

WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED

BANDEL THERMAL POWER STATION

UNITS – 1 to 4 [4 x 82.5 MW]

**REQUEST FOR EXPRESSION OF INTEREST
FOR
UNDERTAKING RENOVATION & MODERNISATION WORK
IN RESPECT OF
PULVARISED COAL FIRED UNITS # 1 TO 4 OF BANDEL THERMAL POWER
STATION**



WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED

**BIDYUT UNNAYAN BHAWAN, PLOTS NO. - 3/C, BLOCK - LA,
SECTOR – III, SALT LAKE CITY,
KOLKATA – 700 098 WEST BENGAL, INDIA**

November 12, 2012

WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED

BANDEL THERMAL POWER STATION
UNITS -1 to 4 [4 x 82.5 MW]

EOI DOCUMENT FOR PRE-QUALIFICATION OF APPLICANT

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EOI NOTICE

**The West Bengal Power Development Corporation Limited
(A Government of West Bengal Enterprise)**

Registered & Corporate Office:

Bidyut Unnayan Bhawan,
Plot No. - 3/C, Block - LA,
Sector – III, Salt Lake City,
Kolkata – 700 098



**REQUEST FOR EXPRESSION OF INTEREST FOR UNDERTAKING
RENOVATION & MODERNISATION WORK IN RESPECT OF PULVARISED
COAL FIRED UNITS # 1 TO 4 OF BANDEL THERMAL POWER STATION**

EOI Notice No. WBPDC/EOI-Adv/12-13/117Corp

Date: November 12, 2012

1.0 The West Bengal Power Development Corporation Limited (WBPDC), an enterprise of Government of West Bengal, intends to enhance and extend the life by 15-20 years of their existing 4 (four) Nos. Pulverized Coal fired Power Generating Units (presently de-rated to 60 MW from original generation capacity of 82.5MW) by undertaking Renovation & Modernisation (R&M) of Steam Generator, Turbine-Generator and their auxiliaries.

2.0 Objective of Renovation & Modernization (R&M) Work

Enhance the generation capacity of age old Units to its original MCR capacity (82.5 MW) for using low calorific value coal as against original designed coal, maintaining the present day's environmental norms and extend the life by 15-20 years by undertaking major R&M of Steam Generator, Turbine-Generator and their auxiliaries including complete replacement of age old pneumatic based Control & Instrumentation system by state of the art DCS technology.

3.0 WBPDC now invites Expression of Interest (EOI) to prequalify the Applicants separately for Steam Generator & its auxiliaries as per Clause No. 4.0, 4.1 & 4.2.1 and for Steam Turbine-Generator & its auxiliaries as per Clause No. 4.0, 4.1 & 4.2.2.

4.0 Qualification Requirement and Eligibility Criteria

Pre-qualification is open to Firms (Applicants) or joint ventures (applicants) having sound financial and technical capabilities in similar nature of activities. The Applicant shall fulfill satisfactorily the eligibility criteria requirements as stipulated under and submit documentary evidences, where applicable.

- 4.1 (a) Applicant should have an establishment in India as a wholly owned subsidiary or as a Joint Venture (JV) Company with majority share holding with the OEM as described in Clause No.4.2.1 & 4.2.2 and having their own functional manufacturing facility in India.
- (b) Applicant should have a minimum annual average turnover of Indian Rupees 200.00 Cr for the last three financial years.
- 4.2 In addition to the requirements stipulated at Para 4.1 above, the Applicant and/or, where applicable, his JV Partner should also meet the requisite qualifying requirements stipulated herein under.
- 4.2.1 (i) Is an Original Equipment manufacturer(OEM), who designs, manufactures and supplies PF front/wall fired Steam Generator and its auxiliary equipments and / or undertakes the type of work specified here under and has adequate technical knowledge and relevant experience.
- AND
- (ii) Applicant should have undertaken at least two major Renovation & Modernization of wall fired B&W Boilers having minimum capacity of 60 MW or above, in India, which are in successful operation with more than 80% PLF for at least three consecutive years.
- 4.2.2 (i) Is an Original Equipment Manufacturer, who designs, manufactures and supplies Impulse-Reaction type Steam Turbines & Alternator and their auxiliary equipments and / or undertakes the type of work specified here under and has adequate technical knowledge and relevant experience.
- AND
- (ii) Applicant should have undertaken at least two major Renovation and Modernization of Impulse-Reaction type Steam Turbines and Alternators having minimum capacity of 60 MW and above, in India, which are in successful operation with more than 80% PLF for at least three consecutive years.
- 5.0 Please refer 'General Description of the Station' as well the Coal Data /Ash Data.
- 6.0 The EOI should be supported with the following information/documents :
- a. Company Name, principal place of business and contact details,
 - b. ROC details demonstrating the company entity and share holding pattern,
 - c. Manufacturing unit details establishing that it is a fully functional unit with references,
 - d. Credentials demonstrating of:-

