APPLICATION FOR TERMS OF REFERENCE FOR EIA STUDY (REVISED FORM-I & FEASIBILITY REPORT)

for the proposed

4 X 135 MW SURGUJA THERMAL POWER PROJECT

at

DISTRICT SURGUJA,
CHHATTISGARH

Submitted to:

Ministry of Environment & Forests, Government of India

Submitted by:

SURGUJA POWER PRIVATE LIMITED
Adani House, Near Mithakhali Circle
Navrangpura, Ahmedabad – 380009
Gujarat

March 2013

Contents

FORM-I

(I) Basic Information

Sl.	Item	Details
1.	Name of the project/s	540 (4x135) MW Coal Washery Rejects based Surguja Thermal Power Project of Surguja Power Private Limited.
2.	S. No. of the schedule	1 (d)
3.	Proposed capacity / area / length / tonnage to be handled / command area / lease area / lease area / number of wells to be drilled	**Capacity-** 540 (4x135) MW **Area-** 47.479 ha (117.273 Acres)
4.	New / Expansion / Modernization	New Project
5.	Existing Capacity / Area etc.	Not Applicable
6.	Category of Project i.e. 'A' or 'B'	A (Thermal Power Plant, Capacity ≥ 500 MW)
7.	Does it attract the general condition? If yes please specify.	Not Applicable
8.	Does it attract the specific condition? If yes please specify.	Not Applicable
9.	Location	
	Plot/Survey/Khasra No.	Enclosed as Annexure-1
	Village	Parsa & Kete
	Tehsil	Udaypur
	District	Surguja
	State	Chhatisgarh
10.	Nearest Railway Station / Airport alongwith distance in kms.	**Ambikapur Railway Station-** 60 kms **Raipur Airport-** 220 kms
11.	Nearest Town, city, District Headquarters alongwith distance in kms.	**Nearest Town-** Udaypur Town (20 kms) **Nearest City-** Ambikapur (60 kms) **District Headquarters-** Ambikapur (60 kms)
12.	Village Panchayats, Zila Parishad, Municipal Corporation, Local body (complete postal addresses with telephone nos. to be given)	**Village Panchayat-** Parsa Gram Panchayat Taluka Udaypur District Surguja Chhattisgarh **Zila Parishad-**Surguja
13.	Name of the Applicant	Surguja Power Private Limited
14.	Registered Address	Adani House, Nr. Mithakhali Circle Navrangpura, Ahmedabad, Gujarat.
15.	Address for correspondence	
	Name	Mr. Santosh Kumar Singh
	Designation (Owner / Partner / CEO)	Authorized Signatory
	Address	10-A, Sambhav Building, Judges Bungalow Road, Bodakdev Ahmedabad - 380 015
	Pin Code	380015

	E-mail	santosh.singh1@adani.com
	Telephone No.	079-25557289
	Fax No.	079-25557176
16.	Details of alternative Sites examined, if any Location of these sites should be shown on a topo sheet.	As per the Environmental Clearance Letter No. J-11015/03/2008-IA.II(M) dated 21.12.2011, for Parsa East & Kente Basan Open Cast Coal Mining Project, the location of FBC Power Plant should be within the ML area. The location has been accordingly revised within the Mining Project area.
17.	Interlinked Projects	Yes, Parsa East and Kente Basan Coal Block of Hasdeo-Arand Coalfield. The coal block has been allotted to Rajasthan Rajya Vidyut Utpadan Nigam Ltd. The mining project and coal washery will be developed and operated by Adani Mining Pvt. Ltd. Surguja Power Private Limited has been formed as SPV, a 100% subsidiary of Adani Mining Private Limited, to implement and operate the Surguja Thermal Power Project. Washed clean coal will be supplied for Thermal Power Plants of Rajasthan Rajya Vidyut Utpadan Nigam Ltd, while the coal washery rejects are proposed to be used by Surguja Power Private Limited for this project.
18.	Whether separate application of interlinked project has been submitted?	Yes, Separate application submitted for Coal Block and Coal Washery. The project has been accorded environmental clearance vide letter no. J-11015/03/2008-IA.II(M) dated 21.12.2011.
19.	If yes, date of submission	31.12.2007
20.	If no, reason	Not Applicable
21.	Whether the proposal involves approval / clearance under: if yes, details of the same and their status to be given. (i) The Forest (Conservation) Act, 1980. (ii) The wildlife (Protection) Act, 1972 (iii) The C.R.Z. Notification, 1991	 Yes. The Project involves transfer of forest clearance under Forest (Conservation) Act, 1980 for 27.108 ha Protected Forest Land and 2.736 ha of Revenue Forest Land. The Final Approval for diversion of forest land for the Open Cast Coal Mining Project has been accorded for 762 ha. No No
22.	Whether there is any Government Order / Policy relevant / relating to the site?	No
23.	Forest Land involved (hectares)	29.844 ha
24.	Whether there is any litigation pending against the project and/or land in which the project is propose to be set up?	Not Applicable

	(a) Name of the court (b) Case No. (c) Orders/directions of Court, if any and its relevance with the proposed project.	

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data.
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	Yes	Permanent change of present land use at project site is expected for setting up of Power Plant. The total area of 47.479 ha includes Main plant, water reservoir, switchyards, green-belt, etc. Presently 17.606 ha is Private Tenancy Land, which has been acquired for Mining Project. The land use at the time of acquisition was Single Cropping Rainfed Agricultural Land, which is now under Mining Project. 27.108 ha is Protected Forest Land and 2.736 ha is Revenue Forest Land, for which Final Approval for diversion has been obtained by Rajasthan Rajya Vidyut Nigam Limited.
1.2	Clearance of existing land, vegetation and buildings?	Yes	Plant layout will be done in such a way that it will create minimum disturbance to existing land, vegetation and habitation.
1.3	Creation of new land uses?	Yes	Change from exiting landuse to Industrial land use for Power Plant & its auxiliary facilities.
1.4	Pre-Construction investigations e.g. bore houses, soil testing?	Yes	Soil investigation will be carried-out at the proposed site.
1.5	Construction works?	Yes	Construction of Power Plant & its auxiliary facilities.
1.6	Demolition works?	No	Not Applicable
1.7	Temporary sites used for construction or housing of construction works?	Yes	Temporary sites would be used for housing of construction workers.
1.8	Above ground buildings, structures, cut or fill or excavations	Yes	The entire Power Plant will be constructed above ground. There will be some cut and fill for foundations, leveling, etc.
1.9	Underground works including mining or tunneling?	No	Not Applicable
1.10	Reclamation works?	No	Not Applicable
1.11	Dredging?	No	Not Applicable
1.12	Offshore Structures?	No	Not Applicable
1.13	Production and manufacturing processes?	Yes	Generation of Electricity from combustion of coal washery rejects and coal as fuel.

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data.
1.14	Facilities for storage of goods or materials?	Yes	Coal Stockyard for storage of coal, Storage tanks for LDO/HFO, Closed Storage yard for chemicals, spare parts, equipments, maintenance tools, etc.
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Yes	For solid waste, it is proposed to dispose / reuse as per plan stated below. **Ash Disposal System:** About 95 Million Tons of ash will be generated over the life of the project of 25 years. It is proposed to use ash to the extent possible for manufacturing of Cement, Building Material, Road Construction, etc. Unutilized ash is proposed to be used for mine backfilling in Slurry/ HCSD (High Concentration Slurry Disposal) form. **For liquid wastes:** The Clarifier underflow of Pre-Treatment Plant shall be collected and recycled back to the Clarifier through Thickener. The entire plant is designed with COC of 5 and will be based on zero discharge. CW system blow down would be partly reused through a secondary clarifier, Pressure Sand Filter and Ultra Filter. Part of the blow down will be taken to Central Monitoring Basin and reused for Dust Suppression, Ash Wetting and Horticulture. A coal settling pond shall be provided to remove coal particles from coal handling plant waste. Decanted water shall be pumped back to the coal dust suppression system. Sewage from various buildings in the power plant area will be conveyed to Sewage Treatment Plant. The treated effluents from the STP will be used for Green Belt. Removed Sludge will be disinfected and used as manure.
1.16	Facilities for long term housing of operational workers?	Yes	Staff Colony will be developed for operation workers along with the colony for Mining Project and is not part of this proposal
1.17	New road, rail or sea trafficking during construction or operation?	Yes	• Approach for the plant from the nearby Bilaspur-Ambikapur road. • Conveyor system for coal washery rejects transportation.

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data.
			• Railway being developed for the mining project will be used for transportation of coal.
1.18	New road, rail, air, waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc.?	Yes	• Conveyor system for coal washery rejects and railway line for coal transportation • Water pipeline from Rehar / Atem river to the plant site • Approach Road for Construction Material Transportation.
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	No	Not Applicable
1.20	New or diverted transmission lines or pipelines?	Yes	New transmission line is proposed from power station to nearest STU / CTU.
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of neither watercourses nor aquifers?	No	Not Applicable
1.22	Stream crossings?	No	Not Applicable
1.23	Abstraction or transfers of water from ground or surface water?	Yes	Abstraction of surface water from Atem / Rehar River @ 14.14 MCM per year (39.284 MLD). 1000 KLD of Groundwater abstraction is proposed for domestic and construction purpose.
1.24	Changes in water bodies or the land surface affecting drainage or run off?	No	Not significant as water study report of Atem / Rehar River basin, indicates sufficient water is available to cater the need of the project.
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Transport of construction materials from nearby sources to construction work area during construction and transport of coal from washery to the plant site during operation.
1.26	Long-term dismantling or decommissioning or restoration works?	No	Not Applicable
1.27	Ongoing activity during decommissioning, which could have impact on the environment?	No	Not Applicable
1.28	Influx of people to an area in either temporarily or permanently?	Yes	Since industry attracts both skilled and unskilled labours, influx of population will be there to some extent.
1.29	Introduction of alien	No	Not Applicable

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data.
	species?		
1.30	Loss of native species or genetic diversity?	No	Not Applicable
1.31	Any other actions?	No	Not Applicable

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply).

Sl.. No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities / rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural (ha)	Yes	Presently the entire land has been acquired for the Mining Project, which will be transferred/leased for the Thermal Power Project. Plant layout will be based on minimum disturbance to existing vegetation.
2.2	Water (expected source & competing users) unit: KLD	Yes	Water of Atem / Rehar River to be used @ approx. 14.14 MCM per year. 1000 KLD of Groundwater abstraction is proposed for domestic and construction purpose, after obtaining permission from Central Ground Water Board.
2.3	Minerals (MT)	Yes	A mix of Domestic Coal (22%) and Coal Washery Reject (78%) will be used for the Project. The total requirement is estimated at 4 MTPA at PLF of 75%.
2.4	Construction material- stone, aggregates, and/ soil (expected source- MT)	Yes	Stone, aggregate, soil, sand etc. from nearby area.
2.5	Forest and Timber (source –MT)	No	Not Applicable
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), Energy(MW)	Yes	• Domestic Thermal E-F Grade Coal and Coal Washery Reject: 4 MMTPA (75% PLF) with a average GCV of 2000 kcal/kg. • LDO& HFO will be used as secondary fuel
2.7	Any other natural resources (use appropriate standard units)	No	Not Applicable

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data.
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, Fauna, and water supplies)?	Yes	1. LDO 2. HFO. 3. Chlorine.
3.2	Changes in occurrence of diseases or affect disease vectors (e.g. insect or waterborne diseases)?	No	Not Applicable
3.3	Affect the welfare of people e.g. by changing living condition?	Yes	The region will turn to industrial and commercial zone from agricultural and rural economy. The industrial and commercial development is expected to have beneficial impact on the local people in terms of commercial and employment.
3.4	Vulnerable groups of people who could be affected by the project e.g hospital patients, children, the elderly etc.	No	Hospitals, schools, road etc. will be developed under CSR activity of the Project Proponent.
3.5	Any other causes	No	Not Applicable

4. Production of solid wastes during construction or operation or decommissioning (MT / month)

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities wherever possible) with the source of information.
4.1	Spoil, overburden or mine wastes	No	Not Applicable
4.2	Municipal waste (domestic and or commercial wastes)	Yes	Will be minimum, since generation will be there from colony area only and the colony is not a part of this proposal.
4.3	Hazardous waste (as per Hazardous Waste Management Rules)	Yes	Oily waste & sludge will be disposed off as per CPCB/MoEF guidelines.
4.4	Other industrial process wastes	Yes	Ash only
4.5	Surplus product	No	Not Applicable
4.6	Sewage sludge or other sludge from effluent treatment	Yes	STP Sludge will be used as manure after disinfection.
4.7	Construction or demolition wastes	No	Construction wastes, if any, will be used for landfill.

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities wherever possible) with the source of information.
4.8	Redundant machinery or equipment	No	Not Applicable
4.9	Contaminated soils or other materials	No	Not Applicable
4.10	Agricultural wastes	No	Not Applicable
4.11	Other solid wastes	No	Not Applicable

5. Release of pollutants or any hazardous, toxic or noxious substances to air (kg/m^3):

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities wherever possible) with the source of information.
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	Emission of dust and gases like NO_2, SO_2 etc. ESP, Low NOx burners and other measures will be taken care to limit the emission within the prescribed norms.
5.2	Emission from production Process	Yes	Emission of dust and gases Like NO_X, SO_2 etc. 1 RCC Stacks of 275 m height, with 4 Steel Flues are proposed for wider dispersion of the pollutants.
5.3	Emission from materials handling including storage or transport	No	Not anticipated with usage of dust extraction and suppression system in ash silo, coal transfer point and coal bunkers. Also closed coal conveyors will be used in coal transportations.
5.4	Emission from construction activities including plant and Equipment	Yes	Regular water sprinkling will be done at the project to minimize the dust emission during construction phase.
5.5	Dust or odours from handling of materials including construction materials, Sewage and waste	Yes	Some dust will be emitted while handling the construction materials like cement or bricks.
5.6	Emissions from incineration of waste	No	Not Applicable
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	Not Applicable
5.8	Emissions from any other sources	No	Not Applicable

6. Generation of Noise and Vibration, and emissions of Light and Heat:

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities wherever possible) with the source of information.
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	Noise would be generated generally from steam turbine, generator, compressors, pumps, fans, coal handling plant etc. but all the equipment will be designed and if required acoustic materials will be provided to have the noise level not to exceed the values as stipulated in CPCB/MoEF norms.
6.2	From industrial or similar processes	Yes	Noise would be generated from transportation of material / machine.
6.3	From construction or demolition	Yes	Some noise would be generated during construction phase but it will be limited to the site only.
6.4	From blasting or piling	No	Not Applicable
6.5	From construction or operational traffic	Yes	During construction and coal transportation traffic
6.6	From lighting or cooling systems	Yes	Indirect process cooling, direct water spraying
6.7	From any other sources	No	Not Applicable

7. Risks of contamination of land or water from release of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities wherever possible) with the source of information.
7.1	From handling, storage, use or spillage of hazardous materials	No	Not Applicable
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	No	Plant will follow the Zero Discharge concept.
7.3	By deposition of pollutants emitted to air into the land or into the water	Yes	Installing ESP and other air pollution control equipment will minimize the impact. Similarly COC maximization along with reuse will generate minimum discharge. ETP will be designed to meet stipulated standards. Treated effluent will be reused within the plant. So there will be no significant impact.
7.4	From any other sources	No	Not Applicable
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	Yes	Minimum impact on land and water due to state of art technology. The plant will be designed, constructed and operated to maintain all parameters within statutory limits.

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment:

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with the source of information.
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	Yes	An assessment of conceptual design will be conducted to minimize the risk of fire at the coal stockyard, LDO & HFO storage tank, chlorine gas leaks from the pipeline/ tonner, breaching of ash pond due to failure of ash pond bound.
8.2	From any other causes	No	Not Applicable
8.3	Could the project be affected by natural disaster causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	No	The Project is proposed in Seismic Zone-III. At the time of construction work the regulations for the seismic zone III will be taken into consideration for designing and setting up the project.

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality:

Sl. No.	Information / Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with the source of information.
9.1	Lead to development of supporting utilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: • Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) • Housing development • Extractive industries • Supply industries • Other	Yes	Roads, railway line, housing development for company workers etc. This will bring mostly positive change on the site.
9.2	Lead to after-use of the site, which could have an impact on the environment	Yes	It would be an industrially planned area.
9.3	Set up precedent for later developments	Yes	Later development will be taken into consideration.
9.4	Have cumulative effects due to proximity to other existing or planed projects which similar effects	No	Not Applicable

(III) Environmental Sensitivity

Sl. No.	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary.
1	Areas protected under international conventions, national or local legislation for their ecological landscape, cultural or other related value	None	No ecological sensitive zone except Protected Forests and Reserve Forests.
2	Areas which are important or sensitive for ecological reasons – Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	None	Only Protected Forests and Reserve Forests within 10 km radius of area.
3	Areas used by protected, important or sensitive species of flora and fauna for breeding, nesting, foraging, resting, over wintering, migration	None	No ecological sensitive zone except Protected Forests and Reserve Forests.
4	Inland, coastal, marine or underground waters	Atem River	4.0 km
5	State, National boundaries	None	Not Applicable
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	None	No tourist or heritage site within 10 Km radius.
7	Defense installations	None	Not Applicable
8	Densely populated or built-up area	None	No major cities within 10 km radius
9	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	None	Not Applicable
10	Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	None	Only Protected Forests and Reserve Forests within 10 km radius from the site.
11	Areas already subjected to pollution or environmental damage. (Those where existing legal environmental standards are exceeded)	None	Not Applicable
12	Areas susceptible to natural hazard which cause the project to present environmental problems (earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions)	None	The site comes under the Seismic Zone III. Therefore, consideration will be taken care during design and construction stages.

"I hereby given undertaking that the data and information given in the application and enclosures are true to the best of my knowledge and belief and I am aware that if any part of the project will be rejected and clearance given, if any to the project will be revoked at our risk and cost.

Date: 20.03.2013

Place: Ahmedabad

(Santosh Kumar Singh)
Authorized Signatory
10-A, Sambhav Building
Judges Bungalow Road, Bodakdev
Ahmedabad- 380015

Signature of the applicant
With Name and Full Address
(Project Proponent / Authorised Signatory)

(IV) Proposed Terms of Reference for EIA Studies

Project	Proposed 540 (4x135) MW Coal Washery Reject based Thermal Power Project
Category	**A** [1(d) Thermal Power Plant ≥ 500 MW]
Project Proponent	**Surguja Power Private Limited**
Location	Village Parsa & Kete, Tehsil- Udaypur, District- Surguja, State- Chhatisgarh

INTRODUCTION

540 (4x135) MW Surguja Thermal Power Project in Surguja district of Chhattisgarh is proposed to be set up by Surguja Power Private Limited a fully owned subsidiary of Adani Mining Private Limited. The project is being taken up to meet power requirements of Chhattisgarh. The project is envisaged to be completed during the 12th Plan period between 2012-2017.

The station would require about 4 MMTPA (PLF @ 75%) of Domestic Thermal Coal and Coal Washery Reject considering the installed capacity as 540 MW. The coal from the washery will be transported through conveyor system.

The water requirement of proposed station will be to the tune of 14.14 MCM per year (approx.). Water is proposed to be drawn from the Atem / Rehar River.

The power generated from the project shall be shared between Chhattisgarh and nearby Grid. The provisions for Power evacuation as considered presently shall be reviewed based on the finalized Associated Transmission System (ATS) of the project.

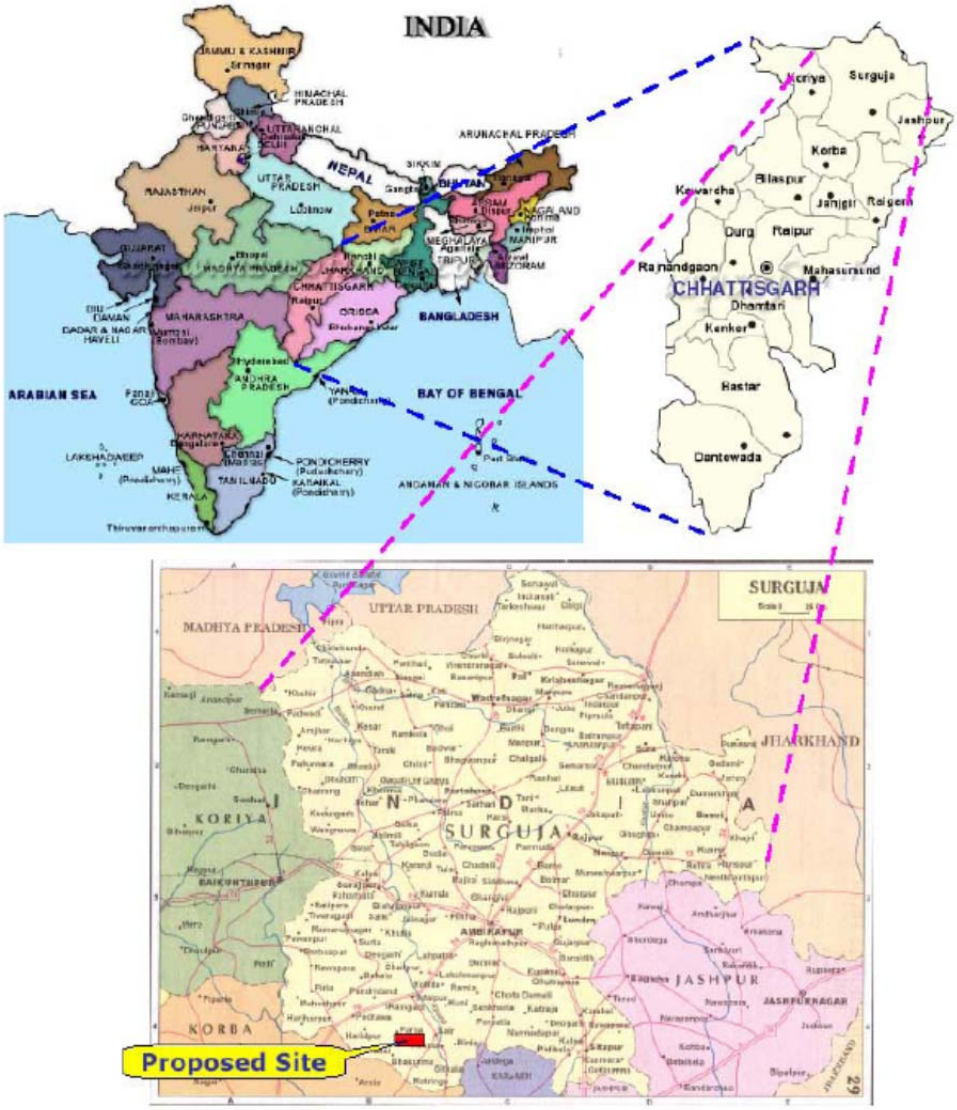
EIA METHODOLOGY

The EIA Report will address all the terms of reference and will be prepared in accordance to the Environment Protection Act 1986 and EIA Notification published by Ministry of Environment and Forests, Govt. of India on 14th September 2006. It will form part of the application to the Statutory Authority. The scope of the EIA Report for the proposed Power Plant includes identifying relevant environmental concerns and focus on potential impacts that may have changed due to the setting up of the plant. The report will also provide an Environment Management Plan and Disaster Management Plan.

The Winter Season, 2011-12 baseline monitoring is being carried out as per the requirement of MoEF.

SITE & STUDY AREA

The proposed 540 (4x135) MW Power Project will be within the Parsa East & Kente Basan Coal Mining Project. Nearest Water source is river Atem / Rehar, which is about 4 / 26 Km from the proposed site. The nearest Railway station is Ambikapur which is approx 60 Km from site.



PROJECT DESCRIPTION

Project Rationale

This section will highlight the goals and objectives of the proposed project. It will also include discussion on the significance of the project in terms of the need for the project in the local as well as the national level, it will also highlight the proposed project in line with existing development plans of the State and Central government and in accordance with the existing or envisioned land use plans.

Project Location

This section will discuss the geographic location of the project. The location of the project will clearly define geographical features (e.g. watersheds, national parks / protected areas, military reservations, etc.) and the general access to the project site (e.g. presence of existing road networks, feeder roads, etc.).

Project Information / Process Information

This portion will include the following

- Statement of the Official name of the project and name/s of proponents (including address, telephone nos., etc.) responsible / liable;
- Vicinity Plan, Processes involved, Site layout, water balance diagram
- Project cost and area
- Resource / Manpower requirements
- Time frame for project implementation

Process Description

The technology to be used for the project and the process components of the project focusing on the materials input and output from the process components including products, fuels, feedstock and utility requirements (gas, electricity, steam and cooling water will be provided. Material balances (also energy balance); flow diagrams and descriptions of the process to be used will also be provided. The process emissions including air, liquid, and associated wastes, and associated pollution abatement equipment will be discussed.

