BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LTD. (BIFPCL)
2X660 MW BIFPCL MAITREE KHULNA STPP (BANGLADESH)

TECHNICAL SPECIFICATION
FOR
COAL FLOWABILITY STUDY

SPECIFICATION NO. PE-TS-421-161-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-201301

VOLUME – IIB

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INTENT OF SPECIFICATION

1.1 A comprehensive coal flowability study of crushed and imported coal for 2X660 MW BIFPCL MAITREE KHULNA STPP shall be conducted by the bidder, for the coal bunker to ensure smooth flow of coal in all seasons with different moisture contents and different percentage of fines to promote mass flow without choking.

1.2 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.3 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, any additional input, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Customer as and when brought to their notice either by the bidder or by customer themselves. However, such requirements shall be binding on the successful bidder without any commercial implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the deviation schedule along with cost of withdrawal; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

SECTION-B
Project Information and Coal Analysis

The Joint Venture of Bangladesh-India Friendship Power Corporation (pvt) Ltd (BIFPCL) intends to construct a 2x 660 $MW_{e,\,gross}$ coal fired power plant (the Plant, the Maitree-STPP Project or the Project) in the district of Khulna for which BIFPCL firms as Employer, utilizing high availability, high efficiency steam cycle technology.

Two power units with steam generator, steam turbine generator and ancillary systems shall be proposed in a technology that enables the Contractor to guarantee a high net efficiency while achieving a high reliability (certain restrictions regarding the technology and the design parameters apply, as detailed herein). A second phase of the same capacity is foreseen as a future possibility, however, this Specification deals only with 2 x 660 $MW_{e,\,gross}$ unless otherwise and expressly stated.

The Plant shall be built on a "green field" basis. It shall be conceptualized in accordance with the above criteria, the thermodynamic cycle adopted must be capable of working successfully over prolonged periods and the system shall be able to withstand severe shocks when connected to the Grid . The steam cycle shall operate with once-through technology at supercritical i.e. with steam temperature of 568°C to 600°C, with established and proven parameters and materials.

The engineering design of the Plant shall be conceptualized in accordance with the above criteria, and therefore it is vital that the thermodynamic cycle adopted must be capable of working successfully over prolonged periods and the system shall be able to withstand severe load adjustments when connected to the Grid. The proposed Plant shall be based on a reference plant of equal size firing similar fuel, which shall have a proven track record. The Tenderer shall submit with the tender detailed information on this reference plant(s) and shall allow the Employer and / or his representatives to contact and visit and examine the reference plant(s) in detail.

The steam boilers shall be designed to burn coal from Australia, Indonesia, South Africa, Mozambique and potentially other countries and to burn high speed diesel for start-up and shut-down purposes. The Plant is designed for the coal range as per design coal list attached.
The steam turbo-generators and thermal cycles shall be selected such, that the Plant heat rate would be optimized under consideration of the investment costs.

Site conditions

The following information on local conditions is investigated or compiled by the Employer. The Contractor is hereby in no way relieved from his duties of carrying out all investigations required for satisfactory performance of his works. The Contractor shall perform his own Site visits and investigations, prior to Contract award in order to familiarize him with the existing conditions of the Site and the surrounding area.

Location, accessibility and present condition of the Site
The site for the Maitree-STPP Project is geographically located between 22° 370'0'' N to 22°34'30''N and 89°32'0''E to 89°34'5''E, approximately 14 km northeast of the Mongla Port and 14 km northwest of the Sundarbans, is infringed by the Passur and Moidara Rivers to the west and south east respectively. The project requires an area of approximately 500 acres.

The topographical survey indicates a natural ground level of +1.15 to + 1.35 meters above sea level. A severe cyclone in 2009 raised the level to 4.47 meters and it was decided to raise the Plant level to +5.00 meters.

Politically, the site is located in Rampal Upazila of the Bagherat District in the Rajnagar Union

Currently, the Site is accessible by boat only.

The nearest inland port is Mongla port at around 14km direct distance.

The proposed Khan Jahan Ali Airport is located at a distance of approximately 12 km from the project site.

