	OWNER & CONSULTANT:	NTPC LIMITED
	EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED, POWER SECTOR.

TELANGANA SUPER THERMAL POWER PROJECT STAGE-II (3X800MW) BTG PACKAGE

(TECHNICAL SPECIFICATION FOR CIVIL WORKS)

SECTION - B
PROJECT INFORMATION

BHEL DOCUMENT NUMBER: PE-TS-546-600-C102-R0

1.00.00 BACKGROUND

Ramagundam Super Thermal Power Project (RSTPP) in District Karimnagar of Telangana was conceived as a coal based super thermal power plant for implementation by NTPC. RSTPP is presently operating with 2600 MW (3x200 MW + 4x500 MW) installed capacity and are under commercial operation.

As per A.P. Re-organisation Act 2014, NTPC has been mandated to set up 4000 MW Coal fired thermal power plant for Telangana State.

Based on this, NTPC has already installed Telangana Stage I of capacity 1600 MW (2 X 800 MW) within the MGR unloading bulb of NTPC's Ramagundam Super Thermal Power Station and situated at 18° 44' 47" (N) to 18° 45' 30" (N) and longitude 79° 28' 06" (E) East to 79° 28' 36" (E). Telangana Stage I units of 800 MW are based on Ultra Super Critical Technology. Both units (2 X 800 MW) of Telangana Stage I are under commercial operation.

The Present proposal is for Telangana STPP, Stage-II of capacity 2400 MW, comprising (3x800 MW) as extension of existing Stage-I, and based on Ultra Super Critical Technology

2.00.00 LOCATION AND APPROACH

Telangana Super Thermal Power Project (TnSTPP), Stage II has also been identified to be located within the MGR unloading bulb are of NTPC's Ramagundam Super Thermal Power Station, adjacent to the existing Telangana Stage I and situated at 18° 44' 47" (N) to 18° 45' 30" (N) and longitude 79° 28' 06" (E) East to 79° 28' 36" (E).

TnSTPP is located at about 51 km from district headquarter Karimnagar and at about 1 km near Ramagundam village. The site is well connected through NH-07 and NH-16 through (Hyderabad-Mancherial Road popularly known as Rajiv Rahadari). Nearest railway station Ramagundam is about 5 km from the plant which lies on the main Kazipet-Balarshah Broad Gauge line of South-Central Railway. The nearest commercial airport Hyderabad is at a distance of about 210 km.

Vicinity Plan of the proposed project is placed at Annexure -I.

For further information apart from given in this sub-section, Bidders are also advised to visit the project site and collect data regarding local site conditions.

3.00.00 CAPACITY

Ultimate Capacity: 4000 MW

STAGE-I	:	1600 MW (2 x800 MW) - Under Commercial Operation
STAGE-II	:	2400 MW (3 X800 MW) - Present Proposal

4.00.00	LAND
	The proposed three units of 800 MW capacity will be set up in the available land (about 90 acres) in MGR unloading bulb area within existing premises of RSTPP.
	The ash disposal area of 607.18 acres has been identified near Ramagundam Ash Dyke area, in the limits of Mogalphas Village of Anthergaon Mandal. This land is located about 10 km from the present Telangana II main plant area.
5.00.00	WATER
	The expected source of water for the project is from Yellampally Barrage, on Godavari River, at a distance of about 12 km from the proposed plant. Water allocation has been made available for the proposed Stage II of Telangana by the State Government. Make up water requirement for this project would be about 3100 cum/hr (about 30 Cusecs). Air cooled condenser system is envisaged for Stage-II of Telangana. Closed cycle cooling water system using ACW Pumps & Aux. Cooling Towers is envisaged for Stage-II of the project.
6.00.00	COAL
6.01.00	Coal requirement for Telanagna STPP, Stage-II (3x800 MW) would be about 12 MTPA at 90% PLF and shall be met from coal mines of SCCL in the vicinity of the project.
6.02.00	Coal Transportation
	Transportation of Coal from Coal Mines to Telangana Stage-II project is proposed by Indian Railways System in BOBR / BOX- N wagons. Presently coal is received from SCCL and the same is transported through MGR system for Telangana Stage I from SCCL. Augmentation of the existing Stage-I railway siding is envisaged to bring coal and material to the proposed site.
6.03.00	Coal Quality
	The primary fuel for the main steam generator shall be coal. The coal quality parameters are indicated in Annexure-IV-2 are to be considered for steam generator design. Typical Imported Coal & its Ash characteristics are indicated in Anenxure-IV-4.
7.00.00	FUEL OIL
	The fuel oils to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Light Diesel Oils having the characteristics given at Annexure-IV-1. High Speed Diesel Oils characteristics given at Annexure-IV-3
8.00.00	MODE OF OPERATION : Middle load (two shifting and load cycling)
9.00.00	STEAM GENERATOR TECHNOLOGY
	The steam generators shall be super critical, once through, water tube type, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas path arrangement shall be single pass (Tower type) or two pass type.

10.00.00 ENVIRONMENTAL EMISSION CONTROL DEVICES

The project is envisaged with environmental emission control devices and steam generator design towards compliance with the applicable emission norms. The secondary NO_x control system (SCR/SNCR or a hybrid of both) and Flue Gas Desulfurization (FGD) system are not included in the scope of this contract. Necessary provisioning for NO_x control as detailed out in specifications shall however be in the scope of the Contractor.