Pre-Construction

This section shall discuss / describe the various components of the projects. This section shall also discuss the major activities to be undertaken during the construction phase, which shall include but not be limited to:

- Site mobilization
- Road construction / improvement
- Camp construction
- Site clearing
- Construction of the major facilities / project components
- Construction of support services e.g. Water & Power supply & Telecommunications, etc.

Operation

This section shall discuss the activities to be undertaken during the operation, which shall include but not limited to:

- Major maintenance activities
- Manpower requirements
- Fuel Requirement
- Energy requirements

BASELINE ENVIRONMENTAL SCENARIO

Description of the existing environment, assessment of historical trends of environmental data specific to the proposed site and description of the socio-economic setting in the area will provide an overall picture of the proposed site before any development activities are undertaken. Thus, equipped with the knowledge of the existing environment and aware of the specifications of the proposed project as described in the preceding sections will be identified and areas of critical importance and impacts of the project can be reliably predicted.

Finally, methodologies used in the data collection (primary data) shall be briefly discussed with the corresponding interpretation of the data obtained. Likewise, ail sources of information (secondary data) shall be identified and appropriately acknowledged.

STUDY MODULES	SCOPE AND COVERAGE	METHODOLOGY (TYPE AND SOURCE)	MAPS / TABLES / FIGURES REQUIRED
A. PHYSICAL ENVIRONMENT			
Inland Topography	• Landform Pattern	• Slope and elevation	• Topographic map
Soils	• Soil physical and chemical characteristics / analysis	• Soil survey	• Soil Sampling Locations • Will be monitored on 8 location including site and ash pond area
Hydrology	• Surface water characteristics, river systems • Groundwater characteristics • Drainage systems	• Groundwater analysis • Characterization of inland surface water	• Water supply and demand projections
Meteorology/ climatology	• Rainfall pattern • Frequency distribution of wind direction • Temperature • Associated atmospheric pressure	• Secondary data from IMD • Primary data collection	• Wind rose diagrams
Air Quality	• Ambient air quality • PM_{10}, $PM_{2.5}$, NO_X, So_X, Mercury and Oxone	• Air quality measurements • Identification of air pollution sources	• Sampling station map • Result of air quality measurements • Ambient Air Quality will be monitored on 10 location including site.
Water Quality	• Physico-chemical characteristics of surface waters and ground water (pH, TSS, DO, BOD, temperature, nitrates, phosphates, and metallic components etc.) • Bacteriological characteristics (total coliform)	• Sampling and analysis	• Sampling station map • Results of laboratory analysis. • 5 surface and 5 ground water samples will be collected to assess the water quality of the region.
Noise Level	• Ambient noise levels at the project sites and nearby community	• Noise quality measurements	• Results of noise level measurements • Sampling stations map • Will be monitored on 10 location including site and nearby highways.
B. BIOLOGICAL ENVIRONMENT			
Flora	• Summary of vegetative cover	• Secondary data collection from	• Flora species inventory

STUDY MODULES	SCOPE AND COVERAGE	METHODOLOGY (TYPE AND SOURCE)	MAPS/TABLES/ FIGURES REQUIRED
		region forest office	
Fauna	• Terrestrial fauna including endangered and threatened fauna species • Fauna species inventory survey	• Secondary data collection from region forest office	• Fauna species inventory
C. SOCIO-ECONOMIC CULTURAL ENVIRONMENT			
Demography	• Population size • Population density, household size • Population by gender • Literacy rate • Occupation and employment status	• Principal data from Census	• Primary Census Abstract
Other Social Services	• School facilities • Telecommunications, water and power facilities	• Principal data from Census	• Village Infrastructure directory
Transportation	• Network and mode of transportation	• Identification of main and access roads, mode of transportation	• Road access map

ASSESSMENT OF ENVIRONMENTAL IMPACTS

There shall be an assessment on feasibility and cost-effective measures to prevent or reduce significant negative environmental impacts identified, to an acceptable level. In this section, the following aspects will be assessed:

- The project component and development activities that result in discharges to the environment and the effect of these on the environment
- Existing conditions in the site area, including existing land-use, resources and other activities, which in combination with the project activity have potential to affect the environment.
- Anticipated environmental effects

This chapter will include appropriate tables and figures to illustrate and summarize the key Information that is relevant in understanding the environmental and socio-economic environment. The environmental and socio-economic impact of the proposed project having regard for regional and cumulative effects will be presented. Wherever possible, the impacts will be quantified. This section will also include measures to address emergency response requirements for accidental events and also estimate costs of those measures and of the institutional training requirements to implement them.

The existing air quality of the region and the impact of the proposed project on regional air quality will be discussed. The component of the project, which will affect **air quality**, will be identified. All emissions as a result of the proposed projects and their effects on the environment will be discussed. Also the ways and means of reducing the air emissions impact will be discussed.

The project activities that will affect **surface water and ground water** will be identified. In this section, the water intake requirements during construction, operation and emergency situations will be estimated and the sources will be identified also. Any

water minimization considerations will be included. The method of plant cooling and the design parameters and criteria for any incremental water management and storage facilities will be provided. The quantity and source of wastewater will be presented including a summary of water quality effects and possibility of recycling.

Project activities during construction and operation phases that will affect **noise levels** and the potential for increased noise resulting from this project will be presented. The effect on noise levels during the construction and operation phase will be ascertained.

Future **waste management** projections, storage and disposal plans and locations will be discussed. The quantity and composition of any waste including solid and hazardous wastes produced will be estimated and classified.

Land-use and Socio-economic information will also be provided. The impact on the resources and the present population will be highlighted. This will include the effects on employment, livelihood, economy and infrastructure.

RESOURCE/ ENVIRONMENT	CONSTRUCTION PHASE	OPERATION / MAINTENANCE PHASE
	IMPACT	IMPACT
Land	• Modification of land forms	• Change in present form
Water	• Change in quality of surface and groundwater	• Change in quality of water bodies due to discharge of effluent
Air Quality	• Dust generation • Change in concentration of pollutant gases	• Change in level of gaseous pollutants i.e. TSP, SO_2 and NO_X
Noise	• Change in noise level	• Change in noise level from various sources
Wastewater / Solid waste management	• Wastewater / Solid waste management	• Solid waste management • Wastewater management
Socio-economic	• Change in employment pattern • Change in Infrastructure facilities	• Change in economy of the region • Employment benefits

ENVIRONMENTAL MANAGEMENT PLAN

Monitoring Program

The EIA shall contain an extensive monitoring program for parameters included in the baseline studies. An Environmental Monitoring Plan containing the following information would serve as a guide in the monitoring activities.

- Frequency of sampling and sampling points
- Sampling parameters: groundwater quality, water quality of the surrounding bodies of water (e.g. BOD TSS, oil and grease, etc.).
- Sampling should be done at the same locations as in the baseline data survey and at effluent release points to check whether permissible requirements are met.
- Work and financial plan for the current year

Information, Education and Communication (IEC) Plan

Plans for Informing, educating and communicating with the State Government and the community regarding the project and its implementation of the EMP should be presented.

Contingency / Emergency Response Plan

Procedures on how to cope with emergencies / accidents shall be outlined in a comprehensive contingency / emergency response plan. The institutional responsibilities will be made clear and the flow of communication in cases of emergencies will be included.

MOUZA - PARSA

DETAILS OF LAND INVOLVED IN THE PROPOSED SITE OF 540 M.W. CAP. POWER PLANT

1 MOUZA - PARSA, P.H.NO. 16, TAHSIL - UDAIPUR DISTT. - SURGUJA

A. TENANCY LAND

SL. NO.	Khasra No.	Total Area in (Ha.)	Acquiered Area (Ha.)	Area Requiered for Power Plant (Ha.)
1	280/3	0.137	0.137	0.137
2	280/4	0.081	0.081	0.081
3	280/5 (P)	0.483	0.483	0.150
4	280/6 (P)	0.242	0.242	0.030
5	280/7	0.137	0.137	0.137
6	280/8	0.235	0.235	0.235
7	280/9 (P)	0.218	0.218	0.055
8	280/10	0.218	0.218	0.218
9	280/11	0.220	0.220	0.220
10	280/12 (P)	0.151	0.151	0.070
11	280/13	0.161	0.161	0.161
12	281/1 (P)	0.101	0.101	0.050
13	281/2	0.101	0.101	0.101
14	281/3	0.101	0.101	0.101
15	281/4	0.102	0.102	0.102
16	282 (P)	0.206	0.206	0.102
17	283 (P)	0.150	0.150	0.020
18	285/1 (P)	0.230	0.230	0.208
19	285/3 (P)	0.462	0.462	0.240
20	285/5 (P)	0.232	0.232	0.170
21	285/6 (P)	0.230	0.230	0.150
22	285/2 (P)	0.922	0.922	0.010
23	285/7 (P)	0.231	0.231	0.195
			TOTAL	**2.943**

1 MOUZA - PARSA, P.H.NO. 16, TAHSIL - UDAIPUR DISTT. - SURGUJA

B. FOREST LAND (REVENUE FOREST)

SL. NO.	Khasra No.	Total Area in (Ha.)	Acquiered Area (Ha.)	Area Requiered for Power Plant (Ha.)
1	721/8 (p)	3.237	2.156	1.087

(ABSTRACT) - For Parsa

1	Tenancy Land	2.943 (Hects.)
2	Revenue Forest	1.087 (Hects.)
TOTAL		**4.030 (Hects.)**

MOUZA - KETE

2 MOUZA - KETE, P.H.NO. 16, TAHSIL - UDAIPUR DISTT. - SURGUJA

A. TENANCY LAND

SL. NO.	Khasra No.	Total Area in (Ha.)	Acquiered Area (Ha.)	Area Proposed for Power Plant (Ha.)
1	`2/1	0.084	0.084	0.084
2	`2/2	0.083	0.083	0.083
3	`2/3	0.084	0.084	0.084
4	3 (p)	0.806	0.806	0.660
5	5/3 (p)	0.186	0.186	0.160
6	8/1 (p)	0.364	0.364	0.101
7	8/2 (p)	0.647	0.647	0.255
8	9	0.543	0.543	0.543
9	10	0.198	0.198	0.198
10	11	0.393	0.393	0.393
11	12	0.061	0.061	0.061
12	`13/1	0.040	0.040	0.040
13	`13/2	0.069	0.069	0.069
14	`14/1	0.106	0.106	0.106
15	`14/2	0.260	0.260	0.260
16	`14/3	0.006	0.006	0.006
17	`17/1	0.320	0.320	0.320
18	`18/1	0.283	0.283	0.283
19	`18/2	0.191	0.191	0.191
20	`18/3	0.049	0.049	0.049
21	`18/4	0.190	0.190	0.190
22	19	0.291	0.291	0.291
23	20	0.061	0.061	0.061
24	21	0.299	0.299	0.299
25	`22/1	0.182	0.182	0.182
26	`22/2	0.214	0.214	0.214
27	`22/3	0.235	0.235	0.235
28	`22/4	0.223	0.223	0.223
29	`22/5	0.056	0.056	0.056
30	`22/6	0.061	0.061	0.061
31	`22/7	0.057	0.057	0.057
32	`24/1`	0.134	0.134	0.134
33	`24/2	0.134	0.134	0.134
34	`24/3	0.133	0.133	0.133
35	`25/3	0.050	0.050	0.050
36	`25/4	0.016	0.016	0.016
37	`25/5	0.017	0.017	0.017
38	`26/1	0.081	0.081	0.081
39	`26/2	0.041	0.041	0.041
40	`26/3	0.040	0.040	0.040
41	`27/1	0.202	0.202	0.202
42	`27/2 (P)	0.203	0.203	0.035
43	`28/2	0.494	0.494	0.494

SL. NO.	Khasra No.	Total Area in (Ha.)	Acquiered Area (Ha.)	Area Proposed for Power Plant (Ha.)
44	29 (P)	0.081	0.081	0.054
45	`30/1 (P)	0.186	0.186	0.012
46	`30/2	0.182	0.182	0.182
47	`30/3	0.121	0.121	0.121
48	`31/1 (P)	0.129	0.129	0.030
49	`31/2	0.154	0.154	0.154
50	`31/3	0.089	0.089	0.089
51	32	0.081	0.081	0.081
52	33	0.036	0.036	0.036
53	34	0.093	0.093	0.093
54	35	0.020	0.020	0.020
55	36	0.028	0.028	0.028
56	38 (P)	0.020	0.020	0.007
57	40	0.085	0.085	0.085
58	41/1	0.029	0.029	0.029
59	41/2 (P)	0.075	0.075	0.025
60	42 (P)	0.599	0.599	0.120
61	129	0.073	0.073	0.073
62	156/1	0.304	0.304	0.304
63	156/2 (P)	0.303	0.303	0.290
64	157/1 (P)	0.117	0.117	0.105
65	157/2	0.433	0.433	0.433
66	157/3	0.344	0.344	0.344
67	157/4	0.324	0.324	0.324
68	158/1 (P)	1.064	1.064	1.030
69	158/2 (P)	1.064	1.064	0.920
70	159/1	1.445	1.445	1.445
71	159/2	0.186	0.186	0.186
72	159/3 (P)	0.973	0.973	0.580
73	159/4	0.206	0.206	0.206
74	162/2 (P)	0.273	0.273	0.065
		Total		**14.663**

1 MOUZA - KETE, P.H.NO. 16, TAHSIL - UDAIPUR DISTT. - SURGUJA

B. FOREST LAND (REVENUE FOREST)

SL. NO.	Khasra No.	Total Area in (Ha.)	Acquiered Area (Ha.)	Area Requiered for Power Plant (Ha.)
1	6 (P)	0.458	0.458	0.030
2	16	0.016	0.016	0.016
3	23	0.737	0.737	0.737
4	`28/1 (P)	1.961	1.961	0.137
5	`28/3	0.579	0.579	0.579
6	130/1	0.497	0.497	0.101
7	130/3	0.049	0.049	0.049
		TOTAL		**1.649**

1 MOUZA - KETE, P.H.NO. 16, TAHSIL - UDAIPUR DISTT. - SURGUJA

C. PROTECTED FOREST (Compartment No. P - 2008, Gumga Block, Range - Udaipur, Division - South surguja

SL. NO.	Khasra No.	Total Area in (Ha.)	Acquiered Area (Ha.)	Area Requiered for Power Plant (Ha.)
1	`1/1	39.916	39.916	27.371

1 MOUZA - KETE, P.H.NO. 16, TAHSIL - UDAIPUR DISTT. - SURGUJA

D. GOVT. LAND

SL. NO.	Khasra No.	Total Area in (Ha.)	Acquiered Area (Ha.)	Area Requiered for Power Plant (Ha.)
1	37 (P)	0.049	0.049	0.029

(ABSTRACT) for Kete

1	Tenancy Land	14.663
2	Govt Revenue Land	0.029
3	Revenue forest (Chhote Jhar/Bade Jhar)	1.649
4	Protected Forest	27.108
	Total	**43.449**

प्रारुप 1
पंजीकरण प्रमाण-पत्र

कॉर्पोरेट पहचान संख्या U40100GJ2012PTC068748 2011 - 2012

मैं एतदद्वारा सत्यापित करता हूँ कि मैसर्स

SURGUJA POWER PRIVATE LIMITED

का पंजीकरण, कम्पनी अधिनियम 1956 (1956 का 1) के अंतर्गत आज किया जाता है और यह कम्पनी प्राइवेट लिमिटेड है।

यह निगमन-पत्र आज दिनांक चौबीस जनवरी दो हजार बारह को अहमदाबाद में जारी किया जाता है।

Form 1
Certificate of Incorporation

Corporate Identity Number : U40100GJ2012PTC068748 2011 - 2012

I hereby certify that SURGUJA POWER PRIVATE LIMITED is this day incorporated under the Companies Act, 1956 (No. 1 of 1956) and that the company is private limited.

Given at Ahmedabad this Twenty Fourth day of January Two Thousand Twelve.

Registrar of Companies, Gujarat, Dadra and Nagar Havelli

कम्पनी रजिस्ट्रार, गुजरात, दादरा एवं नगर हवेली

*Note. The corresponding form has been approved by VILAS SAMBHAJI HAJARE, Assistant Registrar of Companies and this certificate has been digitally signed by the Registrar through a system generated digital signature under rule 5(2) of the Companies (Electronic Filing and Authentication of Documents) Rules, 2006.
The digitally signed certificate can be verified at the Ministry website (www.mca.gov.in).

कम्पनी रजिस्ट्रार के कार्यालय अभिलेख में उपलब्ध पत्राचार का पता :
Mailing Address as per record available in Registrar of Companies office:
SURGUJA POWER PRIVATE LIMITED
ADANI HOUSE,, NEAR MITHAKHALI SIX ROADS, NAVRANGPURA,,
AHMEDABAD - 380009,
Gujarat, INDIA

FEASIBILITY REPORT

4 x 135 MW, SURGUJA THERMAL POWER PROJECT

Developer:

SURGUJA POWER PRIVATE LIMITED

DOC. NO. : SPPL/THERMAL/CHHATTISGARH/FR/R2 **February - 2013**

1. EXECUTIVE SUMMARY:

Adani Group, a US $ 6 billion company based in Ahmedabad, is one of the Business House of the country with diverse interest in global trading, development and operation of Ports, IDC terminal, establishment of SEZ, Oil refining, logistics, gas distribution, Power Generation, Power Transmission and Power Trading etc.

Adani Group has embarked the business opportunity in coal mining sector and for the purpose created a SPV viz. Adani Mining Private Limited (AMPL). The Group have already commenced coal mining operations in Indonesia. Adani Power Limited, a subsidiary of Adani Enterprises Limited, is developing number of Power Projects along with its associated dedicated transmission systems. Presently, Adani Power Limited is setting up a 4620 MW Mundra Thermal Power Station (Stage I: 660 MW, Stage II: 660 MW, Stage III: 1320 MW, Stage-IV: 1980 MW) in Gujarat, 3300 MW (Stage I: 2x660 MW, Stage II: 1x660 MW, Stage III: 2x660 MW) Tiroda Power Station in Maharashtra and 1320 MW Coal based Power Project at Kawai in Rajasthan. Besides, Adani Power Ltd is also planning to develop 2640 MW Coal Based Power Project at Dahej in Gujarat and 1320 MW Coal based Power Project at Chhindwara in Madhya Pradesh.

Surguja Power Private Limited (SPPL), a 100% subsidiary of Adani Mining Private Limited (AMPL) is planning to set up a 540 MW (4 x 135 MW) Thermal Power Project based on the Coal Washery Rejects near the Parsa East Coal Block at Udaypur Tehsil, Surguja Dist, Chhattisgarh. The Group has been assigned work by Rajathan Rajya Vidyut Utpadan Nigam Ltd (RRVUNL) for Mining, Development and Operation of Parsa East Coal Block and supply of beneficiated coal, having guaranteed calorific value. Sizable reject coal will be generated, which shall be utilised for Power Generation by setting up Power Project in the vicinity of the coal block, so as to minimise impact on the environment. Accordingly, the Company proposes to set up 540 MW (4 x 135 MW) Power Project (CFBC Technology for Boilers) near the Parsa East Coal Block for which the company has entered into an MOU with the Government of Chhattisgarh.

The annual coal requirement (washery rejects + linkage coal) would be around 4 MMTPA for the project. The coal rejects would be sourced from the proposed coal washery project being set up near the Parsa East Coal Block and near by coal washery projects and additional washed coal shall be sourced from allocated linkage/mines.

As per the Electricity Act 2003, any Generating Company may Establish, Operate and Maintain Power Generating Station. The proposed 540 MW (4 x 135 MW) Thermal power station would require about 47.5 Hectares of land and would require around 39.284 MLD of water and 4 million metric tonnes of coal (washery rejects + linkage coal) per annum for a plant load factor (PLF) of around 75%.

The project will be financed such that the capital structure is built up to equity capital 30% and loan capital 70%. The Project Cost with Interest during Construction (IDC) and pre-operative expenses is estimated as Rs. 3,500 crores.

It is proposed to have a Environment Friendly Circulating Fluidized Bed Combustion (CFBC) based coal fired boilers, multi-cylinder heat condensing turbines and air cooled generators of 135 MW MCR each with brushless or static excitation system as per manufactures standard. The state-of-the-art technology will be deployed for auxiliaries and sub-systems to ensure safe and continuous operation of the units with minimum unscheduled outages.

The reject coal for the plant will be transported by dedicated conveyor system and washed coal shall be transported by rail/road. The coal handling system of the proposed generating units will have the capacity of 1600 TPH. The coal storage of 15 days for blending coal and 7 days storage for washery rejects shall be kept in plant. Single stage crushing, stacking, reclaiming & feeding system will be provided.

Dry extraction and disposal system is being considered for bottom ash and fly ash for the station.

Ash utilization will be as per MOEF guidelines. It is proposed to use ash to the extent possible for manufacturing of cement, building material, road construction etc. or to fill mine voids.

The condenser cooling shall be in closed circuit cooling system with Induced Draft Cooling Towers (IDCT) using makeup water from Atem / Rehar river.

The proposed electrical system will be equipped with adequately sized equipments and with generous redundancy to ensure uninterrupted operation of the plant. A 400 kV switchyard will be provided for the evacuation of power with required nos. of out going feeders. The exact configuration would be decided after tying up the power evacuation with the purchaser and the receiving sub station voltage level.

The proposed station envisages the state-of-the-art Distributed Digital Control & Management Information System (DDCMIS) which will integrate various closed loop sub-systems, open loop sub-systems, monitoring and information sub-system covering the entire plant. The system will also integrate the various proprietary control packages supplied by the main equipment vendors for harmonious plant operation.

To minimize emission of Suspended Particulate Matter (SPM) along with boiler flue gases, Electrostatic Precipitators of high efficiency and adequate size will be provided at exit end of each boiler to bring down SPM emission level under 50 mg/Nm3. One (1) number quadruple flue 275 m high stack is envisaged for the proposed units. Liquid waste from the plant will be properly treated before re-use and/or disposal.

Adequate facilities will be developed for execution of the project. The project will be implemented on Engineering, Procurement and Construction (EPC) concept.

The schedule of commissioning of first units is envisaged as 27 months and thereafter each unit shall be commissioned within an interval of 3 months each.

SALIENT FEATURES

1.01.00 **LOCATION:** The site is situated about 70.0 Km South-West of Ambikapur railway station of South Eastern Railway. The site is at a distance of 290 Km by road from Raipur, the state capital of Chhattisgarh. The proposed site is well connected by roads from all sides. An existing two lane state highway from Ambikapur to Bilaspur is passing at about 7 km from proposed site.

1.02.00 **LAND:** The project is planned to be accommodated within 47.5 Hectares of land

1.03.00 **CAPACITY:** 540 MW – (4x135 MW)

1.04.00 **MODE OF OPERATION:** Base Load

1.05.00 **FUEL:** Washery Rejects & linkage Coal

1.06.00 **COAL:** Coal requirement of 4 MMTPA (at 75% PLF)

1.07.00 **COAL TRANSPORTATION:** The coal mines of East block of Parsa Coal Fields has been considered as the main source of coal. Washery rejects from Coalfields shall be transported to the power plant by dedicated Belt Conveyors.

Coal for blending shall be transported by Rail/Road from the allotted mines/linkage.

1.08.00 **COOLING WATER:** Make up water requirement for the project would be about **39.284 mld.** Identified source of water is from River Atem/Rehar near proposed site.

1.09.00 **STEAM GENERATOR TECHNOLOGY:** The Steam Generators (SG) shall be of CFBC sub critical, single/double pass (tower type/two pass type), single reheat, radiant furnace, dry bottom, balanced draft, outdoor type, coal fired with all necessary auxiliaries.

1.10.00 **POWER EVACUATION SYSTEM:** Power generated from the proposed Project shall be stepped upto 400 kV and will be evacuated by PGCL and/or CSEB's Transmission Network.

1.11.00 **BENEFICIARY:** It is envisaged that the power generated from the project shall

be absorbed by Chhattisgarh and other states.

1.12.00 **ENVIRONMENTAL ASPECTS:** Necessary regulatory clearances from State Pollution Control Board and Ministry of Environment & Forests will be obtained. This will be in accordance with the procedures laid down in the EIA Notification dated. 14th September, 2006. Environmental Impact Assessment Report will be prepared and State Pollution Control Board will be approached for conducting Public Hearing. Provision shall be made for dry fly ash extraction. Fly ash extracted in dry form shall be transported to a storage silo and shall be given to the user for ash utilization activities.

1.13.00 **COMMISSIONING SCHEDULE:** The commercial operation of the First unit will commence in 27 months from Notice to Proceed (NTP) to EPC Contractor and subsequent units at an interval of 3 months.

