters, steam coil pre-heaters, etc. Smart soot blower system would be provided with soot blowers located at strategic locations.

59. The steam generator would be provided with five or six vertical spindle medium speed coal mills, which would be located in the boiler front, behind the turbine

generator building. The milling system would be so designed that one (1) mill will be spare with unit operating at MCR capacity firing design coal. All the six (6) mills will be operated with worst coal. The coal mills would be provided with dynamic classifiers to control the fineness of ground coal thereby to control the unburnt carbon losses.

60. Sampling arrangement at mill outlet would be provided for the purpose of establishing the average gross calorific value of coal as well as coal fineness. The coal mills would be provided with steam blanketing system for the purpose of fire protection. The SG would be designed to handle and burn HFO as secondary fuel upto about 25 % MCR (maximum continuous rating) capacity of SG, for start-up and for flame stabilization during low-load operation or during mill change overs. For unit light up and warm up purposes, LDO would be used with air atomization. Alternatively, a suitably sized LDO fired auxiliary package boiler would be provided to supply the unit auxiliary steam including steam for heating up of HFO, in which case the main SGs will not be provided with LDO firing facilities. The fuel oil pressurizing units and fuel oil heating equipment would be appropriately provided along with High-energy electric arc igniters to ignite the fuel oil guns.

61. In order to increase the turbine cycle efficiency and to reduce the boiler feed pump power consumption, the SGs and steam turbine generators be capable of operating on sliding pressure mode. The load range for the sliding pressure operation would be from about 40% steam turbine generator maximum continuous rating (TGMCR) to 100% TGMCR.

62. The draft plant would comprise primary air fans, forced draft fans, and induced draft fans. The draft fans would be provided with features to reduce power consumption during operation of the power plant. Electrostatic precipitator (ESP) and fly ash hoppers would be provided for the collection of fly ash. The ESP would be provided with micro-processor control system to optimize and minimize the electric power consumption. The ESP would be designed for worst coal firing with outlet dust concentration of 100 mg / Nm^3 (Max.) as stipulated by state/central pollution control board to be achieved.

<u>Steam Turbine Generator And Accessories</u>

63. The steam turbine generators (STG) would be rated for 800 MW (Nominal) maximum continuous output at the generator terminals, with throttle steam conditions of 247.05 ata at 565^{0}C / 593^{0}C reheat , 0.082 ata condenser back pressure and 0% make up(Heat balance as per Figure-III.2b). The STG output, at valve wide-open (VWO) condition would be about 854.9 MW.

64. The steam turbine would be a four cylinder reheat, extraction and condensing turbine.

65. The turbine generator would be complete with all accessories such as protection system, lube and control oil systems, seal oil system, jacking oil system, seal steam system, turbine drain system, 60% TGMCR HP /LP bypass system, electro-hydraulic control system, automatic turbine run-up system, on-line automatic turbine test system and turbine supervisory instrumentation.

66. The turbine generator would also have all necessary indicating and control devices to permit the unit to be placed on turning gear, rolled, accelerated and synchronized automatically from the control room. Other accessories of the turbine generator would include an oil purification unit with transfer pumps, and clean and dirty oil storage tanks of adequate capacity.

Figure III.2b
Heat Balance Diagram for Proposed UMPP

Plant Cycle

67. The condensing plant would comprise two condensers, one each for the two LP turbines. Each condenser would be of two pass design of single shell construction. The condenser would be suitable for use of sea water for condenser cooling. The condenser would have titanium tubes rolled into titanium clad carbon steel sheets. 2 x 100% capacity vacuum pumps would be provided to create vacuum in the condenser during start-up and to remove the non-condensable gases liberated during normal operation.

68. The regenerative cycle would consists of four low-pressure heaters, a variable pressure deaerator, two streams of three high pressure heaters and one gland steam condenser.

69. Under normal operating conditions, drains from the high-pressure heater would be cascaded to the next lower pressure heater and finally to the deaerator. Drains from low pressure heaters would be cascaded successively to the next lower pressure heater and finally to the condenser hot well. The exact routing of the drains in low pressure heater system i.e, ultimate draining to condenser or to pumped forward to condensate line would be decided during the optimization of number of heaters. Heaters would be provided with drain level controls to maintain the drain level automatically throughout the range of operation of the heaters. The system would consist of split-range control valves to take the drain to a lower pressure heater or to the condenser through a flash box.