11.00.00 CONSTRUCTION POWER

The requirements of the construction power supply for the project would be met from the existing 33 kV/11 kV construction switchgear located near Raw water p/H inside Ramagundam STPP.

12.00.00 NOT USED

13.00.00 PLANT WATER SCHEME

Brief Description of the Plant Water scheme is described further in below clauses. Scope of supply for the same is detailed further in Sub Sections. Plant water scheme is included in Part-E of the technical specification.

13.01.00 Equipment Cooling Water (ECW) (Unit Auxiliaries)

All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. 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 primary circuit DM water shall be cooled through plate type heat exchangers by Auxiliary Circulating Water (ACW) from ACW system in a closed secondary circuit. The hot secondary circuit ACW shall be cooled in the Aux. cooling towers and shall be returned back to the system.

It is proposed to provide independent primary cooling water circuit for Turbine Generator & its auxiliaries and Steam Generator & its auxiliaries on Unit basis.

13.02.00 Aux. cooling water System Description

In a closed secondary circuit, ACW system has been envisaged to cool DM water, used in the primary circuit. ACW pumps (Unit dedicated) have been envisaged in ACW system to supply the cool ACW water from a common aux. cooling tower (Aux. IDCT) basin to PHEs and hot ACW water (Outlet from Plate heat exchangers) shall be returned to Aux. cooling tower of all units through pipes. Cooled water from Aux. cooling tower will be led to ACW pumps through pipes/ducts by gravity. ACW Water shall be provided at terminal points for the Bidder for the purpose of secondary cooling.

13.03.00 Other Miscellaneous Water Systems

ACW system blow down water shall be sent to Ash Water Tank for meeting water requirement of Ash Handling plant and CMB for reuse. The plant service water

	requirement, Aux Cooling water system make-up, APH wash & FGD system make up shall be met from PT plant of ACW system (PT-ACW). Make-up water requirement for dust suppression system shall be meet from service water system. The waste service water collected from various areas and coal-laden water from coal handling plant shall be treated as per requirement and reused. The quality of Raw water, Clarified Water & DM Water are given in this sub-section at Annexure-III-A, and III-B & III-C.
14.00.00	ENVIRONMENTAL ASPECTS Telangana STPP, Stage-II is proposed to be constructed on the land already available in the Ramagundam Bulb area and other area near Stage I. Environment Clearance for Telangana STPP Stage-II has been applied. TOR for the project has been accorded by MoEF&CC. Further EIA Study is being carried out.
15.00.00	DELETED
16.00.00	METROLOGICAL DATA The metrological data from nearest observatory is placed at Annexure-II.
17.00.00	CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Part-B of this section. Refer Annexure – E to Section – D-1, Part-B of Technical Specification for Criteria for Earthquake Resistant Design of Structures and Equipment.
18.00.00	CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT Refer Annexure – D to Section – D-1, Part-B of Technical Specification for Criteria for Wind Resistant Design of Structures and Equipment.
19.00.00	Vulnerability Atlas of India (VAI), prepared by Building Materials, Training and Promotion Council (BMTPC) under Ministry of Housing and Urban Affairs, is a comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/UT-wise hazard, maps with respect to earthquakes, winds and floods for district-wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and landslides. The main purpose of this Atlas is its use for disaster preparedness and mitigation at policy planning and project formulation and construction stage. The VAI provides necessary information for risk analysis and hazard assessment and is available at website www.bmtpc.org.

As per Government's directive, it is mandatory for the bidders to refer VAI for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning, designing and execution of the project in terms of following details:

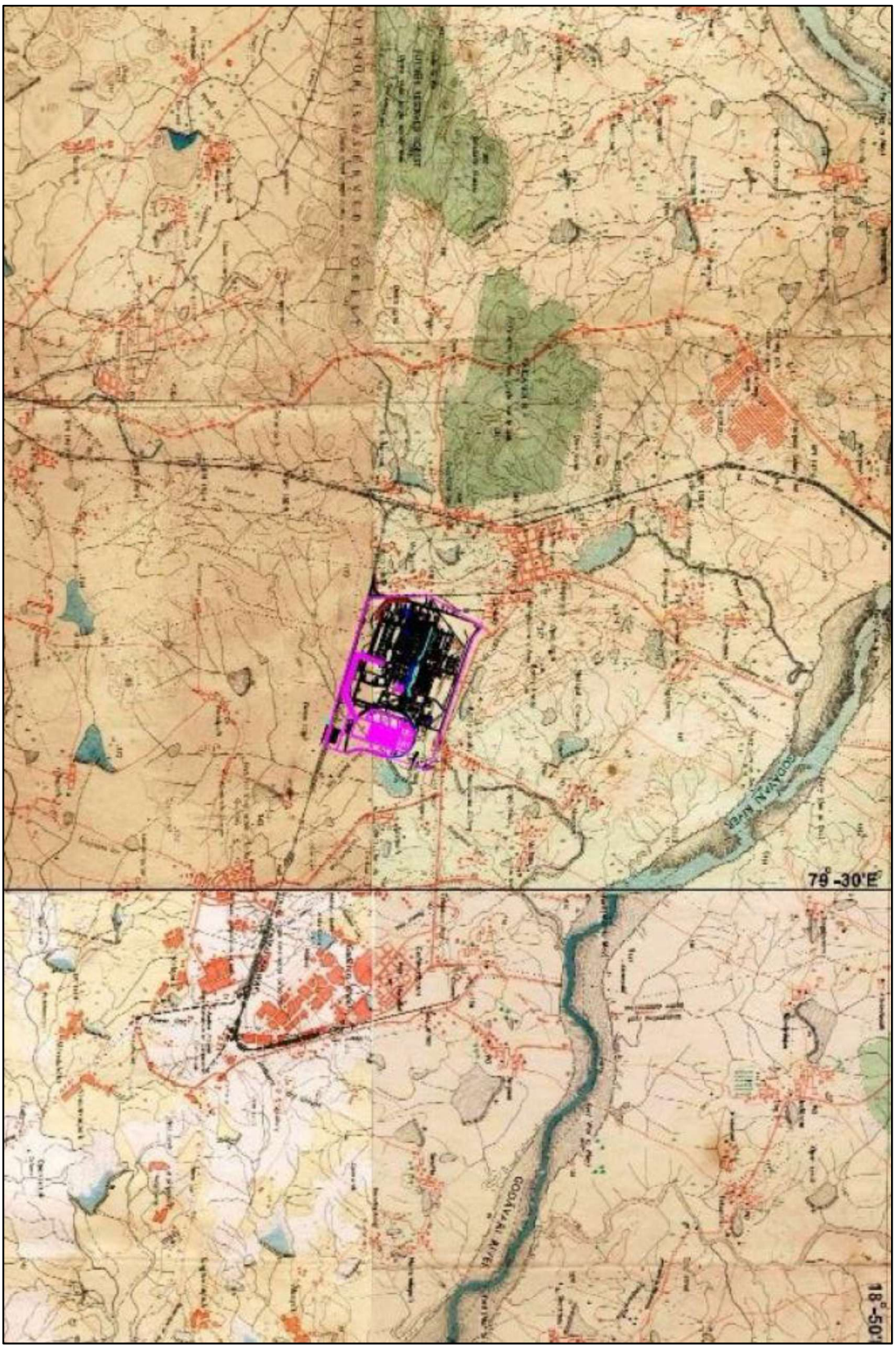
i. Seismic zone (II to V) for earthquakes
ii. Wind velocity
iii. Area liable to floods and Probable max. surge height
iv. Thunderstorms history
v. Number of cyclone storms/sever cyclone storms and max sustained wind specific to coastal region
vi. Landslides incidences with Annual rainfall normal
vii. District wise Probable Max. Precipitation

Accordingly, bidder should refer VAI while planning, designing and execution of the project.

However, for design of structures/facilities and equipment, the criteria for earthquake resistant design of structures and equipment, the criteria for Wind Resistant Design of Structures and Equipment and design parameters for drainage facilities, stipulated in the Technical Specification shall be followed.

For other information like area liable to floods, probable max. surge height, landslide, thunderstorm, cyclone etc. agencies are required to refer the VAI.

Annexure-I



BACK

जलवायवी सारणी

CLIMATOLOGICAL TABLE

स्टेशन : STATION : रामगुंडम Ramgundam — अक्षांश LAT 18°46' — देशांतर LONG. 79°26' — समुद्री तल माध्य से ऊंचाई HEIGHT ABOVE M.S.L. 156 मीटर METRES — प्रेक्षणों पर आधारित BASED ON OBSERVATIONS 1971-2000