1.14.00 **PROJECT FINANCING:** Debt equity ratio shall be 70:30. Equity portion shall be met from the promoter's contributions and the debt portion is proposed to be arranged through commercial borrowings / bonds.

1.15.00 **PROJECT COST:**

Cost Estimates:

The project is proposed to be set up at an aggregate cost of Rs. 3,500 crores comprising of expenditure towards land, EPC cost, water, Township, Coal transportation cost, transmission line, preliminary and pre-operative expenditure, contingencies, Interest during Construction and Margin Money for working Capital.

A summary of components of Project Cost is given below:

Particular	Estimated Cost (Rs. in Crores)
Land & Site Development	20
Engineering, Procurement & Construction Cost	2750
Township	35
Water Arrangement	15
Coal Supply Arrangement	30
Transmission Line	150
Total Hard Cost	**3000**
Pre-operative Expenditure	60

Interest During Construction Period	285
Contingencies	65
Margin Money for working capital	90
Total Cost	**3500**

6.2 Financing Structure:

The Project cost is estimated at Rs. 3500 Crore & is proposed to be finance with senior debt, sub debt & equity in ratio of 70:30. The proposed components of financing are:

Particular	Rs. in Crores	%
Capital Contribution – Equity	1050.00	30
Senior Debt Finance	2450.00	70
Total	3500.00	100

6.3 Interest during Construction Period:

The interest during construction (IDC) period estimated at Rs. 285 Crore has been calculated assuming an implementation period of 27 months for the first unit and thereafter each unit shall be commissioned within an interval of 3 months each for the fourth unit from Notice to Proceed (NTP) to EPC contractor.

6.4 Working Capital:

The provision for margin money for working capital has been made at Rs. 90 Crore.

TABLE OF CONTENTS

INTRODUCTION

1.00.00 BACKGROUND

Power development is one of the key infrastructural elements for the economic development of the country. In recent years, power development has assumed paramount importance in view of its role in rapid development of industry, agriculture and service sector in the country. The installed capacity of the country was only 1713 MW in 1950 but has already grown to around 2,11,766 MW as per latest reports of power ministry.

Even after considerable capacity addition in recent years our country faces a peak power deficit of about 9%, which leads to Load Shedding to the Industrial Sector leading to huge loss of productivity.

2.00.00 PROPOSAL

The present proposal is to implement 540 MW Coal Based Thermal Power Project at Parsa East Block, Udaypur Tehsil, Surguja: Dist, Chhattisgarh State. Basic inputs like coal, land, water etc will be tied up with Govt. of Chhattisgarh and Ministry of Coal, GOI.

DEMAND ANALYSIS AND JUSTIFICATION

1.00.00 GENERAL:

A 4 x 135 MW Surguja Thermal Power Project, in Surguja district of Chhattisgarh will be taken up by M/s Surguja Power Private Limited a 100% subsidiary of M/s Adani Mining Pvt. Limited, which is a fully owned by M/s Adani Enterprises Limited. The project is being taken up to meet power requirements of Chhattisgarh, western region & India. The project is envisaged to be completed during the 12th Plan period.

2.00.00 PRESENT STATUS OF DEMAND & AVAILABILITY:

The review of the statistics reveals that there is an energy shortage to the tune of 8.8% all-India basis in the period Apr-Dec 2010. Notably there is an acute shortage in the certain areas of the country.

The peak demand shortage on all-India basis for this period was nearly 9981 MW. It may be noted that the peak demand is actually restricted demand and is likely to be much higher.

Keeping the present scenario of shortages in energy and peak demand in view and to maintain a GDP (Gross Domestic Product) growth of 8% to 10%, the Government of India has very prudently set a target of about 212,000 MW of power generation capacity by March, 2012.

3.00.00 THE POWER SCENARIO IN CHHATTISGARH:

As per **Load Generation Balance Report for the year 2012-13**, released by Central Electricity Authority, Ministry of Power, Government of India, comparison of present installed capacity in the state, region and all India level and Peak Demand Supply Gap are indicated in below mentioned table;

Present Installed Capacity

Sr. No	Description	Unit	Chhattisgarh	Western Region	All India
1	Hydel	MW	120.00	7447.50	37416.40
2	Coal based	MW	5175.94	43537.00	121610.88
3	Gas based	MW	0.00	8254.81	18903.05
4	Diesel based	MW	0.00	17.48	1199.75
5	Renewable energy	MW	281.15	8450.04	25856.14
6	Nuclear	MW	47.52	1840.00	4780.00
7	Total	MW	5624.61	69546.83	211766.22

(as on 31.01.2013)

Energy Requirement v/s Availability (2011-12) (Annex-II of the LGBR 2012-13)

Sr. No.	Parameters → / Region ↓	Energy Requirement	Energy Availability	Peak Deficit/ Surplus	Peak Deficit/ Surplus
		MU	MU	MU	%
1	Chhattisgarh	15,013	14,615	-398	-2.7
2	Western Region	2,90,421	2,57,403	-33,018	-11.4
3	All India	9,37,199	8,57,886	-79,313	-8.5

Peak Demand Supply Gap (2011-12) (Annex-III of the LGBR 2012-13)

Sr. No.	Parameters → / Region ↓	Peak Demand	Peak Availability	Peak Deficit/ Surplus	Peak Deficit/ Surplus
		MW	MW	MW	%
1	Chhattisgarh	3,239	3,093	-146	-4.5
2	Western Region	42,352	36,509	-5,843	-13.8
3	All India	1,30,006	1,16,191	-13,815	-10.6

From the above tables it is evident that a substantial quantity of power is required to meet the peak demand in the State of Chhattisgarh as well as other regions of India. With the availability of required infrastructure facilities, the State of Chhattisgarh has the potential to grow as a power hub in the country.

In conclusion it can be stated that the gap between availability of power and the demand is not likely to be closed in the foreseeable future either in western region or in Chhattisgarh state unless all out efforts are made to add capacity considering the fuel availability and evacuation.

The major advantage in planning the proposed Thermal Power Plant in Surguja district may be summarized below:

- Sufficient land is already available for installation of the proposed power plant. Land acquisition would not pose any problem with minimum Relocation & Rehabilitation.
- Site is well connected by road.
- Nearest rail head (B.G) at Ambikapur is within 70 Km from proposed site.

- Water required for the station can be assured from nearby rivers Atem/Rehar
- A number of Transmission networks of both State Grid and PGCIL are available within reasonable distance.
- The location of proposed Site is nearby Coal mines reducing coal logistics cost.
  The Unit rating and plant location will meet the operational requirements of the project. The plant concept and the technical features of the selected plant and equipment are standard and proven.
  The "low cost of power" would prove to be the strong point of this project whenever the full competition would be unleashed in the power sector in the near future.

FEASIBILITY STUDIES

1.00.00 SITE SELECTION:

As per Environment Clearance granted by Ministry of Environment and Forest (MoEF) for Mining, Power Plant shall be located within Mining Project Area. An area of 47.5 Hectares near village **Parsa**, is identified within Mining Project Area but outside Mine Lease area, by efficiently utilising Infrastructure Facilities. The nearest Railway station for this site is Ambikapur and nearest Water source is river Atem/Rehar, about 3.0/26 Km from the proposed site.

2.00.00 LOCATION AND APPROACH:

The proposed site is located near Parsa village in Surguja District of Chhattisgarh State. The nearest Railway station is Ambikapur which is approx 70 Km from site. The vicinity plan of the project site is placed at Exhibit - 1.

3.00.00 LAND:

The project is planned to be accommodated within 47.5 Hectares of land. The detail of land break-up is as follows:

Sl. No.	Description	Area in Ha
1	Coal stock pile - Reject based (1,00,000 MT - 7 days)	7.35
2	Raw coal (60,000 t-15 days)+Conveying+CHP	
3	Power Block	7.02
4	Switch yard	4.07
5	Reservoir	5.28
6	Water treatment	2.40
7	Admn+ Stores+Fire Station+WS	1.04
8	Cooling Towers, Cold water channels area including CW Pump House and its associated piping	5.51
9	AHP*	1.60
10	Fuel oil	0.30
11	Road, drains, miscellaneous	12.93
12	Green Belt	As per mine plan
	Total area	**47.50**

* Ash disposal area: Ash generated will be used for Mine Backfilling.

4.00.00 WATER:

Water Source

The source of water for the project would be the Atem/Rehar River. A pipe-line of about 3/26 Km will be laid to meet the make up water requirement. To meet the exigencies adequate water storage will have to be provided at the project

site.

Water Requirement and Commitment:

Make up water requirement for the project (4X135 MW) would be about 39.284 MLD (14.14 MCMPA). As per current water study report of Atem/Rehar River basin, sufficient water is available to cater the need of the 540 MW Project at Surguja.

5.00.00 COAL REQUIREMENT:

Coal Washery rejects Requirement and Availability:

The Coal Washery Rejects from the proposed coal washery plant will have GCV of 2,000 Kcal/Kg and ash content of about 58%. The Coal washery rejects requirement will be about 4 MMTPA (corresponding to 75% PLF). Project developer has applied to concerned Authorities for long term coal linkage for the clean coal to blend with the coal washery rejects.

Coal Transportation:

Coal (washery rejects) would be transported from Coal washery plant to the power station through Belt Conveyors. Clean Coal shall be transported to power station by rail/road.

Coal Quality:

The coal quality considered for FR is as follows:

Ash	:	50-59%
GGV (kcal/kg)	:	1850-2300 Kcal/Kg
Total Moisture	:	12-15%

6.00.00 RAILWAY SIDING:

The railway siding being developed by Surguja Rail Corridor Private Limited for Transportation of washed coal will be utilised for bringing the linkage coal, if required, for blending with the coal washery rejects.

7.00.00 CONSTRUCTION WATER:

A water pipeline of about 3/26 km (depending upon intake from Atem or Rehar River) with suitable diameter will be laid from intake point to Project site.

8.00.00 CONSTRUCTION POWER:

The requirements of the construction power supply for the project would be met from the nearest CSEB/PGCIL substation.

LAYOUT SYSTEMS

1.00.00 GENERAL LAYOUT PLAN:

The General Layout Plan for the project has been developed taking into consideration the various aspects like land acquisition, ground features, ground contours, villages in the vicinity, corridor for outgoing transmission lines, road/rail approaches, prevailing wind direction, location of raw water intake pump-house and associated pipe corridors. Accordingly, the switchyard has been planned to face towards North.

The main power house is expanding from west to east with other permanent facilities like service building, workshop, O&M stores etc located towards the west of the main plant, keeping the expansion side free for construction activities. The intake/discharge ducts have been routed in the corridor between transformer yard and the switchyard. Two nos. of CWPH for a total of four units are envisaged on the south side of Power block. One (1) no. single stack quad flue chimney has been planned.

The Induced draft cooling towers for the project are appropriately located considering their safe distance from the switchyard and the main plant. The water treatment plant and the DM water facilities are located on Southern most part of area.

The Coal Handling Plant (CHP) and the coal stockyard for the plant are located towards North-West side of the main plant, considering the washery reject transportation from West and linkage coal from North side, thus minimizing the cost of the CHP works.

Adequate space provision has been kept in the layout for lay-down and pre-assembly activities, open stores, contractor's offices and stores etc. Construction offices and storage sheds are located close to the main approach road to the plant. Administration Building is proposed to be located near the main approach road.

Raw water reservoir for 15 days water requirement has been provided towards South - West of main plant.

Green belt has been provided all along the periphery of the plant boundary. Space has also been kept outside the plant boundary for diversion of existing roads and drains.

2.00.00 INTRODUCTION:

2.01.00 The main plant building arrangement for the proposed stage of the plant envisages longitudinal disposition of TG set. The main power house will be 260 m wide and about 270 m long consisting of TG bay and heater bay. A rail cum road is provided along "A" row for handling generator stator and transformers.

Service Building is envisaged at the start of unit # 1 for this phase of the

project. An interconnection walkway is also provided between Service cum Control Room Building and operating floor level in AB bay for movement of personnel.

2.02.00 DESCRIPTION OF LAYOUT:

2.02.01 Mechanical Area:

AB Bay:

The layout envisages AB bay of width 32 m and floors at EL (+/-) 0.00 m, (+) 6.50 m, (+) 12.50 m. The operating floor of the unit is kept at (+) 12.50 m and the mezzanine floor is at (+) 6.5 m. Boiler feed pumps (BFP) are located at EL (+/-) 0.00 m.

The AB bay at EL (+/-) 0.00m would house other equipment like vacuum pumps, control fluid equipment, oil equipment for BFP and heat exchangers & pumps for closed cycle DM cooling water system. The three number condensate extraction pumps are to be located in the pit adjacent to turbo-generator raft at approximately EL (-) 4 m. The drain cooler and gland steam condenser are located at local platform or pipe mounted near B-row at EL (+) 4 m. Roof of TG hall is envisaged at (+) 37 m. Oil equipment for the Main Turbine is located at 0.0 m.

2.02.02 Turbine Hall EOT Cranes:

Two (2) numbers Electrically Operated Travelling (EOT) crane are envisaged in turbine hall for erection and maintenance of turbo-generators (excluding generator stator) and their auxiliaries. The main hook capacity of crane is considered to be 5% over and above the heaviest component/ equipment (including lifting beam and slings etc.) to be handled in TG hall or at least 80 Tonnes (approx.) and the aux. hook capacity shall be 15 Tonnes (approx). Further, the turbine hall EOT crane will have necessary facilities such as lifting beam with swivelling arrangement and slings for erection as well as maintenance of the equipment provided in AB bay.

2.02.03 BC Bay:

The BC bay of width 10.0m would consist of floors at EL (+/-) 0.00 m, (+) 6.5 m, (+) 12.5 m, (+) 17.5 m, (+) 31.25 m, (+) 35.5 m. The BC bay floor at EL (+/-) 0.00 m would house LP/HP dosing system equipment, condensate polishing unit, SWAS room and fire fighting (inert gas) cylinders and Central Lube Oil system. The floor at EL (+) 6.5 m would house LP heaters. The HP heaters are to be located at EL (+) 12.5 m. The floor at EL (+) 17.5 m would house Air Handling units and Ventilation equipment rooms. The floor at EL (+) 31.25 m has been planned for Auxiliary Steam Pressure Reducing De-super-heating Station, Control Station of feed water system and Cooling Towers for AC system. The Deaerator is to be kept at EL (+) 35.5 m.

2.02.04 Boiler Area:

Boiler, air pre-heater, ID/FD/PA fans, ESP, Coal Bunker and chimney are

located with tentative dimensions as indicated in layout drawing. Coal feeders have been located on the Front side of the Boiler. Approach roads/ passages have been identified on the side of Feeder/Bunker bay. Distance of 10 m between C-row (last row of powerhouse columns) and D-row (1st row of Boiler columns), has been kept to facilitate the movement during erection and operation phase of the plant. C-D Bay is also used to route Critical Piping from Boiler to TG set. Two elevators - one for passengers and one for goods have been envisaged for each Boiler.

The main conveyor shall be located at the start of the Unit # 1. Two no. coal handling transfer towers shall be provided in boiler area feeding to Feeder/bunker bays of each unit with cross conveyors. Ash handling facilities such as Ash Silo, Control Room / Switchgear room / Transformers and Transport Air Compressor House is located across the road located behind the chimney at the end of Main Power House The ESP/VFD control room for ID fans and MCCs for ESP along with air conditioning and ventilation equipment for the same are envisaged to be located in ESP Control Room. ESP Control Room has been located by the sides of Respective ESPs of the Units

Air conditioned space for locating the remote I/O cabinet has been identified in boiler area for steam generator equipment and near first row of ESP for ash handling plant equipment.

2.02.05 Air Compressor:

Air Compressors for instrument air and service air requirement shall be installed in a separate building in transformer yard near service building.

2.03.00 Electrical Areas:

AB Bay: Electrical switchgears and MCCs of the unit are located in the electrical annexe located at the start of unit in AB bay. The 11 kV/ 3.3 kV switchgear along with DC Batteries are to be located at (+) 3.5 m floor elevation. 415 V switchgears, DC distribution board and Battery Chargers are to be located at (+) 12.0 m floor elevation of the electrical annexe. Since all the switchgears are envisaged to have bottom entry cables, two cable spreader rooms have been envisaged, from EL (+/-) 0.00 m to (+) 3.5 m and other from EL (+) 8.5 m to (+) 12.0 m. Boiler MCC have been located in B-C bay at EL (+) 27.0 m with a provision of cable spreader room at EL (+) 23.5 m.

2.03.01 Transformer Yard / Busducts / MCCs:

One (1) no. three phase Generator Transformer (GT) along with two no. (2) Unit Auxiliary Transformers (UAT) and one no. (1) number station transformer (ST) for each of the unit are located in front of A-row in the transformer yard. One number spare Generator Transformer common for all units shall be provided in transformer yard area.

Necessary rail track has been provided outside A-row for the generator

stator handling. Stator handling can be accomplished without disturbing the transformers. Separate rail tracks have been envisaged for handling GTs and STs.

Bus ducts have been considered for connecting Unit and Station Transformers to respective 6.6 kV switchgears. The bus duct from the Unit Auxiliary and Station Transformers to the switchgears inside electrical annexe would be supported below the floor at EL (+) 6.5 m and would drop down to the switchgears from above. DG sets are located in transformer yard in a separate room.

2.04.00 Control and Instrumentation:

The Central Control Room for the present stage has been envisaged in Service cum Control Room Building at EL. 19.8 m. Control Equipment. Room (CER) is envisaged to be unitized and shall be located in B-C-D bay at operating floor level. The control room houses the control desk and control station for certain off site facilities also.

Air conditioning room for Central Control Room/CER alongwith its MCC has been located in A-B bay at EL (+/-) 0.0 m. UPS and C&I batteries are located at 6.5 m of B-C-D bay. SWAS room shall be located at EL (+/-) 0.00 m of BC bay.

Necessary cable shafts have been provided at B-row/C-row for routing of power cables in the Electrical Bay and Control Equipment area.

CIVIL WORKS

1.00.00 LAND DEVELOPMENT:

The general topography of the site is generally even with mild undulations. In absence of Topographical Survey detail, plant site levelling is proposed to be done by grading. Levelling shall be done by excavation in reservoir area and filling in the low grounds in plant area.

2.00.00 GEOTECHNICAL DATA & FOUNDATION SYSTEM:

2.01.00 Geotechnical Investigation:

Geotechnical investigation will be carried out to ascertain the foundation requirements. It is learnt that rock is likely to be encountered at a depth of about 10 to 15 m from ground level.

Open cast foundations shall be considered. The foundation design shall be reviewed on receipt of geotechnical investigation data.

In the absence of chemical analysis on soil / ground water samples, it is assumed that Ordinary Portland Cement (OPC) / Portland Pozzolona Cement (PPC) and HYSD reinforcement may be considered and the grade of concrete for foundations.

3.00.00 MAIN PLANT BUILDING:

3.01.00 Foundation System:

1. All major foundations of equipment and structure shall be supported on open cast foundations.

2. Turbo Generator (TG), ID, PA & FD Fans shall be supported on a RCC top deck, which shall rest on steel helical spring units and viscous dampers.

For TG foundation, steel helical spring units & viscous dampers shall be supported on an RCC, framed sub-structure. The sub-structure shall be supported on a base-mat. Steel helical spring units & viscous dampers for ID, PA, & FD Fans shall be supported on RCC sub-structure which in turn shall be supported on pile foundation/ base raft.

The boiler feed pump shall be supported over block foundation resting on ground.

3.02.00 Structural System:

1. Main Power House:

The building shall be multi span framed structures consisting of structural steel columns, beams and trusses. This shall be braced in longitudinal

direction and moment resistant in transverse direction. Main power house building shall comprise of turbo generator (AB) bay and multi-level heater (BC) bay. All platforms and floors shall be supported on structural steel.

2. Service Building cum Control Tower:

Service Building cum Control tower shall be of structural steel framing. It shall be a separate building near gable end of the main power house.

3. Feeder / Bunker Building:

Feeder / bunker building shall be single span multi-storied framed structure consisting of structural steel beams, columns and bunkers. The building shall have floors at feeder location and tripper location. Feeder and bunker building shall be braced in longitudinal as well as in transverse direction. Hoppers shall be made of stainless steel. The bunker shall be of MS.

Requirement of lining shall be finalised after coal flowability study.

4. Conveyor Galleries and Transfer Points:

Overhead conveyor galleries in the main plant (boiler area) shall be of structural steel frame with cladding and roofing. Seal plate shall be provided for full length. Transfer points and intermediate supporting trestles shall be made of braced steel framed structures. The staircase shall be of external type.

5. Cable and Pipe Racks:

(a) Structural steel trestles and galleries with provision of walkway with grating shall be provided for supporting overhead cables and pipes in the main plant and outlying areas. However, for below ground routing, RCC trench with removable pre-cast concrete covers / box culverts shall be provided.

(b) Pipes and cables running along the boiler structure, Feeder & bunker buildings and ESP structures etc shall be supported on steel girders resting on the steel bracket fixed to the boiler/ ESP / Feeder & bunker building structures.

(c) Pipes between boiler and C-row will be supported on the steel girders resting on the steel brackets at the boiler & C-row columns. These steel girders shall have sliding joint on main powerhouse and fixed / hinged on boiler structure.

6. Other Buildings:

ESP control, DG set, air washer and other similar buildings located in power block shall be of framed structure.

3.03.00 Civil Concepts:

Roof of TG hall shall be provided with colour-coated metal deck sheet over which a RCC layer shall be laid.

Roof of other buildings i.e., de-aerator, bunker building, TPs etc, shall be provided with the metal deck sheet and / or RCC depending upon the clear height of the roof.

Intermediate floors of all buildings including main powerhouse building shall be provided with cast-in-situ RCC slab. External cladding of all buildings shall have combination of brick work, light weight aerated concrete blocks, metal cladding, aluminium composite panel & structural glazing.

For main plant building initial height of 3 m along A-row and C-row and gable ends shall be provided with brick wall followed by colour-coated metal cladding and structural glazing.

Control room area shall have light weight aerated concrete panels /brick wall on external face.

Internal partitions shall be provided with brick wall / decorated veneer in aluminium framework. However control room internal partitions shall be provided with single or double glazing in aluminium framework.

Roof shall be provided with electrometric membrane or other suitable water proofing treatment.

Windows shall generally be of aluminium. Doors of control room and office area shall be of aluminium frame with glazing or particle board panels. All fire exits shall be provided with fire proof doors. Hollow metal doors shall be provided for switch-gear room, cable vaults etc.

Entire area from transformer yard to chimney shall be provided with paving in combination with interlocking concrete blocks and high wearing resistant concrete.

3.04.00 Architectural Concepts:

Main plant building shall be architecturally treated in such a way that it retains a monumental scale and yet, presents a pleasing composition of mass and void with suitable and functionally designed projections and recesses. The overall architectural character of the plant buildings shall be in harmony with the architectural character of the main plant building. Due considerations shall be given to climatic conditions, landscape design, building orientation, interior design. All buildings and structures shall be architecturally treated in such a way so as to be in complete harmony with the main plant, surrounding structures and environment.

All finishes for floors, walls, ceiling, structural elements, partitions for offices and industrial areas shall be suitable for their aesthetics, durability and functional requirements and shall include the latest building material &

technology.

Architectural elevations of main plant or other buildings, may have curve, arches or simple straight lined profiles. For natural and uniform distribution of light, roof and adequate glazing shall be provided in all buildings.

4.00.00 CHIMNEY:

One (1) no. quadruplet flue steel lined reinforced concrete chimney for all four units is being proposed. The flue gas emission point shall be 275 meters above the plant grade level. The RCC for the chimney shell and other super structure shall be of M-30 grade and for foundation & grade level slab it shall be of M-25 grade.

Liner(s) shall essentially be constructed from structural steel and shall be of the hung type (with multiple point liner support) system. The liner(s) shall be provided with resin bonded wool type thermal insulation. The portion of the liner(s) projecting above the chimney roof, however, shall be constructed of shaped acid resisting bricks. Brick liner shall be protected by a reinforced concrete mini-shell also constructed from the roof slab. Suitable expansion joints shall be provided between the steel and the brick liners. Internal platforms shall be provided for enabling access to various elevations of the stack and to provide support to the steel liner(s). External platforms shall also be provided.

The structural steel transition inlet ducting shall be bottom supported. This transition ducting shall be suitably profiled from a rectangular shape at the chimney inlet to a circular shape up inside the chimney where it shall be connected to the suspended circular steel liners through suitable (non-metallic) fluro-elastomeric fabric expansion joints. Transition ducting shall also be thermally insulated.

Internal platforms shall be of structural steel construction. The chimney roof shall, however, comprise of a reinforced concrete slab supported over a grid of structural steel beams. The external platforms shall be of reinforced concrete construction of grade M-30.