70. The TG unit would be provided with a TGMCR HP-LP bypass system:

(a) To prevent a steam-generator trip in the event of a full export load throw-off and to maintain the unit in operation at house load.

(b) To prevent a steam-generator trip following a turbine trip and enable quick restart of the turbine generator set.

(c) To minimize warm restart duration of the unit after a trip.

(d) To conserve condensate during start-up.

(e) To facilitate quick load changes in both directions without affecting the steam generator operation during start-ups.

Feed Cycle Equipment

Condensate Pumps

71. The condensate from the condensate hot well would be pumped by 2 x 100% capacity condensate pumps, one working and one standby to the de-aerator, through the gland steam condenser, drain cooler and low pressure heaters. The pumps would be vertical, cannister type, and multistage centrifugal pumps driven by AC motors.

Boiler Feed Pumps

72. Feed water would be pumped from the deaerator to the steam generator through the high pressure heaters by means of 2 x 50% capacity motor driven boiler feed pumps provided with variable speed hydraulic coupling. The boiler feed pumps would be horizontal, multistage, centrifugal pumps of barrel type.

Low Pressure Heaters

73. The low pressure heaters would be of shell and tube type with U-shaped stainless steel tubes, with their ends rolled in carbon steel tube sheets.

Deaerator

74. The deaerating feed water heater would be a direct contact, variable pressure type heater with spray-tray type or spray type of deaeration arrangement. The feed water storage tank would have a storage capacity adequate to feed the steam generator for 6 minutes when operating at MCR conditions.

High Pressure Heaters

75. The high pressure heaters would be of shell and tube type with stainless steel U-tubes welded into carbon steel tube sheets. The HP heaters would be provided with a de-superheating zone and a drain cooling zone in addition to the condensing zone.

Gland Steam Condenser

76. A surface type gland steam condenser would be used to condense the gland steam exhausted from the turbine glands. The gland steam condenser would be of single-pass type with the main condensate flowing through the tubes to condense the steam. Exhausters would be provided to evacuate the air from the shell side and maintain the shell at the required negative pressure.

Turbine Lube Oil and Control Fluid System

77. A complete lubricating oil system would be provided for the steam turbine generator unit. The control fluid system may be fully separated from the lubricating oil system or integrated with the lube oil system as per the turbine manufacturer's standard. The lube oil system would comprise lube oil pumps, main oil tank, lube oil coolers, lube oil filters, piping, valves, fittings etc. The control fluid system would have its own pumps, motors, coolers, strainers, piping, valves and fittings.

Turbine Lube Oil Purification System

78. The quality control of lubricating oil is important for maintenance management of a turbine,.Hence removal and separation of the solid and water which are mixed into the oil are necessary. For the lube oil purification purpose it is proposed to provide filter type (coalescer) oil purifier.

Condensate Polishing Unit

79. In order to maintain high purity of the feed water condensate polishing unit is envisaged in the condensate system.

Fuel Oil System

80. The steam generators would be designed for the use of heavy fuel oil (HFO) for start up and flame stabilization purposes.

81. The steam generators would be provided with a light oil (LDO) system for initial light up and warming up of the steam generators. In addition, one common auxiliary package boiler with LDO as the fuel is also being tentatively planned. The steam from this boiler

would cater to the auxiliary steam during start-up and also would heat up the HFO, which in turn would be used for steam generator light up and warming up purpose.

82. Necessary facilities for fuel oil receipt, storage and forwarding to steam generators would be provided in the premises of power plant.

Chemical Dosing System

83. Ammonia dosing system would be provided to ensure chemical conditioning of the condensate / feed water for controlling the alkanity. The ammonia solution would be injected into the condensate at the condensate extraction pumps discharge.

84. The low-pressure ammonia dosing system would comprise solution preparation-cum-metering tanks with motorised agitators, two positive displacement type dosing pumps, piping, valves, instruments and local control panel. Each dosing pump would be sized to cater to the 100% dosing requirements of each of the 800 MW (Nominal) units. Oxygen dosing will also be provided.