- (i) Boiler OEM and Designer status holding PF Wall Firing Technology with reference lists in India and overseas.
 - (ii) Turbine OEM and Designer status holding Impulse-Reaction Technology with reference lists in India and overseas.
 - e. Credentials in support of the required boiler R&M experience stated above.
 - f. Audited financial statement of last three years
 - g. Litigation History:
The Applicant should provide accurate information on any litigation or arbitration resulting from contracts completed or under its execution over the last ten (10) years. A consistent history of awards against the Applicant or any partner of a joint venture may result in rejection of the application.
- 7.0 The Expressions of Interest (EOI) must be submitted in 3 (Three) Copies including one Original in a sealed envelope clearly marked as below separately for Boiler & its auxiliaries and Turbine-Generator & its auxiliaries.

“EXPRESSION OF INTEREST FOR R&M WORK OF BANDEL THERMAL POWER STATION UNITS # 1 TO 4”

And **delivered not later than 15.00 Hours on 30th November, 2012 (Friday)** to the address below:

The Director (Projects)
West Bengal Power Development Corporation Limited
Bidyut Unnayan Bhaban, 3/C, Block-LA, Sector-III,
Salt Lake City, Kolkata – 700 098.
Tel No. +91-33-2335-0581, Fax No. 91-33-2339-3286
e-mail: <akghoshal@wbpdcl.co.in>

Sd/-

Director (Projects)

The West Bengal Power Development Corporation Limited

Details of Letter of Application & Proforma

Details of Letter of Application & Proforma

<u>Sl. No.</u>	<u>Form No.</u>	<u>Description of the Form</u>
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9.	Form-5	: Financial Capability
10.		: Litigation History

FORM NO. : 1

LETTER OF APPLICATION

[Letter head paper of the applicant or partner responsible for a joint venture, including full postal address, telephone number, fax number, telex number and cable address]

Date

To

(Name and address of the Applicant)

Ladies and/or Gentlemen,

1. Being duly authorised to represent and act on behalf of(hereinafter referred to as “the Applicant”), and having reviewed and fully understood all of the pre-qualification information provided, the undersigned hereby apply to be pre-qualified by yourselves for the proposed R&M work of Units No. 1 to 4 of Bandel TPS .

2. Attached to this letter are copies of original documents defining

- a) The applicant’s legal status
- b) The principal place of business
- c) The place of incorporation (for applicants who are Corporations), or the place of registration and the nationality of the owners (for applicants who are partnership or individually – owned firms).

3. You and yours authorised representatives are hereby authorised to conduct any enquiries of investigations to verify the statements, documents, the information submitted in connection with this application and to seek clarification from our bankers and clients regarding any financial and technical aspects. This letter of application is also served as authorization to any individual or authorised representative of any institution referred to in the supporting information, to provide such information deemed necessary and as requested by you to verify statements and information provided in this application, such as the resources, experience, and competence of the Applicant.

4. You and your authorised representatives may contact the following persons for further information:-

General and managerial inquiries	
Contact 1	Telephone 1
Contact 2	Telephone 2

Personnel inquiries	
Contact 1	Telephone 1
Contact 2	Telephone 2

Technical inquiries	
Contact 1	Telephone 1
Contact 2	Telephone 2

Financial inquiries	
Contact 1	Telephone 1
Contact 2	Telephone 2

a. For applicants for joint ventures, all the information requested in the pre-qualification documents is to be provided for the joint venture, if it already exists,

and for each party to the joint venture separately. The lead partner should be clearly identified. Each partner in the joint venture shall sign the letter.

b. Applications by joint ventures should provide on a separate sheet equivalent information for each party to the application.