An internal structural steel staircase, supported from the shell wall, shall be provided for full height of the stack. Suitable embedments shall be provided in the shell wall for this purpose.

An internal ladder shall be provided having its support from the concrete shell inside the chimney and shall be provided for a small height, over the last staircase landing, to access the chimney roof through a roof access hatch. External ladders shall be provided on each of the mini-shells over the roof.

The flooring panels of the platforms and treads of the staircase shall be of chequered plate construction. Handrails for platforms and staircase shall be of tubular construction.

The external portion of the wind shield shall be coated with alternate bands of red and white colours to meet the aviation safety requirements. The mini-shells and the top few meters of the internal surface of the windshield shall be painted for acid and heat protection with bituminous paint

The other components of the chimney(s) include cast iron caps over mini-shells, liner test ports (for continuous pollution monitoring), liner hatches, reinforced concrete roof slab protected for acid and heat protection, grade level slab of reinforced concrete with a metallic hardener floor finish, a large electrically operated grill type roll-up door (with only the bottom small portion of the curtain of solid shutter type) at grade level and personnel access metallic doors at grade level and at all floors, a personnel access hatch in the roof slab, rain water drainage system, flue liner drainage system, roof drain basin, louvers with bird screens for ventilation openings and all gaps in the wind shield, mild steel discrete strakes, painting of chimney shell surfaces and painting/coating of all structural steel work and miscellaneous ferrous components (for a maintenance free life of at least ten years), all finishing works, electrical power, distribution boards, lighting panels, power and control cabling and wiring systems, cable conduits, stair and platform lighting, socket outlets, lightning protection and grounding system, aviation obstruction lighting, communication system and a rack and pinion elevator. The chimney(s) shall have a suitable foundation. There shall be at least one metre working space around the flues.

5.00.00 DM PLANT AND PT PLANT CIVIL WORKS:

5.01.00 DM Plant Civil Works:

DM plant building shall be of approximate size 60mx15m with RCC framed structure. The clear height of DM plant portion shall be 7m and that of office cum MCC block shall be 10m with two storeys. D. M. Plant Regeneration building shall be of 20m x15m x 6m(ht).

Acid/alkali (chemical) storage area shall be approximately 25mx15m in size. It shall be an open paved area with RCC dyke wall of 500mm height all around.

Three nos. flexible pad type foundations using well graded sand shall be provided for DM water storage tank-of approximately 15m diameter and 12m ht. with 75mm thick bitumastic anti-corrosive layer at top.

One no. neutralization pit of approx. size 20mx10mx3m (deep) shall be provided with twin compartments.

Acid/alkali storage tank supports, effluent drains, neutralization pit, regeneration area and acid/alkali storage area shall be provided with AR brick/tile lining.

Grade of concrete for all structures shall be M25.

5.02.00 PT Plant Civil Works:

Pre-treatment plant shall consist of following structures.

Two (2) nos. RCC reactor type clarifiers for CW system with approx. diameter of 35m and side water depth of 5m. Clarifier shall be provided with one no. stilling chamber.

One (1) no. RCC reactor type clarifier for DM system with approx. diameter of 10.5m and side water depth of 5m. with one no. stilling chamber.

One no. two storied chemical house building of approx. size 24m x 22m x 12m (ht) with RCC framed structure and brick wall panels. The chemical house shall have provision of alum/lime solution preparation tanks, provision to house PT-Chlorination plant equipment and space for storage of chlorine toners and other chemicals like lime, alum etc.

Two nos. gravity filter house buildings (one for potable water system and the other for DM system) to house gravity filters, filtered water sump and filtered water pump house. Each filter house building shall have RCC framed structure and brick wall panels. A filtered backwash pit 20mX5mX6m and filtered water sump of size 10mX3mX3.5m alongwith Filtered pump house (10mX3mX5m) shall be provided.

One no. RCC clarified water storage tank of capacity 300 cum together with clarified water pump house of approx. size 17mx7.5mx5m (ht).

One no. filter backwash water sump and one no. sludge sump with RCC slab roof and provision for mounting backwash water/sludge pumps.

All PT plant structures shall be shall be with concrete of grade M25.

6.00.00 CW & MAKE UP WATER SYSTEM:

6.01.00 CW System:

C.W. pump house (10 nos. of pumps) for 4 X 135 MW units shall be constructed & water shall be pumped to condenser through C.W. ducts of 2500 mm diameter.

Hot water from condenser shall be conveyed to Induced Draft Cooling Towers through 2500 mm diameter discharge ducts by single stage pumping by C.W pumps only.

Both intake and discharge ducts shall be MS pipes encased with concrete. Cold water from cooling tower to C.W. pumps shall be conveyed through open approach channel.

Substructure of all the pump houses shall be RCC of grade M-30. Super structure shall be of steel. C.W. pump houses shall have mild steel (MS) sheet cladding. Other structures shall have brick cladding. Roof of pump houses shall have permanent steel deck with cast in situ RCC laid over it. Open approach channel shall be RCC of grade M-30.

6.02.00 Make-up Water System:

Closed cycle cooling water system with cooling towers has been proposed for the

project. The make-up water requirement for the project (4X135 MW) would be met from Atem/Rehar River, through a pipeline. A Fifteen (15) days storage capacity raw water reservoir along with a raw water pump house shall be constructed inside the plant boundary to cater to the makeup water requirements of the project. About 45 acres of land shall be required for locating the reservoir. Water in the reservoir shall be drawn through pipeline from Atem/Rehar River the intake structure shall be gravity type.

7.00.00 COAL HANDLING SYSTEM:

7.01.00 Crusher House:

Crusher house shall be of structural steel with permanently colour coated steel sheet cladding. Floors and roof slabs shall be of RCC. Crushers shall be supported on RCC deck slab which in turn will rest on vibration isolation system consisting of springs & dampers. Ironite flooring has been considered for floors. Pile foundations have been considered for column foundations.

7.02.00 Transfer Points

Transfer points shall be of structural steel with RCC floors/roof and shall have permanently colour coated steel sheet cladding. Floors shall be provided with ironite finish. . Pile foundations are envisaged for column foundations.

7.03.00 Conveyor Tunnel:

Tunnel from track hopper transfer point to pent house shall be of RCC construction with chemical injection grouting and polymer modified cementitious coating as water proofing treatment. Ironite flooring will be provided on tunnel flooring.

7.04.00 Conveyor Galleries:

Conveyor galleries shall be of structural steel with trestles at regular intervals. These shall have permanently colour coated steel sheets as side & roof cladding. Pile foundations have been envisaged for trestle foundations.

7.05.00 Stacker/Reclaimer Foundations:

The stacker/reclaimer rails shall be supported on RCC longitudinal beams which in turn will be supported on Pile foundation.

7.06.00 Pent House, CHP Control Room, Pump house & MCC Rooms:

These shall be RCC buildings with brick wall enclosures.

Track hopper, tunnel, S/R foundations, penthouse, stockyard drainage & TH control room are proposed to be included in the scope of CHP civil works package.

Civil & structural works associated with TPs, CH, conveyor galleries, PH & CHP control bldg. are proposed to be included in the scope CHP mechanical package.

8.00.00 FUEL OIL HANDLING SYSTEM:

The following civil works are to be provided for fuel oil handling system as mentioned below:

a) Unloading trench (550m approx.) for unloading oil from tankers along with unloading header trench.

b) Unloading pump house (25mx15mx4m) to have 2 nos. LDO unloading pumps, LDO transfer pumps etc.

c) Foundation for 2 nos. LDO tanks (500 m3 capacity each), Foundation for 1 no. day oil tank of 100 m3 capacity

d) Containment wall around the tank area for all tanks.

e) Pressurizing Pump house (600 sq. m.) pressurizing pumps etc.

f) Miscellaneous foundations for pumps, pipe racks, pipe lines etc.

g) Oil water separator pit

h) Paving and drains around tanks.

i) LDO Unloading platform.

The pressurizing pump house building shall have composite construction, with RCC columns and structural steel roof, ie steel trusses supported on RCC columns and shall have metal deck roof, with RCC slab. The roof shall be supported on steel purling, spanning over the roof trusses.

The fuel oil unloading pump house is envisaged to be of RCC construction.

9.00.00 ASH HANDLING SYSTEM:

The Civil works involved in ash handling system including ash water recirculation system are as follows:

1. Bed Ash System
2. Transport Air Compressor House
3. Pump house
4. Switch gear/MCC and Control Room for all buildings
5. Extraction air compressor house
6. Silo foundation
7. Steel Trestles for supporting piping within plant area and dry fly ash transportation pipe pedestals upto silos near plant boundary.
8. RCC pedestals for supporting ash disposal pipes
9. Miscellaneous works like Transformer Foundation, Fencing, Paving etc.
10. Miscellaneous structures/ Foundation for buffer hopper Tower and Collector tank Tower
11. Maintenance Road

All pump houses and other buildings shall have RCC framed structural arrangement with brick cladding & metal deck roofing filled with RCC.

For routing of the ash pipes at road crossing local hump / culvert or bridges shall be provided.

All super-structure work related to dry ash handling (including silos, buffer hopper, collector tank) and bottom ash handling are included in mechanical package.

10.00.00 ASH DISPOSAL SYSTEM:

All efforts will be made to utilize the fly ash generated. Unutilised fly ash and bed ash will be disposed for mine backfilling.

Ash will be disposed off / transported for the back filling of the mines.

11.00.00 COAL TRANSPORTATION:

The coal required for the project will be transported through conveyor belts from coal washery to project. Clean coal from allotted linkage shall be transported to project by rail/road.

Oil required for the project will be transported through road.

12.00.00 ROADS, DRAINS & SEWERAGE:

1. Roads:

All roads shall be bituminous. Major roads including approach to the plant shall be two-lane (7.0/7.5 m wide), with 2.5/2.25 metre wide raised shoulders on both sides except in periphery of main plant where main plant side shoulder shall be uniformly merged with paving. However, for approach road to individual buildings and patrol road along plant boundary shall be single lane (3.75 m wide with 1 m wide shoulders on both sides).

2. Drains:

Drains shall be constructed on both sides of roads except on patrol road where drain shall be provided only on inner side of the road and shall be connected to the trunk drain, which finally gets connected to the raw water reservoir. All drains shall be of RCC with rectangular section. Existing drainage channel passing through the plant site shall be suitably diverted.

3. Sewerage:

A network of underground sewerage system shall be provided in the plant area. Sewage Treatment Plant shall be provided and shall have sufficient capacity to cater for the discharge of plant. C.I. pipes shall be used for catch pipes and RCC concrete pipes shall be used for trunk sewage disposal pipes. However, C.I. pressure pipes shall be used for disposal under pressure.

13.00.00 SWITCHYARD CIVIL/STRUCTURAL WORKS:

The civil and structural work for switchyard bays shall be provided as per switchyard single line diagram. Towers shall be supported on raft foundations and equipment such as BPI, LA, CT, CVT, CB, Isolator, Wave trap etc as shown in switchyard single line diagram shall be supported on isolated/combined foundations as required.

14.00.00 LANDSCAPE:

Landscaping is envisaged to create an aesthetically appealing ambience in an otherwise industrial environment. The landscape shall consist of both hard and soft type of treatment.

MECHANICAL SYSTEMS

1.00.00 STEAM GENERATOR AND AUXILIARIES:

1.01.00 General:

The Steam Generators (SG) shall be of sub critical technology based design, recirculation type, double pass tower type, direct coal fired, single reheat, radiant, dry bottom type, balanced draft furnace, suitable for outdoor installation, top supported, having sub-critical steam parameters with all necessary auxiliaries. Boiler design shall be suitable for variable pressure operation from 30% to 100% BMCR with 15% throttle margin. The main parameters at 100% BMCR shall be tentatively as mentioned below:

1	Main steam flow at super-heater outlet	:	490 T/Hr
2	Pressure at superheater outlet	:	150 kg/cm2(a)
3	Temperature at SH outlet	:	540 + /- 5 deg C
4	RH steam flow	:	425 T/Hr
5	Steam temperature at reheater outlet	:	540 +/- 5 deg C
6	Feed water temperature at economizer inlet	:	249 +/- 5 deg C

1.02.0 COMBUSTION CHAMBER:

A balanced draft, water-cooled combustor of fusion welded membrane wall type construction complete with water wall tubes, headers, drains, etc. to make it gas and pressure tight envelope shall be provided. Spray type attemperator is envisaged to control the superheater outlet temperature for varying loads. The superheater and reheater tubes will be a combination of radiation and convection type. Economizer will be non-steaming type and shall be of modular construction, so that if required, addition of loops is possible. Lower part of furnace / water wall will consist of rifle / wrap around / helical / plane tubes as required.

1.03.00 Steam Generator Circulation System:

The circulation system shall ensure adequate circulation ratio during rapid start-ups and load changes to prevent overheating of the water wall tubes with maximum possible heat flux in the furnace. Wherever the skin metal temperature of water wall tubes is anticipated to be 400 deg. C and above, 1Cr 1/2 Mo alloy steel shall be used. An allowance of at least 4 mm towards erosion shall be provided over and above the designed water wall thickness in severe erosion prone area and an allowance of 1 mm towards erosion shall be provided

over and above the designed water wall thickness in other areas.

1.04.00 Air and Flue Gas System:

The air and flue gas system shall be designed to meet the requirements of 100% BMCR conditions. The air and flue gas system shall consist of 2x 60% capacity centrifugal backward curved fans of each type, tubular air preheater (APH), Air heater bypass system, cold air, hot air and flue gas ducting, dampers and expansion joints etc.

The air and flue gas system for each of the steam generator unit shall be balanced draft system and shall consist of 2 x 60% capacity PA fans, 2 x 60% capacity SA Fans, 2 x 60% capacity centrifugal type ID fans with variable speed hydraulic coupling, 1 x 100% tubular air preheater for preheating the Primary and Secondary Air.

2 x 100 % high pressure blowers for sealing/ purge air requirements,2 x 100 % high pressure blowers for fluidizing the ash coolers, 2 x100 % blowers for ash classifier (if applicable) with 100 % isolation and appropriate handling arrangement for isolation of individual streams with associated cold air, hot air and flue gas ducting and dampers to handle the steam generator requirements shall also be provided.

1.05.00 Fuel Oil Burning System:

Start-up, warm up and low load (upto 30%) carrying shall be done by Light Diesel Oil (LDO). Boiler will be so designed that oil firing for flame stabilization will not be required beyond 30% MCR. Necessary pumps, filters shall be provided. The burners, air registers etc. will have Independent pneumatic drives and the entire operation of purging, insertion, air & fuel sequencing removal and blow off shall be automatic. Ignition of LDO shall be directly by high energy arc igniters.

1.06.00 Coal Burning System:

The COAL burning system shall be designed to meet the requirement of steam generator at 100% BMCR condition. To transport the solid fuel (coal) from the bunker outlets to the boiler, the system shall be complete with isolation valves /gates, chutes, feeders, with all supports / hangers, instrumentation, etc. for a complete system.

Fuel feeders shall be of gravimetric and draglink type complete with variable frequency motor, coupling, coupling guard, base plate, foundation bolts, motorised inlet gates, measuring devices, sliding joints, devices complete with all accessories to detect presence and absence of coal, paddle type solid fuel stoppage alarm system for control of fuel bed thickness in feeder, and auto declutching arrangement to low /high torque. Separate feeders shall be used for each location feeding the coal into furnace walls/ for each location on siphon seals. Drag chain type coal Feeders shall be used to feed and control the coal into the combustor.

The coal feeders shall be designed with ample capacity range as well as reserve

capacity to allow for variation in size, quality and moisture content of the coal. With one of the feeders out of service, the remaining feeders shall be able to meet the fuel, requirement of 100% BMCR with worst fuel. All surfaces in contact with coal shall be made of corrosion and erosion resistant stainless steel unless specified otherwise elsewhere in the specification. The casing of the feeder shall be air tight and designed to withstand an explosion pressure of 3.5 kg/cm2 (g) in accordance with the National Fire Protection Association, USA's recommendations. Coal bunkers shall ensure uniform mass flow without arching and rat holing.

Rotary air lock feeders shall be provided in each coal feed stream to act as a pressure seal between pressurising combustion chamber and coal feed system. Each feeder and rotary valve shall deliver coal to the combustion chamber through an inclined gravity feed chute or drag link feeders connected to combustor or loop/siphon seal lignite feed ports. The feeders shall be link chain operated and flights shall be made of SS 316 material. At each coal feeder port purge air or booster air shall be provided to assist coal feeding. Feeder should be operable in both forward and reverse directions.

1.07.00 Soot Blowing System:

Fully automatic, sequentially controlled, microprocessor based steam soot blowing system, complete with provision for individual operation of any soot blower pair and facility to bypass any soot blower, will be provided. The system will have short retractable rotary wall blowers for the furnace and long retractable rotary blowers for the superheater, reheater and economizer.

1.08.00 Auxiliary Steam System:

Each unit will be provided with two Auxiliary Pressure Reducing Stations i.e., high capacity and low capacity PROS taking their steam tap-offs from MS line and CRH line respectively. The high capacity auxiliary PROS will be designed for a minimum capacity of 100 T/hr. Low capacity auxiliary PROS will be sized for minimum 20 T/hr capacity and will be operated during the normal operation of the unit.

Auto-change over between the low and high capacity aux. PROS stations depending on the station auxiliary steam requirement is also envisaged. Each unit will have its own auxiliary steam header whereas for station services, a common station auxiliary steam header is also proposed.

1.09.00 **Elevators:**

One (1) number passenger cum goods elevator of capacity 3,000 Kgs. shall be provided for each steam generator.

1.10.00 Electrostatic Precipitator:

It is proposed to install high efficiency electrostatic precipitator having an efficiency that limits the outlet emission to 50 mg/Nm3 while the boiler is

operating at its MCR, firing worst coal having maximum ash content.

The electrostatic precipitators will have two (2/7 or 2/8) 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. ESP specific collection area shall not be less than 250 m2/m3/sec at 100% BMCR. Electrostatic precipitator will be provided with microprocessor based programmable type rapper control system and ESP management system to ensure the safe and optimum operation of ESP. ESP transformer rectifier sets will use high fire 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 and trip the ESP in case of high ash levels in the ash hoppers which will jeopardize the safety of ESP otherwise.

In order to limit the particulate emission to specified levels even under contingency such as wide variations in the coal properties etc., it is proposed that installation of Flue Gas Conditioning (FGC) shall also be explored to function in association with ESPs as stipulated above. However, final selection shall be based on techno-economic consideration.

1.11.00 Provision of Lime Dozing System:

Space provision for the Lime dozing system, to be installed in future (if required), shall be kept.

1.12.00 Chemical Dosing System:

Chemical dosing system complete with preparation and metering tanks 2X100% of capacity dosing pumps , connecting piping , valves and fittings will be provided to control the quality of water at the steam generator.

1.13.00 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. For obtaining the sustained high efficiency and availability of the boiler, it shall be designed for low NOx formation by adopting the appropriate burners, high efficiency at part load, flexibility to burn coal within the range specified, quick start-up and two shift operation capability, adequately sized furnace for burning high ash coal and low flue gas velocities to minimize erosion.

2.00.00 TURBINE AND ITS AUXILIARIES:

The scope of each TG unit of 135 MW shall broadly cover the Steam Turbine along with its integral systems and auxiliaries like lube oil system, control-fluid system, condenser, 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.

2.01.00 Steam Turbine:

The steam turbine shall be tandem compound, single reheat, regenerative, condensing, multi cylinder design with separate HP, separate IP and separate LP casing(s), or combined HP-IP and separate LP casing(s), 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 is 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. Apart from constant pressure operation, the turbine shall also have the facility for sliding pressure operation. The turbine shall be provided with suitable margins for VWO flow.

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

1.	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.	135 MW
2.	Turbine throttle steam pressure	132 to 137 kg/cm2 (abs)
3.	Turbine throttle Main steam/ Reheat Steam temperature.	537/537 C
4.	Variations in rated Steam temperature & pressure	As per IEC-45.
5.	Pressure drop in reheat circuit i.e between HPT Exhaust & 1 PT inlet.	10% of HPT exhaust pressure.
6.	Condenser pressure-Design/ Maximum	Design later/Max-89(mm Hg abs)
7.	Turbine speed	3000 rpm
8.	Frequency variation range from rated frequency of 50 Hz	(+) 3% to (-5%) (47.5HZto51.5HZ)
9.	DM Water make up to thermal cycle under EMCR condition.	3% of throttle steam flow
10.	Final feed water temperature for heat rate (HR) guarantee point & EMCR condition.	245 +/- 5 Deg C
11.	Turbine protection against water induction.	As per ASME-TDP-1 (latest)
12.	No. of extractions for regenerative feed water Heating	As per cycle optimisation by the bidder.

2.02.00 Condenser:

Single pass or double pass condenser with stainless steel tubes of welded type as per ASTM-A-249-TP304, shall be adopted. The condenser shall be with divided water box construction. It shall be horizontal, surface type with integral air cooling section. Condenser hot well shall be sized for three (3) minutes storage capacity (between normal and low-low level) of total design flow with the turbine operating at V.W.O condition, 3% make-up, design back pressure. The condenser shall be adequately sized to cater to all the conditions of turbine operation including the abnormal operating conditions such that condenser would not be a bottleneck at any stage of operation. The exact condenser parameters shall be optimised on the basis of site data and most economical combination of cooling surface and circulating water quantity. The condenser shall be designed, manufactured and tested in accordance with the latest applicable requirements of the Heat Exchange Institute (HEI), USA. Provision of separate sponge rubber ball type condenser on-load tube cleaning system for each half of the condenser including ball circulation pumps, strainer, ball monitoring system etc. shall-be made.

2.03.00 Air Extraction System:

Each unit shall comprise of (2x100%) vacuum pumps along with all accessories and instrumentation for condenser air evacuation. The vacuum pumps and accessories shall be used to create vacuum by removing air and non-condensable gases from steam condenser during plant operation. Vacuum pumps shall be of single/two stage liquid ring type with both stages (if two-stage pump is selected) mounted on a common shaft. Vacuum pumps shall be sized as per latest HEI requirements.

2.04.00 Lube Oil System:

Each turbine generator shall have a complete self contained lubrication oil system. The system shall cater to the lubrication requirements of the bearings, requirements of turbine turning gear during start-up and shutdown and jacking oil requirement during turning gear operation. In addition, it shall also supply oil to the generator seals under emergency condition.

The system shall specifically include the following:

(a) Centrifugal / gear type, Main oil pump (MOP) directly driven by Turbine with capacity to cater lube oil for bearings & emergency seal oil requirement Further, 2x100% AC Aux. oil pumps for start up, shut down of TG unit and as standby to M.O.P. for automatic operation, each pump having capacity to cater to lube oil, jacking oil & turning gear oil requirement.

OR

2x100% AC oil pumps with capacity to cater lube oil for bearings & emergency seal oil requirement. Each pump shall also be capable of

start up, shut down of TG unit and stand by to each other for automatic operation to cater lube oil, jacking oil & turning gear oil requirement

(b) 1 x 100% DC emergency oil pump for meeting lube oil requirements of bearings during emergency, with automatic starting on low lube oil pressure preset value.

(c) One (1x100%) each AC and DC motor jacking oil pumps shall be provided to lift the rotor at the bearing during turning gear operation.

(d) Each unit shall be provided with an oil tank of sufficient capacity to allow 5 to 8 oil changes per hour (at normal operating level), fitted with non-corrodable strainers, level indicators & necessary manholes. 2x100% duty vapour extraction fans driven by motors shall also be provided.

(e) 2x100% capacity oil coolers shall be provided for cooling the lubricating oil. The cooling medium shall be DM water (condensate quality).

(f) A lube oil purification unit shall be permanently connected to the piping system for each TG unit for purifying 20% of the total oil charge in the system per hour on a continuous bypass basis. Each unit shall be complete, self-contained with centrifuge, explosion-proof motors, motor-driven feed pumps, heaters etc.

(g) A centralised lube oil storage and purification system consisting of a central purifier (capacity and type same as unit purifier), two central oil tanks (each with capacity one half times the capacity of one unit oil tank), two transfer pumps (for dirty and clean oil) shall be provided. This is for storing and purifying oil from unit oil tanks and also for adding new oil to the system and also for transferring the fresh oil to the unit oil tanks. In case of maintenance of the unit purification system, this system shall serve as a backup system.

2.05.00 Turbine Control Fluid System:

For the governing and control system of the turbine a complete self contained control fluid system shall be provided. Fire resistant fluid shall be employed to minimise fire hazards. The system will comprise of:

i. A control fluid reservoir of adequate capacity to ensure fluid supply of acceptable purity.
ii. 2x100% AC motor driven pumps to pump the fire resistant fluid from the fluid reservoir through the system.
iii. 2x100% capacity control fluid coolers designed for service with DM water (condensate quality).

