Jindal PowerLimited

EUP1 4X250 MW and EUP2 & EUP3 4X600 MW

O P JINDAL SUPER THERMAL POWER PLANT TAMNAR, RAIGARH, CHHATTISGARH

TECHNICAL SPECIFICATION

(Part – IIA)

Sub-Section – A (Introduction & Detail Scope of Work)

FOR

FLUE GAS DE-SULPHURISATION (DeSOx)

SYSTEM PACKAGE

Bidding Document No.: JPL-OPJSTPP-FGD-03

1.00 Project Information

As per the new Indian law published by Ministry of Environment, Forest and climate change (MoEF & CC) vide notification dated 07.12.2015 emission norms for the thermal power plants have been revised drastically which leads to reduction of permitted emission level values in respect of various parameters including suspended particulate matter (PM10), SOx, NOx and Mercury. Details are as under

Item	Installed before 31.03.2003	Installed in the period 01.01.2003-31.12.2016	Installed after 01.01.2017
PM[mg/NM3,STP]	100	50	30
SO2[mg/NM3,STP]	600(<500MW) 200(>=500MW)	600(<500MW) 200(>=500MW)	100
NOx[mg/NM3,STP]	600	300	100
Hg[mg/NM3,STP]	0.03 (>=500MW)	0.03	0.03

All our units of EUP1 4X250 MW and EUP2 & EUP3 4X600 MW units are commissioned during the period year 2007 to 2016.

The timelines identified for JPL TPP are as under;

For 600 MW Units

UNITS	U#1 600 MW	U#2 600 MW	U#3 600 MW	U#4 600 MW
FGD IMPLEMENTATION PLAN AS PER CEA	Mar-21	Dec-21	Mar-22	Jun-22

For 250 MW Units

UNITS	U#1 250 MW	U#2 250 MW	U#3 250 MW	U#4 250 MW
FGD IMPLEMENTATION PLAN AS PER CEA	Mar-22	Mar-22	Jun-22	Jun-22

As per feasibility study done by Owner's Consultant & CEA recommendations, proposed emission control technology for these TPPs is as below:

Plant Name	De Sox System
Tamnar 4x250MW **(EUP-1),**	- Wet limestone Forced Oxidation FGD - Semi Dry / Dry Flue Gas Desulphurization System / Ammonia based FGD
Tamnar 2x600MW **(EUP-2),**	- Wet limestone Forced Oxidation FGD - Ammonia based FGD - Sorbent Polymer Catalyst Technology
Tamnar 2x600MW **(EUP-3),**	- Wet limestone Forced Oxidation FGD - Ammonia based FGD - Sorbent Polymer Catalyst Technology

JPL is open to all available Technologies viz. Semi Dry / Dry FGD, Limestone based FGD, Ammonia based FGD, and Sorbent Polymer Catalyst. Technology vendors are required to prepare their proposal based on the technology they would like to recommend for EUP-1, EUP-2 and EUP-3 separately. Bidders may accordingly choose any of the technology mentioned here under.

2.0 BRIEF DESCRIPTION DIFFERENT TECHNOLOGIES FOR REDUCING SULPHUR DIOXIDE EMMISION

2.10 Wet limestone Flue Gas Desulfurization

In this technology, limestone is used as reagent, which is ground in the mill and mixed with water to make slurry and sprayed on the absorber through nozzles. The flue gas coming out from the ID fan is sent to absorber where it reacts and forms the gypsum. The cleaned flue gas is sent to the chimney. The system is a once-through, wet type in which the SO2gas is permanently bound by the sorbent which must be disposed of as a by-product, gypsum. The by-product is produced is wet in nature, and flue gas leaving the absorber is saturated with moisture.

Vendor to consider an option of not generating gypsum as by-product. Vendor to plan to dispose off FGD by-product slurry together with the fly ash via existing ash slurry.

