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From
Chief Engineer/IPC&RAC,
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To
The Commission Secretary,
TGERC, Vidyut Niyantran Bhavan,
Sy.No.145-P, G.T.S. Colony,
Kalyan Nagar, Hyderabad 500 045.

Lr No. CE(IPC&RAC)/DE (IPC)/F. /D. No. 1988/2026-27, Dt. 30.09.2026

Sub: TGSPDCL – IPC – M/s. SCCL – 1×800 MW Stage-II Singareni Thermal Power Project – Submission of Detailed Project Report (DPR) – Reg.

Ref: 1. Lr. No. CE(IPC&RAC)/DE(IPC)/F. /D.No.1928/26-27, Dt.26.09.2026.
2. Lr. No. CE(IPC&RAC)/DE(IPC)/F. /D.No.1965/26-27, Dt.29.09.2026.

With reference to the subject and references cited above, it is respectfully submitted that, in continuation of the petitions filed before the Hon'ble Commission seeking consent under Section 86(1)(b) of the Electricity Act, 2003 and Section 21(4) of the Telangana Electricity Reforms Act, 1998 in respect of the draft Power Purchase Agreement (PPA) between TGSPDCL, TGNPDCL and M/s. SCCL for procurement of power from the 1×800 MW Stage-II Singareni Thermal Power Project, the Detailed Project Report (DPR) of the said Project is hereby submitted.

The DPR of the 1×800 MW Stage-II Singareni Thermal Power Project, furnished by M/s. SCCL, is submitted herewith for the kind perusal and consideration of the Hon'ble Commission in connection with the aforesaid petitions relating to the procurement of power from the Project.

It is therefore requested that the Hon'ble Commission may kindly take the enclosed DPR on record and consider the same in continuation of the petitions already filed before the Hon'ble Commission.

Encl: Detailed Project Report of SCCL
Stage-II 1×800 MW Thermal Power Project

Yours faithfully,


(Sri. L. Pandya)

Chief Engineer/IPC&RAC

Copy to:
The CE/IPC&RAC/TGNPDCL/ Warangal.
The ED/Commercial/TGPPCC/ Vidhyuth Soudha, Hyderabad.

THE SINGARENI COLLIERIES COMPANY LTD
(A Government Company)



TGERC HYDERABAD INWARD

30 SEP 2023

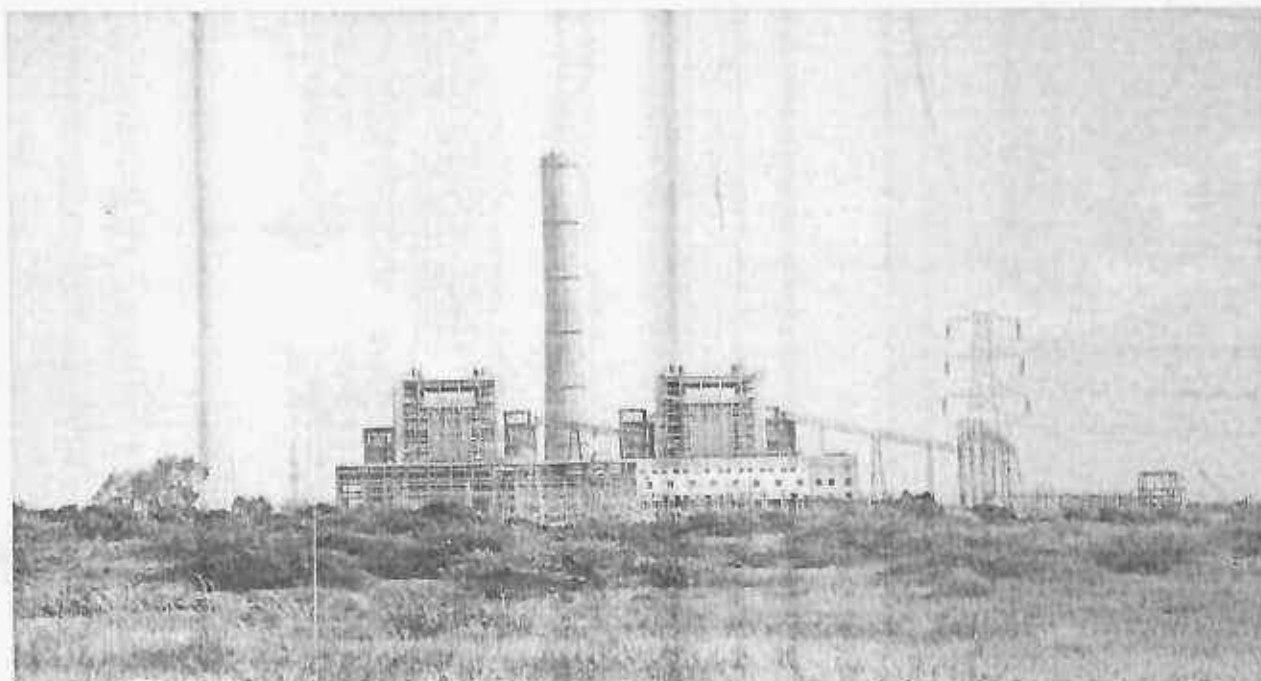
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DETAILED PROJECT REPORT

