



NTPC-SAIL POWER COMPANY PRIVATE LIMITED

(A Joint Venture of NTPC & SAIL)

PROJECT: ROURKELA PP-III

PACKAGE NAME: EPC PACKAGE FOR ROURKELA PP-III (1X250 MW)

SALIENT TECHNICAL FEATURES

A Brief Scope of work

Brief scope of work for the subject package is as follows:

Design, engineering, manufacture, supply, construction, erection, testing & commissioning work on the basis of single point responsibility, completely covering the following activities and services in respect of Steam Generator, Steam Turbine Generator and Electrostatic Precipitator, all Balance of Plant (BOP) systems, all electrical systems including Switchyard, complete Control & Instrumentation and complete Civil and Structural works covered under the specifications.

- a) Basic Engineering of the plant including preparation of Plant Definition Manuals
- b) Detailed design of all the equipment and equipment system(s) including civil, structure steel & Architectural works included in bidder's scope
- c) Providing engineering drawings, equipment sizing & performance data, instruction manuals, as built drawings and other information;
- d) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required
- e) Complete manufacturing including shop testing/type testing;
- f) The complete Civil, structural and architectural works including topographical survey, site leveling, construction water for plant area, water supply and sanitation, infrastructure works including roads & drainage for plant, Effluent & sewage treatment facility for plant, plant boundary wall, main plant area structures and foundations including turbine building, bunker building, boiler structure, ESP structure, service building, compressor house, complete coal handling plant and Ash handling plant, chimney, pipe/cable galleries and pipe/cable trenches, duct banks, pedestals, cooling towers, balance of plant buildings including CW System, PT, DM and Intake structures and well, ETP & STP buildings and structures, offsite structures and buildings, transformer yard structures, switchyard structures, fuel oil handling system and fire protection system structures and foundations, bridges and culverts for crossing of roads / Rail Tracks inside plant area, fencing / boundary wall around the land boundary, landscaping and other miscellaneous buildings and structures.
- g) Packing and transportation from the manufacturer's works to the site including logistic studies, insurance, customs clearance & port clearance, port charges, if any.
- h) Receipt, storage, preservation, handling and conservation of equipment at the site;

- i) Fabrication, pre-assembly, if any, erection, insurance, testing, commissioning and completion of facilities including putting into satisfactory operation all the equipment including successful completion of initial operation;
- j) Performance and guarantee tests after successful completion of initial operation;
- k) Supply of spares on FOR site basis;
 - Reconciliation with Customs Authorities, in case of foreign Bidders;
 - Satisfactory conclusion of the Contract;
 - Insurance and other requirements

Detailed scope of work has been specified in the bidding documents.

Major Technical Features

1.00.00 Steam Generator

1.01.00 Type

The Steam Generator shall be of single pass (Tower type) or two pass type with single reheat and sub-critical parameters.

1.02.00 Other Features of Steam Generator Design

The Steam Generator shall be direct pulverized coal fired, top supported, single reheat, radiant, dry bottom, with balance draft furnace and shall be suitable for outdoor installation. It shall be suitable for variable pressure and constant operation.

1.03.00 Rating of Steam Generator(s)

Steam Generator shall be designed to cater to duty requirements at Boiler Maximum Continuous Rating (BMCR) specified below:

Capacity of Steam Generator and Rated Steam parameters:	Steam Flow (T/Hr)	Temp. (Deg C)	Pressure Kg/cm2(a)
i) At super-heater outlet	102% of the turbine VWO steam flow requirement.	To achieve turbine throttle main steam temperature as indicated in spec. The steam temperature at Superheater outlet shall be at least 3°C higher than the rated main steam temperature at HP turbine inlet.	To achieve turbine throttle steam pressure as indicated spec. Steam pressure at superheater outlet shall be at least 5 kg/cm2 higher than the rated main steam pressure at HP turbine inlet
ii) At re-heater outlet		To achieve reheat steam temperature at Turbine Inlet.	---