Site climatic conditions
The Plant site is from the climatic point of view under maritime tropical conditions. The assumed meteorological conditions for the Site are as follows:

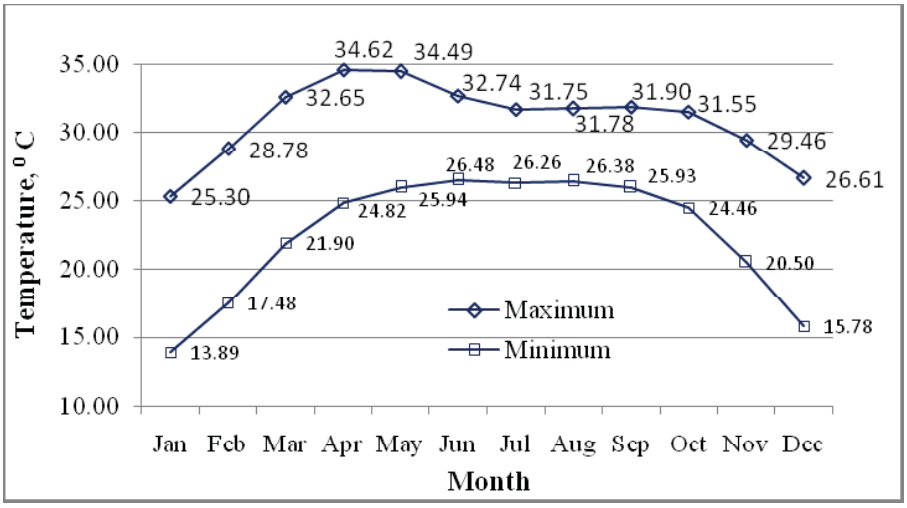
The project site is located in the country's South Central Zone consisting of three dominant seasons:

- summer season-March to May
- monsoon season-June to October
- winter season-November to February.

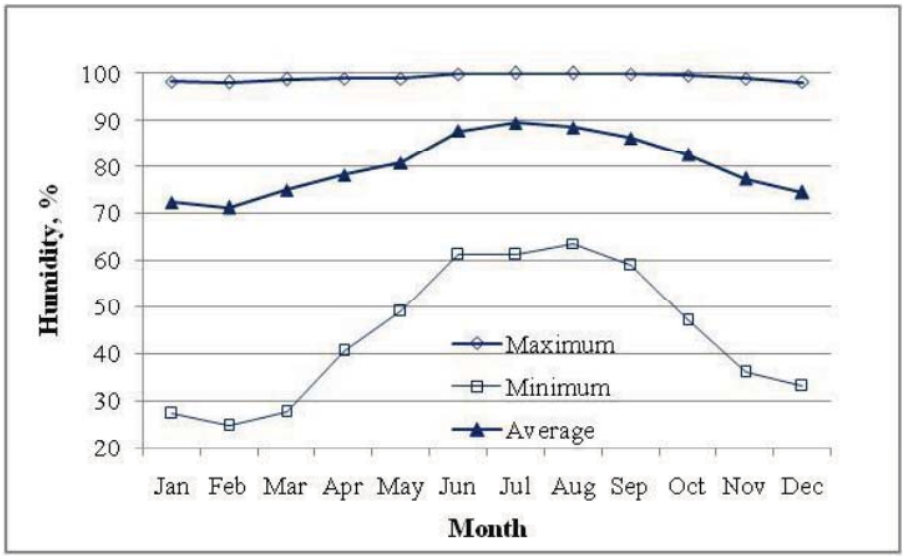
During the Monsoon Season occasional cyclonic storms can occur.

The climatic conditions in the area are continuously monitored by the Bangladesh Meteorological Department (BMD) at the Mongla Meteorological Station.

The temperature varies only slightly throughout the year with the highest temperature of 36.9°C and the lowest temperature of 12.2°C recorded in the period from 1989 to 2008. This distribution is depicted in figure below.