for

**1X800 MW Singareni TPP Stage-II, Jaipur(Mandal)
Mancherial (District), Telengana State**



CONSULTANT



CONSULTANCY WING

ABBREVIATIONS

ABT	Availability based Tariff
ADP	Air Drying Plant
AHP	Ash Handling System
AHU	Air Handling Unit
APH	Air Preheater
ASME-TDP	American Society of Mechanical Engineers - Turbine Damage protection
ASTM	American Society of Testing and Materials
ATRS	Automatic Turbine Run Up System
ATS	Associated Transmission System
ATT	Automatic Turbine Testing System
BA	Bottom Ash
BCU	Bay Control Unit
BFP	Boiler Feed Pump
BHMS	Battery health management system
BMCR	Boiler Maximum Continuous Rating
BOD	Biochemical Oxygen Demand
BOP	Balance of Plant
BPU	Bay Protection Unit
C&I	Control & Instrumentation
CACA	Closed air circuit air cooled type
CAD	Cold Air Damper

CAG	Cold Air Gate
CC	Climate Change
CCR	Central Control Room
CCTV	Closed Circuit Television System
CEP	Condensate Extraction Board
CER	Control Equipment Room
CHP	Coal Handling Plant
CLCS	Closed Loop Control System
CMB	Central Monitoring Basin
COC	Cycle of Concentration
COD	Commercial Operation Date
CPU	Condenser Polishing Unit
CRT	Cathode Ray Tube
CT	Current Transformer
CTBD	Cooling Tower Blow Down
CVT	Capacitive Voltage Transformer
CW	Circulating water
DAS	Data Acquisition System
DB	Distribution Board
DC	Direct Current
DCS	Distributed Control system
DDCMIS	Distributed Digital Control, Monitoring & Information System

DFDR	Digital Fault Disturbance Recorder
DFR	Disturbance Fault Recorder
DG	Diesel Generator
DIDW	Double Inlet Double Width
DM	Demineralization
DP	Differential Pressure
DVR	Digital Voltage Regulator
EAC	Expert Appraisal Committee
ECO	Economizer
ECP	Electrical Control Desk
ECW	Equipment Cooling Water System
EHG	Electro Hydraulic Governor
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EMCR	Economic Maximum Continuous Rating
EMG	Environmental Management Group
EOT	Electrically Operated Traveling
EPC	Engineering, Procurement, Construction
EPMS	Electrostatic Precipitator Management System
ESP	Electro Static Precipitator
ETP	Effluent Treatment Plant
FD	Forced Draft

FFL	Finished Floor Level
FGD	Flue-gas Desulfurization
FGL	Finished Ground Level
FRLS	Fire Retardant Low Smoke
FRP	Fiber reinforced Plastic
FY	Financial Year
GCB	Generator Circuit Breaker
GIU	Graphical Interface Unit
GLP	General Layout Plan
GPS	Global Positioning System
GRP	Generator Relay Panel
GT	Generator Transformer
HAD	Hot Air Damper
HAG	Hot Air Gate
HART	Highway Addressable Remote Transducer
HCSD	High Concentration Slurry Disposal
HEA	Heavy Energy Arc
HEI	Heat Exchange Institute
HFO	Heavy Fuel Oil
HMI	Human Machine Interface
HP/LP Bypass	High Pressure/ Low Pressure
HPH	High Pressure Heater

HPS	Heavy Petroleum Stock
HPT	High Pressure Turbine
HRH	Hot Reheat
HT	High Tension
HV	High Voltage
HVAC	Heating, Ventilation and Air conditioning
I/O	Input/Output
IBR	Indian Boilers Regulations
IDC	Interest During Construction
IEC	International Electro technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IM silo	Intermediate Silo
JB	Junction Box
KBD	Keyboard
kV	Kilo Volt
KW	Kilo Watt
LAN	Local Area Network
LDO	Light Diesel Oil
LED	Lighting Emitting Diode
LETP	Liquid Effluent Treatment Plant
LIE	Local Instrument Enclosure
LIR	Local Instrument Rack

LPH	Low Pressure Heater
LSHS	Low Sulphur Heavy Stock
LT	Low Tension
LV	Low Voltage
LVS	Large Video Screen
M&C	Maintenance and Calibration
MCC	Motor Control Center
MCCB	Moulded Case Circuit Breaker
MCC	Motor Control Center
MCR	Maximum Continuous Rating
MDBFP	Motor Driven Boiler Feed Pump
MGR	Merry Go Round
MNW	Master Network
MOEF	Ministry of Environment & Forests
MOP	Main Oil Pump
MOT	Main Oil Tank
MS	Main Steam
MSEP	Mild Steel Epoxy Paint
MSRL	Mild Steel Rubber Line
MTPA	Million Ton Per Annum
MTPH	Metric Ton Per Hour
MU	Million Unit