5. This application is made with the full understanding that:

- a) Prequalifying applicants will be subject to verification of all information submitted for prequalification;
- b) You reserve the right to reject or accept any application, cancel the prequalification process, and reject all applications.
- c) You shall not be liable for any such actions and shall be under no obligation to inform the Applicants of the ground for the above.

8. The undersigned declared that the statement made and the information provided in the duly completed applications are complete, through, and correct in every detail.

Signed	Signed
Name	Name
For and on behalf of (name of the applicant or lead partner of a joint venture)	For and on behalf of (name of partner)

Signed	Signed
Name	Name

For and on behalf of (name of partner)	For and on behalf of (name of partner)

Signed	Signed
Name	Name
For and on behalf of (name of partner)	For and on behalf of (name of partner)

FORM NO. : 1A

GENERAL INFORMATION

All individual firms and each partner of a joint venture applying for prequalification are requested to complete the information in this form. Nationality information should be provided for all owners or applicants who are partnerships or individually owned firms.

1.	Name of Firm	
2.	Head Office Address	
3.	Telephone	Contact
4.	Fax	Telex
5.	Place of incorporation / registration	Year of incorporation / registration

Nationality of owners		
	Name	Nationality
1.		
2.		
3.		
4.		
5.		

FORM NO. : 2

GENERAL EXPERIENCE RECORD

Name of Applicant or Partner of Joint Venture

All individual firms and all partners of a joint venture are requested to complete the information in this form. The information supplied should be the annual turnover of the Applicant (or each member of a joint venture) for each year.

Use a separate sheet for each partner of a joint venture.

Year	Turnover

FORM NO. : 2A

JOINT VENTURE SUMMARY

Names of all partners of a joint venture
1. Lead Partner
2. Partner
3. Partner

Total value of annual turnover, in terms of sales billed to clients.
--

Partner	Form 2 page no.	Year 1	Year 2	Year 3
1. Lead Partner				
2. Partner				
3. Partner				
TOTAL				

FORM NO. : 3

PARTICULAR EXPERIENCE RECORD

Name of applicant or partner of a joint venture

To prequalify the applicant shall be required to pass the specified requirements applicable to this form, as set out in the 'Prequalification Requirements to Applicants' R&M Work.

On a separate page, using the format of form-3A, the applicant is requested to list all contracts and their valuation in INR of a similar nature and complexity. The partners of a joint venture should provide details of similar contracts proportionate to their share in the joint venture. The value should be based on the INR of the contract. The information is to be summarized, using form-3A for each contract completed by the applicant or by each partner of a joint venture.

Where the applicant proposes to use the name of joint ventures for R&M of major equipment namely boiler, turbine, generator, ESP and Control & Instrumentation, the information in the following forms should also be supplied.

Applicants have to enclose evidence documents for the work completed. Users' certificates are to be submitted.

FORM NO. : 3A

DETAILS OF CONTRACTS OF SIMILAR NATURE AND COMPLEXITY OF R&M WORK

Name of applicant of a partner of a joint venture

Use a separate sheet for each contract.

1	Number of contract
	Name of Contract
	Country
2	Name of employer
3	Employer Address
4	Nature of R&M works relevant to the contract for which the applicant wishes to pre-qualify
5	Contract role (check one) Sole contractor Partner in a joint venture / associate
6	Value in specified currencies at completion, or date of award of contracts,
	Total contract Amount(name of currency)
	Sub contract amount (if the role was sub-contractor)(name of currency)
	Responsible contract amount (if the role was partner in a joint venture) :(name of currency) (percentage of share)
7	Date of Award
8	Date of completion
9	Contract / sub-contract duration (years and months)
10	Specified the Guaranteed requirements after R&M a) Turbine heat rate : b) Boiler efficiency : c) SPM at ESP outlet : d) End user certificate :

FORM NO. : 3B (i)

PAST EXPERIENCE AND PERFORMANCE

1. R&M of Steam Turbine & its Auxiliaries of Unit Capacity 60 MW or above

No.	Country	Name of the R&M Project	Original Installed Capacity (MW)	Heat Rate Achieved /Guaranteed after R&M	Name of Owner	Date of Actual Commissioning after R&M	Name of Manufacture and/or subcontractor

Note : Enclose completion certificates & Performance certificates of the actual Owners.