माह		स्टेशन का मासत दाब STATION LEVEL PRESSURE hPa	वायु तापमान AIR TEMPERATURE माध्य MEAN सूखा बल्ब DRY BULB °C	गीला बल्ब WET BULB °C	दैनिक अधिक मध DAILY MAX °C	दैनिक न्यून मध DAILY MIN °C	चरम EXTREMES माह में उच्चतम HIGHEST IN THE MONTH °C	माह में निम्नतम LOWEST IN THE MONTH °C	दिनांक और वर्ष DATE AND YEAR	उच्चतम HIGHEST °C	दिनांक और वर्ष DATE AND YEAR	निम्नतम LOWEST °C	दिनांक और वर्ष DATE AND YEAR	आर्द्रता HUMIDITY सायंकाल आर्द्रता RELATIVE HUMIDITY %	वाष्प दाब VAPOUR PRESSURE hPa	मेघ की मात्रा CLOUD AMOUNTS समस्त मेघ ALL CLOUDS आकाश का अष्टमांश Oktas of sky	निम्न मेघ LOW CLOUDS	वर्षा RAINFALL मासिक योग MONTHLY TOTAL मि.मि. mm	वर्षा के दिनों की संख्या NO. OF RAINY DAYS	वर्षा में सबसे नम महीने का योग TOTAL IN WETTEST MONTH WITH YEAR मि.मि. mm	वर्षा में सबसे शुष्क महीने का योग TOTAL IN DRIEST MONTH WITH YEAR मि.मि. mm	24 घंटों में सबसे भारी वर्षा HEAVIEST FALL IN 24 HOURS मि.मि. mm	दिनांक और वर्ष DATE AND YEAR	माध्य पवन गति MEAN WIND SPEED कि.मी. प्र. घ. Kmph
जनवरी JAN	I	998.3	19.9	17.0	30.7	15.6	33.4	10.5		35.3	28 1974	8.0	4 1991	74	17.4	1.6	0.7	11.5	0.7	53.0 1966	0.0	47.6	20 1979	2.6
	II	994.4	28.2	20.2										45	17.2	1.5	0.6							
फरवरी FEB	I	996.3	22.9	18.8	33.5	18.5	36.5	13.3		39.4	29 1980	8.4	22 1993	65	18.6	1.8	0.9	9.7	0.7	77.2 1998	0.0	56.8	6 1998	3.3
	II	992.1	31.4	21.3										38	17.2	1.3	0.7							
मार्च MAR	I	994.5	26.9	21.0	37.5	21.8	40.7	16.5		43.0	29 1966	13.0	11 1979	57	20.2	1.3	0.5	9.2	0.7	71.6 1951	0.0	40.4	12 1987	3.5
	II	989.6	35.3	22.7										30	17.4	1.5	0.7							
अप्रैल APR	I	991.6	30.5	23.7	40.5	25.7	43.7	21.2		45.6	30 2000	15.4	20 1971	55	23.8	1.8	0.5	13.7	1.1	97.7 1997	0.0	62.0	24 1961	4.6
	II	986.2	38.2	24.1										29	18.8	2.7	1.3							
मई MAY	I	988.2	32.8	24.4	42.1	28.3	45.3	23.4		47.3	24 1964	20.4	1 1977	49	23.9	2.5	0.7	34.7	2.4	142.2 1977	0.0	111.2	1 1977	4.5
	II	983.1	39.7	25.2										29	20.4	3.3	1.6							
जून JUN	I	985.5	29.8	24.5	37.4	26.8	43.8	22.6		47.2	8 1953	19.4	3 1973	65	26.6	5.2	1.8	180.1	8.7	373.3 1989	0.0	158.8	15 1998	4.9
	II	981.4	34.9	25.8										49	25.9	5.6	2.4							
जुलाई JUL	I	985.9	27.2	24.5	32.6	24.8	36.6	22.2		41.0	6 1966	18.8	14 1973	79	28.5	6.3	2.4	328.2	14.5	727.2 1988	104.3 1970	131.6	17 1986	3.6
	II	982.7	30.5	25.7										68	29.2	6.5	2.7							
अगस्त AUG	I	986.7	26.7	24.4	31.4	24.5	34.8	22.6		37.9	4 1960	19.8	31 1965	82	28.7	6.3	2.6	285.8	13.1	638.9 1986	46.4 1984	161.9	13 1986	2.9
	II	983.6	29.5	25.5										72	29.4	6.6	2.8							
सितम्बर SEP	I	989.8	27.3	24.7	33.1	24.3	35.7	22.1		38.6	28 1967	17.8	30 1972	80	29.2	4.9	1.9	166.9	8.2	430.4 1998	13.1 1985	145.3	20 1998	2.0
	II	986.2	30.2	25.6										69	29.3	5.7	2.5							
अक्टूबर OCT	I	993.5	26.2	23.1	33.3	22.1	35.8	17.7		38.4	11 1957	15.0	30 1992	76	26.0	3.0	1.1	102.5	4.7	539.6 1973	0.0	135.8	24 1973	1.6
	II	989.9	29.9	24.1										61	25.5	3.8	1.7							
नवम्बर NOV	I	996.7	23.1	19.7	31.5	18.0	34.1	13.4		36.6	6 1977	9.0	30 1970	71	20.4	2.0	0.6	24.0	1.7	118.0 1962	0.0	70.2	5 1961	1.5
	II	993.2	27.8	21.3										54	20.3	2.6	0.9							
दिसम्बर DEC	I	999.1	19.6	16.6	30.0	14.4	32.4	10.4		35.5	14 1964	7.5	24 1994	72	16.8	1.5	0.3	6.5	0.6	109.4 1962	0.0	101.2	2 1966	1.7
	II	995.3	26.6	19.5										49	17.2	1.9	0.5							
वार्षिक जोड़ या माध्य ANNUAL TOTAL OR MEAN	I	992.2	26.0	21.8	34.5	22.1	45.6	9.4		47.3	24	7.5	24	69	23.3	3.2	1.2	1172.8	57.0	1747.1	565.2	161.9	13	3.0
	II	988.2	31.8	23.4						5	1964	12	1994	49	22.3	3.6	1.5			1983	1952	8	1986	
वर्षों की संख्या NUMBER OF YEARS	I									53		53		30	30	30	30	30	30	50	50	50		24
	II	30	30	30	30	30	30	30																

Annexure-II

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : रामगुंडम
STAION : Ramgundam