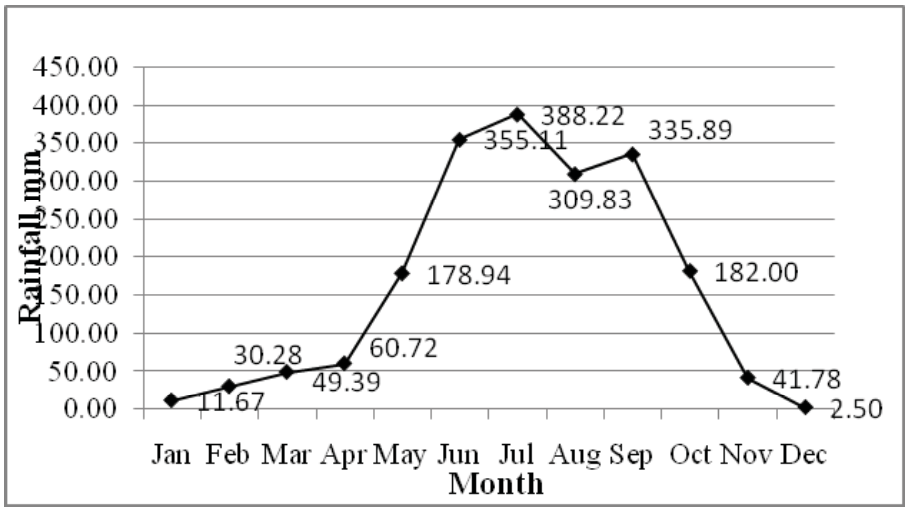


The relative humidity varies drastically during the Monsoon Season with 80% to 90% and the lowest levels of 20% to 30% during the Summer Season. The humidity profile recorded in the same period as the temperature is visualized in below figure.



The maximum rainfall occurs during the Monsoon Season by varying between 300 mm and 350 mm with almost no rainfall during the Winter Season.

The average evaporation in the project area varies between 3 - 5 mm/day with its peak of 16 mm/day during July. The average rainfall for the period between 1991 and 2008 is depicted in below figure.



Below definitions are to be used as typical data for the different climatically seasons at the site.

Average Site Condition ASC

Ambient Temperature:	27.3 °C
Ambient Humidity	87 %
Ambient Pressure	1007.6 mbar
River Water Temperature:	29.8 °C

Summer Site Condition SSC

Ambient Temperature	36.9 °C
Ambient Humidity	60 %
Ambient Pressure	1007.9 mbar
River Water Temperature:	33 °C

Winter Site Conditions WSC

Ambient Temperature	12.2 °C
Ambient Humidity	100 %
Ambient Pressure	1017.2 mbar
River Water Temperature:	20°C

Reference Site Conditions RSC

Ambient Temperature	31 °C
Ambient Humidity	88 %
Ambient Pressure	1007 mbar
River Water Temperature:	32°C
Wind speed	1 m/s

B0.2.8 Fuel

The Plant shall be operated with imported sub-bituminous and bituminous coal as the principle fuel. Coal will be supplied via bulk carrier vessels (barges and vessels up to 25,000t, to be unloaded at the Coal Jetty.

The Plant will have to be able to be fully operational and in accordance with all guarantee parameters with all coals on a 100 % basis that comply with the coal characteristics as indicated.

For reference purposes, the list that contains the performance coal and the design range for the coals is included.

Performance Coal and Design Coal Range

Denomination	Unit	Method	Performance coal	Min	Max
Heating Values (at 25°C)					
GCV (HHV) (as received basis)	kcal/kg	ASTM D 5865	5700	5200	6300
NCV (LHV) (as received basis)	kcal/kg	ASTM D 5865	5400	4900	6000
Proximate Analysis (as received)		ASTM D 3172			
Total Moisture	% ar	ASTM D 7582, D3173, D3302	11,00	7,00	24,00
Volatile matter	% daf		50,93	25,00	54,00
Ash	% ar	ASTM D 7582, D3174	13,19	4,00	20,00
Ultimate Analysis (as received)					
Sulfur	% ar		0,85	0,35	< 0.99
Ultimate Analysis (dry ash free)					
Carbon	% daf	ASTM D 5373	80,00	76,70	86,85
Hydrogen	% daf	ASTM D 5373	6,10	3,85	6,80
Oxygen	% daf	ASTM D 5373	11,50	5,84	67,14
Nitrogen	% daf	ASTM D 5373	1,30	1,23	2,28
Sulfur	% daf	ASTM D 4239	1,12	0,45	1,20
Chlorine	% daf	ASTM D 6721, D4208	0,00	0,00	0,10
Grain size		ASTM D 4749			
< 2mm	%		15	15	30
2-50 mm	%		80	70	85
> 50 mm	%		5	3	5
Hardgrove Grindability Index °H		ASTM D409	42	40	68
Ash					
Ash fusion temperature (in reducing atm.)					
Initial deformation	°C	ASTM D1857	1360	1100	1540
Softening (spherical)	°C	ASTM D1857	1400	1180	1560
Hemispherical	°C	ASTM D1857	1420	1220	1580
Fluid	°C	ASTM D1857	1460	1250	1590
Ash Analysis					
SiO_2	%	ASTM D 6349	53,60	42,50	77,00
Al_2O	%	ASTM D 6349	28,30	13,70	37,70
Fe_2O_3	%	ASTM D 6349	5,90	2,45	15,00
CaO	%	ASTM D 6349	5,00	0,45	9,95
MgO	%	ASTM D 6349	0,60	0,30	4,65
Na_2O	%	ASTM D 6349	0,30	0,06	1,05
K_2O	%	ASTM D 6349	0,60	0,30	1,80
TiO_2	%	ASTM D 6349	1,60	0,53	2,80
SO_3	%	ASTM D 6349	4,00	0,10	11,60
P_2O_5	%	ASTM D 6349	0,10	0,04	1,80
Mn_3O_4	%	ASTM D 6357	-	0,00	0,08
Cr_2O_3	%	ASTM D 6357	-	0,00	0,50