MVA	Mega Voltage Ampere
MW	Mega Watt
MWC	Meter of Water Column
NFPA	National Fire Protection Association
NG	Neutral Grounding
NOC	No Objection Certificate
NOx	Nitrogen oxides
O&M	Operation & Maintenance
OFAF	Oil Forced Air Forced
OFC	Optical Fiber Cable
OLCS	Open Loop Control System
ONAN	Oil Natural Air Natural
OPC	Open Platform Communication
ORP	Oxidation Reduction Potential
ORT	Operation Review Team
OWS	Operator Work Station
PA	Primary Air
PB	Push Button
PCP	Process Connections and Piping
PH	Pump House
PLC	Programmable Logic Control
PLCC	Power Line Carrier Communication

PLF	Plant Load Factor
PM	Particulate Matter
PMU	Phasor Measurement Unit
PP	Poly Propylene
PPA	Power Purchase Agreement
PPC	Portland Pozzolana Cement
PRDS	Pressure Reducing & De-superheating Station
PRT	Project Review Team
PT	Pre Treatment
PV	Photo Voltaic
PVC	Poly Vinyl Chloride
QA	Quality Assurance
QB	Quartzoid Bulb
RCC	Reinforced Cement Concrete
RCE	Revised Cost Estimate
RH	Reheater
RIO	Remote Input/Output
RLDC	Regional Load Dispatch Center
RO	Reverse Osmosis
RTU	Remote Terminal Unit
SAS	Substation Automation System
SBT	Standby Transformer

SCADA	Supervisory Control and Data Acquisition
SCAPH	Steam Coil Air Pre Heater
SCCL	Singareni Collieries Company Limited
SCR	Selective Catalytic Reduction
SDH	Synchronous Digital Hierarchy
SERS	Sequence of Events Recording System
SF6	Sulphur Hexafluoride
SG	Steam Generator
SH	Super Heater
SLD	Single Line Diagram
SO2	Sulphur Dioxide
SPM	Suspended Particulate matter
ST	Station Transformer
STG	Steam Turbine Generator
SWAS	Steam & Water Analysis
TAC	Transport Air Compressor
TDBFP	Turbine Driven Boiler Feed Pump
TDS	Total Dissolved Solid
TEFC	Totally Enclosed Fan Cooled
TETV	Totally Enclosed Tube Ventilated
TG	Turbo Generator
TMC	Thousand Million Cubic Feet

TMCR	Turbine Maximum Continuous Rating
ToR	Terms of Reference
TP	Terminal Point
TPH	Ton Per Hour
TPP	Thermal Power Project
TR	Ton of Refrigeration
TSCS	Turbine Stress Control System
TSPCB	Telangana State Pollution Control Board
TSS	Turbine Supervisory System
TTD	Terminal Temperature Difference
UAT	Unit Auxiliary Transformer
UCD	Unit Control Desk
UPS	Uninterrupted Power Supply
USA	United States of America
UT	Unit Transformer
UTP	Unshielded Twisted Pair
VFD	Variable Frequency Drive
VT	Voltage Transformer
VVVF	Variable Voltage Variable Frequency
VWO	Valve Wide Open
WCM	Working Capital Margin
XLPE	Cross Linked Polyethylene

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

1.00.00
BACKGROUND

Power development is one of the key infrastructure elements for the economic growth of the country. The state of Telangana has ambitious plans for infrastructure & industrial development and thus, require quantum of reliable power sources. Singareni Collieries Company Limited (SCCL), a joint venture of Government of India & Government of Telangana was formed to extract coal resources available in the state. After having achieved commendable success in the mining operations, SCCL has been entrusted to execute a Thermal Power Project in present Mancheri district, TS along with various other mining projects. Accordingly, SCCL has executed 2x600MW thermal power project and the same is being operated successfully. To fulfill ambition of state government getting self-reliant on power generation, SCCL has taken decision to increase the power generating capacity of Singareni STPP with addition of third unit with a capacity of 800MW.

The present proposal is to establish 1X800 MW coal based SCCL Thermal Power Project for the benefit of Telangana State during 2026-27 period.

SCCL has retained the services of NTPC Ltd. to prepare the Detailed Project Report for the proposed 1X800MW Singareni Thermal Power Project, Unit-III.

2.00.00
PROJECT HIGHLIGHTS
2.01.00
Location

SCCL Thermal Power Project is located in Mancheri district of Telangana, between 18°-48'-30" to 18°-50'-38" latitude and 79°-34'-00" to 79°-35'-30" longitude. The site is situated near village Jaipur. The nearest railway station Mancheri on Nagpur-Kazipet main railway line of South Central railway 14.6KM away from the project site.