माह / MONTH		मौसम परिघटना / WEATHER PHENOMENA — के साथ दिनों की संख्या / No. OF DAYS WITH: वर्षण 0.3 मि.मि.या अधिक / PPT 0.3 mm Or more	ओले / HAIL	गर्जन / THUNDER	कुहरा / FOG	धूल भरी आंधी / DUST STORM	झंझावात / SQUALL	पवन / WIND — पवन की गति के साथ दिनों की संख्या (कि. मी. प्र. घं.) / No. OF DAYS WITH WIND SPEED (Km. p. h.): 62 या अधिक / 62 Or more	20-61	1-19	0	पवन की दिशा के दिनों की संख्या का प्रतिशत / PERCENTAGE No. OF DAYS WIND FROM: उ / N	उपू / NE	पू / E	दपू / SE	द / S	दप / SW	प / W	उप / NW	शांत / CALM
जनवरी JAN	I	1.0	0.0	0.5	0.4	0.0	0.0	0	0	11	20	3	5	3	6	11	4	0	1	67
	II							0	0	13	18	1	10	7	8	8	3	2	1	60
फरवरी FEB	I	1.1	0.0	0.8	0.0	0.0	0.0	0	0	14	14	4	8	2	11	15	6	1	2	51
	II							0	0	14	14	2	8	4	7	14	7	4	2	52
मार्च MAR	I	1.2	0.0	1.3	0.0	0.0	0.0	0	0	18	13	2	4	3	14	22	7	1	2	45
	II							0	0	16	15	2	4	1	5	16	12	6	3	51
अप्रैल APR	I	2.0	0.0	3.0	0.0	0.1	0.0	0	0	21	9	2	2	3	14	26	15	3	3	32
	II							0	0	18	12	3	6	2	6	14	13	7	6	43
मई MAY	I	3.8	0.0	4.7	0.0	0.0	0.1	0	0	24	7	3	2	2	9	16	16	10	18	24
	II							0	0	19	12	4	5	3	6	9	8	10	12	43
जून JUN	I	12.9	0.0	7.6	0.0	0.0	0.0	0	0	23	7	2	1	1	2	3	16	27	24	24
	II							0	0	21	9	5	3	1	2	4	14	25	14	32
जुलाई JUL	I	19.2	0.0	7.0	0.0	0.0	0.0	0	0	20	11	2	0	0	1	2	15	25	16	39
	II							0	0	17	14	3	1	0	0	3	12	19	14	48
अगस्त AUG	I	19.0	0.0	5.6	0.0	0.0	0.0	0	0	18	13	2	0	0	0	2	9	26	19	42
	II							0	0	17	14	1	1	0	1	1	7	26	16	47
सितम्बर SEP	I	12.4	0.0	6.8	0.0	0.0	0.0	0	0	15	15	2	1	1	1	2	6	16	19	52
	II							0	0	14	16	3	5	2	2	1	4	15	11	57
अक्तूबर OCT	I	6.7	0.0	4.3	0.0	0.0	0.0	0	0	12	19	5	9	2	4	3	2	3	9	63
	II							0	0	13	18	4	15	8	3	1	2	3	4	60
नवम्बर NOV	I	2.5	0.0	0.5	0.0	0.0	0.0	0	0	11	19	6	14	2	2	1	2	1	5	67
	II							0	0	12	18	4	18	8	2	1	1	4	2	60
दिसम्बर DEC	I	0.9	0.0	0.1	0.2	0.0	0.0	0	0	7	24	4	7	2	3	4	1	0	2	77
	II							0	0	11	20	1	18	8	2	2	1	1	1	66
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	82.6	0.0	42.1	0.7	0.1	0.1	0	1	195	169	3	4	2	6	9	8	9	10	49
	II							0	1	185	179	3	8	4	4	6	7	10	7	51
वर्षों की सं NUMBER OF YEARS	I, II	30						30				30								

माह / MONTH		मेघ / CLOUD — मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्टमांश / No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS: 0	ले-2 / T-2	3-5	6-7	8	निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्टमांश / No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS: 0	ले-2 / T-2	3-5	6-7	8	कुहरा 8 / FOG 8	दृश्यता / VISIBILITY — दृश्यता सहित दिनों की संख्या / No. OF DAYS WITH VISIBILITY: 1 कि.मी. तक / UP TO 1 Km.	1-4 कि.मी. / 1-4 Kms.	4-10 कि.मी. / 4-10 Kms.	10-20 कि.मी. / 10-20 Kms.	20 कि.मी. से अधिक / OVER 20 Kms.
जनवरी JAN	I	18	5	4	3	1	22	5	3	1	0	0	0.1	1.5	8.1	17.6	3.6
	II	15	8	5	2	1	20	9	2	0	0	0	0.0	0.0	2.6	23.0	5.4
फरवरी FEB	I	15	4	4	4	1	18	5	4	1	0	0	0.0	0.7	7.0	16.1	4.2
	II	15	8	4	1	0	17	9	2	0	0	0	0.0	0.1	1.9	19.9	6.2
मार्च MAR	I	19	6	4	2	0	23	6	2	0	0	0	0.0	0.4	6.0	19.1	5.5
	II	15	8	6	2	0	19	10	2	0	0	0	0.0	0.0	2.1	21.8	7.2
अप्रैल APR	I	13	8	6	2	1	22	6	2	0	0	0	0.0	0.0	4.4	19.2	6.4
	II	6	10	9	4	1	10	15	5	0	0	0	0.0	0.1	1.6	21.1	7.2
मई MAY	I	10	8	8	4	1	19	9	3	0	0	0	0.0	0.0	3.0	20.9	7.1
	II	4	8	12	6	1	7	17	7	0	0	0	0.0	0.1	1.4	21.5	8.1
जून JUN	I	2	4	7	8	9	10	10	8	1	1	0	0.0	0.0	4.8	19.0	6.2
	II	1	3	9	11	6	3	14	11	1	1	0	0.0	0.1	4.0	19.4	6.5
जुलाई JUL	I	1	1	6	9	14	6	10	13	1	1	0	0.0	0.5	6.6	20.0	3.9
	II	0	1	6	12	12	2	12	15	1	1	0	0.0	0.4	5.5	20.4	4.7
अगस्त AUG	I	1	2	5	9	14	4	11	14	1	1	0	0.0	0.2	7.6	19.7	3.4
	II	0	1	5	12	13	2	12	15	1	1	0	0.0	0.3	6.5	19.8	4.4
सितम्बर SEP	I	2	5	8	9	6	8	11	10	1	0	0	0.0	0.0	5.8	20.5	3.7
	II	0	2	8	14	6	2	14	13	1	0	0	0.1	0.3	4.4	20.8	4.4
अक्तूबर OCT	I	9	6	7	6	3	18	8	5	0	0	0	0.0	0.6	6.7	17.6	6.1
	II	5	7	9	7	3	9	13	8	1	0	0	0.0	0.5	3.8	20.6	6.1
नवम्बर NOV	I	14	6	5	3	2	23	5	2	0	0	0	0.0	0.5	7.9	16.6	5.1
	II	10	7	7	5	1	17	9	4	0	0	0	0.0	0.1	3.9	21.1	4.9
दिसम्बर DEC	I	17	6	4	3	1	24	5	2	0	0	0	0.0	1.5	8.1	16.9	4.5
	II	13	8	6	3	1	21	8	2	0	0	0	0.0	0.1	3.3	22.9	4.7
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	123	61	67	63	51	198	90	67	6	4	0	0.1	5.8	76.2	223.2	59.8
	II	82	71	88	79	45	130	141	85	6	3	0	0.1	2.0	41.0	252.2	69.7
वर्षों की सं NUMBER OF YEARS	I, II	30					30						30				