(Place and Date)

(Representative)

FORM NO.: 3B (ii)

PAST EXPERIENCE AND PERFORMANCE

2. R&M of Steam Generator & its Auxiliaries of Unit Capacity 60 MW or above:

No.	Country	Name of the R&M Project	Original Installed Capacity (MW)	Steam Generator Capacity & Guaranteed efficiency Achieved after R&M	Name of Owner	Date of Actual Commissioning after R&M	Name of Manufacture and/or subcontractor
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Note : Enclose completion certificates & Performance certificates of the actual Owners.

(Place and Date)

(Representative)

FORM NO. : 4

SUMMARY SHEET: CURRENT R&M CONTRACT COMMITMENTS / WORK IN PROGRESS

Name of Applicant or partner of a joint venture

Applicants and each partner to an application should provide information on their current R&M commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received or for contracts approaching completion but for which an unqualified, full completion certificate has yet to be issued

Name of Contract	Value of the work	Estimated completion date
1.		
2.		
3.		
4.		
5.		
6.		

FORM NO.: 5

FINANCIAL CAPABILITY

Name of Applicant or Partners of Joint Venture

[Applicants/each partners of Joint Venture should provide the following information to demonstrate that they meet the requirements stated in the EOI Notice for prequalification for Applicants in clause 4.1.(b).]

1. Name of the Firm:

.....

2. Individual and Cumulative Turnover in the last three audited financial years (in Rs.):

	<Amount in Rs>	<Amount in Rs>	<Amount in Rs>	<Amount in Rs>

(Please provide Published Annual Account for Balance Sheet and Profit and Loss statements as proof)

Signature:

Seal

FORM NO. : 6

LITIGATION HISTORY

Name of Applicant or Partner of a joint venture

[Applicants/ each of the partners of a joint venture should provide information on any history of litigation or arbitration resulting from contracts executed in the last ten (10) years or currently under execution as stated in the EOI Notice for Prequalification for Applicants in clause 6.(g). A separate sheet should be used for each partner of a joint venture].

Year	Award FOR or AGAINST Applicant	Name of client, cause of litigation, and matter in dispute	Disputed amount in INR

General Description of the Station

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

Erstwhile West Bengal State Electricity Board established Bandel Thermal Power Plant during the year 1964 by installing 4(four) coal based Units each having capacity of 82.5 MW with M/s Westinghouse, USA make Turbine-Generator and Babcock & Wilcox, USA make Steam Generator. In the year 1982, another 1X210 MW (Unit No.5) coal based unit was set up in the plant as an extension of the then station. The ownership of the plant was transferred to The West Bengal Power Development Corporation Limited from Erstwhile West Bengal State Electricity Board in the year 2001.

The Unit No.1, 2, 3 & 4 were commissioned respectively on 4th September'1965, 18th October'1965, 17th February'1966 and 3rd August'1966. Since inception Units are continuously generating and have crossed more than 2, 75,000 running hours. As a result, Units are facing various specific and generic problems. Life expectancy of the units has gone down and performances of the units have drifted away from its designed value and are not able to achieve rated generation 82.5MW. At present units are still generating after de-rated to 60MW. Even overhauling of all the load bearing equipments of the units do not have sustained impact on the Unit Heat Rate and efficiency.

Only through a planned R&M and LE (life extension) program, it is possible to achieve highest efficiency or Unit Heat Rate for a sustained period of time i.e. for next 15(fifteen) to 20(Twenty)years.

In view of the above WBPDC has decided for renovation & modernization (R&M) and life Extension (LE) of those Units.

The Applicant shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of EOI. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data/information as may be necessary shall have to be obtained / collected by the Bidder from site.