2.01.01
Airport

The nearest commercial airport at Shamshabad, Hyderabad is located at a distance of approximately 250 kms from the project site.

2.01.02
Distance of the project site from nearest cities

Mancheri	14.6 kms
Hyderabad	200 kms

2.02.00	Land Requirement	The land requirement for the project has been estimated as 127.31 hectares for the proposed Stage-II. Main Plant, Balance of Plant including Coal Handling Plant, , Ash Disposal Pipeline Corridors, Construction Stores & Offices, Laydown & Fabrication Yard, and Labor Colony etc. shall be accommodated within the land already in possession of SCCL. There is no need of any additional patches of land required to be acquired.		
2.03.00	Capacity	:	1X800 MW	- Present proposal
2.04.00	Mode of Operation	:	Base Load	
2.05.00	Fuel	:	Coal	
2.06.00	Coal Availability and Linkage	Annual coal requirement for the plant shall be 4.05MTPA considering gross calorific value of 3550 Kcal/Kg and PLF of 90% and the same is proposed to be met from Naini Coal Block.		
2.07.00	Coal Transportation	The envisaged mode of coal transportation from the coal mines to the power plant is by MGR system in bottom open /BOX-N Wagons. The rakes shall be unloaded by into existing track hopper/ Wagon Tippler.		
2.08.00	Cooling Water Source, Requirement and Commitment	Water allocation of 1TMC from Godavari River can be drawn through pump house located at shetpally and another 2 TMC from river pranhita can be drawn through pump house located at devulavada. Source of water during the no-flow period in the river will be from infiltration galleries constructed on Godavari River at a distance of about 9 km from site. Water will be brought to site through pipelines. Plant water reservoir for three weeks' storage has been already constructed for phase-i units shall be utilized for this unit-iii also keeping in view of lean flow of river during summer months. The makeup water requirement for the project would be about 2000 m ³ /hr. This water allocated for stage-I of SCCL STPP is sufficient to operate stage-II, unit-III (1x800mw) also. Presently, induced draft cooling towers have been proposed for the project.		
2.09.00	Steam Generator Technology			
DETAILED PROJECT REPORT SCCL TTP Stage-II (1X800MW)		Doc. No.: CW-EN-11159-DPR-00Z		EXECUTIVE SUMMARY
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2.10.00
Power Evacuation System

Power Generated from this 800 MW unit would be stepped up to the evacuation voltage level through suitably rated Generator Transformer and will be evacuated through 400kV transmission systems.

2.11.00
Beneficiary States

Telangana State Power Coordination Committee (TSPCC) has informed vide letter dated 05.12.2017 that TSDISCOMs are willing to enter into long term PPA with STPP for purchase of entire 800 MW Capacity proposed under stage -II.

2.12.00
Project Financing

The overall debt-equity ratio proposed is 75:25. Equity will be financed from internal resources of SCCL, whereas the debt portion is proposed to be financed from Domestic Commercial Borrowings. The proposed financing plan is as given below:

	Foreign Component	Domestic Component
Equity :	-	25%
Domestic Commercial Borrowings : /Bonds	-	75%

2.13.00
Project Cost

The project cost (current) as on 3rd Qtr 2024-25 is as given below:

Project Cost excluding IDC	:	8600.79	crores
Interest During construction (IDC)	:	995.20	Crores
Project Cost including IDC	:	9595.99	Crores
Working Capital margin (WCM)	:	Nil	
Project cost including IDC & WCM	:	9595.99	Crores
Cost/MW (Incl. IDC & WCM)	:	11.99	Crores

2.14.00

COST OF ENERGY

1st full year operation	:	561	Paise/kWh
- Fixed Charges	:	299	Paise/kWh
- Variable Charges	:	262	Paise/kWh
Levelized cost of energy	:	527	Paise/kWh

2.15.00

Commissioning Schedule

Commercial Operation Date (COD) of the 800 MW unit is envisaged in 48 months for expansion project from the zero date.

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EXHIBIT - 09	IMPLEMENTATION SCHEDULE

CHAPTER – 1

INTRODUCTION

INTRODUCTION

1.01.00

BACKGROUND

Power development is one of the key infrastructure elements for the economic growth of the country. The entire Indian Economy hinges on the availability of reliable and quality power at competitive rates. The state of Telengana has ambitious plans for rapid industrialization, 24x7 power to all, reliable power to agriculture and thus, require quantum of reliable power sources.

The development of the power sector in the country, since independence has been predominantly through the State Electricity Boards formed in each state under the Electricity (Supply) Act 1948, with responsibility for generation, transmission and distribution of electric power. Singareni Collieries Company Limited (SCCL), a joint venture of Government of India & Government of Telangana. SCCL has been managing coal mining activities successfully for more than 100 years. After implementation of several coal mining projects, SCCL has been entrusted to execute a Thermal Power Project (2x600MW) at Jaipur Mandal, district Mancherial, TS along with various other coal mining projects. SCCL has completed 2x600MW power project successfully and both the units are operating commercially. Having completed Singareni Thermal Power Project Stage-I (2x600MW) power project, SCCL has ventured in to developing Stage-II (1x800MW) power project in the same compound of Stage-I where required land is available.