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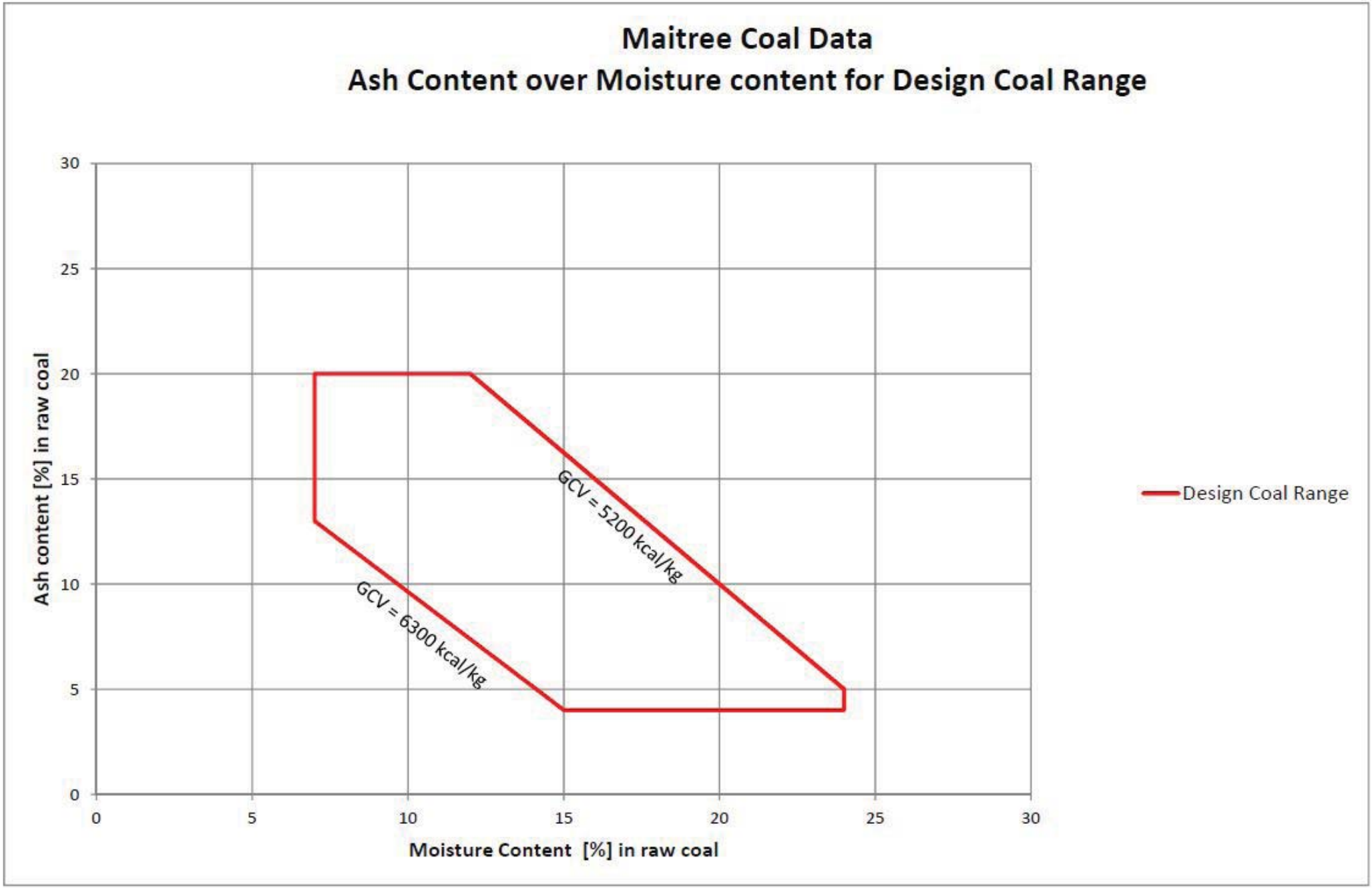
Maitree Coal Data
Ash Content over Moisture content for Design Coal Range
Ash content [%] in raw coal
Moisture Content [%] in raw coal
0
5
10
15
20
25
30
GCV = 5200 kcal/kg
GCV = 6300 kcal/kg
Design Coal Range