2.00.00 APPROACH TO SITE

Bandel Thermal Power Station site is located near Tribeni town in the district of Hugli in West Bengal. Plant is about 50 km from Kolkata. Bandel, from which the power plant gets its name, is another nearby town which is the nearest major railway station on the main Howrah – Bardhaman railway line of Eastern Railway. Nearest railway station is Triveni on Bandel – Katwa branch line of Eastern Railway. The area is included in the Triveni Chandrahati Gram panchayat. Its latitude and longitudinal extents are 22^o 54' N and 88^o 24' E, respectively. The neighborhood of the thermal power plant includes Triveni Tissue Township, Bansberia Municipality, Chandra Hati Gram Panchayet No. 1 and 2, Kuntighat, benipur, Raghunathpur. Triveni is well connected by metalled road.The Grand Trunk Road (National Highway No. 2) runs about 2.0 Km from the plant. The plant is situated on the western

bank of river Hugli (also called Ganga), about 1km away from Assam road. It is connected to National Highway 2 by Assam Road and then Delhi Road.

Nearest Airport – Kolkata.

Nearest Seaport – Kolkata/ Haldia

3.00.00 **LAND**

The Bandel Power Station is built over approximately 102.258 Acre of Land. The locations of various facilities and plant auxiliaries for existing Units are as per enclosed General Layout Drawing. The plant has two ash disposal ponds each covering approximately 34.42 Acre (Pond-1) & 37.087Acre (Pond-2) of land.

Plant has its own residential township built up around 121 Acre of land which is about 4Kms away from plant boundary.

4.00.00 **SOURCE OF COAL**

The Coal for the Power Station is normally supplied from the Eastern Coal fields (ECL) and captive coal mines of WBPDCCL.

Coal is transported from the coal fields to the Power station in Box-N rake loads through Howrah-Bardhaman broad-gauge line of Eastern Railways.

Fuel oil (HFO/LDO) is transported by railway oil tankers from nearest oil depot.

5.00.00 **SOURCE OF WATER**

The water requirement for the Power station is met by drawing water from the western bank of river Hugli. The Power station is operating on open cooling Water system.

6.00.00 **ASH DISPOSAL AREA**

The ash disposal area for the station is located about 1 Km from the plant site.

7.00.00 **SALIENT CLIMATOLOGICAL AND DESIGN DATA**

7.01.00 Unless otherwise specified, the following design conditions shall be considered for the equipment offered:

- a) Design ambient temperature : 50 °C maximum, 5 °C minimum
- b) Average annual rainfall : 1581 mm
- c) Seismic zone : Zone-III as per IS-1893 latest revision
- d) Wind load : In accordance with IS-875 for a basic wind speed of 47 m/sec upto a height of 10 metres above mean ground level.
- e) Altitude : 3.0Mtrs. above MSL.

8.00.00 **BRIEF DESCRIPTION OF EXISTING PLANT & MACHINERY OF UNIT # 1 to 4**

8.01.00 **BOILER & BOILER AUXILIARY**

8.01.01 **DESIGNED /OPERATING PARAMETERS OF BOILER AT MRC**

Drum Pressure	:	113 kg/cm ²
Main Steam Pr. at Super heater outlet	:	106.5 kg/cm ²
Main Steam Temperature at Super heater outlet	:	543.33 ⁰ C
Peak Evaporation capacity (for 2hrs.)	:	295 T/hr.
Steam requirement at full load of 85.2 MW	:	272.1 T/hr.
Feed Water Flow	:	272.1 T/hr
Feed Water Temperature at full load at Economizer inlet	:	242.2 ⁰ C
Feed Water Temperature at full load at Drum inlet	:	287.78 ⁰ C
Reheater outlet Pressure	:	34.23kg/cm ²
Reheater outlet Temperature	:	543.33 ⁰ C
Furnace heat release rate	:	148.63kCal/m ³ /hr.
Air heater gas outlet Temp.	:	155.55 ⁰ C
Draft	:	
a) In Furnace	:	0.26 in Cm of water
b) At Economiser outlet	:	10.4 in Cm of water
c) In Air Heater outlet	:	21.18 in Cm of water
Fuel Fired (T/hr)	:	43.5
Number of Coal Burners in use	:	9
Total air (T/hr)	:	183
Excess Air at air heater exit (%)	:	20