Annexure-III-A

RAW WATER ANALYSIS for Telangana St#2

S.No.	Constituent	As	mg/l (except pH & turbidity)
1.	Calcium	$CaCO_3$	92
2.	Magnesium	$CaCO_3$	98
3.	Sodium	$CaCO_3$	115
4.	Potassium	$CaCO_3$	20
5.	Total Cation	$CaCO_3$	325
6.	Total Hardness	$CaCO_3$	190
7.	p Alkalinity	$CaCO_3$	25
8.	m Alkalinity	$CaCO_3$	200
9.	Chloride	Cl^-	80
10.	Sulphate	$CaCO_3$	45
11.	Total Anion	$CaCO_3$	325
12.	Reactive Silica	SiO_2	30
13.	Colloidal Silica	SiO_2	10
14.	Total Silica	SiO_2	40
15.	Iron (as Fe)	ppm	1
16.	pH value	-	7.5-8.7
17.	Turbidity	NTU	500 (Max)
18.	*TDS	ppm	500
19.	TSS	mg/L	400 (Max)
20.	Temp (Range)	deg C	26-36
21.	KMnO4 (non-organic matter)	ppm	2
22.	TOC	ppm	11
23.	Chemical oxygen Demand (COD)	-	20
24.	Biochemical oxygen Demand (BOD)	-	12
25.	Equivalent Mineral Acidity (EMA)	-	125
26.	Dissolved Oxygen (DO)	-	10
27.	Oil & Grease	ppm	20

*TDS value is calculated based on total ionic load.

Annexure-III-B.

CLARIFIED WATER ANALYSIS for make-up to CW system: Telangana St#2

SN	Constituent	As	mg/l (except pH & turbidity)
1.	Calcium	$CaCO_3$	100
2.	Magnesium	$CaCO_3$	105
3.	Sodium	$CaCO_3$	115
4.	Potassium	$CaCO_3$	20
5.	Total Cation	$CaCO_3$	340
6.	Total Hardness	$CaCO_3$	205
7.	p Alkalinity	$CaCO_3$	25
8.	m Alkalinity	$CaCO_3$	205
9.	Chloride	Cl^-	85
10.	Sulphate	$CaCO_3$	50
11.	Total Anion	$CaCO_3$	340
12.	Reactive Silica	SiO_2	30
13.	Colloidal Silica	SiO_2	10
14.	Total Silica	SiO_2	40
15.	Iron (as Fe)	ppm	2
16.	pH value	-	7.5-8.7
17.	Turbidity	NTU	20 (Max)
18.	*TDS	ppm	520
19.	TSS	mg/L	30 (Max)
20.	Temp (Range)	deg C	26-36
21.	$KMnO4$ (non-organic matter)	ppm	2
22.	TOC	ppm	11

23.	Chemical oxygen Demand (COD)	-	22
24.	Biochemical oxygen Demand (BOD)	-	12
25.	Equivalent Mineral Acidity (EMA)	-	135
26.	Dissolved Oxygen (DO)	-	10
27.	Oil & Grease	ppm	20

*TDS value is calculated based on total ionic load.

Annexure-IIIC

DM WATER ANALYSIS

SN	Parameter	Value
1	Silica (Max.)	0.02 ppm as SiO2
2	Iron as Fe	Not detectable
3	Total Hardness	Not detectable
4	pH	6.8-7.3
5	Conductivity	Not more than 0.1 micromhos/cm at 25 deg C

ANNEXURE-IV-1

LIGHT DIESEL OIL CHARACTERISTICS

AS PER IS 15770-2008

	Characteristics	LDO
1.	Pour Point (max)	21 °C & 12°C for Summer and Winter respectively
2.	Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0
3.	Sediment percent by mass (max)	0.10
4.	Total sulphur percent by mass (max)	1.5
5.	Ash percentage by mass (max)	0.02
6.	Carbon residue (Rams bottom) percent by pass (max.)	1.50
7.	Acidity inorganic	Nil
8.	Flash point (Min.) - Pensky Martens	66 deg.C
9.	Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2
10.	Water content, % by volume (max)	0.25
11.	GCV(kcal/kg)	10,000