SCCL has acquired the services of NTPC Limited to prepare the Detailed Project Report for the proposed Stage-II (1X800MW) Singareni Thermal Power Project.

1.02.00

The present proposal is to establish 1X800 MW coal based unit of Singareni Thermal Power Project Stage-II. The proposed land is already acquired by SCCL and in possession of SCCL for project implementation.

Make-up water requirement for the plant shall be met from River Pranahitha at a distance of 43.50 KM. Depending upon analysis of water, suitable water treatment system will be provided.

The power generated in the new unit will be evacuated through 400 kV transmission lines.

CHAPTER – 2

DEMAND ANALYSIS AND JUSTIFICATION

DEMAND SUPPLY SCENARIO

2.00.00 The Demand-Supply scenario and project Justification is described below as furnished by project owner, SCCL

2.01.00 POWER SCENARIO OF TELANGANA STATE

The power scenario i.e. installed capacity & actual power supply position in Telangana State is given below:

2.01.01 OVERVIEW

Installed Capacity of Southern region

Sector	Thermal	Nuclear	Hydro (Renewables)	RES (MNRE)	Total
State	21544.44	0	11819.83	597.88	33962.15
Private	19135.95	0	0	45235	64370.95
Central	15584.60	3320	0	541.90	19446.5
Total	56264.99	3320	11819.83	46374.78	117779.6

Source: CEA Report on Installed Capacity as on 31-01-2022.

Installed Capacity of Telangana State

Sector	Thermal	Nuclear	Hydro (Renewables)	RES (MNRE)	Total
State	6242.50	0	2479.93	41.22	8763.65
Private	2221.27	0	0	4703.78	6925.05
Central	2017.42	148.73	0	10.00	2176.15
Total	10481.19	148.73	2479.93	4755.00	17864.85

Source: CEA Report on Installed Capacity as on 31-01-2022.

POWER SUPPLY SCENARIO OF TELANGANA STATE

In FY 2020-21 energy requirement in Telangana was 66998 MU, of which 4.0 MU could not be met resulting in an energy deficit of nearly 0.01% with a maximum historic peak demand of 13,688 MW in 2020-21.

SCCL informed that Telangana formed in the FY 2014-15 and the data till 2013-14 may not be relied upon for the projection. Therefore, Historical data from 2014-15 is presented below.

As can be seen from the table below, peak power demand has increased by 5,357 MW during the period FY 2014-15 to FY 2020-21 against which peak energy requirement has increased by 16082 MU.

Historical Power Supply Position in Telangana State

Telangana state demand								
Period	Peak Demand (MW)	Peak Met (MW)	Peak Deficit/ Surplus (MW) (-/+)	Peak Deficit/ Surplus (%) (-/+)	Energy Requirement (MU)	Energy Availability (MU)	Energy Deficit (MU) (-/+)	Energy Deficit/ Surplus (%) (-/+)
2014-15	8,331	6,648	-1,683	-20%	50,916	48,788	-2,128	-4.20%
2015-16	6,854	6,849	-5	-0.1%	50,254	49,948	-306	-0.61%
2016-17	9187	9187	0	0.0%	53029	53017	-12	-0.02%
2017-18	10298	10284	-14	-0.1%	60318	60237	-81	-0.13%
2018-19	10815	10815	0	0.0%	66489	66427	-62	-0.09%
2019-20	13168	13168	0	0.0%	68306	68303	-3	0.00%
2020-21	13688	13688	0	0.0%	66998	66994	-4	-0.01%
2021-22 (E)	13711	13578	-133	-1.0%	80003	81829	1,826	2.28%

Source: FY 2015-16 to FY 2020-21 data is taken from CEA Load generation balance reports.

For the Period FY 2021-22 (Estimation) data is as received from SCCL

FUTURE DEMAND OF TELANGANA STATE

The future demand in Telangana upto 2026-27 as per the 19th Electrical Power Survey is given below.