		The steam temperature at reheater outlet shall be at least 3°C higher than the rated reheat steam temperature at IP turbine inlet.	
iii) Feed Water Temp. at Economizer Inlet		To be optimized by the bidder but not less than 249°C	

1.04.00 Limiting Parameters for Steam Generator Design

The Steam Generator design shall comply with the following limiting parameters with 'design coal' firing, under stipulated ambient air conditions.
Flue gas temperature at air-heater outlet - 125°C (minimum) (Corrected)

1.05.00 Operating Requirements

1.	Minimum load without oil support for flame stabilization	40% BMCR
2.	Operation without HP heaters in service	Steam generator shall also be designed for continuous operation with HP heaters out of service. The steam generator heat output under HP heaters out condition shall be at least 100% BMCR heat output with HP heater in service.
3.	Steam generator control range	The automatic control range of Steam Generator shall be from 50% TMCR to 100% BMCR. Under the above control range, the steam temperatures at SH & RH outlets shall be maintained at their rated values.
4.	Mode of Steam Generator Operation	The Steam Generators shall be designed for variable pressure and constant pressure operation.
5	Rate of loading / unloading <ul style="list-style-type: none"> • Step load change • Ramp Rate 	Minimum + 10% per minute <ul style="list-style-type: none"> ○ Minimum + 3% per minute (30% to 50% load) ○ Minimum + 5% per minute (50% to 100% load)

1.06.00 Coal/Ash data

The primary fuel for the steam generator shall be coal. Light Diesel Oil (LDO) shall be used for start-up, coal flame stabilization and low load operation.

2.00.00 Electrostatic Precipitator (ESP)

2.01.00 System Description:

The Electrostatic Precipitators shall be of outdoor type and installed on the cold end side of regenerative air preheaters. The flue gas shall be drawn from air preheater outlets of the balanced draft, pulverized coal fired Steam Generator and guided through adequately sized duct work into the specified number of independent gas streams of each ESP. Similarly, the flue gas after the Electrostatic Precipitators shall be led to the suction of the induced draft fans.

2.02.00 Service Conditions

The Steam Generators are designed to burn pulverised coal. LDO shall be used during startup and at low loads for warm up and flame stabilisation of Steam Generator. The ESP shall be designed to remove fly ash particles (to meet the stipulated ESP emission levels) from the flue gas generated in the Steam Generator with pulverized coal firing.

3.00.00 Steam Turbine

3.01.00 Type

The steam turbine shall be tandem compound, single reheat, regenerative, condensing with sub-critical parameters, multi-cylinder design with separate HP, separate IP and separate LP casing(s) OR combined casing for HP-IP and separate casings for LP Turbine OR separate HP and combined IP-LP casing directly coupled with generator suitable for indoor installation.

3.02.00 Rating

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

1	Output under economic maximum continuous rating (EMCR) (guaranteed output load) at generator terminals	:	250 MW
2	Turbine throttle steam pressure	:	150 Kg/cm ² (min)
3	Turbine throttle main steam temp.	:	537 ⁰ C (min)
4	Reheat steam temp. at turbine inlet	:	537 ⁰ C (min)
5	Condenser pressure	:	77 mm Hg (abs)
6	Turbine speed	:	3000 rpm
7	Frequency variation range around rated frequency of 50 Hz	:	+ 3% - 5% (47.5 Hz to 51.5 Hz)

3.03.00 Other Features

Turbine shall be capable of operating continuously with valves wide open (VWO) to swallow at least 105% of EMCR steam flow to the turbine at rated main steam and reheat steam parameters and also the corresponding output shall not be less than 105% of rated load with 3% make up and 77 mm Hg (abs) condenser pressure.

The steam turbine shall have minimum six uncontrolled extractions for regenerative feed heating based on optimised cycle and shall be suitable for satisfactory operation under tropical conditions.

4.00.00 Generator

4.01.00 Type

Three phase, horizontal mounted, indoor installed, two-pole, class F winding insulation, Stator water/Hydrogen cooled, cylindrical hydrogen cooled rotor.