ANNEXURE-IV-2

PROPOSED COAL AND ASH CHARACTERISTICS FOR TELANGANA - II (3 X 800 MW)						
S.No	Characteristics (as received basis)	Range of 95 % coal supplies			Range of 5 % coal supplies	
		Column - 1	Column -2	Column - 3		
1.0	PROXIMATE ANALYSIS	Design	Worst	Best	Worst	Best
1.1	Total Moisture() %	10	14	9	15	8
1.2	Ash (%)	39	45	34	47	32
1.3	Volatile Matter (%)	23	19	26	18	27
1.4	Fixed Carbon (%)	28	22	31	20	33
1.5	Total	100	100	100	100	100
2.0	ULTIMATE ANALYSIS					
2.1	Carbon (%)	40	31.4	45	30.22	46.9
2.2	Hydrogen (%)	2.55	2.9	2.86	2.64	3.01
2.3	Sulphur (%)	0.38	0.35	0.48	0.28	0.55
2.4	Nitrogen (%)	0.76	0.56	0.85	0.53	0.94
2.5	Oxygen (%)(By difference)	6.75	5.41	6.99	4.09	7.7
2.8	Total Moisture (%)	10	14	9	15	8
2.9	Ash (%)	39	45	34	47	32
2.10	Carbonates (%)	0.53	0.32	0.78	0.17	0.86
2.11	Phosphorus (%)	0.01	0.02	0.03	0.02	0.03
2.12	Chloride (%)	0.02	0.04	0.01	0.05	0.01
	Total	100	100	100	100	100
2.11	GCV (Kcal/Kg)	3800	3300	4300	3200	4500
2.12	Hard Grove Index	60	55	65	50	68
2.13	YGP (mg/Kg)	70	75	65	77	60
3.0	ASH ANALYSIS					
3.1	Silica (%)	63.8	64.1	62.1	65.2	62
3.2	Alumina (%)	24.2	25.1	23.35	24	23.19
3.3	Iron Oxide (%)	4.4	4.7	4.8	4.2	4.4
3.4	Titania (%)	1.7	1.46	1.9	1.2	1.1
3.5	Phosphoric Anhydride (%)	0.8	0.5	0.85	0.35	0.8
3.6	Lime (%)	2.85	2.25	3.15	3.2	3.96
3.7	Magnesia (%)	1.1	0.99	1.75	0.75	1.95
3.8	Sulphuric Anhydride (%)	0.2	0.1	0.3	0.15	0.4
3.9	Sodium Oxide (Na_2O)	0.4	0.35	0.75	0.29	0.89
3.10	K_20 (by difference)	0.55	0.45	1.05	0.66	1.31
	Total	100	100	100	100	100
4.0	ASH FUSION RANGE					
	REDUCING ATMOSPHERE					
4.1	Initial Deformation Temp(°C)	1150	1100	1200	1100	1200
4.2	Hemispherical Temp(°C)	1300	1250	1350	1250	1350
4.3	Fusion Temperature (°C)	1400	1400	1400	1400	1400

ANNEXURE-IV-3

HIGH SPEED DIESEL OIL CHARACTERISTICS
[AS PER IS 1460-2005 (BS-II)]

S.No.	Particulars	Unit	Value
1.	PHYSICAL PROPERTIES		
	a. Distillation volume recovery @ 350^0C	% vol. (min)	85
	b. Distillation volume recovery @ 370^0C	% vol. (min)	95
	c. Kinematic Viscosity @ 40 Degree C	cSt	2.0 – 5.0
	d. Density @ 15 Degree C	kg/m^3	820 – 860
	e. Pour Point		
	- Summer	Degree C (max)	15
	- Winter	Degree C (max)	03
	f. Cold Filter Plugging Point		
	- Summer	Degree C (max)	18
	- Winter	Degree C (max)	06
	g. Flash Point (Abal)	Degree C (max)	35
	h. Lubricity WSD 1.4 @ 60 Degree C	Microns (max)	460
2.	HEATING VALUE		
	a. Higher Heating Value (HHV)	Kcal/Kg	11,000
	b. Lower Heating Value (LHV)	Kcal/Kg	10,300
3.	ACIDITY		
	a. Inorganic	mg KOH/g	Nil
	b. Total	mg KOH/g	0.2 (max.)
4.	Copper Strip Corrosion 3 hours @100^0C	No.	1 (max)
5.	RCR on 10% residue	% wt.	0.3 (max)
6.	CONTAMINANTS		
	a. Ash	ppm (wt.)	100 (max)
	b. Sediments	% wt	0.05 (max)
	c. Total Sulphur	% wt	0.05 (max)
	d. Water Content	% volume	0.05 (max)
	e. Trace Metals		
	- Na + K	ppm (wt)	0.30 (max)
	- Vanadium	ppm (wt)	0.50 (max)
	- Lead	ppm (wt)	0.50 (max)
	- Calcium	ppm (wt)	2.0
	- Ni + Zn	ppm (wt)	Nil
7.	Nitrogen content (FBN)	% wt.	0.015