A control fluid purifying unit using Fuller's earth shall be provided for each turbo-set permanently connected to the piping system for purifying at least 2% of the total fluid charge in the system per hour on a continuous bypass basis. 2x100% capacity AC motor driven purification pumps to circulate oil through

purification system are envisaged. Necessary filters, strainers, piping, fittings, valves and instruments shall be provided. All the components including piping which are coming in contact with the control fluid shall be of stainless steel.

2.06.00 Gland Steam Sealing System:

A fully automatic gland sealing steam supply system shall be provided for the TG set & the turbine drives for BFPs. HP and IP turbine shaft glands will be sealed to prevent escape of steam into the atmosphere and the LP turbine glands will be sealed for preventing leakage of atmospheric air into the turbine. Steam will be used for sealing these spring backed labyrinth glands.

During start-up and low loads (say upto 40% load), seal steam will be supplied to the turbine glands from the auxiliary steam header through a seal steam regulating valve. During normal operation (say above 40% load), the HP and IP turbines will be of self-sealing type and under that condition the auxiliary steam source will be cut off and the leak-off steam from HP and IP glands will be used for sealing the LP glands. The excess leak-off steam will go to the condenser. A gland steam condenser will be provided to condense and return to the cycle, all gland leak off steam including that from BFP turbines. A de-superheating type bypass shall be provided during outage of gland steam condenser. 2x100% capacity vapour exhausters shall be provided to remove non-condensable gases from the gland steam condenser. The exhaust gases shall be left above the TG Hall roof level.

2.07.00 Governing / Regulation System:

The turbine will have throttle or nozzle controlled type governing. The steam turbine generator unit shall be equipped with an electro-hydraulic governing system backed up by 100% mechanical-hydraulic or electro hydraulic control system. The governing system shall be highly reliable and operationally safe and it shall be capable of controlling with stability the speed of the turbine at all power outputs between zero and the specified maximum power output when the unit is operating isolated or the energy input to the steam turbine when the unit is operating in parallel with the other units. The turbine governing system shall be designed for high accuracy, speed and sensitivity of response. The governing system shall limit the over speed of the turbine on loss of full load to value less than 8% of the rated speed. The steady state regulation shall be adjustable within +3% to +8% of the rated speed. The dead band at rated speed and at any power output within the rated output shall not exceed 0.06% of the rated speed.

2.08.00 HP/LP Bypass:

The HP and LP bypass stations shall be capable of meeting the following requirements:

a) Quick start-up of the steam generator from cold, warm & hot conditions.

b) Parallel operation of the bypass with turbine in the event of large load throw

off.

c) House load operation followed by complete external load throw-off.

d) To keep the steam generator in operation so as to avoid a fire out in the steam generator following full load rejection.

The HP/LP Bypass system shall be sized for about 65% of BMCR steam flow (exact capacity shall be decided later) with rated main steam parameters at upstream of valves. The LP bypass will be sized for steam inlet conditions (pressure and temperature) of HRH line corresponding to about 60% TMCR.

2.09.00 Regenerative Feed Heating Cycle:

Regenerative feed heating plant shall be designed for all operating conditions including transients like sudden load throw-off, HP-LP Bypass in Operation, one or two heaters going out of service etc. The condensate from the condenser shall be pumped by the condensate extraction pumps through the train of LP heaters to the deaerator. In deaerator, the condensate shall be heated to saturation temperature and fed to the boiler feed pump, which increases the feed water pressure to suit the steam generator requirements.

Feed water then passes through two trains of 50% capacity HP heaters which raise the feed water temperature to nearly 245 +/-5 deg C (tentative). Finally the feed water is fed to boiler.

2.10.00 HP & LP Heaters:

Regenerative feed heating cycle shall consist of LP heaters, one drain cooler, deaerator and HP heaters. The number of LP & HP heaters shall be based on the optimisation of feed heating cycle.

Feed water shall be heated by uncontrolled turbine extraction steam from turbine inter-stage tap-off and cold reheat line in feed water heaters, depending on optimisation of cycle. The deaerator shall normally operate under variable pressure on extraction steam from the turbine. Each feed water heater shall be capable of handling the drains from the preceding heater under operating conditions of the unit

Heaters shall be arranged for removal from service and bypassing of condensate flow around each heater individually excepting for HPHs. Each train of HPH can be isolated & bypassed and not the individual heater.

The equipment shall be designed in accordance with latest applicable standard/codes of Heat Exchanger Institute, ASME, IBR etc. The feed water heaters shall be of U-tube with all welded stainless steel tubes, surface type, horizontal with integral condensing and drain cooling zones. The HP heaters shall also have de-superheating zone.

2.11.00 Deaerator:

Horizontal, direct contact spray or spray cum tray type deaerator with a

horizontal feed water storage tank shall be provided. The deaerator shall be capable of deaerating all the incoming condensate and HP heater drains. It shall effectively remove the dissolved oxygen in condensate and completely remove the traces of carbon dioxide. The minimum capacity of feed water storage tank shall be 6 minutes of BMCR flow between normal operating level and low-low level with a filling factor of 0.66. The deaerator shall operate without any vibration and water hammer during any transients, loss of full load followed by HP-LP bypass coming into operation and at any steady load from 0% to 110% of rated capacity. The deaerator shall be designed to give dissolved oxygen content not greater than 0.005 ml/litre in feed water at the deaerator outlet under all operating conditions.

2.12.00 Boiler Feed Pumps:

It is proposed to have 3x50% Motor driven boiler feed pumps per unit with the booster pumps mounted on the common shaft. Each pump shall be designed to give parameters to suit the steam generator requirements such that two feed pumps shall be capable of meeting the full requirement of the boiler turbine unit with the third pump as a standby. The feed pump shall be able to handle feed water of pH 8.5 to 9.5 and of temperature of about 185 deg. C (tentative).

The boiler feed pumps shall be of horizontal, centrifugal type with stiff shaft design. The boiler feed pumps outer casing shall be of barrel type with end removal. The inner pump assembly comprising of shaft, impellers, stage casings shall be capable of being removed and replaced as a unit without disturbing the feed piping. Each feed pump shall be provided with ON-OFF recirculation control valve to protect the pump under low flow condition. The boiler feed water system shall be designed to operate primarily in an automatic mode over the range of system design loads. The arrangement will provide automatic start-up of the standby feed pump under conditions like tripping of running pumps, discharge header pressure low, etc.

The feed flow shall be controlled by throttling the control valve of motive steam for drive turbine in case of turbine driven pumps whereas hydraulic coupling shall be utilised to achieve speed control of motor driven pump. Provisions will be made for warm-up of stand by pump, if required.

2.13.00 Condensate Pumps:

Each unit shall have 3 x 50% capacity motor driven condensate extraction pumps (two operating and one standby). The condensate pumps shall be vertical canister type, multistage, centrifugal diffuser design with a double suction first stage impeller designed for condensate extraction service having low suction head requirement. The pumps shall be capable of handling the condensate from the condenser together with feed heater drains when the machine is operating at maximum unit output with HP Heaters out with 3% make-up and discharging this quantity through the gland steam condenser, condensate polishing unit and LP heaters to Deaerator.

The pump shall have adequate margins on capacity and head to cater for most adverse conditions of operation such as:

i) HP & LP bypass in operation.

ii) HP heaters out of service and unit operating at its maximum load during an under frequency operation (i.e. at 47.5 Hz).

2.14.00 Turbine Hall EOT Cranes:

Two (2) numbers electrically operated travelling crane is envisaged in the turbine hall for erection and maintenance of turbo-generators and their auxiliaries. The main hook capacity of each crane shall be 5% over and above the heaviest component/equipment to be lifted working in tandom operation (including lifting beam and slings etc.) to be handled in TG hall or 80 T whichever is higher and the aux. hook capacity shall be 15 Tonne (approx.).

2.15.00 LP Chemical Dosing System:

The purpose of LP dosing system is to maintain the pH of condensate and feed water and to effectively deal with residual dissolved oxygen in condensate and feed water. The arrangement shall consist of the total system for dozing hydrazine and ammonia at boiler feed pump suction and on condensate line.

3.00.00 FUEL TRANSPORTATION AND HANDLING SYSTEM:

3.01.00 Coal Transportation:

The annual coal requirement shall be about 4 Million Metric tonnes based on gross calorific value of 2000 Kcal/Kg and 75% plant load factor.

The envisaged mode of coal transportation from the coal washery to the power plant is Conveyor belts.

3.02.00 Coal Handling System:

The capacity of the CHP has been worked out to meet the peak daily coal requirement of Four (4) units of 135 MW.

The overall operating hours of the coal handling plant shall be 16 hours spread over two shifts per day leaving third shift exclusively for routine inspection and maintenance. The proposed CHP shall cater to the peak daily requirement of coal for the four units.

The coal handling plant shall be of 1600 TPH rated capacity with belt conveyors alongwith facilities for receiving, unloading, crushing and conveying the crushed coal to boiler bunkers and stacking/reclaiming the coal to / from crushed coal stockyards.

Coal received at power plant shall be conveyed to the crusher house for sizing

of coal to (^) 10 mm.

From the crusher house, the crushed coal can either be conveyed directly to the coal bunkers through a series of conveyors or stacked on to the crushed coal stockpiles by means of stacker reclaimers. Motorised travelling trippers shall be provided to feed crushed coal into the raw coal bunkers of the boilers.

One (1) no. Rail mounted, travelling stacker-reclaimers, bucket wheel type are proposed for coal stockyard management. Coal stockyards proposed shall have crushed coal storage equivalent to 15 days coal consumption at 100% PLF.

Dust suppression and service water system shall be provided throughout the coal handling plant

A centralized main CHP control room shall be provided to control and monitor the operations of the entire coal handling system.

3.02.01 Fuel Oil Handling & Storage System:

Fuel Oil unloading and storage system shall be designed to handle light oil (LDO). Light oil (LDO) shall be used for cold start-up warm-up and low load (up to 30%) operation of the steam generator while firing coal.

It is proposed to transport LDO to the power plant by Road. The oil from road tankers shall be unloaded to unloading header by gravity which shall then be pumped to storage tanks through unloading pumps.

For storage of light oil (LDO) two (2) tanks each of capacity 500 KL shall be provided.

A set of pressurizing pumps shall draw the oil from the storage tanks for pumping the oil to the steam generator units. A separate day oil tank of 100KL capacity for shall be provided. Oil shall be drawn from the main LDO storage tanks for feeding to day oil tank.

4.00.00 ASH HANDLING SYSTEM:

The Ash generated inside Boiler (Bed Ash) shall be extracted and disposed off in dry form. The fly ash shall be extracted in dry form from the electrostatic precipitator hoppers. This dry fly ash is taken to buffer hoppers for its onward transportation in dry form to storage silos for utilization. In case of non utilization, fly ash shall be disposed by mine void backfilling.

4.01.00 Bed Ash Removal System:

The combustor bottom ash removal system shall adequately control the bed inventory, classification, removal, cooling and transfer of the bottom ash, over the full operating load range of the steam generator for the specified range of fuel. The bed pressure drop shall be monitored for the measure of ash inventory and the bottom-ash flow shall be adjusted to maintain the desired bed pressure drop. Bottom ash shall be cooled to about 120°C sufficiently for ash removal equipment

to handle.

At least two adequately sized ash drains shall be provided in the combustor to drain the bed ash. Two 100% capacity bottom ash cooler shall be provided to remove the oversize ash particles.

Two (2x100%) full capacity ash cooling fans / blowers shall be provided and each fan shall be sized to meet the air requirements to cool the entire bottom ash.

4.02.00 Fly Ash Handling System:

Pneumatic conveying system (either vacuum system of pressurized system) shall be employed for extraction of fly ash from the electrostatic precipitator hoppers in dry form. This dry ash shall be taken to buffer hoppers of each unit. The dry ash buffer hoppers shall be located adjacent to the ESP. Dry ash from buffer hoppers shall be transported either to intermediate silos for filling mine voids in HDSD form or to storage silos near the plant boundary. The transport air system shall be provided for each unit, for transportation of ash from buffer hoppers to the silos.

5.00.00 WATER SYSTEM AND PLANT UTILITIES:

5.01.00 Source of Water

Raw water is proposed to be used for meeting the complete water requirement of the project. The source of raw water for the project is River Atem/Rehar which is at a distance of about 3/26 kms from the plant boundary.

5.02.00 Water Requirement:

Water requirement for this project would be about 39.298 mld. (i.e. 14.14 MCMPA)

5.0300 Type of Circulating Water System:

Re-circulating type CW system with cooling towers has been envisaged for the project.

5.0400 Makeup Water System:

5.04.01 Make-up water system shall be designed for drawl and pumping of water to reservoir so that during lean season make-up water for the plant is made available on continuous basis. Water drawl and raw water storage arrangement shall be described in the Civil section.

It is proposed to provide three (2) numbers of Makeup Water Pumps in the make up water pump house at river end. Make up water pumping capacity shall be designed so that one (1) number of pump shall be able to pump total water committed for the plant. It is proposed to provide two (2) make up water pipelines of carbon steel construction from make up water pump house to the reservoir(s) in the plant. The makeup water pipelines shall be laid below ground and shall be protected against corrosion using suitable coating. The pipeline

shall be designed in such a way that each pipeline shall deliver discharge of one (1) make up water pump.

5.04.02 Required Handling equipments such as Monorail hoists & EOT cranes of suitable capacity shall be provided in the pump house to meet the maintenance requirements of pumps and associated equipments.

5.04.03 Three nos (3) (2W + 1S) Raw water pumps for feeding water to PT Plant, Ash handling plant, etc shall be provided in a raw water pump house near the reservoir.

5.05.00 Circulating Water System:

5.05.01 Clarified water shall be supplied as makeup water to re-circulating type CW system. Clarified water shall be supplied from the water pre-treatment plant to the cold water channel of CW system. Water from cold water channel will enter into the CW pump house through bar screens/trash racks at low velocity to filter out debris. Isolating gates shall be provided after the screens to facilitate maintenance. The total water requirement for the condenser and auxiliary (unit auxiliaries) cooling is estimated to be about 20000 Cu.m/hr per unit considering temperature rise of circulating water across the condenser of about 10 deg. C. It is proposed to operate CW system at about 5 Cycle of Concentration (COC).

5.05.02 A common Circulating Water Pump House shall be provided for two units. Two (2) numbers of working pumps shall be provided for each unit. CW pump shall be of Vertical Wet pit or Concrete Volute type. All the pumps are proposed to be located in pump house and the discharge header of all the pumps shall be interconnected. One (1) No. standby pump is envisaged for Two (2) units of 135 MW. For carrying circulating water from CW pump house to each TG unit and from each TG unit to cooling towers, steel lined concrete duct would be provided. For interconnecting C.W. duct with CW pump, condenser and cooling towers, steel pipes would be used.

5.05.03 Monorail hoists shall be provided for maintenance requirement of bar screens and gates of CW pump house. EOT crane of suitable capacity shall be provided in each CW pump house to meet the maintenance requirements of CW pumps and associated equipments.

5.05.04 The cooling tower for the main Circulating Water System will be Induced draft type.

5.06.00 Equipment Cooling Water System:

5.06.01 Closed circuit cooling water system would be adopted for unit auxiliaries of steam generator and turbine generator. DM water would be used in Primary cooling water circuit for cooling of various auxiliaries which in turn shall be cooled in a secondary circuit by circulating water through a set of plate type heat exchangers. The secondary circuit cooling water would be tapped from the CW pipe at the upstream of condenser and the return water from the circuit would be led to the CW discharge pipe after condenser. Re-cooled water from cooling tower will be led to the CW pump house through the cold water channel by gravity. As the

pressure required for coolers of SG auxiliaries and TG auxiliaries are different, it is proposed to provide two independent primary circuits i.e one for SG auxiliaries of each unit and one for TG auxiliaries of each unit. However, secondary cooling water circuit shall common. The primary circuit of cooling system of TG auxiliaries shall be provided with 3 x 50% capacity DM cooling water pumps, 3 x 50% -capacity Plate type Heat exchangers, associated piping, valves etc. In the primary circuit of cooling system of SG auxiliaries, 2x100% capacity DM cooling water pumps, 2 x 100% capacity Plate type Heat exchangers, associated piping, valves etc shall be provided. The common secondary cooling system shall be provided with 3 x 50% capacity Auxiliary Cooling water pumps, set of self cleaning filters, associated piping, valves etc.

5.06.02 For cooling of station auxiliaries such as Air compressors, compressors of ash handling plant and condensing water requirement of AC plant, an independent cooling shall be provided through a set of station auxiliary cooling water pumps, piping network. The hot water from station auxiliary cooling water circuit shall be terminated into the hot water riser pipes of all the cooling towers of main CW system so that the water may be cooled by any of the tower in service. The station auxiliary cooling water pumps shall draw water form the channel of main CW system.

5.07.00 Miscellaneous Water Systems:

5.07.01 A pipe network for distribution of potable water for plant shall be provided from the overhead storage tanks. In addition potable water requirement for the colony shall be supplied from the water treatment plant. Required number of potable water pumps for colony and plant area shall be provided.

5.07.02 A 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 shall be provided which shall draw water from the service water tank.

5.07.03 In addition to the above, DM water make up water system, boiler fill pumping system, Air-preheater wash water system and HVAC make up system shall also be provided as per requirement and required quantity of pumps for these services and their parameters shall be finalised as per final plant layout and requirements of the main plant equipment.

5.08.00 Water Treatment Systems:

The water treatment system of the project comprises of Water Pre-treatment Plant, Water Demineralising Plant, Chlorination Plant, Condensate Polishing Plant and CW Treatment Plant as described below:

6.00.00 Water Pre-Treatment Plant:

6.00.01 The pre-treatment plant would be designed to remove suspended/colloidal matter in the raw water. Separate pre-treatment plant shall be provided for meeting the CW system & Demineralisation (DM) Plant. A common chemical

house shall be provided to store chemicals such as chlorine, lime, alum & coagulant aid and respective lime, alum and coagulant dosing equipments such as tanks, pumps etc for all the PT systems. However independent chemical preparation tanks and chemical dosing pumps shall be provided for each PT system.

6.00.02 The Water PT system for CW system shall be designed to facilitate operation of CW System at a COC of about 5. Two (2) reactor type clarifiers each of 1200 Cu. M/hr capacity shall be provided for CW system. Water PT system for DM Plant would consist of One (1) reactor type clarifier of 130 Cu. M/hr capacity and two (2) gravity filters each of 130 Cu. M/hr capacity.

6.00.03 Each of the clarifier shall be provided with a stilling chamber cum aerator and provision for dosing of alum, lime, coagulant aid and chlorine. There shall be one standby gravity filter for each water PT system. Water from the clarifiers shall be led to clarified water storage tank and to the filters as the case may be. Water from the clarified water storage tank shall be pumped to other BoP systems and CW system make up by separate sets of pumps.

6.00.04 From the gravity filters, filtered water would flow by gravity to respective filtered water reservoirs and filtered water would be pumped to DM plant and potable water system.

6.00.05 Required hoists, cranes and weighing scales shall be provided for handling pumps, chemicals, chlorine tonne containers etc.

6.00.06 The Water pre-treatment plants shall be provided with required instrumentation, interlocks, controls and control panels to facilitate safe & reliable operation.

7.00.00 Water De-Mineralization Plant:

The DM plant shall be sized to meet the make up water requirement of the steam cycle, make up to closed circuit auxiliary system and stator water cooling system.

The D.M. plant shall consist of Two (2) streams of 45 Cu. M/hr capacity and each stream shall comprise of activated carbon filter, cation exchanger, degasser system (comprising of degasser tower, degassed water tank, degassed water pumps and degasser blowers etc), anion exchanger and mixed bed exchanger. The cation resins shall be regenerated with hydrochloric acid and the anion resins with sodium hydroxide. The regeneration facilities shall consist of the bulk acid & alkali.

Storage tanks, alkali solution preparation system, acid & alkali measuring tanks and dosing ejectors etc. The plant shall be designed for semi automatic operation with PLC based control. Two (2) nos. D.M. water storage tanks each of 1200 Cu.M capacity shall be provided to store DM water. One neutralisation pit shall be provided for neutralising the pH and discharging the effluent water from the DM plant.

8.00.00 Chlorination Plant:

Chlorination plant shall be provided for chlorine dosing in the CW system to

avoid the growth of algae and bacteria. Separate Chlorination plant shall be provided for water PT plant and CW system, CW Chlorination system would consist of Three (3) numbers of chlorinator-evaporator sets of 100 Kg/hr capacity and PT Chlorination system shall consist of three (3) numbers of chlorinator sets of 10 kg/hr capacity with associated pumps etc.

Each Chlorination system shall be provided with required chlorine tonne containers, instrumentation, panels, chlorine leak detectors etc. Complete chlorination plant shall be located indoor. Chlorine leak absorption system as plant emergency measure shall be provided for each of the Chlorination plants to neutralise chlorine leakage from the plant.

9.00.00 Condensate Polishing Plant:

For maintaining the feed water purity, condensate polishing plant shall be provided in the feed water cycle at the downstream of condensate extraction pumps as per the existing practice. The condensate polishing plant shall be of full flow, deep mixed resin bed type consisting of consisting of 2 x 50% capacity service vessels for each unit. The resins to be used would be strongly acidic cation and strongly basic anion type, appropriate for condensate polishing system. A common external regeneration facility shall be provided. The exhausted charge of resins from the service vessel shall be hydraulically transferred to the resin separation/cation regeneration vessel for regeneration and reuse. Spare charge of resin shall be kept in the mixed resin storage tank for immediate exchange of resins with the exhausted ones. One additional charge of resin shall be procured for use during start up of both the units. Acid, Alkali & DM Water Storage for regeneration, and Wastewater Neutralisation facilities shall be provided separately for the external regeneration facility.

10.00.00 CW Treatment System:

It is proposed to provide suitable chemical treatment programme of acid dosing and scale cum corrosion inhibitor dosing for the CW system for control of CW system water chemistry. It is proposed to provide acid & chemical storage tanks and dosing pumps as a part of CW treatment system. The plant shall be provided with neutralization pits, disposal pumps with required corrosion measurement rack, instrumentation for interlocks and controls, control panels etc. to facilitate safe & reliable operation.

10.00.01 Effluent Treatment System:

The liquid effluents shall be collected and treated / recycled generally as per the following design philosophy.

The waste effluents from neutralization pits of DM plant and Condensate Polishing Plant shall be collected in the respective neutralisation pits and neutralised before pumping to the central monitoring basin before final disposal.

CW system blow down would be used as make up to Ash handling Plant. Excess CW blow down if any shall be led to Central Monitoring Basin. Blow down (if required) from ash water re-circulation system shall also be led to Central

Monitoring Basin.

A coal settling pond shall be provided to remove coal particles from coal handling plant waste. Decanted water shall be pumped back to the coal dust suppression system

Service water effluent drains from various areas shall be separately routed to a sump. From the sump the service water shall be pumped upto plate separators/tube settler for treatment of suspended solids. Treated service water shall be sent back to service water to the extent possible tank for reuse.

All the plant liquid effluents shall be mixed in CMB and finally disposed off from central monitoring basin up to the final disposal point using carbon steel pipe using 2 x 100% capacity pumps.

11.00.00 FIRE DETECTION AND PROTECTION SYSTEM:

A comprehensive fire detection and protection system is envisaged for the complete power station. This system shall generally conform to the recommendations of TAC (INDIA)/ IS:3034 & NFPA- 850.

The following fire detection and protection systems are envisaged:-

Hydrant system for complete power plant covering the entire power station including all the auxiliaries and buildings in the plant area. The system shall be complete with piping, hydrants, valves, instrumentation, hoses, nozzles, hose boxes/stations etc.

Automatic high velocity water spray system for all transformers located in transformer yard and those of rating 10MVA and above located within the boundary limits of plant, main and unit turbine oil tanks and purifier, lube oil piping (zoned) in turbine area, generator seal oil system, lube oil system for turbine driven boiler feed pumps, consisting of detectors, deluge valves, projectors, valves, piping, instrumentation etc.

Automatic sprinkler system for selected coal conveyers.

Automatic medium velocity water spray system for cable vaults and cable galleries of main plant switchyard control room, CHP control room and ESP control room consisting of smoke detectors, linear heat sensing cable detectors, deluge valves, isolation valves, piping, instrumentation, etc.

Automatic medium velocity water spray system for coal conveyors, coal galleries, transfer points and crusher house consisting of QB detectors, linear heat sensing cables, deluge valves, nozzles, piping, instrumentation, etc.

Automatic medium velocity water spray system for un-insulated fuel oil tanks storing fuel oil having flash point 65 deg C and below consisting of QB detectors, deluge valves, nozzles, piping, instrumentation, etc.