8.01.02 BOILER AUXILIARY EQUIPMENT

(i) COAL FEEDER

Type : Drag link
Make : STOCK, USA
Number : 3

(ii) COAL MILLS

Type : Ball Mill EL-76
Make ; Babcock & Wilcox, USA
Number : 3

(iii) PRIMARY AIR FAN

Type : PE-7035-1-2166-2A
Number : 3
Maker : Davidson & Co. Ltd.
Fan control : Radial vane

(iv) FORCED DRAUGHT FAN

Type : PE-20316-1050-4054-D
Number : 2
Maker : Davidson & Co. Ltd.
Fan control : Constant speed vane control

	<u>M.C.R.</u>	<u>Design</u>
Capacity (T/hr)	: 182.67	195.2
Air temperature (°C)	: 42.77	42.77
Fan power KW	: 149	186

(v) INDUCED DRAUGHT FANS

Type : PE-20316-1070-9056-HD
Number : 2
Maker : Davidson & Co. Ltd.

	<u>M.C.R.</u>	<u>Design</u>
Capacity (m ³ /min)	: 3385	3654

Gas temperature (°C) : 155.5 155.5

(vi) AIRHEATER

Two air heaters , each as follows :

Type : Babcock Vertical Tubular

8.01.03 ELECTROSTATIC PRECIPITATOR (ESP)

Originally the Units were equipped with Mechanical Dust Collectors. Subsequently, ESP was installed and retrofitted during early 90s by BHEL.

8.02.00 TURBINE & TURBINE AUXILIARY

(i) STEAM TURBINE

Manufacturer : Westinghouse Electric Company, USA.

Maximum Rated Output of Turbine : 87.5 MW

Rated Output of Turbine : 82.5 MW

Rated speed : 3000 RPM

Number of Cylinder : 2

Rated Inlet Steam Pressure : 105 kg/cm² abs.

Rated live steam temperature : 538⁰ C

Rated reheat steam temperature : 538⁰ C

Rated Steam flow : 284 T/hr.

Exhaust Pressure : 63.5mm of Hg.

No. of Extraction : 5

Blading

Number of Stages in H.P. Turbine : 1 Curtis Stage with 2-rows of rotating blades and 1-row of stationary blades & 11 pair of rows of Reaction stages

Number of Stages in I.P. Turbine : 22 pairs of rows of Reaction bladings

Number of Stages in L.P. Turbine : 12(2x6) Pairs of rows of Reaction bladings

(i) BRIEF DESCRIPTION OF STEAM TURBINE

The Turbine is a Two (2) Cylinder, Tandem compounded, double flow, reheat and condensing type. The HP & IP Stages are mounted on a single HP-IP combined drum type bored integral rotor forging. The LP turbine is

straight reaction double flow with steam entering at the centre of turbine. Rigid type flange couplings between two turbine rotors and Generator are used and rotor are located axially by high pressure rotor thrust bearing installed in front pedestal/thrust pedestal. These three rotating elements are supported on six bearings housed in turbine pedestals. The rotor gland are labyrinth type. The HP inlet and outlet glands are steam sealed whereas LP glands are water sealed.

The high pressure and intermediate pressure inner casings are of alloy steel castings and split in horizontal plane are assembled in a single outer casing which is also made of alloy steel casting and split at in horizontal plane. The high-intermediate pressure and low pressure turbine rotor are machined from solid alloy steel forgings. A separate stud shaft is bolted to the inlet end of HP-IP shaft to form the thrust bearing collar and to carry the oil impellers and the over speed trip.

The unit is provided with Two (2) Steam Chests. One located on each side of HP turbine casing. Each steam chest contains one Throttle Valve (Emergency Stop Valve) and three Plug type Governing valves. The main steam from Boiler enters the HP turbine through Throttle Valves, six (6) plug type Governing valves and five (5) inlet sleeves connected to the nozzle chambers which are located in the inner casing with slip joints. Three of these inlet chambers are in bottom casing and two are in top casing. After expansion in HP cylinder, steam flows to the reheater through two exhaust openings in the outer casing base and reheater, steam enters IP turbine through Intercepting valves. After expansion in intermediate pressure section, steam passes through a single cross over pipe and enters the LP turbine at a portion mid way along the length of the cylinder and then divides into two equal axially opposed flows. Each flow passes through six reaction stages from where it finally flows to the condenser. Condenser is installed on RC foundation and these are connected to LP turbine exhaust with expansion bellows in between to take care of expansions. There is a provision of motorized Turing Gear arrangement.