Telangana Demand Projections till 2036-37							
Period	Peak Demand (MW)	Peak Met (MW)	Peak Demand Deficit/ Surplus (MW)	Energy Reqmt.	Energy Availbty.	Energy Deficit/ Surplus (MU)	Remarks
2022-23	15,338	13,859	-1,479	88,130	67,994	-20,136	-4.20%
2023-24	16,086	16,750	664	91,836	87,331	-4,505	NTPC Telangana 2X800MW shall be added
2024-25	16885	18247	1,362	95776	100759	4,983	5X800MW TSGENCO Shall be added
2025-26	17738	18247	509	99945	100759	814	
2026-27	18653	19047	394	104345	106567	2,222	STPP- 800MW proposed in this DPR Shall be added to the Grid
2031-32	22951			128412			
2036-37	27814			158055			

Source: Peak Demand/Energy Requirement - 19th EPS Survey of CEA

Peak met/Peak Demand Deficit/Surplus/Energy Availability/ Energy Deficit/Surplus/ Remarks - Data provided by SCCL

Peak demand for Telangana state during 2026-27 period is projected as 18653 MW which is about 5000 MW more than the peak demand in 2020-21 period. From the above table, it is observed that for every 5 years there is an increase of peak demand of approximately 4500MW from 2021-22 to 2036-37.

2.01.02 Existing Generation Capacity

Energy availability from existing sources as on FY 2020-21 was about 66,994 MU inclusive of market purchases and coal based power from long-term sources constituted nearly 99.9% of energy availability.

2.01.03 PPA with Discoms of Telangana:

SCCL informed that they had already obtained the formal communication from Telangana Discoms that they will enter into PPA with SCCL for the purchase of the power to be produced from this 800MW Plant.

2.01.04 Justification for the Project:

- The Telangana government has initiated the ambitious Kaleshwaram lift irrigation project along with the existing ones, to meet the needs of the agriculture consumers in the State where 24 hours free supply to agriculture is being provided by state government from 2018. The expected additional loads and energy requirement as indicated by the Irrigation department, due to projected use of LIS pump-sets has shown an increase of 13% from 1617 MU in FY 2020-21 to 1830 MU in FY 2021-22 and increase of 190% from 1830 MU in FY 2021-22 to 5325 MU in FY 2022-23.
- To meet such increasing power demand as detailed above, power sector need to grow at accelerated pace since there is a confirmed increase in demand in every five-year period.
- Government of India is planning to replace old underperforming units with modernized high efficiency thermal plants.
- As Telangana State is one of the most preferred state for industrialization, the industrial demand for power will be ever increasing. Added to the industrial demand, the agriculture need as well as domestic consumption coupled with the improved standard of living of the population will be on the rise.
- 19th power survey projects peak demand for Telangana State as 18653MW in the year 2026-27, which is about 5000 MW more than the projected demand for the year 2020-21.

- Further the state of Telangana became the highest purchaser of electricity from power exchanges in FY 2019-20. Telangana purchased 5926.33MU and sold 986.28MU in FY 2019-20.
- The growth of prices in short term power market may be a concern in future for Telangana which can be avoided by buying power from SCCL's new thermal project. This will help the state to reduce over dependency on short term exchange traded power. This will also mitigate the peak shortage (projected in FY 2021-22) due to varying nature of renewable energy injected into the grid.
- Implementation of 24X7 supply across the State is likely to increase the electricity consumption substantially. Various factors that have been considered for future energy projections include:
 - Demand from Domestic segment
 - Agriculture supply for 24 hours in a day
 - Implementation of Lift Irrigation Schemes
 - Urban development in cities of Hyderabad, Warangal, Nizamabad and Karimnagar.
 - Upcoming major projects such as Hyderabad Metro Rail, Hyderabad ITIR region

Considering above facts & data, it is prudent to go for a coal based supercritical unit of 1X800MW utilizing the space available and utilizing existing facilities of Stage-I.

CHAPTER - 3
FEASIBILITY STUDIES

FEASIBILITY STUDY

3.01.00

SITE SELECTION

The proposed site for Singareni TPP Stage-II (1x800MW) was selected by SCCL based on the following considerations:

1. Availability of suitable & adequate land
2. Availability of reliable source of water
3. Availability of road and railway access
4. Environmental aspects
5. Availability of infrastructural facilities

The land acquired by SCCL at Jaipur as discussed earlier meets other basic inputs also like proximity of water source, Railway network and road access. The site is generally in conformity to the siting criteria of MoEF. No wildlife sanctuaries/national park or any ecological sensitive area of national importance exists within 7 kms radius of proposed site. No archaeological monument and defense installations exist within 10 kms of proposed site. The site is away from railway lines. Prima facie, the area is free from homesteads. Considering availability of land for locating the proposed power plant, fairly flat, not prone to flooding, free from dwelling units and availability of water source within distance of 8.5 kms, the proposed site, which generally meets environmental guidelines has been selected for setting up of the stage-II Singareni power project. Stage-I units (2x600MW) are in operation within the same compound. Proposed project is expansion of Stage-I.

Acres 1983-20 Guntas of land is already in possession of SCCL for the purpose of developing power project. In which Stage-I (2x600MW) has already been constructed and is in operation. Land required for Stage-II (1x800MW) can be managed with in acquired land of 1983 acres by SCCL.

3.02.00

LOCATION & APPROACH

Proposed site falls in Jaipur Mandal, District Mancherial of Telengana State is situated between 18°48'30" to 18°50'35" Northern latitude and between 79°34'00" to 79°35'30" Eastern longitude. The proposed plant site is surrounded by village Jaipur, Pegadapally, Gangipalli.