Foam injection system for fuel oil / storage tanks consisting of foam concentrate tanks, foam pumps, in-line inductors, valves, piping & instrumentation etc.

For protection of central control room, control equipment room, computer room and other electronic equipment rooms of main plant, Inert Gas extinguishing system as per NFPA-2001 would be opted.

Fire Detection and Alarm System - A computerised analogue, addressable type early warning system shall be provided to cover the complete power plant. Following types of fire detection shall be employed.

a. Multi-sensor type smoke detection system
b. Photo electric type smoke detection system.
c. Combination of both Multi-sensor type and photo electric type smoke detection systems.
d. Linear heat sensing cable detector.
e. Quartzoid bulb heat detection system.
f. Infra red type heat detectors.
g. Spot type heat detectors.

Portable and mobile extinguishers, such as pressurised water type, carbon-dioxide type, foam type, dry chemical powder type, will be located at strategic locations throughout the plant

Required fire tenders/engines of water type, DCP type/foam type, trailer pump with fire jeep etc shall be provided in the fire station.

It is proposed to use provide two numbers of Steel tanks for storage of fire water system. Fire water pumps shall located in the fire water pump house and horizontal centrifugal pumps shall be installed in the pump house for hydrant and spray system and the same shall be driven by electric motor and diesel engines as per the regulations of approving (TAG) authority. The water for foam system shall be tapped off from the hydrant system pumps.

For the above fire water pumping station, automatic pressurisation system consisting of jockey pumps and air compressors shall be provided.

Complete instrumentation and control system for the entire fire detection and protection system shall be provided for safe operation of the complete system.

12.00.00 Plant & Instrument Air System:

For instrument air requirement of main plant and auxiliaries, Three (3) numbers of air compressors each of 60 Nm^3/min capacity with Three (3) Air Drying Plants (ADP) of same capacity are envisaged. The discharge pressure of the compressors shall be such that a delivery pressure of 7.5 Kg/cm^2 (g) is available at the outlet of ADP. The compressors shall be of oil free reciprocating or screw type and shall provide moisture and oil free air. These compressors shall be provided with all the accessories such as suction filters, inter coolers, after coolers, air receivers etc.

The air drying plants shall be capable of achieving a dew point of (-)40 deg. C at atmospheric pressure. Individual air receiver shall be provided near each air compressor and further unit air receivers shall be provided near main plant of each unit.

Three (3) numbers of plant air compressors of capacity 60 Nm^3/min shall be provided to meet the Service air requirements of the plant. The compressors shall be same type as that of instrument air compressors.

13.00.00 AIR CONDITIONING SYSTEM:

Air conditioning system shall be provided for all those areas which require close control of environment conditions and shall cover the following areas:

a) Control tower areas including Control Rooms, Control Equipment Rooms, Telecommunication Rooms, Microprocessor, Computer and Programmers Rooms, Data Storage Rooms, UPS Rooms, Instrumentation Laboratory and Steam & Water Analysis Rooms, Conference Room, Shift Charge Engineer's Room, AVR Room and Inverter Room, Generator Exciter Panels Room (if applicable), Relay Rooms, Switchyard Control Room including Computer Rooms, Telemetry Room, PLCC & Telex Room.

b) ESP/VFD control rooms, Control rooms of CHP & Ash Handling Plant

c) Required areas in Service / Facilities Building / Administration Building / Auditorium / Satcom Building

d) Water Treatment Plant Control Rooms, Water and Fuel Analysis Room, Instruments Room.

e) Any other area which contains control and instrumentation equipment requiring air conditioning or otherwise requires to be air conditioned.

A common chilled water type air conditioning plant shall be provided for air conditioning in main plant area of all the units. It is proposed to provide steam powered Vapour Absorption Chillers (VAC) as main AC units and screw or centrifugal type chillers as standby units. Chilled water shall be pumped to each area and each area shall be air-conditioned through dedicated air handling units located locally.

For other areas, where air conditioning heat load is high, of the order of 60-100 TR and above, central chilled water type air conditioning plant using reciprocating or screw or centrifugal type chillers shall be provided. For areas where AC load is of the order of 40-60 TR, Direct Expansion (D-X) type chillers unit or multiple Package Air Conditioners (PAC) units shall be provided depending on the availability of space/ layout etc. Smaller areas which are away from the PACs/central chilling units which may require air conditioning of the order of 5 TR rating shall be served with split or window AC units as per requirement.

In determining air conditioning load (TR), equipment load, heat load due to solar heat gain, occupancy, lighting and transmission gain shall be considered as per established design practice.

All air conditioned space shall be maintained at 24 deg C +/- (plus or minus) 1o C 50% +/- (plus or minus) 5% RH.

Further critical areas like programmer's room, control room etc which are required to be air conditioned even during failure of normal power supply shall be provided with emergency package air conditioners which shall operate on emergency Diesel Generator sets.

All air conditioned areas shall be supplied with filtered air. Both re-circulated and fresh air shall be filtered separately.

All air conditioning equipment shall have standby capacity as per standard practice

14.00.00 VENTILATION SYSTEM:

Ventilation system shall be designed to supply fresh outdoor air and shall be selected for maintaining inside conditions for those areas where close control of temperature is not required, but nevertheless have a stipulated maximum temperature.

Basically two types of ventilation systems, namely Evaporative Cooling System (i.e. air washer system) and dry mechanical system, shall be employed in various areas of the plant for the purpose of ventilation.

The areas to be ventilated by Evaporative Cooling System shall be as follows:

a) All floors of turbine hall including "BC Bay" other than the area which are air conditioned

b) Switchgear rooms and cable galleries of main plant

c) Non air-conditioned area of ESP/VFD control room

d) Any other areas where equipment heat load is high and requires ventilation by evaporating process like CW pump house.

e) Non air-conditioned areas of ESP/VFD building shall be ventilated by Unitary Air Filtration System.

All other buildings /areas such as switchgear rooms, pump houses, store, canteen and toilets etc shall be e ventilated by mechanical ventilation process using combination of supply air fans and roof exhausters or wall mounted exhaust fans.

All evaporating cooling system shall be designed based on 90% saturation efficiency of air washer. Air quantity shall be selected in such a way so as to maintain an inside temperature of 5 deg C below maximum design ambient during summer or a minimum air change rate of 5 to 6 per hour which ever is higher

All mechanically ventilated areas shall be designed to a maximum inside temperature of 3 deg C above maximum design ambient during summer or 10 air change rate per hour (for general area) and 15 air changes rate per hour for battery room whichever is higher.

All ventilation system shall work on 100% fresh filtered air.

Turbine hall and electrical switchgear / control rooms shall be designed for positive pressure ventilation, which shall be achieved with the assistance of roof extractors besides air washer by sizing the exhausters to extract 60-75% of total air delivered by supply air fans. All battery rooms, kitchens, toilets shall be designed for negative pressure ventilation.

15.00.00 STORM WATER PUMPING:

The storm water shall be collected from the storm water drainage network as per final layout of drainage system. Water shall be collected in pump house sump and the same shall be pumped back to the reservoir in the plant. In each location, three numbers of pumps shall be provided and capacity of all the pumps shall be designed to discharge maximum expected storm water from the plant. No standby pump is envisaged. However provision shall be kept for in pump houses for installation of one more pump in future.

ELECTRICAL SYSTEMS

1.00.00 ELECTRICAL SCHEME:

The basic electrical scheme is being envisaged as under:

1.01.00 Power Evacuation:

Surguja TPP will comprise of four nos. of coal fired units each of capacity of 135 MW each. The Power evacuation voltage level of the project shall be 400 kV. Power Generated from each 135 MW unit would be stepped up to the evacuation voltage level through suitably rated Generator Transformer.

The power generated from the project shall be shared between Chhattisgarh and nearby Grid region. The provisions for Power evacuation as considered presently shall be reviewed based on the finalized Associated Transmission System (ATS) of the project.

1.02.00 Start-up Power Requirement:

The start up power of the plant has been envisaged to be drawn from seperate 132 kV transmission line or 400 kV system itself through above mentioned transmission lines meant for power evacuation.

1.03.00 Intermediate Voltage Level:

For meeting the station loads and remote loads from plant boundary, a 33 kV switchyard has been proposed.

1.04.00 The above schemes as considered presently, shall be reviewed based on the finalized ATS of the project. The provision now being kept is, thus tentative.

1.05.00 All electrical equipments shall be rated for the maximum ambient air temperature of 50 deg. C and relative humidity of 100%.

2.00.00 GENERATOR:

The main parameters of Generator would be as follows:

a)	Nominal rating	;	135 MW
b)	Rated output	:	160 MVA
c)	Power factor	:	0.85 (lag)-0.95 (leading)
d)	Rated voltage	:	As per manufacturer's Standard (in the range of 18-24kV)
e)	Speed	:	3000 rpm
f)	Short circuit ratio	:	Not less than 0.48

The Generator winding will be Y connected with the phase & neutral terminals brought out for connection to isolated phase bus duct. The star point will be connected to earth through a transformer having the secondary shunted by a resistor

The stator winding of the Generator shall be Air cooled.

The excitation system shall be static / brushless type.

Besides the other electrical protections, the Generator shall have the following additional protections/monitoring:

- Alkaliser unit
- End winding vibration monitor
- Online Partial Discharge (PD) Monitoring System

3.00.00 BUSDUCT:

The connection between the generator and generator transformers shall be through isolated phase busducts. The busduct shall be continuous enclosure, self cooled type and shall be equipped with air pressurization system. The tap off and neutral connection shall also be of isolated phase construction. The busduct will have on all aluminium construction.

The tentative parameters of the generator busduct are:

Voltage rating : 15.75 kV +/- 10% kV
Current rating (main run) : Later
Current rating (delta run) : Later
Current rating (tap off) : Later

Necessary current and voltage transformers shall be provided in the busduct for generator excitation control, performance testing, metering, protection and synchronization. Surge protection equipment and a generator neutral grounding cubicle with distribution transformer and secondary resistor, will also be provided. The connection between the unit and station switchgear and transformers to unit and station switchgear will be by means of segregated busduct with aluminium conductor and enclosure.

4.00.00 GENERATOR TRANSFORMER (GT):

Each 135 MW unit shall have Single three phase transformers with combined rating of 160 MVA, for the Generator Transformer. These would be OFAF cooled, with an OFF circuit tap changer One no. single phase unit shall be provided as spare.

5.00.00 AUXILIARY POWER SUPPLY SYSTEM:

The voltage adopted for the AC auxiliary system are :

415V : for motors rated upto 200 kW

6.6 kV : for motors above 200 kW and above

The electrical auxiliary system proposed will derive station supply from 400 kV system via suitably rated transformers and unit supply via unit transformer connected with the unit. These transformers will feed station and unit boards, which will have a fault rating of 40 kA break & 100 kA make. The scheme is shown in the single line diagram.

Interconnection between unit and station boards, between different station boards will be provided to cater for unit or station transformer outage, as shown in single line diagram.

6.00.00 LOADS AWAY FROM PLANT BOUNDARY:

For meeting makeup water pump house loads, which shall be covering approximately 3/26 km from the plant boundary, existing / separate 33 kV line shall be used. Raw water system loads shall be fed through 33 kv aux. transformers of suitable ratings to meet the power at different voltage levels. These shall be located at the respective places.

7.00.00 UNIT AUXILIARY TRANSFORMER (UAT):

Two winding unit transformer with ONAN/ONAF cooling shall be provided with each unit. The transformer is sized for the connected unit loads corresponding to the maximum continuous rating of the unit. The transformer will have on load tap changer. The size and details of the transformer are as per the single line diagram.

8.00.00 STATION TRANSFORMER (ST) / ICT:

The transformer will be ONAN/ONAF/OFAF cooled & will have an on load tap changer.

9.00.00 AUXILIARY TRANSFORMERS:

For meeting the demand of various systems i.e. unit auxiliaries, CHP, station auxiliaries, ash water re-circulation system, make up water system etc. suitable rating of 2x100% transformer /feeders shall be provided. Ash handling system shall be provided with 3x100% transformers / feeders.

10.00.00 LT TRANSFORMERS:

Power distribution at 415 Volts will be catered by 2x100% or 3x50%, LT transformers. All these transformers will be delta connected on the HT side and star connected on the LT side. The LT star point will be solidly earthed. These transformers shall be mineral oil filled for outdoor

installation or epoxy cast resin /resin encapsulated type in case of indoor installation.

The transformers rated 1000 kVA and above will be connected with the respective switchgears by the LT busducts.

11.00.00 NEUTRAL GROUNDING ARRANGEMENT:

High resistance neutral grounding with distribution transformer and secondary resistance shall be adopted for neutral grounding of generator.

HT systems feeding to motor loads shall be low resistance, non-effectively earthed to limit the earth fault current upto 300 Amps, 415V system shall be solidly earthed. 220V DC system shall be kept ungrounded. Emergency diesel generator shall be ungrounded.

12.00.00 HT SWITCHGEAR:

Switchgears shall be indoor, metal clad draw out type with SF6 or vacuum breakers. Contractors cum fuse units may be used for auxiliaries such as coal conveyors/crushers, ash handling motors, which require comparatively frequent switching.

13.00.00 LT SWITCHGEAR:

The LT transformers shall feed power to the 415V switchgears, which in-turn would distribute power to various MCCs located at load centres. The 415 V system will have duplicate incomer and bus coupling arrangements so that a changeover can be made from either of the two step down transformers to restore power in case of failure of one of the above two transformers. The 415 Volts switch boards shall be indoor, draw out type compartmentalized with air break circuit breakers. The distribution boards, clarifloculator's MCCS, if any, will be with fixed construction. Adequate numbers of AC & DC Distribution Boards are also envisaged for feeding to various loads.

14.00.00 DC SYSTEM:

Each unit will have a 220 V DC system comprising of two nos. of Ni-Cad/ Lead acid plate batteries, and two nos. of float cum boost chargers to supply power to DC emergency pumps, emergency lighting, protection, annunciation, indications and control etc. The required level of redundancy would be achieved with the interconnections between these two batteries and chargers. Each of the unit batteries shall be sized for supplying the total DC load of the unit for a period of 30 minutes under a complete black out condition. Separate two nos. of 220V DC Ni-Cad/ Lead acid plant batteries, along with two nos. of float cum boost chargers have been considered for switchyard requirements. Two nos. 50 V DC battery along with chargers have

also been considered for switchyard Power Line Carrier Communication (PLCC) systems. AWRS, CHP, Makeup Water, Raw Water and Colony switchgears shall have separate DC systems as indicated in Bill of Quantity.

15.00.00 EMERGENCY POWER SUPPLY SYSTEM:

For the safe shutdown of the plant under emergency condition and in case of total power failure, diesel generating sets shall be installed for feeding certain essential applications like battery chargers, emergency lighting, essential air conditioning/ventilation and all auxiliaries necessary for barring operation of main and BFP turbines etc. The unit emergency switchgear section shall be fed by 'one diesel generator of adequate capacity.

One Nos. Diesel Generator (DG) set per unit alongwith one standby DG set common for all the 04 units shall be provided as indicated in the single line diagram. Cable interconnection shall be provided from DG to respective unit emergency switchgear.

16.00.00 PROTECTIVE RELAYING:

The necessary protective relaying system according to established norms shall be provided for EHV switchyards, over head lines, generators, transformers, motors, auxiliary system etc., to minimize damage to equipment in case of fault and abnormal conditions. The summary of protection details to be provided for the equipment is given below:

16.01.00 Generator

1 Generator differential protection, 3-pole (87G) high impedance or biased type having operating time of 25 milli second or lower at 5 times the current setting.

2 87 GT - Overall differential covering generator, GT and unit auxiliary transformers.

3 Excitation transformer instantaneous and time delayed over current protection on HV side of excitation transformer, if applicable.

4 Accidental back energisation protection closure/flash over of EHV breaker or EHV isolator (96).

5 Stator earth fault protection covering 100% of winding (64G1) working on the principle of low frequency injection method.

6 Stator standby earth fault protection covering 95% of winding (trip) (64G2) with adjustable time delay.

7 Inter-turn fault protection.

8 Duplicated loss of field protection (40G1&40G2) with under voltage check feature.

9 Backup impedance protection, 3-pole (21G).

10 Negative sequence current protection (alarm) with I_2^2 t element for trip (46G);

11 Duplicated low-forward power interlock for generator (37G1&37G2).

12 Two stage rotor earth fault protection (alarm and trip) working on principle of continuously monitoring rotor insulation value even during machine shutdown period (64 F).

13 Definite time delayed over voltage protection (59G) for alarm and trip.

14 Over-fluxing protection (99G&99T) having inverse time characteristic suitable for matching generator/generator transformer over fluxing capability.

15 Generator under frequency protection with alarm and stage tripping (81G).

16 Local breaker back up (or breaker failure protection).

17 Pole slipping protection (98).

18 Monitoring of generator VT fuses.

In addition, the generator would have winding temperature recorders and instruments for measuring coolant temperature, flow, pressure, conductivity and purity, with alarm and trip contacts as necessary. The protection against stator overheating would be provided by the generator temperature monitoring system. Limiters for stator current, V/f, Rotor current and under excitation would be included in Automatic Voltage Regulator.

16.02.00 Generator Transformer and Overhead Connection:

1 Generator-transformer differential protection for individual phase (87T) bias type having instantaneous high set over current elements.

2 Over head line connection differential protection (87HV) covering overhead connections between generator transformer & breaker including HV winding of generator transformer.

3 Back-up earth fault protection on generator transformer HV neutral (51NGT).

4 Buchholz relay, winding temperature, oil temperature and oil level alarm and trip.

5 Fire protection to trip EHV generator / breaker, exciter field breaker and unit incoming breaker.

6 Accidental back energisation protection closure/flashover of EHV breaker, EHV isolator (96).

16.03.00 Unit Auxiliary Transformer:

1 Unit transformer differential protection 3-pole (87UT).

2 Unit transformer back up over current protection (51UT).

3 Unit transformer L.V. Restricted earth fault and standby earth fault protection (64 RUT & 51 NUT).

4 Bucholz relay, winding temperature, oil temperature and oil level alarm and trip

5 Fire protection to trip EHV breaker, exciter field breaker and 11kV unit incoming breaker.

16.04.00 Station Transformer/Interconnecting Transformer:

1 Transformer differential protection 3-pole (87T).

2 Back-up over current protection on HV and LV side (51 ST).

3 Restricted earth fault protection (64R) on HV&LV side

4 Back-up earth fault protection on LV side.(51 N)

5 Buchholz relay, winding temperature, oil temperature and oil level alarm and trip.

6 Fire protection to trip it's HV side breaker

7 Local breaker back up (or breaker failure) protection for the breaker on HV side of station transformer.

8 Over fluxing protection (99T)

9 Directional Back-up O/C and E/F protection on HV and LV (67 RYB/N for HV and LV) for ICT only.

17.00.00 ELECTRICAL CONTROL CONCEPT:

Central Control Room (CCR):

The complete control of generators and auxiliary system shall be provided in the DDCMIS system covered under "Control and Instrumentation" having large video screens. On the operation desk CRTs/Keyboard shall be provided so that operator can control all the breakers via DDCMIS.

The Switchgears shall have Communicable Numerical relay system -for protection, Controls, metering and monitoring of the Switchgears. The Switchgears shall have Communicable Numerical relay system for protection, Controls, metering and monitoring of the Switchgears. All the relays shall be networked to a dedicated HMI through data concentrator for Monitoring and supervision of all the breaker panels. All such data flow shall be linked to DDCMIS as well.

In addition to the above, the Substation Automation System LAN shall be extended upto Main Plant Control Room to facilitate control of switchyard bay equipment from Main Plant Control Room. A separate workstation shall be provided for this purpose in the Main Plant Control Room. All the data related to switchyard such as line /transformer loadings, alarms and annunciations etc. shall be available on this workstation.

Further, the exchange of SOE data between Generator Relay Panels (GRP) and DDCMIS shall be through a communication gateway, eliminating the need of hardwiring of protection signals between GRP and DDCMIS.

18.00.00 CABLES:

For HT cable, single core and three core XLPE insulated cables with aluminium conductor would be employed. For 415 V and DC systems, single core XLPE insulated cables with aluminium conductor would generally be used for higher current ratings and multicore XLPE/PVC insulated cables with aluminium conductor would be used for lower ratings. All control cables would be multicore, PVC insulated with copper conductors.

The cables shall be laid overhead/ in trenches or directly buried. Inter plant cabling for main routes shall be laid on overhead trestles/pipe racks.

The cables laid in EHV switchyards, transformers yards and those buried in earth would be armoured. All other cables would generally be unarmored. These cables would have FRLS properties.

19.00.00 STATION GROUNDING:

Buried grounding mats employing suitable dia. MS rods, shall be provided for EHV switchyards, main plant area, pump house etc, for keeping the step and touch potential within safe limits. All the connections above the ground would be of galvanized steel. Adequate lighting protection would be provided for EHV switchyards, transformers yards, all buildings and chimneys etc.

20.00.00 LIGHTING SYSTEM:

Adequate lighting arrangement shall be made for the entire power plant employing lighting distribution boards, panels, HPSV, T5 type fluorescent and incandescent (only for DC lighting) lighting fixtures, lighting masts etc.

Normal lighting of the plant will operate with the station AC supply. About 20% of these fixtures will also have arrangement for being fed from diesel generators on failure of station AC supply. Emergency DC lighting, which will normally be off, would be provided for all strategic locations. 24 V AC supply network in both boiler and turbine areas shall be provided for safe lighting

inside enclosed space for maintenance purpose.

21.00.00 SWITCHYARD:

21.01.00 Type: Conventional Outdoor:

Conventional outdoor switchyard has been considered for the project.

21.02.00 Proposed Arrangement for Power Evacuation:

The proposed arrangements for the project will be designed suitably after finalizing the beneficiaries'.

21.03.00 Bus Switching Scheme:

It is proposed to adopt the standard breaker and half switching scheme for the 400 kV switchyard.

21.04.00 Salient Features of Main Equipments:

1 Insulation Coordination:

The 400 kV system is being designed to limit the switching surge over voltage to 2.3 p.u. and power frequency over voltage to 1.5 p.u. All the materials/equipment shall perform all its functions satisfactorily without undue strain under such over voltage conditions. Consistent with these values and protective levels provided by the lightning arrester.

2 Switchyard Equipments:

400 kV Switchyard structures and bus work for connecting four (4) nos. Generator Transformers GT- 1 to GT- 4, Six (6) nos. 40 MVA Station Transformers, four (4) nos. Line bay feeders including 400 kV equipment such as Circuit Breakers, Disconnecting Switches, Current Transformers, Capacitive Voltage Transformers, Lightning Arresters, Wave Trap, etc., and their support structures & provision to be made for line reactors.

3 Protection of Switchyard Equipment & Outgoing Lines:

(a) Busbar Protection:

Each busbar will have a separate three phase differential protection alongwith area zone bus wire supervision and hand reset relays.

(b) Breaker Failure Protection:

All circuit breakers shall be provided with breaker failure protection to take care of stuck breaker condition. If in the event of fault, a breaker fails to trip on receipt of a trip command, the breaker failure protection shall de-energize that particular bus to which the faulty breaker is

connected and also send trip impulse to the remote end breaker to isolate the fault.

(c) Line Protection:

Each EHV line shall be provided with duplicated Numerical Distance Protections (Main I and II) based on different hardware platforms. These shall be of three zone carrier aided distance protection operating on permissive under-reach principle. Each line shall also be provided with a two stage over voltage protection

(d) Power Line Carrier Communication (PLCC):

Power line carrier communication equipment complete for speech transmission line protection and data channels shall be provided for the transmission line at both end of the line. For the purpose of matching of frequency of transmission and receivers at the two ends of the line, the equipment at both ends of the line shall be arranged by the Power Grid Corporation of India Ltd. Only wave trap and PLCC battery feeders have been considered for cost purposes.

(e) Metering System:

0.2 accuracy class Availability based Tariff (ABT) energy meters for export & import of active and export and import of reactive energy meters shall be provided for each outgoing lines, generator feeders/ICTs. Static meters of 0.2 Accuracy class have been considered for active energy measurement at other locations for energy accounting/trend analysis.