4.02.00 Rating

Generator and its excitation system shall have a capability at least matching the declared maximum continuous rated output of the associated steam turbine (for the designed secondary cooling water temperature) at all power factors between 0.85 lagging and 0.95 leading with +3% to -5% frequency variation, terminal voltage variation of +/- 5% and combined voltage & frequency variation of 5%. It shall be ensured that when the Generator is working at this capability and design cooling water temperature, no part of the Generator shall attain a temperature in excess of the temperature limits specified for class B insulation as per IEC-34.

4.03.00 Also the generator and its excitation system shall be capable of continuous stable operation without any excessive temperature rise at the peak output of the associated steam turbine under VWO & HP heater out condition, etc. as available for the designed secondary cooling water temperature, at all power factors between 0.85 lagging and 0.95 leading with +3% to -5% frequency variation, terminal voltage variation of +/- 5% and combined voltage & frequency variation of 5%. Temperature of different parts may exceed those permissible for class B insulation under such operating conditions, but shall be lower than those permissible for class F insulation as per IEC-34.

4.04.00 Rated Parameters

Power Factor	-	0.85 (lagging)
Terminal voltage	-	16.5 KV
Frequency	-	50 Hz
Speed	-	3000 rpm
Short circuit ratio	-	Not less than 0.48 (without negative tolerance)

5.00.00 **Coal Handling Plant**

Coal Handling Plant shall be designed based on specified Indian Coals. The plant shall also be designed for blending of imported coal and Indian coal in the proportion 30:70 by weight. Rated capacity of CHP shall be as specified in the technical Specification.

The design capacity of the conveyors shall be 120% of the rated capacity. Wagon tippler shall be side-discharge type (Rotaside) and shall conform to RDSO G-33 Rev. 1.

6.00.00 **Ash Handling Plant**

Ash handling system consists of the following sub systems:

- Bottom Ash Handling System
- Jet pump and Water Impounded Hopper System – An intermittent system consisting of water impounded hoppers, clinker grinders, jet pumps, dewatering bins, etc.
- Dry Fly Ash Conveying System by Pressure Conveying System: It shall consist of screw compressors, air lock/pump tanks, ash intake & discharge valves, CI & MS pipes, instrument air compressors etc.
- Dry Fly Ash Transportation system: The dry fly ash from the buffer hoppers in each unit shall be transported to either silos for slurry disposal system or to storage silos. The user industries shall take the dry fly ash from storage silos either in closed tankers or in open tankers.
- Ash Disposal System: The fly ash shall be disposed off by high concentration slurry disposal (HCSD) system. Fly ash in suitable proportions shall be mixed with water to form high concentration combined slurry. The slurry shall be pumped to the disposal area by means of positive displacement pumps. Bottom ash shall be disposed off in lean phase by conventional slurry disposal pumps.

7.00.00 **CW Pumps**

CW equipment & Systems shall be provided as per the scope of technical specifications.

8.00.00 **Cooling Tower**

The Cooling towers of induced draft type and associated equipment & systems shall be provided as per the scope of technical specification.

9.00.00 **WATER TREATMENT SYSTEM**

Water treatment system covers pre-treatment, chlorination, Liquid Effluent Treatment & Modification of existing De-mineralization system.

10.00.00 FIRE DETECTION, ALARM & PROTECTION SYSTEM

Automatic fire protection, detection and alarm system shall be provided as per the scope of technical specifications.

11.00.00 Raw Water System

Raw water system which include intake well, Approach Bridge, raw water pumps & piping and desilting basin shall be provided as per the scope of technical specification.

12.00.00 Electrical Systems

The electrical items shall cover following:

- Generator, Excitation System and its Auxiliary Systems
- Motors, Electric Actuators
- Generator Busducts, MV Busducts and Generator Circuit Breaker.
- Power Transformers, Transformer Maintenance Testing & Monitoring Equipments, Auxiliary Oil Filled/ Dry type Transformers, Indoor Transformers
- MV Switchgears, LV Switchgears and LV Busducts, Numerical Relay Networking, DC System, Battery and Battery Charger
- HT Power Cables, LT Power and Control Cables, Cabling, Earthing and Lightning Protection, Lighting, DG Sets
- 220KV GIS.
- Control & Protection of EHV system and Generator Relay Panels, Substation Automation System (SAS) based on IEC 61850 protocols.
- Complete Electricals for Offsite Areas, VFD systems
- Type Tests and Mandatory Spares as specified.