Chemical reactions taking place are given below,

i) Absorption:SO2+ H2O → H2SO3
ii) Neutralization: CaCO3 + H2SO3 → CaSO3 + CO2+ H2O
iii) Oxidation: CaSO3+ 1/2O2 → CaSO4
iv) Crystallization: CaSO4+ 2H2O → CaSO4.H2O

2.20 Semi Dry/ Dry Flue Gas Desulfurization

This technology use lime slurry as reagent. The lime (slaked or quick lime) is mixed with water at a controlled rate to maintain a high slaking temperature that helps to generate fine hydrates of lime with high surface area. The flue gas post ESP enters the spray dryer absorber where gas stream is cooled by the reagent slurry spray. The mixture then passes through the fabric filter for removal of particulate before entering the ID fan. A portion of the un-reacted lime, gypsum and the reaction products collected in the fabric filter is mixed with water and returned to the process as high solid slurry. The remaining solids are directed to a storage silo for by product. The by-product is semi-dry/dry in nature and flue gas leaving the absorber is not fully saturated with moisture

Primary reactions in the spray dryer are as follows:

i) Ca(OH)2+ SO2 CaSO3.1/2H2 + H2O
ii) Ca(OH)2+SO3 + H2O CaSO4.2H2O
iii) CaSO3 +1/2 O2 CaSO4

2.30 Ammonia Based FGD System

In Ammonia based FGD process, ammonia with high reactivity is used as absorbent to capture SO_2 in the flue gas, and the by-product of the process is ammonium sulfate fertilizer.

$SO_2 + H_2O + x\ NH_3 \Longrightarrow (NH_4)\ x\ H_2\ x\ SO_3$ (1)

$(NH_4)\ x\ H_2\ x\ SO_3 + ½\ O_2 + (2\text{-}x)\ NH_3 \Longrightarrow (NH_4)_2\ SO_4$ (2)

$SO_2+H_2O \longleftrightarrow H_2SO_3$	*Dissolution of SO2*
$H_2SO_3 + NH_3 + H_2O \longrightarrow (NH_4)_2SO_3$	*Neutralization*
$(NH_4)_2SO_3+H_2SO_3 \longrightarrow NH_4HSO_3$	*Neutralization*
$(NH_4)_2SO_3+½\ O_2 \longrightarrow (NH_4)_2\ SO_4$	*Oxidation*
$NH_4HSO_3+½\ O_2 \longrightarrow NH_4HSO_4$	*Oxidation*
$NH_4HSO_4+NH_3+H_2O \longrightarrow (NH_4)_2SO_4$	*Neutralization*

Reaction (1) shows SO2 dissolution in water to form sulfurous acid.
Reaction (2) shows neutralization of sulfurous acid with ammonia to form ammonia sulphite.

Ammonium sulphate solution is refined through concentration, crystallization, solid-liquid separation, drying to obtain ammonium sulphate fertilizer

2.40 Sorbent Polymer Catalyst (SPC) Technology

It is a unique fixed catalyst and sorbent system for removing gas phase SO2 and mercury from industrial flue gas. The SO2 Control System has an added advantage of mercury control. The system is based on discrete stackable Modules that are installed downstream of a particulate collection system (i.e., tail-pipe solution). The modules utilize an open channel design which results in very low pressure drop. In practice, flue gas after a Particulate Matter collection device (bag house or ESP) is first quenched with water to cool and humidify the gas stream (< 60 °C (approx.) and > 95% relative humidity (approx.) preferred operating window). The cooled gas is then directed through a bank of modules. Operation is passive; the modules will continuously convert SO2 to liquid.

3.00 Relevant Site Information:

a. Site Elevation Above MSL: < 260 M
b. Basic wind speed: 39 m/sec as per IS-875 Part-III (latest revision)
c. Seismic Zone: III as per IS-1893 (latest revision)
d. Ambient Air Temperature: 50^0 C Max and 6.4^0 C Min
e. Relative Humidity (Max): 90 %
f. Annual Average Rainfall: Between 1000 – 2000 mm