4 Control Philosophy for Switchyard:

The control, protection and data acquisition including SOE data for switchyard bays shall be accomplished by Substation Automation System comprising of Bay Control Units, Bay protection Units Operators Workstation, engineering Workstation, Large Video Screen (LVS) etc. The Bay Control Units and Bay Protection Units shall be located suitably either in Switchyard Control Room or in bay kiosks. The SA system will be based on standard communication protocol I EC 61850. The Substation Automation System shall facilitate following functionality:

i. Dynamic display of switchyard mimic, real time measurement values, etc.

ii. Monitoring ON/OFF status and remote closing/ synchronising o circuit breakers, isolators and earth switches

iii. Display of Switchyard alarms, events and trends

iv. Interlocking functions

v. Sequential Event Recording

vi. Communicating with protection relay lEDs for settings and Disturbance Recording functions

vii. System self supervision

viii. Hard copy printing and other network functions

As already described in control philosophy for CCR, it is also proposed to provide two numbers of OPC compliant gateways in the station level network such that desired interface with main plant DCS can be achieved. Two (2) more gateways each shall be provided in the station level network for sharing information with RLDCs. These two would communicate through IEC:60870:5:101 standard protocol.

22.00.00 CONSTRUCTION POWER:

The requirements of the construction power supply for the project would be met at 33 kV level from the CSEB's nearby receiving station situated in Mine area. Necessary 33 kV substation and 33 kV ring main/LT sub-stations shall be provided for the required power plant area.

23.00.00 BLACK START FACILITY:

The arrangement to get the black start-up power from the Grid shall be as per the Regional Load Dispatch Canters (RLDCs) start-up procedure of the region. Hence no separate dedicated black start facility is being envisaged for this project.

24.00.00 ELECTRICAL LAB EQUIPMENT:

One set of electrical lab equipment shall be provided for the plant.

CONTROL & INSTRUMENTATION SYSTEM

1.00.00 GENERAL:

The function of the Control & Instrumentation System would be to aid the operator in achieving safe and efficient operation of the unit, resulting in cost effective power generation with optimum fuel consumption and reduced emission levels. The C&I system would be of the type which normally relieves the operator of continuous duties and would take pre-planned corrective actions in case of process drift or if unsafe trends or conditions develop in any regime of operation viz. start-up, shutdown, normal working and emergency conditions. The design of C&I system would be such as to permit on-line localization, isolation and rectification of fault in the minimum possible time.

2.00.00 CONTROL ROOM CONFIGURATION & LAYOUT:

It is proposed to have air-conditioned Common Control Room for all the three units at operating floor along with Programmer's Room, UPS etc. The boiler, turbine and generator along with their associated auxiliaries would be controlled and monitored from the Common Control Room. The control system cabinets and equipment would be located in air-conditioned Control Equipment Room (CER) at operating floor. UPS, 24V DC Modular Power Supply and associated batteries would be located at + 8.5 meters below CER. It is proposed to locate Steam and Water Analysis System (SWAS) room for the unit at +0.0 meters. The exact locations of these items shall be finalized according the main plant layout.

3.00.00 UNIT CONTROL & MONITORING PHILOSOPHY:

As per the currently used practices for main plant control, Large Video Screens (LVS) would be provided for all regimes of operation. A Unit Control Desk (UCD) for mounting monitors / Keyboards (KBDs) would also be provided which shall generally be used as a back-up for all regimes of operation. For operation during disturbed/emergency operating conditions in the plant, very few back-up conventional devices / instruments like hardwired TRIP push button stations, would also be provided on the UCD itself in draw-out sections.

The control, monitoring & operation of the off site and auxiliary plants shall be carried out from control desk of the respective plants / combined control rooms. Large scale integration of control systems, unification of various control areas shall be attempted to economise on number of operation and maintenance staffs, inventory etc. in line with recent practices. It shall also be possible to control all the plant auxiliary system with DDCM1S based control system through redundant station wide LAN or other wise.

For all such plant information, link shall be provided for collections of data in the main plant control room for the information of unit-incharge/shift-incharge etc. through Station Wide LAN,

4.00.00 MEASURING INSTRUMENTS (PRIMARY & SECONDARY):

The primary measuring instruments such as transmitters, switches, sensors etc., for the measurement of parameters like pressure, temperature, level, flow etc., would be used. Use of local gauges / switches shall be kept as minimum. Measurements like coal bunker level, coal feeder speed etc., and all other measurement systems required to ensure complete and satisfactory operation would also be included. Microprocessor based vibration monitoring system for monitoring of vibration of major equipments would also be provided. In view of the all round stress on clean environment and environmental monitoring instruments such as SOx, NOx, O_2, CO_2 and dust emission measurements shall also be provided.

5.00.00 DISTRIBUTED DIGITAL CONTROL, MONITORING & INFORMATION SYSTEM (DDCMIS):

In line with current practices, microprocessor based Distributed Digital Control, Monitoring & Information System (DDCMIS) would be provided for the safe, reliable and efficient operation of Steam Generator (SG), Turbine Generator (TG) and Balance of Plant (BOP) and all auxiliaries.

It is proposed to use optimum number of two-tier Large Video Screen (LVS) and Monitors for the purpose of control, information and alarm monitoring as mentioned above. Each of the screens would be 100% interchangeable (i.e. control or monitoring or alarming function for any part of the plant can be performed from any Monitor) and would provide complete control, monitoring, supervisory and display functions for control system variables and control system status. Changes in system configuration, tuning constants and similar engineering and maintenance functions would be done from Engineer/Programmer console.

Adequate numbers of printers would be provided for logs, reports and alarms. In addition to this, historical data storage and retrieval system would be provided.

Alarm Annunciation System and Sequence of Events Recording System (SERS) will be envisaged to be performed in DDCMIS itself.

It is envisaged to provide alarm analysis system for this project. Advanced software packages, which result in improving the efficiency of power plant operations such as heat rate, combustion efficiency, plant life monitoring etc. would be examined and included during specification stage.

Master and slave clock system would be provided to ensure uniform time indication throughout the plant and also for time synchronization among various microprocessors based control systems.

5.01.00 SG-C&I System:

The SG -C&l system would generally include the following:

1. Furnace Safeguard Supervisory System for Boiler
2. Auxiliary PROS Control
3. Soot Blower Control
4. Coal Feeder Control, etc.
5. Boiler Metal temp, Boiler Drains & Vents including Start up Drains & vents.
6. Other miscellaneous SG related controls

5.02.00 TG-C&I System:

The TG -C&l system would generally include the following:

1. EHG Control System
2. Automatic Turbine Run Up System (ATRS)
3. HP-LP Bypass Control System
4. Main & BFP Turbine Stress Control System (TSCS)
5. Automatic Turbine Testing System (ATT)
6. Turbine Protection System
7. Main & BFP Turbine Supervisory Instruments (TSI)
8. Generator Auxiliaries Control System
9. TG Area Vents, Drains including start up Drains & Vents
10. Other miscellaneous TG related controls

5.03.00 Balance of Plant (BOP) C&l System

The balance of plant C&l system would generally include the following as a minimum:

1. Modulating Control of the Steam Generator
2. Modulating Control of the Feed Water/Condensate Cycle
3. Binary Control of the Auxiliaries of the Steam-Generator (SG)
4. Binary Control of the Auxiliaries of the Turbine-Generator (TG)
5. Control of Electrical System Breakers and Balance Equipment
6. Other miscellaneous controls for common / off-site areas.

5.04.00 Ash Handling System DDCMIS:

Ash Handling Control System comprising of binary and modulating Controls of dry and wet ash handling system, bottom ash handling system etc

5.05.00 Coal Handling System DDCMIS:

Coal Handling Control System comprising of binary and modulating controls, of crushers , conveyers, dust suppression systems etc.

5.06.00 Water System DDCMIS:

Water System Control System comprises the binary and modulating controls of DM plant, CPU Re-generation system, PT plant, Liquid Effluent Treatment system, Cooling Tower system, Ash water recirculation system etc.

5.07.00 Make Up Water System DDCMIS:

Make up Water Control System comprises of binary and modulating controls of make-up water pumps, Raw water pumps etc.

5.08.00 Other Common System DDCMIS:

A Stand-alone common system shall be provided for control and monitoring of some common system plant like Compressor, CW system, Air conditioning System, Ventilation system etc. and for some station level controls / supervisory functions.

6.00.00 CONTROL AND INSTRUMENTATION FOR PLANT AUXILIARY PACKAGES LIKE FIRE PROTECTION ETC.:

Microprocessor based system along with intelligent detectors for Fire Alarm and Protection system and associated cables and accessories.

PLC based control and instrumentation systems for Fire water pump house, Foam system pump house and Hydrant Booster pump house.

All the above system will be connected to Station LAN. Provision for operation of the above systems through supervisory control.

7.00.00 STEAM & WATER ANALYSIS SYSTEM (SWAS):

Recognizing the importance of water chemistry in the power plant a comprehensive Steam and Water Analysis System (SWAS) is envisaged for on line analysis of chemical parameters at all critical points in condensate, feed water and steam cycle.

8.00.00 POWER SUPPLY SYSTEM (UPS & DC SYSTEM):

To provide AC & DC power supplies to various C&l systems under SG, TG & BOP C&l systems, following power supply has been envisaged in line with present practices.

Uninterrupted Power Supply (UPS) system to feed AC load like Human Machine Interface (HMI) and peripherals of DDCMIS and SG/TG C&l system, etc. The UPS would consist of chargers, inverters, batteries and distribution boards.

Independent 24V DC modular DC power supply systems with Ni-Cd batteries shall be provided for independent control systems. Each set of power supply system shall consist of 2X 100% chargers, 1X100% Nickel-Cadmium batteries for one hour duty, 1X100% DC distribution board for powering the DC load requirement of Contractor's system.

Major Control systems like SG-C&I system, TG-C&I system, BOP-C&I system, CW pump house, Water system -etc. shall be provided with two such sets ol power supply system.

Remote I/O cabinets wherever feasible shall be powered from the nearest power supply system to the extent possible, considering the voltage drop requirements. For other remote I/O cabinets independent power supply modules with sealed maintenance free Ni-Cd batteries, suitable for mounting in remote I/O cabinets shall be provided.

Intelligent Battery management system shall be provided for each set of 24VDC power supply system of rating 300 Amps or above and UPS batteries.

9.00.00 CONTROL VALVES, ACTUATORS & ACCESSORIES:

Control valves would be pneumatically operated in most of the applications. However, for few applications electric/hydraulic actuators would be employed. Electronic microprocessor based positioners shall be provided for pneumatic control valves and dampers.

10.00.00 INSTRUMENTATION CABLES:

All instrumentation cables including both prefabricated and non-prefabricated type would be with Fire Retardant Low Smoke (FRLS) type Poly Vinyl Chloride (PVC) overall sheath. Multi pair cables of 0.5 sq. mm. shall be used extensively for C&l cables. Wherever required prefabricated cables may also be used. Fibre optic cables shall be provided for Remote I/O bus, CCTV, Station LAN etc.

11.00.00 PUBLIC ADDRESS SYSTEM:

A central exchange based Public Address (PA) system would be used to provide proper communication throughout the plant (including Coal Handling Plant) with the help of handset stations, loudspeakers, potable handset stations etc.

12.00.00 CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM:

In addition to public address system, to provide security and surveillance of different operating areas in the plant and as an aid to operators Digital Closed Circuit Television (CCTV) system would also be provided. Adequate number of dome type cameras with facilities like zoom, pan, tilt etc. would be provided at various operating areas. The monitors would be located at control locations such as central control room, operation in-charge room etc. CCTV System shall be interfaced with DDCMIS MMIPIS to portray plant images on the LVS.

13.00.00 PROCESS CONNECTION & PIPING:

Impulse pipes, Instrument air/ Service air headers and pipes shall be provided on as required basis along with all supports.

All process transmitters/switch devices would be installed in Local Instrument Enclosures (LIE) in boiler area and in Local Instruments Racks (LIR) in turbine area. LIRs will not be provided for auxiliary plants where grouping of instruments is not feasible.

14.00.00 MAINTENANCE & CALIBRATION EQUIPMENT:

One set of maintenance and calibration equipment has been envisaged. It would consist of calibration equipment required for maintenance of C&l system /devices used in the unit. The exact equipments/ items including those required for maintenance, re-commissioning of fibre optic cables shall be procured in consultation with site.

15.00.00 PLANT PERFORMANCE ANALYSIS, DIAGNOSIS & OPTIMIZATION SOFTWARE (PADO):

The PG based online plant Performance Analysis, Diagnosis & Optimization (PADO) system for the station shall be provided. The PADO shall incorporate the complete thermal design model of the unit. The system shall use the measured data from the Distributed Digital Control, Monitoring & Information System (DDCMIS) through appropriate interface.

The PADO system shall provide the following functions in a modular and seamlessly integrated environment, using a common plant model and a dynamically shared database.

i) Performance analysis and monitoring of systems and components,
ii) Emission analysis and monitoring.
Hi) System and performance diagnosis
iv) System and performance optimization.
v) Boiler performance optimization including optimized operation of soot blowing system.
vi) Boiler stress condition analyzers
vii) Interactive water and gas chemistry management system
viii) Regenerative cycle performance optimization system.

ENVIRONMENTAL ASPECTS

1.00.00 REGULATORY REQUIREMENTS:

Necessary regulatory clearances from State Pollution Control board and Ministry of Environment & Forests will be obtained. This will be in accordance with the procedures laid down in the EIA Notification dated 14th September, 2006. Environmental Impact Assessment Report will be prepared and State Pollution Control Board is approached for conducting Public Hearing.

The various measures proposed to be adopted to minimize the pollution from the proposed Surguja Thermal Power Project are as follows:

2.00.00 POLLUTION CONTROL MEASURES :

2.01.00 Air Pollution Control System:

The major air pollution control systems are following:

2.01.01 Electrostatic Precipitators:

High efficiency Electrostatic precipitators (ESP) of 99.9% would be installed to control the emission of fly ash particles. The precipitators would be designed to limit the particulate emission to 50 mg/Nm3 under all design conditions. To ensure the safe and optimum operation of the ESP's, each stream of precipitator would be supervised and monitored by a separate microprocessor based rapper control EP Management System (EPMS). It would also monitor and display the status of ESP stream.

2.01.02 Stack:

To facilitate wider dispersion of emissions, 1 no. of single stack four flue Chimney of 275 m height will be provided. The chimney would be provided with personal access for regular monitoring of stack emissions.

2.01.03 Dust Extraction and Suppression System:

For the control of fugitive dust emission within and around the coal handling plant, coal dust extraction and suppression systems would be provided. Dust suppression system would be installed at all the transfer points in CHP and at coal stack yard. Dust extraction system would be provided in crusher house.

2.01.04 Space Provision for Lime dozing. in future:

Space provision for retrofitting Lime dozing system would be kept in the layout.

2.02.00 Water Pollution Control System:

An effluent management scheme would be implemented with the objective of optimization of various water systems so as to reduce intake water requirement which would result in lesser waste water discharge. The effluent management scheme would essentially involve collection, treatment and recirculation / disposal of various effluents. Adequate treatment facilities would be provided to all the waste streams emanating from the power plant to control water pollution. This would include cooling towers to control thermal pollution and physico-chemical and biological treatment for other effluents. Efficient operation of these treatment plants would be ensured so that the quality of effluents conforms to the relevant standards, prescribed by the Regulatory Agencies. All the treated effluents would be discharged through a single point outlet from Central Monitoring Basin (CMB).

The effluents from STPS can be broadly classified into the following broad categories:

a. Thermal discharges from Condenser cooling water.
b. Miscellaneous wastes like Coal Handling Plant waste, Service Waste Water, Oily Waste Water, DM Waste Water.
c. Effluent from ash pond.
d. Sanitary waste from plant and township.

The treatment proposed for the above effluents is briefly discussed below:

2.02.01 Condenser Cooling System:

A closed cycle condenser cooling system with cooling towers is envisaged to minimise thermal discharges from the plant. However, periodic blow down from the system would have to be resorted to avoid build-up of TDS. The blow down would be sent to the Central Monitoring Basin (CMB) for dilution and disposal.

2.02.02 Settling Pond for Coal Handling Plant Waste:

The waste from coal handling plant would be high in suspended solids. A settling pond would be provided and waste from coal stockyard, crusher house, track hopper, transfer points etc. would be routed to the settling pond. The decanted waste from the settling pond would be sent to CMB for further dilution and disposal.

2.02.03 Oil Separator for Oily Wastes:

Oil separator will be provided to trap oils from effluents arising from oil handling area.

2.02.04 Service Waste Water:

The service water effluent drains shall be separately routed to a sump and treated in plate separator/ tube settler for treatment of suspended solids.
The treated service water would be discharged through the main plant drain to CMB.

2.02.05 Neutralization Pit:

DM Plant effluents will be neutralized in neutralization pit before routing to the Central Monitoring Basin (CMB)

2.02.06 Sewage Treatment Plant for Sanitary Wastes from Plant and Township:

The sewage from plant and township would be treated in a sewage treatment plant. It would be provided with extended aeration system to control BOD and suspended solids. The treated sewage conforming to prescribed standards would be either utilized for plantation purpose or would be discharged.

3.00.00 NOISE:

The major noise generating sources are turbines, generators, compressors, pumps, fans, coal handling plant etc. Acoustic enclosures shall be provided appropriately to control the noise level below 90 dB (A). Personal protective equipments shall be provided to the persons working in high noise area.

4.00.00 SOLID WASTE MANAGEMENT:

Surguja TPP, being a coal fired power station, would generate large quantity of ash. All efforts would be made to utilize the fly ash for various purposes. However, unused fly ash and bottom ash would be disposed off safely by mine backfilling.

5.00.00 GREEN BELT DEVELOPMENT:

Green belt of suitable width will be developed around at he project. Extensive afforestation at plant township and ash disposal area will be undertaken which would not only act as lung space in the area but would also improve aesthetics.

6.00.00 FLY ASH UTILIZATION:

Ministry of Environment & Forest's Notification on Ash Utilization dated 14-09-1999 and its amendment dated 27-08-2003 stipulates that new power stations shall have to utilize ash to the extent of 30% in 3 years of commissioning and to attain 100% utilization by 9th year.

Adani Group as a socially conscious company considers utilization of ash produced at its coal based power station as a thrust area of its activities. The proposed thermal power project (4X135 MW) in Distt. Surguja shall produce about 2.5 Million tonne of ash annually. In order to gainfully utilize the ash in various application areas and to meet the requirement of gazette notification for ash utilization following actions are proposed.

1. The company shall provide system for 100% extraction of dry fly ash along with suitable storage facilities. Provision shall also be kept for segregation of coarse and fine ash, loading this ash in to closed / open

trucks. This will ensure availability of dry fly ash required for manufacture of Fly Ash based Portland Pozzolana Cement (FAPPC), asbestos cement products, use in cement concrete works, ash based building products and other uses of ash.

2. The company shall make efforts to motivate and encourage entrepreneurs to set up ash based building products such as fly ash bricks etc.

3. Pilot cum demonstration fly ash brick manufacturing plant shall be set up at this thermal power project and bricks produced shall be utilized in the construction activities and also for demonstration to the local entrepreneurs to encourage them for manufacturing ash bricks in the area.

4. To promote use of ash in agriculture / wasteland development - show case project shall be taken up in the vicinity of power stations.

5. All government/ private agencies responsible for construction/ design of buildings, development of low lying areas, and construction of road embankments etc. within 100 kms of the plant area shall be persuaded to use ash and ash based products in compliance of MoEF's gazette notification.

6. Any, unused fly ash and bottom ash would be disposed off safely by mine backfilling.

With all the efforts mentioned above - it is expected that fly ash generated at the thermal power stations shall be utilized in the areas of cement, concrete and asbestos cement products manufacturing, brick manufacturing, road construction etc. However, in order to prepare realistic road map for 100% Ash Utilization, detailed market study shall be carried out. Based on the recommendation of study, detailed Road Map for 100% Ash Utilization in line with MOEF gazette notification shall be prepared and submitted to the regulatory authorities.

COST ESTIMATE & FINANCIAL ANALYSIS

6.1 Cost Estimates:

The project is proposed to be set up at an aggregate cost of Rs. 3,500 crores comprising of expenditure towards land, EPC cost, water, Township, Coal transportation cost, transmission line, preliminary and pre-operative expenditure, contingencies, Interest during Construction and Margin Money for working Capital.

A summary of components of Project Cost is given below:

Particular	Estimated Cost (Rs. in Crores)
Land & Site Development	20
Engineering, Procurement & Construction Cost	2750
Township	35
Water Arrangement	15
Coal Supply Arrangement	30
Transmission Line	150
Total Hard Cost	**3000**
Pre-operative Expenditure	60
Interest During Construction Period	285
Contingencies	65
Margin Money for working capital	90
Total Cost	**3500**

6.2 Financing Structure:

The Project cost is estimated at Rs. 3,500 Crore & is proposed to be finance with senior debt, sub debt & equity in ratio of 70:30. The proposed components of financing are:

Particular	Rs Crores	%
Capital Contribution – Equity	1050.00	30
Senior Debt Finance	2450.00	70
Total	3500.00	100

6.3 Interest during Construction Period:

The interest during construction (IDC) period estimated at Rs. 285 Crore has been calculated assuming an implementation period of 27 months for the first unit and

thereafter each unit shall be commissioned within an interval of 3 months each for the fourth unit from Notice to Proceed (NTP) to EPC contractor.

6.4 Working Capital:

The provision for margin money for working capital has been made at Rs. 90 Crore.

PROJECT IMPLEMENTATION

1.00.00 PROJECT SCHEDULE:

The commercial operation of the first unit will be in 27 months from Financial Closure and subsequent units at an interval of 3 months thereafter.

The implementation schedule of Surguja Thermal Power Project (4X135 MW) is indicated in EXHIBIT-2 which shows optimum schedule for the project with different activities shown in bar chart. The zero date of the project has been reckoned from Main Plant Award. Activities like evaluation of tenders, commercial negotiations, finalisation of contract and placement of orders have been shown from the date of investment approval to the placement of main plant order

2.00.00 PROJECT MANAGEMENT"

The major phases of the project during its implementation are classified as under: -

- Design and engineering phase
- Tendering and award phase
- Manufacturing
- Inspection and expediting
- Construction/erection phase, and
- Commissioning phase

The methodology adopted for executing the project is elaborated below.

2.01.00 Planning Phase:

2.01.01 Contract Packaging:

The Company intends to implement the project through a single EPC Contract. The EPC contract will cover complete mechanical, electrical, instrumentation and associated civil works including site development and approach roads but excluding colony. The colony would be executed through a separate contract.

Indicative scope of the packages envisaged is as below:

a) EPC Package:

EPC Package will include Steam Generator & Auxiliaries, Steam Turbine Generator & Auxiliaries, Power Cycle equipment including BFPs, CEPs, Regenerative system LP & HP Heaters, Deaerator, HP Piping, HP & LP Bypass Systems, Station C & I, plant electrical systems like Switchyard, HT & LT Transformers, packages like Coal Handling System, water intake system, Ash Handling System, Water treatment & DM Plant, CW System, Fire Protection System, Instrument & Process air system, Cranes & hoist, Plant Miscellaneous pumps, Piping and Systems; and Civil, structural and architectural work of the plant including Civil works for all equipment, all buildings in the plant, chimney, Cooling towers, civil works for off-shore structures, etc.

EPC Contractor will establish a comprehensive reporting structure, which broadly includes:

- Management Reports – Progress Reports, Exception Reports, etc.
- Quality Assurance and Control Programme – Shop and site
- Site Safety, Health and Environment
- Statutory Permits and Clearances

b) Other Works:

This will be carried out by SPPL through separate contractors / suppliers. This will include procurement of standard tools, mobile equipment, fire tender and construction of residential colony.

The development of EPC package is initiated at the stage when the Feasibility Report is being considered for approval. The EPC package is developed before finalisation of the Master Network programme of the project to ensure that Master Network heads are developed in accordance with the EPC package for better monitoring and control.

2.01.02 Master Project Implementation Programme-Master Network (MNW):

The Master Network identifies the key milestone dates for each package in the area of engineering, procurement, manufacturing, dispatch, construction, erection, testing & commissioning. The Master Network, which is the overall programme of the project implementation, will be finalized in consultation with the EPC Contractor and Implementation Consultant. The date of Notice-to-Proceed of the EPC contract will be the zero date of the Master Network.

2.01.03 Implementation Consultant:

The Project Company will monitor the project in consultation with Implementation Consultant, who will assist them through out the development of the Project, from preparation of RFP document for the EPC Contractor till handing over of the Plant by the EPC Contractor.

The Implementation Consultant would undertake the various tasks related to the engineering, design, project implementation/management and monitoring. Apart from this, they would also provide necessary engineering back up support during construction, installation and commissioning at site.

The drawings and documents generated by the EPC Contractor would be reviewed and checked/ approved by the Implementation Consultant to ensure the following:

- Compliance to the contract requirements

- Compliance to the various local/ statutory authorities
- Correct design and technology
- Various interfaces amongst various systems / equipment / sub-contractors

Further, Implementation Consultant will also be involved in shop inspection of various critical equipment / components in line with the agreed project quality assurance plan.

Implementation Consultant will also be involved in ensuring field engineering / construction quality as well as ensuring that the contractor meets all guaranteed parameters during performance testing of the Unit.