13.00.00 C & I Systems

The control system, called Distributed Digital Control Monitoring & Information system (DDCMIS) is envisaged to be procured under this package for control and operation of:

- Integral control & protection of boiler including Burner Management System and Boiler protection system.
- The integral control & protection of Steam Turbine Generator including Electro-hydraulic control & Turbine Protection system.
- Modulating controls of the Steam Generator (SG) {Combustion Control- Fuel Flow/Air Flow; Furnace Draft Control, FW flow control etc.}.
- Modulating controls of Feedwater & Condensate Cycle {Hotwell level control, Deaerater Level control, Heater Level Control, etc.}.

- Binary control of auxiliaries of Steam Generator (SG) {Forced draft (FD) fan, Induced Draft (ID) Fan, Primary Air (PA) Fan etc.}.
- Binary control of auxiliaries of Turbine Generator (TG) {Boiler Feed Pump (BFP), Condensate Extraction Pump (CEP) etc.}.
- Electrical Breaker including synchronization circuits.
- Coal Handling Plant.
- Water System (PT Plant, DM Plant, Cooling Tower etc.).
- CW System.
- Air Conditioning and Ventilation systems.
- Ash Handling Plant.
- Make-up water System.
- Fire Detection, Alarm & Protection System.

Human Machine Interface & Plant Information System (HMIPIS) is based on Large Video Screen (LVS) displays supported by TFT monitor based Operator Work Stations (OWS). These devices through customized user-friendly displays, soft alarm facia and pop-up displays are used for giving fast pin-pointed faults/status to the operator. Local ON/OFF operation of equipments is envisaged through Graphical Interface Unit (GIU). The total system is networked through a Station-Wide LAN for use of real time data of various plant areas by other users like maintenance, planning, efficiency enhancement groups etc.

The sequence of events recording & alarm annunciation are also implemented as a part of DDCMIS system. A GPS based master and slave clock system is to be provided for uniform and synchronized timing signals throughout the entire station.

The power supply for the control system is based on 24V DC provided through microprocessor based modular charger system and for the peripherals and other subsystem through 230V Single Phase UPS.

Main Equipment related instruments like Flame Monitoring system, Coal Bunker Level measurement system, gravimetric feeder control system, Acoustic Pyrometer, Acoustic Steam Leak detection system, Furnace and Flame viewing system, Turbine stress control / evaluation system, Turbine supervisory and diagnostic system etc are also procured through this package.

Field instruments like pressure, DP, flow & level transmitter, analyzers along with their process connection & piping as well as measurement systems like vibration monitoring system etc are also procured through this package.

A plant-wide CCTV system based on IP technology is included in this package for surveillance of plant equipment as an aid to the operation.

Apart from above, an on-line Steam & Water analysis system (SWAS), PA system, Operator control desks, panels, shielded twisted pair cables as well as optical fiber cables for system interconnection and all types of Instrumentation Cables are also included in this package.

14.00.00 Civil Works

The scope of civil works shall include the analysis, design, construction, erection of all civil, structural and architectural work and all other items mentioned in this specification.

Entire civil engineering work including Design & engineering for all buildings, structures and facilities for foundations and equipments, roads, ramps, paving, parking areas, Supply / procurement of all materials, storm water drainage , plumbing & sanitary fittings, service lines and all other miscellaneous civil engineering works within the battery limit as shall be necessary for completing this package on a turnkey basis.

Civil works shall cover survey works, site leveling works, design, preparation of general arrangement drawings, construction and fabrication drawings, supply of labour & materials and construction of all civil, structural and architectural works by the Bidder.