Road Link: The proposed site is situated at a distance of 12 km (approx) from Mancherial town and 250 km from Hyderabad and plot is approachable

from National Highway (NH-63). The district head quarter Mancherial is about 14.6 kms.

Rail Link : The nearest railway station is Mancherial which is about 14.6 kms from the site. The nearest major Railway Station is at Mancherial at a distance of about 14.6 kms on westren side.

Airport : The nearest airport is at Hyderabad at a distance of approx. 250 kms.

Vicinity Plan indicating the location of project site is attached in **Exhibit-1**.

3.03.00 LAND

The expansion project comprising of one unit of 800 MW is proposed to be accommodated in within land (1983 Acres) acquired by SCCL for the purpose of power plant development. The site is situated on northern side of the existing units of Stage-I in between Jaipur & Mancherial. Main plant shall be on of Stage-I main plant building. Switchyard shall be located north of the existing switchyard. Coal Handling Plant shall be located north of existing coal handling plant. Water System facilities are proposed to be located on the east side of the chimney. The type of land is semi agricultural with low yield. The land is fairly flat with undulations in few pockets and is not prone to flooding.

3.04.00 MAKEUP WATER

Make-up water requirement for the plant shall be met from river Godavari and river Pranahita at a distance of about 43.5 kms. Quantity of make-up water required for 1X800 MW would be about 2000 Cum/hr with ash water recirculation system and 2650 Cum/hr with once through ash water system. Make-up water is proposed to be used as make up for condenser cooling, ash sluicing, coal dust suppression and other plant processes. Make up water shall be drawn from the river through already available infiltration gallery and pump house. A Raw Water Reservoir with a storage capacity of 25 Lakh Cubic Meter is already constructed for Stage-I units and the same is proposed to be utilized for Stage-II unit also. However, necessary pipeline from 2nd chamber Reservoir-2 outlet is to be laid up to Make-up water pump house. Depending upon analysis of water, suitable water treatment system will be provided.

3.05.00 FUEL REUIREMENT AND AVAILABILITY

3.05.01 Coal Quality

The primary fuel for this project has been considered as Coal. The composition of fuel characteristics and quality of coal has been considered as per the coal parameters of existing Station of SCCL for DPR preparation. The coal quality considered for DPR is as follows:

Ash	:	40 %
Volatile Matter	:	21.0%
Fixed Carbon	:	43.11%
GCV	:	3550 (kcal/kg)
Total moisture (average)	:	10.52 %

3.05.02 Coal Quantity

As per EC report dated 18-12-2019 the daily coal requirement for 1x800 MW units shall be about 4.05 MTPA based on Gross Calorific Value of 3550 kcal/kg at 90% PLF. The coal is proposed to be met from Naini coal block. The daily maximum coal requirement shall be about 12340 tonnes at 100% PLF.

3.05.03 Coal Transportation

The envisaged mode of coal transportation from coal mines to the power plant is Indian railway system in bottom open/BOXN wagons. The rakes with bottom open shall be unloaded into existing track hopper of stage-I and rakes with BOX-N wagon shall be unloaded by proposed Wagon Tippler for stage-II. New railway tracks are proposed for the wagon tipping and BOX-N rakes.

3.05.04 Railway Siding

For transporting the equipment and material to the power house through rail, railway siding from the nearest rail head to project site shall be provided. The development of Railway siding is completed taking branched from nearest Indian railway system. The broad gauge rail route distance from nearest railway station at Mancheril would be approximately 12 kms.

3.06.00 POWER EVACUATION

The power generated in the units will be evacuated through 400 KV transmission lines by TSTRANSCO.

3.07.00 ENVIRONMENTAL CONSIDERATIONS

The project site has been selected taking into consideration siting guidelines of MoEF. There is no ecological sensitive area such as biosphere, national park, wildlife sanctuary within a radius of 7 kms from the project site. There is no archaeological/cultural/historical monument of national importance within a radius of 10 kms. The project site does not involve forest land.

In accordance with the procedures prescribed under the EIA Notification 2006, the proposed Power Plant comes under category-A, which requires prior Environmental Clearance from Ministry of Environment & Forests (MoEF & CC). An Environmental Impact Assessment (EIA) Study has been carried out and EIA report for this project prepared as per Terms of Reference (ToR), approved by the Expert Appraisal Committee (EAC), MoEF.

Environmental Clearance (EC) has been obtained from MoEF&CC vide letter dated 18-12-2019.

Further details on environmental aspects have been covered in chapter-9.

3.08.00 CONSTRUCTION WATER

The water requirement for construction of the project would be met from river Pranahita.