ANNEXURE-IV-4

TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS			
Sl.No.	**Characteristics**	**Imported Coal**	
	(as received basis)		
		Worst	**Best**
1.0	**Proximate Analysis**		
1.1	Total Moisture (%)	20	16
1.2	Ash (%)	10	10
1.3	Volatile Matter (%)	30	45
1.4	Fixed Carbon (%)	40	29
1.5	Total (%)	100	100
2.0	**Ultimate Analysis**		
2.1	Carbon (%)	56.4	62.4
2.2	Hydrogen (%)	4.5	4.9
2.3	Sulphur (%)	0.9	0.8
2.4	Nitrogen (%)	0.9	0.5
2.5	Oxygen (%) (By difference)	7.3	5.4
2.6	Carbonates (%)	0	0
2.7	Phosphorous (%)	0	0
2.8	Total Moisture (%)	20	16
2.9	Ash (%)	10	10
	Total	100	100
2.10	GCV (Kcal/Kg)	5800	6500
2.11	Hard Grove Index	45	60
2.12	YGP (mg/kg)	100	70
3.0	**Ash Analysis**		
3.1	Silica (SiO_2) (%)	32.74	34.94
3.2	Alumina(Al_2O_3) (%)	30.5	28.43
3.3	Iron Oxides(Fe_2O_3) (%)	18.2	15.2
3.4	Titania (TiO_2)	1.56	1.76
3.5	Phosphoric Anhydride(P_2O_5) (%)	0.44	0.54
3.6	Lime (CaO) (%)	6.12	7.62
3.7	Magnesia (MgO) (%)	1.83	1.93
3.8	Sulphuric Anhydride (%)	6.95	7.65
3.9	Sodium Oxide (Na_2O) (%)	0.3	0.4
3.10	Balance alkalies (by difference)	1.36	1.56
	Total	100	100
4.0	**Ash Fusion Temperature**		
	reducing temperature		
4.1	Initial deformation Temp (°C)	1100	1250
4.2	Hemispherical Temp. (°C)	1300	1350
4.3	Flow Temp. (°C)	1400	1400

ANNEXURE-IV-6

METHANOL CHARACTERSTICS

SN	Fuel Property	Unit	Methanol
1	Chemical Formula		CH3-OH
2	Fuel Carbon	Wt%	38
3	Fuel Oxygen	Wt%	12
4	Density at 20 deg C	kg/m3	792
5	LHV	Kcal/kg	4800
6	Boiling Temp	^{0}C at 1 bar	65
7	Vapour Pressure	bar at 20^{0}C	0.13
8	Kinematic viscosity	cSt at 20^{0}C	0.74
11	Auto Ignition	^{0}C	470
12	Heat of Vapourization	kcal/kg	260
15	Flammability limit	vol %	6-36
16	Flash Point	^{0}C	12

Annexure-IV-7(A)

S.N.	Technical Data	Unit	Specifications for Torrefied Pellet
1	Base Material		Agro residue: Which means the leftover portion of the agriculture produce such as stubble/straw/stalk/husk of those agro residue which are surplus and not being used as animal fodder such as paddy, soya, arhar, gwar, cotton, gram, jawar, bajara, moong, mustard, seasam, til, maize, sunflower, jute, coffee etc., groundnut shell, coconut shell, castor seed shell etc., pine needle, elephant grass, sarkanda and horticulture waste such as dry leaves and trimmings generated during the maintenance and pruning of trees and plants. Wood obtained from tree cutting shall not be treated as agro residue and shall be not to be used as base material or mixing purpose whatsoever.
2	Diameter	mm	In case of cylindrical shape: Diameter: Not more than 35 mm Length: Random For other shapes: No dimension should exceed 35 mm.
3	Fines % (<3 mm) (ARB*)	Wt%	fines ≤ 5%
4	Gross Calorific Value (GCVARB*)	Kcal/Kg	Refer below
5	Moisture (ARB*)	Wt%	<= 15% (not more than 15%)
6	Bulk density	Kg^3	600

*ARB – As Received Basis

Annexure-IV-7(B)

The sample was prepared by torrefying rice straw at 300 deg C with a holding time of one hour. Following analysis are carried out at NETRA using the powdered torrefied rice straw samples and the results of various testing for the specific sample is tabulated below:

a. Proximate Analysis (wt %, Air Dried Basis)

M	Ash	VM	FC
6.68	21.66	47.68	23.98

b. Ultimate Analysis (wt %, Air Dried Basis)

C	H	N	S	O
46.65	3.93	1.13	0.14	19.81

c. GCV : 4201 kcal/kg

d. Ash Fusion Temperature under reducing conditions: ^{0}C

IDT	ST	HT	FT
1134	1357	1374	1422

e. Ash Elemental Analysis (Elements expressed as Oxides in %w/w)

Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	Fe2O3
2.423	7.783	4.623	67.48	1.9	1.9	6.15	4.21	0.39	0.03	2.83

Annexure-IV-7(C)

For the Torrefied Rice Straw Pellets (Prepared by torrefaction of rice straw at 300 deg C with holding time of 1 hr) tested at NETRA, the test results are as follows:

A. For Anion (ISO 16994:2016 E-Solid Biofuels- Determination of total content of sulphur and chlorine)-reported as wt % dry basis

a. Chlorine (Cl): 0.32%

b. Fluorine (F) : 0.09%

B. For Cation (ISO 16967:2015 E-Solid Biofuels- Determination of major elements ...)- Reported as wt % dry basis

a. Sodium (Na): 0.31%

b. Potassium (K): 2.04%

Note: The above details as at Annexure-IV-7(A), IV-7(B & IV-7(C) are indicative only and shall vary based on the exact raw material and its subsequent processing.