4.00 Detailed Inputs comprising of the following:

Plant operation data at minimum & maximum load

- Maximum Continuous Rating (MCR) and Total Annual Operating Hours @ MCR

- Minimum Stable Load
- Annual Capacity Factor
- Net Plant Heat Rate
- Total Boiler Heat Input
- Dispatch Mode / Plant Operating Scheme
- Ambient Atmospheric / Climate Conditions
- Number of Annual Cold and Warm Starts
- Desired Availability / Redundancy Philosophy
- Control system
- Fuel data
- Flue Gas data
- Fly Ash data
- Emission data
- Utilities detail
- Desired waste water data

For Design Input Data, refer Annexure A11 (EUP1) & A12 (EUP2 & EUP3)

5.00 General Scope of Work:

The intent of this document is to define all the systems required to be supplied, installed and commissioned in an operating plant to take care of the revised emission norms stipulated by the MoEF. The modifications required in the operating plant to ensure continues operation without major shut downs are also part of the scope of the bidder. The Detailed scope for the civil, mechanical, electrical and C&I works shall include but not limited to Design, Engineering, Manufacture, Assembly, Testing at manufacture's works, Packing, Forwarding, Procurement, Supply & Delivery including transportation upto site including Transit Insurance, receiving & unloading, proper stacking, storage, transportation/shifting from stores to erection site, pre-assembly, assembly, complete installation, Erection, Testing & Commissioning of Flue Gas De- Sulphurization (FGD) DeSox dismantling, repairing, supply of labour, supervision, tools & tackles, testing & measuring instruments for commissioning, implements, commissioning, trial operations, PG Test etc. complete with all materials, accessories for efficient & trouble free installation and operation as per specification and scope defined in Bidding Documents of Flue Gas De-Sulphurization (FGD) DeSOx for 1000 MW (4X250 MW) – EUP1 and 2400 MW (4 X 600 MW) – EUP 2 & 3, O.P Jindal Super Thermal Power Project at Tamnar, Raigarh District of Chhattisgarh.

6.00 Execution Methodology

The Bidders have to quote for the entire scope of work on an **EPC Basis** with Price Breakup furnished as per the Price Schedule. In case any Bidder does not furnish the Price Schedule in the desired format such Bidders shall be termed as Non Responsive.

However, alternately, as the Technology suppliers for the FGD installation are pre dominantly international suppliers and, JPL in order to optimize the cost would like to get limited works executed by the Technology suppliers. JPL's parent company namely JSPL has expertise in fabrication and erection of steel structures as well as all types of technological structures. JPL along with its associate company PPEL has expertise in Project management, Civil construction and mechanical and electrical erection works. In view of the expertise available within the company and its associated companies a Division of Responsibilities has been identified and JPL would like the bidders to furnish prices in the Price Schedule for their Scope of Work. JPL also would like the bidders to indicate the take out prices in the Price Schedule for the scope of work identified to be executed by JPL and its associates.

However, if the Take out Prices offered by the Bidder is not as per market prevailing prices then Bidder will have to execute the entire scope of works. Owner reserves the Right to exercise the Take out Price option without assigning any reason what so ever.

Responsibilities of Civil & Erection Agency: (Pertaining to Take out prices)

- Receiving and unloading, proper stacking, storage, transportation / shifting from stores to erection site.
- Erection and commissioning of plant and equipment including and modification work, dismantling, repairing, supply of labor, supervision, tools & tackles, testing & measuring instruments for commissioning.
- Supply of fabricated structures, Technological Structures (Tanks & Vessels) and site fabricated technological structures like Absorber Tower, Stack, Atmospheric Storage Tanks and Ducts etc.
- Construction of Civil, structural and Architectural Works.
- Erection all risk Policy / Construction all risk Policy

7.00 The FGD comprises the following system for EUP-1 & EUP-2 & 3

This technical specification covers detailed scope of works for Wet Limestone Forced Oxidization DeSOx system only. Bidders offering alternate Technologies should similarly divide the scope under Mechanical system, Electrical system, Control & Instrument system & Civil, Architecture & Structural works sub section

and provides Technical Data Sheet for all. Similarly all the tender drawings should be submitted according to the Technology being offered.