There are five (5) Extractions in the Condensate and Feed heating system with two (2) HP Heaters, one Deaerator and two (2) LP Heaters.

8.03.00 CONTROL & INSTRUMENTATION

All major closed loop controls of the Unit are accomplished through Pneumatic Control System supplied by M/s Bailey, USA and non-critical controls are achieved through M/s Fisher, USA make Pneumatic type Self – controllers.

9.00.00 COAL & RAW WATER DATA

9.01.00 Analysis of Coal

The Steam Generator shall be able to operate with following Grade of Coal to meet the steaming requirement of the Unit at TMCR of 82.5

MWe with peaking at 87.5 MWe (limited to 2 hours daily) after R&M of the Units.

PROXIMATE ANALYSIS OF COAL (As received Basis)					
Sl. No.	Description	Symbol	Worst Coal	Design Coal	Range of Adequacy Coal
1	Total Moisture	TM%	15.00	12.00	12-15
2	Ash	A%	40.00	36.00	33 - 40
3	Volatile Matter	VM%	19.00	22.00	23- 19
4	Fixed Carbon	FC%	26.00	30.00	31 -26
ULTIMATE ANALYSIS (As Received Basis)					
1	Carbon	C%	29.73	37.32	40.60 – 29.73
2	Hydrogen	H ₂ %	3.70	3.92	4.02 - 3.7
3	Nitrogen	N ₂ %	1.80	1.60	1.40- 1.80
4	Oxygen (by difference)	O ₂ %	8.66	8.32	8.12- 8.66
5	Sulphur.	S%	0.50	0.40	0.40 - 0.50
6	Carbonates	CO ₃ %	0.58	0.40	0.40 - 0.58
7	Phosphorous	P ₂ %	0.03	0.04	0.03 - 0.04
8	Total Moisture	TM%	15	12	12-15
9	Ash	A%	40	36	33 - 40
10	Total	%	100	100	
11	Gross Caloric Value (as received basis)	GCV Kcal/Kg	3300	4000	4300 - 3300
12	Hard grove index	HGI	55	60	50 - 65
13	YGP index	mg/Kg	95	80	

9.02.00 Analysis of Ash

ASH ANALYSIS					
SI. No.	Description	Symbol	Worst Coal	Design Coal	Range of Adequacy Coal
1	Silica	(SiO ₂)%	59.79	56.70	60.00 - 56.00
2	Alumina	(Al ₂ O ₂)%	25.36	23.00	26.00 - 23.00
3	Iron Oxide	(Fe ₂ O ₂)%	7.20	1000	7.00-10.00
4	Titania	(TiO ₂)%	1.20	1.50	1.20- 1.50
5	Phosphoric Anhydride	(P ₂ O ₅)%	2.60	3.00	2.60-3.00
6	Lime	(CaO)%	0.88	1.50	0.88-1.50
7	Magnesia	(MgO)%	0.55	1.00	0.50- 1.00
8	Sulphuric Anhydride	(SO ₂)%	1.20	1.40	1.20- 1.40
9	Alkalies (by diff.)	(Na ₂ O+K ₂ O)%	1.22	1.40	1.2- 1.40
ASH FUSION RANGE (Under reducing atmosphere)					
1	Initial Deformation Temperature	IDT °C	1100	1100	1100-1150
2	Hemispherical Temperature	HT °C	1300	1350	1250-1400
3	Flow Temperature	ET °C	1400	1400	1400- 1450

9.03.00 Raw Water Data

Different Characteristics	Results
Ammonia, free (as NH ₃) Albumemoib .4ppm	- 0.02 ppm
Carbon Dioxide free (as CO ₂)	-< .5ppm
Silica (in solution (as SiO ₂))	5
Dissolved Oxygen (O ₂)	- 5.3ppm
Suspended Solids	-
Dissolved Solids	438 108
pH	7.5 – 8.0 7.8
Organic Matter (In terms of Oxygen absorbed from acid permanganate solution in 4 hours)	2.0 .6ppm
Appearance	Turbid / slight Turbid
Odour	Nil
Turbidity	500 NTU 316