1.0 SCOPE OF WORK

A comprehensive flowability study of crushed and imported coal for 2X660 MW BIFPCL MAITREE KHULNA STPP shall be conducted by the bidder as per reputed international codes and standards (e.g.: ASTM D6773, ASTM D6128, ISO 15117-1, American, British, European, Japanese, Bangladesh etc. except for Indian and Chinese codes and standards), for the coal bunker to ensure smooth flow of coal in all seasons with different moisture contents and different percentage of fines. The bunkers are required to promote mass flow without choking with the fines content and moisture content of coal samples indicated in the specification. The report of study shall contain the following:

a) Sample preparation & Size analysis - Preparation of required samples of coal for flowability studies and Size analysis of as received sample.

b) Moisture determination of as received coal.

c) Bulk density determination.

d) Bulk density variation with normal stress (compressibility test).

e) Coal flowability tests (Shear tests) shall be conducted for 3 nos. of samples which shall be delivered to the successful bidder: Sample 23, 10 and 13/14 equivalent to worst, design and best coal respectively:

Names of the mines for respective coal sample numbers are:

- Sample 23 - BUMI Resources [Kaltim Prima Coal mine complex]
- Sample 10 - BUMI Resources [Arutmin mine complex]
- Sample 13 - BUMI Resources [Arutmin mine complex] / Sample 14 - BUMI Resources [Arutmin mine complex]

f) The tests shall be conducted for two moisture levels (nominal case and critical/worst case corresponding to maximum valley angle to be predicted as per study) to establish wall angle of friction against welded steel construction, stainless steel (SS 304), Effective angle of friction, Flow Functions, Flow Factor and Storage time effect at 24 and 72 hrs for all flowability conditions.

g) Evaluation of Mass Flow design parameters viz., slope of hopper with specified material of construction and critical outlet diameter to prevent cohesive arching at different moisture levels.

h) Amount of "Active content" in the bunker, that is, effective storage material excluding the dead storage shall be mentioned in the study. The recommendations of the study shall ensure that the "active content" of the bunker shall be as large as feasible, reducing the stagnant mass to a minimum.

i) All measures which are necessary to reduce the effects of funneling, arching, bridging and segregation of the stored coal like poking holes / coal anti-bridging devices (such as vibrators or compressed air cannons) shall also be suggested with details.

j) Angle of repose of the coal samples shall be measured and included in the study.

2.0 Additional information:-

a) Type of bunker – circular on top and conical on bottom.

b) Outlet diameter of bunker – 914 mm.

c) Maximum extraction rate of the bunker shall be considered as 71 TPH

d) Project Information and Coal analysis (of performance coal) are attached as per Section-A

e) Amount of coal per bunker – 675 Tonnes

f) The material of construction of bunker shall be welded steel with 6mm thick SS 304 grade liner provided in entire conical portion of the bunker.

g) Particle size inside the bunker shall be (-)25 mm. Flowability test shall be conducted for (-)25 mm coal size. In case it's not feasible to conduct on lumps, bidder shall conduct the test on coal fines and extrapolate their findings for lumps ((-)25mm coal size).

h) For all capacity (volume) calculation, unit weight of coal shall be assumed as 800 kg/m^3.

DRAWINGS/ DOCUMENTS TO BE SUBMITTED WITH THE BID FOR TECHNICAL EVALUATION

Bidder shall submit the following drawings / documents along with their bid

a) Copy of resolved pre-bid clarifications, if any, duly signed & stamped

b) **Deviation schedule** with reference to specific clauses of the specification along with reason for such deviation and cost-of-withdrawal in the format given with price format.

c) Un priced copy of price format indicating quoted/ not quoted against each row/column

d) International codes and standards which shall be referred for coal flowability study shall be clearly brought out in the offer.

Note:

- OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS.
- DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.

PRE-BID CLARIFICATION SCHEDULE

S. No.	Section / Clause / Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE:_____

NAME:_____

DESIGNATION:_____

COMPANY: _____

DATE:_____

COMPANY SEAL