2.02.00 Tendering, Award of Contracts & Engineering Phase:

2.02.01 Engineering, Planning, Monitoring and Control:

The Basic Engineering Studies are initiated as soon as Feasibility Report has been submitted and all major technical parameters of the project are finalised and documented as part of Revised Cost Estimates (RCE) alongwith the detailed estimates of cost and quantities.

The Engineering plan and schedule the project engineering activities within the time frame specified for the engineering milestones in the finalised Master Network. The Engineering programme at Level-2 accordingly shows the dates for data availability, tender drawing release, specification release, bid evaluation and construction drawing release, etc.

The schedule drawn up by each Engineering discipline also takes into consideration the assistance from External Engineering Consultants that can be advantageously supplemented to the internal resources depending upon the complexity of an equipment system, the need for inducting latest available technology, the large quantum of fairly simple engineering work, etc. The engineering manpower resources are then allocated depending upon the priorities in the schedule of each engineering discipline.

Departmental reviews are conducted by Project Engineering Coordinators to evaluate the work actually performed vis-a-vis detailed schedules. Corrective actions within the scope of the discipline heads are identified and the plans updated. The Engineering status appraisal from the heads of different Engineering Disciplines is then reviewed to check the various areas of specification release, bid evaluation, drawing releases, etc. against the target level-2 programme dates. If any delay is expected to affect the schedule of other control centres, the corrective action to rectify the situation by either re-allocating priorities of internal resources or by seeking the assistance of External Engineering Agencies is resorted to.

2.02.02 Contracts Planning, Monitoring and Control:

Based on the key event dates identified in the Master Network, detailed plan for pre-award activity up to award of contract is finalised and monitored vigorously.

When the EPC Contract is awarded, detailed programme in the form of networks is tied up with the EPC contractor to clearly indicate the owner's obligation and the EPC Contractor's responsibilities. The owner's inputs in terms of land availability, construction power/water availability, civil fronts etc. while that of the EPC contractor's in terms of drawing submission, manufacture, supply, transportation, erection and commissioning is clearly brought out in the programme.

Monthly progress reports are generated for monitoring & tracking purposes.

2.02.00 Manufacturing, Inspection and Expediting Phase:

2.03.01 Inspection and Expediting:

Visits will be made periodically to the works of equipment supplier, in coordination with EPC contractor, for inspection and ensuring that works progress as per schedules. The manufacturing & quality plans finalized at the time of contract award would be utilized for monitoring the manufacturing & quality status. Specified reports at regular intervals would be submitted highlighting the areas of schedule variations, if any, their likely impact on delivery schedules, any recommendations for improvement etc.

2.03.02 Quality Assurance:

An independent Quality Assurance Group for ensuring the quality during the project engineering, procurement and manufacturing, as well as during material storage is organized in the Corporate Office. The EPC Contractor would be asked to follow a comprehensive Quality Assurance and Control Programme developed by the Project Company/Consultant for the entire project. The quality control and assurance activities would be supervised by the Project Company/Implementation Consultant and / or through the appointed offsite approved agencies for shop as well as field activities.

Before the award of the contract the QA deptt. shall discusses with the prospective EPC contractor and finalize mutually acceptable inspection programme and detailed quality plans. In the post-contract stage, the inspection reports generated by the inspectors are reviewed to evaluate the quality status with respect to the specified levels and necessary coordination of all actions necessary to ensure the achievement of the required quality levels.

The quality plans after discussions and finalization with the contractor form a part of the contract document.

2.04.00 Construction Phase and Commissioning Phase:

2.04.01 Construction Planning, Monitoring and Control:

Site activities start progressively with the award of EPC Contract based on the Master Network schedule (Level-1 network), during the award, Level-2 networks are finalised, keeping in view the interface events needed to be realised. Execution group at site starts interaction with the EPC contractor soon after the receipt of the Letter of Award to establish the site office. Based on the L-2 network, site Field Engineering Group also starts interaction with Central Engineering Group to get the required drawings in the sequence in which they are needed for continuous work for the next six months.

2.04.02 Project Review Team Meeting:

A Project Review Team headed by the Project Head with members from various departments at the head office and site is constituted for every project to review the progress of project on a monthly basis. The meeting of the team is conducted every month. This is chaired by the Project Head and attended by different departments of Head Office and Site. The meeting reviews both pre-award and post-award progress of EPC contract.

Interface problems among Engineering, Contracts and Site affecting project execution are also reviewed and appropriate decisions taken to expedite the release of drawings, materials and such other requirements.

Budgetary review is also done during this meeting and shortfall, if any, identified and responsibility center fixed to get the commitment.

OPERATION & MAINTENANCE PHILOSOPHY

1.00.00 GENERAL:

The purpose of this section is to broadly outline the operation and maintenance philosophy to be adopted for this project. This will act as a useful input for basic as well as Detailed Engineering of the Project so that all required provisions for optimum Operation and Maintenance of this plant are made during the Engineering stage itself.

2.00.00 OPERATION PHILOSOPHY:

2.01.00 Overall Requirement:

2.01.01 Base Load Station:

TPP at Surguja will be a pit head coal based station and will be basically designed to work as base load station.

2.01.02 Design:

The design of Surguja (4X135 MW) TPP will cover adequate provision for the following:

a) Capability of rapid unloading from full load to no load under controlled conditions in not more than 20 minutes to minimize turbine cooling.

b) Capability to achieve full load within 30 minutes after synchronising subsequent to an 8 hour shutdown (overnight).

2.01.03 House Load Operation:

The main plant, auxiliaries as well as all associated systems and controls will be designed to permit house load operation, without shutting down the unit in the event of sudden loss of load demand due to tripping of transmission lines or other grid disturbances. It should also be designed for part load operation on consistent basis.

2.01.04 Participation in Load Frequency Control:

The design of main plant control systems will permit participation of variable pressure operation and two shift operation in load frequency control in the event of system disturbances.

2.02.00 DESIGN FOR HIGH UNIT AVAILABILITY:

2.02.01 General:

High availability of the unit and all associated auxiliaries and sub-systems is one of the main O&M objectives for ensuring high PLF and low partial loading. This

objective will be implemented by adopting the following principles: -

a) Use of equipment and systems whose design performance and high availability has been fully established by a considerable record of successful operation for similar service conditions in coal fired utility power stations.

b) Use of only field proven design concepts and conservative designs.

c) Special consideration for proper approach for ease of operation and maintenance while selecting the equipment and while finalizing the location and layout plans.

d) Strict implementation of quality assurance norms during design, manufacture as well as installation and commissioning stage.

e) Strict compliance with approved commissioning documentation, comprising of Standard Checklists, Testing Schedules and Commissioning Schedules etc., forming a part of commissioning documents for the project.

f) Easy accessibility and maintainability of the equipment shall be the prime consideration during selection of the same.

g) Approachability of equipment for easy operation shall be considered during detailed engineering stage.

2.02.00 Sizing of Critical Equipment-Margins & Standby:

Provision of adequate margins will be made while sizing all-important auxiliaries and sub-systems to ensure operation of the unit under the worst conditions and after normal wear. The following aspects will be kept in view:

a) The unit as a whole shall be suitable to generate at 105% of the name plate rating on a sustainable basis to meet the requirement of the grid.

b) Each major equipment (fans, BFP's, CEP's, CC pumps, ECW pumps, CW pumps etc) will be capable of meeting 60% of Boiler MCR requirements. However, while sizing adequate range-ability and turndown capability will also be provided for proper operation of related control systems.

c) The unit and equipment control system shall be designed in such a way that the unit will survive the loss of major equipment and continue to operate at a lower load.

d) The number and size of Feeders will be so selected that with worst coal at BMCR one Feeder will be spare. With worst coal at TMCR and

also with design coal at BMCR two Feeders will be spare.

2.02.03 Coal Handling Plant:

The design and sizing of coal handling plant has an important bearing on station plant load factor. Hence, the following steps will be taken while designing the coal handling plant so as to ensure high PLF for the stations:

a) CHP shall be able to meet the daily coal requirement considering 101% PLF and design coal.

b) Adequate standby capacity will be provided in the coal handling plant and for crushers so that outage of a single crusher or other equipment will have no effect at full load operation of station with worst coal.

c) CHP evacuation rate shall match with coal transportation system unloading rate such that there is no detention of loaded coal rake at the track hopper/wagon trippler terminal.

d) Adequate number of properly designed suspended magnets and online magnetic separators, Metal Detectors will be provided to segregate magnetic and non-magnetic materials respectively.

e) To minimise the dust nuisance in CHP area, effective dust suppression system shall be provided in wagon tippler, bunker floor, transfer points and stockyard. Dust extraction system shall be provided in the crusher house.

f) Effective provision shall be made for accurate and reliable measurement of incoming coal and coal consumed by each unit.

g) In order to take care of unforeseen disruption in coal supplies, coal stockyard equal to 15 days full load requirement will be designed at station end.

h) In order to avoid flooding of underground portions, all conveyor galleries shall be over-ground except wagon tippler and connected conveyors.

i) Coal bunkers shall be designed to avoid choking /rat holing etc. after carrying out coal flowability studies.

J) Provision of blending of different types of coal shall be kept while designing CHP so as to feed coal to bunkers within reasonable quality range.

2.03.00 Design for Efficient Operation:

The basic and Detailed Engineering of the project will be done so as to help in

achieving high standard of Operational Performance especially with respect to efficiency & Heat Rate. This may include the following key indices.

a) Low auxiliary power consumption

b) Low make-up water consumption

c) No oil support above 40% MCR operation.

d) Optimum efficiency and heat rates for the units and their sub system by achieving design parameters.

Provision will be made for accurate and reliable measurement of coal receipt, coal consumption per unit oil receipt and oil consumption per unit, total D.M. Water production and make-up water consumption per unit, generator output, auxiliary power consumption, flue gas oxygen content etc. These values will be fed to Information System (IS) and daily reports regarding receipt, consumption and stock position will be prepared.

Adequate provision of sequence controls, safety interlocks and protection, automatic modulating controls and operator guidance messages through CRT will be made to assist the operators in safe and efficient operation of these units.

Provision will be made for on-line performance calculations for the unit and major sub-systems in DAS. On line CRT display of heat rate penalties due to deviation of key parameters from the design values will be provided by HMI.

Provision shall be made to monitor power being exported from the station.

TO ACHIEVE OPTIMUM EFFICIENCY, FOLLOWING PROVISIONS SHALL BE MADE:

a) Spray water for reheater steam shall be tapped from feedwater line after the high pressure heaters to take advantage of the gain due to feedwater heating. However, to compensate for the passing of spray control valves due to excess spray water pressure, multistage or equivalent valve shall be used before spray control valves.

b) Condenser shall have an on line tube cleaning system. Provision shall also be made to supply condenser with clean & suitably chemically treated water to avoid fouling in condenser tubes and for proper functioning of the tube cleaning system.

c) High pressure feedwater heaters shall be designed for negative TTD to gain maximum heat from extraction steam.

d) Optimum heat transfer in boiler 'shall be monitored and effected by installing a boiler cleanliness monitoring system. Intelligent soot

blowing using the above should be a part of the system.

e) HP and IP turbine first few stage fixed & rotating blades shall be designed so as to have minimum erosion between Overhauls.

f) Turbine shall be provided with high and sustained efficiency seals, with proven record of satisfactory performance.

g) Large equipments like ID fans shall be provided with variable frequency drive to reduce power consumption during part load operation.

h) Tubular Air Preheaters shall be provided to completely avoid the air leakage.

i) Care shall be taken not to use film type fills in CTs to avoid blockage and efficiency loss.

j) ESPs and associated Flue gas treatment equipments shall be designed to achieve parameters better than latest environmental norms for chimney gas without flue gas conditioning.

2.04.00 Instrumentation for Efficiency Monitoring:

a) Flue gas exit temp, measurement shall be done using multiple thermocouple sensing from different points of a grid in the cross section of duct

b) Pr. Helium Detector/Temp, measurement instruments at HP & IP turbine inlet and outlet, all extraction lines, drip lines and heater inlet/outlet feedwater line are required to be of very high accuracy to provide accurate temp. Press measurement for correct cylinder efficiency & heater performance calculations condenser performance with on line instruments.

c) Flue gas sampling provision at Air Preheater inlet and outlet shall be of multiple probe type for collecting samples from different points in a grid across the cross section.

d) High temperature O_2 probes shall be provided at the furnace exit so as to monitor combustion efficiency.

Instrumentation for Reliability:

Main turbine/ Generator, shall be having on line performance & vibration based diagnostic system.

Accuracy of the on-line instruments used for absolute pressure/ differential pressure, temperature for determining cylinder efficiency, heater performance and condenser performance shall be of 0.2% class or equivalent.

2.05.00 Design for ABT Requirement:

Under ABT regime, following further operating conditions are required to be taken care of:

a) There are 96 time blocks in a day of 15 mins. each and there may be a requirement of changing Unit load with change in frequency in each block.

b) Unit may have to be kept under reserve shut down and brought back fast as per grid demand,

c) Very high availability target (> 80%) to be met for full fixed charge recovery.

d) Minimum Partial Loading.

e) To meet such extended requirements, following design considerations are to be met;

i) Unit should be designed for a faster ramp up/ Ramp down rate without effecting undue thermal stresses.

ii) Unit shall be capable of meeting the requirement of fast start up and quick loading till full load.

iii) Steam generator, Turbine generator and their auxiliaries shall be designed to run with satisfactory performance from one overhaul to another without requiring any major shutdown.

2.06.00 Operation Management System (OMS):

The operation of this project will be optimized by implementing Operation Management System. This system covers clear definition of responsibilities of all key executives including shift-in-charge, AGM/DGM (Operation), AGM (O&M)/GM etc. and lays down the procedure for detailed analysis of O&M problems. It also covers the system of daily reporting to Corporate Office and monthly operation review team (ORT) meetings.

2.07.00 Operation Review Team (ORT) Meetings:

The following important aspect will be covered during the monthly ORT meetings:

a) Review of actual performance of the station and each unit vis-a-vis targets and norms for key operating parameters like generation, availability and deviations on heat rate, specific coal/oil consumption, make-up water consumption, auxiliary power consumption etc.

b) Review of specific O&M problems of the project and progress of corrective actions.

c) Review of external constraints like coal supply problems, power

evacuation problems and other related difficulties.

d) Review of commercial and financial performance.

e) Review of house keeping standard.

Proper implementation of OPMS and regular ORT meetings are expected to help in achievement of high standard of plant operation.

2.08.00 Training of O&M Personnel:

Since O&M cadre for this project is likely to be largely based on fresh engineering graduates, considerable importance has to be given to training of O&M personnel so that the required skills in various specialised disciplines could be created in the shortest possible time. It is therefore very important to ensure that all engineers meant for maintenance become fully familiar with their area of work (O&M Dept.). This will be achieved at least 24 months prior to synchronisation of unit by:

a) Study of O&M Manuals and Drawings.

b) Review / Preparation and finalization of commissioning documents.

c) Supervision of pre-commissioning and commissioning activity.

d) Preparation of documents for maintenance management system.

e) Participation in actual maintenance work in similar project.

f) Participation in annual overhauling work in one project.

g) Training at manufacturer's works in specialized areas/ simulator/ other utilities.

This on-the-job training activity will be co-ordinated by AGM (O&M) and Project Co-ordinator from Corporate Training in the areas of operation and maintenance of modern facilities shall also be organised

2.08.01 Training of Operation Engineers:

I) Simulator Training:

The operation engineers will undergo extensive training on replica simulator at Simulator Training Institute, Korba/Sipat. This training will be so designed as to fully equip the operators with the requisite know how and confidence to effectively handle all plant upsets and crisis situation which are likely to arise in a plant.

ii) Training at manufacturers Works and other Utilities:

The operation engineers will undergo extensive training at manufacturers work for familiarisation and for design/testing aspects. They will also be

imparted training in the running units of other utilities also where new technologies have already been adopted by these utilities and our organisation is in the process of absorbing these technologies.

2.08.02 Training of Maintenance Engineers:

Maintenance engineers will be imparted training at manufacturers work for familiarization and for design/testing aspects.

3.00.00 MAINTENANCE PHILOSOPHY:

3.01.00 Maintenance Management System:

The maintenance of this project will be carried out as per the well developed maintenance management system. This system aims at maximizing the availability of generating units while ensuring minimum maintenance cost and safety of plant and personnel. The maintenance management system shall aim to have no break down from overhaul to overhaul. The maintenance management system covers organizational structures, preventive maintenance schedules, predictive maintenance detailed work specification covering all maintenance jobs, permit to work system, long term maintenance planning, safety aspects etc. This system provides for daily maintenance planning meeting for about 30 minutes for finalizing maintenance schedule for next 24 hours and resolution of interface problems between departments. These meetings are supplemented by meeting of HODs for half an hour daily to accelerate the decision-making process and to lay down the priorities and guidelines for maintenance work during the next 72 hours.

3.02.00 Spare Parts Management System:

The primary objective of spare part management system will be to ensure timely availability of proper spare parts for efficient maintenance of the plant without excessive build-up on non-moving inventory. The spare parts management system will cover the following aspects:

a) Proper codification of all spares and consumable.

b) Spare parts indenting and procurement policy.

c) Criteria for ordering of mandatory and recommended spares.

d) Judicious fixation of inventory levels and ordering levels for spare parts based on experience in similar projects.

e) Development of indigenous sources/in house capability for imported spare parts.

f) Development of more than one source wherever practicable.

3.03.00 Availability of O&M Manuals:

a) All contracts will include provision of 8 sets of "DRAFT" O&M Manuals to be supplied by vendor within 12 months from the date of LOA.

b) The draft O&M Manuals will be reviewed by project engineering group / corporate engineering and corporate knowledge team to ensure completeness and proper coverage. The final manuals will incorporate all the comments.

c) Schematic diagrams, P&I diagrams, wiring diagrams, cable schedule, valve schedules, pipe schedule etc shall also be submitted by vendor.

d) "FINAL" O&M Manuals (15 sets prints and 3 CD ROMs), which will be distributed to all concerned as per the approved distribution policy of the company, will be available to all concerned at least 18 months prior to synchronisation of unit to avoid problems in preparation of commissioning document as well as proper installation & commissioning of equipment.

3.04.00 Special Tools and Tackles:

All contracts will include the provision for supply of two unused sets of all special tools and tackles which are required for installation, Commissioning and proper maintenance of plant and equipment. These two sets of special tools and tackles will be handed over to O&M department within one (1) month of commissioning of the first unit

Suitable lifting tools and tackles shall be provided for carrying out maintenance with full safety.

Quick erect scaffolding for boiler furnace and set of sky climber shall also be part of special tools and tackles.

Pneumatic tools, roller support in turbine rotors shall also be arranged.

4.00.00 COAL SUPPLY MANAGEMENT:

The minimum requirement of coal will be based on operating norms. However, the monthly requirements will be finalised through Coal Supply Agreements. In order to meet the actual requirements of the project, the mines will keep a provision for 10% increase or decrease in supplies from the agreed average level.

The coal loading and handling plant at Mine and coal handling plant will be designed to meet the peak requirement on daily basis with adequate reserve capacity to take care of normal breakdowns and maintenance requirements.

5.00.00 ENERGY CONSERVATION ASPECTS:

5.01.00 Introduction:

All consumers of electricity, irrespective of their power demand, are

required to become conscious about energy conservation and should think of ways and means to optimise their energy consumption. But it is all the more very important for a power plant, which happens to be one of the biggest consumer of electricity, to think of reducing its own power consumption.

5.02.00 Selection of Steam Parameters and Feed Heating Cycle:

Thermal efficiency of the Cycle can be improved by raising main steam parameters (pressure and temperature), introducing reheating of steam at a suitable stage of expansion, improving condenser Vacuum and optimimizing regenerative feed water heating arrangement. Improvement in thermal efficiency means saving in fuel burnt in boiler and also significant saving in power consumption of plant auxiliary equipment in turn an effort towards energy conservation.

The thermal cycle parameters shall be optimised for this range of unit rating by selecting parameters of Main steam temperature, pressure, reheat steam temperature and condenser pressure to provide an optimum thermal cycle. The cycle employs regenerative feed water heaters thereby ensuring optimum turbine heat rate. The losses through flue gas have been kept to a minimum.

5.03.00 Coal Handling Plant:

Coal Handling Plant for feeding coal to the Boiler Bunkers has been envisaged with the following major features to minimize the consumption of energy:

a) Coal handling plant layout shall be finalized with very less number of conveyers in order to minimize the total coal-conveying path.

b) Crusher house height shall be reduced preventing un-necessary conveying of coal to higher- elevations.

c) For dust control at coal transfer points dust suppression system shall be provided exclusively for reducing the energy consumption levels to almost nominal values compared to dust extraction system, which are restricted to crush house only.

5.04.00 Monitoring of Key Parameters:

The following critical parameters/systems shall be monitored regularly to keep them in line with design values and to achieve optimum efficiency:

i) Boiler water and steam pressures.
ii) Boiler water and steam temperatures.
iii) Boiler water and steam flows.
iv) Percentage of flue gas oxygen provided by a grid of probes and excess air.
v) Combustion air and flue gas side draft loss,
vi) Exit gas temperatures at different sections,

vii) Fuel and combustion air flows,
viii) Superheat and reheat spray flows.
ix) Boiler flame intensity from scanners as well as flame monitors,
x) Condenser vacuum
xi) Soot blower operation,
xii) Un-burnt carbon in ash.
xiii) Oxygen & Carbon mono oxide in flue gas, provided by a reliable on-line measurement.
xiv) Coal quality (as fired)
xv) CW inlet and CW outlet temperatures.

The above list is not exhaustive. Any deviation in the parameters shall be corrected at the earliest. However, efficiency test as envisaged shall be carried out regularly to ascertain the efficiency gaps.

5.05.00 Chemistry:

Continuous monitoring and control of water and steam purity in the plant cycle will further improve the heat transfer rate in heat exchanger tubes, it lean be achieved by the following chemistry control philosophy:

Chemistry Control =:

1. The 100% Condensate to be treated in CPU. Therefore a standby 50% treatment facility shall be available all the time.
2. The make up water should have the following characteristics:
    a. Conductivity less than 0.1 (js/cm,
    b. Silica less than 5 ppb,
3. The parameters to be monitored by on-line instruments and core parameters are indicated in Control room with alarm and the limit value. The total chemistry control and monitoring is done by Chemistry expert software to alert and inform operator for desired actions.
4. Following parameters are to be monitored continuously on-line in water /steam cycle:
    a. Cation conductivity at CEP discharge; CPU outlet; Feed water and Main steam
    b. Conductivity -—do—
    c. pH at Feed water
    d. Silica at Feed water and main steam
    e. Dissolved Oxygen at Condensate and Feed water
    f. Sodium at Main steam; CEP discharge and CPU
    g. ORP at CEP discharge and Feed water
5. The adequate arrangements including nitrogen capping (for dry or wet preservation) shall be provided for proper lay up of the all the water and steam touched system when unit is under shut down.
6. The chemical feeding (like ammonia and Hydrazine) shall be performed by automatic mode.

5.06.00 Operational Optimisation:

Automatic controllers are provided for plant optimization. The unit capacity controller shall set load demand keeping the safety of the equipment inherent.

The main controllers used for optimum performance of the whole plant are as follows:

a) Unit Capacity Controller
   i) Boiler Capacity Controller
   ii) Turbine Capacity Controller

b) Combustion Control
   i) Coal flow
   ii) Air flow

c) SH/RH Steam temperature controller

d) Chemical dosing controller
   i) Hydrazine
   ii) Ammonia
   iii) Phosphate

e) Main steam pressure controller

f) FW flow Controller (Drum level)
   i) Low range
   ii) High range

g) Deaerator level

h) Hot well level
   i) HP/LP bypass
   ii) PA header

In addition to above, HMI is programmed to carryout on-line performance calculation like unit/turbine gross/net heat rate and efficiencies of boilers/Turbines/all major auxiliaries and thus giving immediate feedback to the management for analysis by unit performance improvement & optimisation. IS system also has provision for different logs.

Land requirement for Surguja Power Plant

Sl. No.	Description	Area in Ha
1	Coal stock pile - Reject based (1,00,000 MT - 7 days)	7.35
2	Raw coal (60,000 t-15 days)+Conveying+CHP	
3	Power Block	7.02
4	Switch yard	4.07
5	Reservoir	5.28
6	Water treatment	2.40
7	Admn+ Stores+Fire Station+WS	1.04
8	Cooling Towers, Cold water channels area including CW Pump House and its associated piping	5.51
9	AHP	1.60
10	Fuel oil	0.30
11	Road, drains, miscellaneous	12.93
12	Green Belt	As per mine plan
	Total area	**47.50**