- **Lime stone storage and crushing system consisting of :**
  - Lime stone unloading system
  - Lime stone storage system
  - Lime stone crushing system
  - Crushed Lime stone storage & conveying system
- **Lime stone milling and slurry system consisting of :**
  - Lime stone milling system
  - Lime stone slurry preparation and distribution system
- **Flue gas system**
  - Inlet ducts
  - Booster Fans
  - Stacks & Measurement equipment
- **Absorber system consisting of :**
  - Absorber vessel
  - Spray headers
  - Nozzles
  - Mist eliminators
  - Reaction tank
  - Forced Oxidation system
  - Emergency quench system
  - Anti foaming system
  - Adipic acid system
- **Gypsum handling system consisting of :**
  - Gypsum slurry transfer pumps (gypsum bleed pumps)
- **Process water system consisting of :**
  - Water Storage
  - Water transfer pumps
- **HVAC system**
- **Fire Fighting system**
- **Compressed Air System**

The Configuration of the FGD plant is shown in the Process Flow Diagrams as

below: EUP-1 Annexure – 1
EUP-2 & 3 Annexure – 5

Detailed design and engineering of all the equipment and equipment system(s).

The general scope detailed above shall cover the following:

(i) Complete manufacture including shop testing/ type testing.

(ii) Providing engineering data, drawings, Commissioning procedures and O & M manuals, etc. for the Consultancy Engineer (PMC) review, approval and records.

(iii) Packing and transportation from the manufacturer's workshop to site including transit insurance, customs clearance/ port clearance, if required.

(iv) Receipt, unloading, storage, preservation, conservation and insurance of equipment at site.

(v) Fabrication, pre-assembly, (if any), erection, testing and putting into satisfactory operation of all the equipment including successful completion of facilities.

(vi) Associated civil, structural, architectural, electrical and C&I Design works.

(vii) Commissioning and completion of facilities and Performance Guarantee Tests after successful completion of initial operation.

(viii) Furnishing of spares on FOR site basis and handing over to Owner's stores.

(ix) Reconciliation with custom authorities, if applicable.

(x) Satisfactory completion of the contract.

Based on site visit, bidder shall submit proposed layout for entire facility with their techno-commercial bid. Bidder shall clearly define all necessary modifications and relocation of existing facilities, if required, along with proposed Layout to be submitted with the bid. The modification arrangement is to be proposed in such a manner that the shutdown required for integration of the FGD system is kept minimum. Any modification in the existing ducting or temporary ducting, dampers shall be planned in advance and installed in minimum time.

In the absence a modification document, the bid shall be deemed incomplete and may be liable for rejection.

The Bidder shall be responsible for providing all material, equipment and services, specified or otherwise which are required to fulfill the intent of ensuring operability and the reliability of the complete system covered under this specification.

Cleaning of any debris produced by the bidder during erection and commissioning shall be done immediately at each front by the bidder so as not to hinder the safe operation of the operating power plant.

Bidder to extend all help and documentary support for compliance and addressing any statutory issues raised at site which pertains to the area/ work under bidder's scope.

CONSTRUCTION FACILITIES

The following facilities will be provided to Bidder for scope of work:

1. Site space will be provided to the Bidder on free of cost basis. However, porta offices, storage and workers rest areas near place of work shall be arranged by the bidder. Rooms provided with in the guest house for the staff residence will be free of charge.
2. Drinking and service water will be provided to Bidder's, staff and other personnel working for Bidder at the work site free of cost.
3. Construction water for erection site shall be made available at one convenient location for each unit free of cost.
4. Space required for bidder's storage, pre assembly and fabrication areas shall be provided by owner free of charge within the plant premises.
5. Construction power will be provided at 2-3 locations (fabrication yard, construction site) and at one convenient location for each unit for erection activities from the supply point of Owner on free of charge basis.
6. Area lighting at the construction / erection site, office areas shall be provided by Owner free of charge.
7. Fire tender required during the project execution stage will be provided by Owner.
8. First aid facilities are existing at site and same shall be shared by Owner.

In line with Gazette Notification on Ash Utilization issued by MOEF and its amendment thereafter, only ash based bricks are permitted for construction at the project.