3.09.00 CONSTRUCTION POWER

The requirement of the construction power supply for stage -II (1X800 MW) would be met from existing construction power supply network by either using the existing substations or by providing new substations by extending the 3.3 kV overhead line by tapping from the existing 3.3 kV overhead line.

3.10.00 STATUTORY CLEARANCES

3.10.01 Consent from State Government

The project has been allotted to SCCL by Govt. of Telangana State.

3.10.02 LAND AVAILABILITY

Required land is already acquired by SCCL for the purpose of power project and stands in the name of SCCL in revenue records.

3.10.03 WATER AVAILABILITY

The Govt. of Telangana State has accorded its commitment for release of required water from river River Pranahita (2 TMC) for stage-I units

[2x600MW]. Same is sufficient to cater to the requirement of proposed stage-II Unit of 1x800MW capacity. Copy of letter is enclosed as **Annexure-2**.

3.10.04 Fuel Commitment

Naini mines have been allocated to SCCL for their original 3x600MW power project. As MOEF has advised to go for super critical technology power generation for Unit-3. Now, SCCL shall approach MOC for getting the same allocated to 2x600MW and 1x800MW. Copy of mine allocated to SCCL is enclosed as **Annexure-3**.

3.10.05 NOC from Airport Authority of India

No objection certificate has already been issued by Airport Authority of India for construction of tall chimney by SCCL at the proposed location of the Plant. Chimney height with FGD for the proposed stage -II (1X800 MW) is shall be 150 M.

3.10.06 EC from MoEF&CC

Environmental Clearance (EC) has been obtained from MoEF&CC.

3.10.06 Defense Clearance

As no defense establishment is located nearby the proposed site, Defense Clearance is not required.

CHAPTER - 4

LAYOUT PLAN

LAYOUT PLAN

4.01.00 GENERAL LAYOUT PLAN

General Layout Plan (GLP) for the project is developed and placed as at **Exhibit-2**. The layout of the proposal Stage-II (1X800MW) has been developed in the space available between the existing plant boundary wall and stage-I units on North side of the plant. Non plant Buildings like Service building, Administrative Building, Workshop, Canteen, Store are not envisaged for stage-II. O & M store shall be envisaged for stage-II.

The switchyard orientation has been planned towards west side of the main plant block taking into consideration the requirement of power evacuation. The main power house is along East-West direction. The Chimney is towards east of main plant. The ash slurry/ash water pump house is kept near the main plant boiler in north direction. FGD plant has been kept towards east of main plant beyond chimney.

The water treatment plant and the RO plant facilities are located in east direction of the main plant beyond the FGD area. The coal handling plant and the coal stockyard are located near the coal handling plant of stage-I and conveyor routing to stage-II shall be from behind the switchyards.

The main plant building arrangement for the proposed stage of the plant envisages longitudinal disposition of TG set. The main power house will be 148.5 M long and 41.0 M wide consisting of TG bay and heater bay.

An interconnection walkway is also provided between Unit-2 of stage-I and stage-II TG Building at operating floor level for movement of personnel.

Reference drawings for Main Plant Layout:

Description	Drawing No.	Exhibit
Equipment Layout Plant at EL (+/-) 0.0m	CW-EN-9755-G-F-003	3
Main Plant Layout Plant at EL (+) 4.0M/5.1/9.0M/13.0M/14.0M/18.0M/25.0M/33.0M/37.0M/42.0M	CW-EN-9755-G-F-004	4
Main Plant Cross-Section	CW-EN-9755-G-F-005	5

4.03.00 DESCRIPTION OF LAYOUT

4.03.01	Mechanical Area AB Bay The layout envisages AB bay of width 29.0 M and floors at EL (+/-) 0.00M, (+) 4.00M, (+) 9.0M, (+) 12.5M, & (+) 18.0M. The operating floor of the unit is kept at (+) 18.0M and the mezzanine floor is at (+) 9.0M. The AB bay at EL (+/-) 0.0M would house other equipment like vacuum pumps, control fluid equipment, heat exchangers & pump for closed cycle DM cooling water system, drip pump for LP heaters, HP/LP Bypass valves, Seal oil equipment for the generator, drain tank for TG, and flash tanks. Condensers envisaged for turbine. The three number condensate extraction pumps for the unit are to be located in the pit adjacent to turbo-generator raft. Roof of TG hall is envisaged at approximately (+) 36.5M. Oil equipment for the Main Turbine along with coolers & pumps for the generator are located at EL 9.0M. Openings have been provided on operating floor for handling different equipment by EOT cranes. Equipment lay down area is also identified at EL 18.0M in this bay.
4.03.02	Turbine Hall EOT Cranes One (1) number Electrically Operated Traveling (EOT) crane is envisaged in turbine hall for erection and maintenance of turbo-generators and their auxiliaries.
4.03.03	BC Bay The BC bay of width 12.0m would consist of floors at EL (+/-) 0.00 M, (+) 4.0MM /5.1MM, (+) 9.0 MM, (+) 12.5MM, (+) 14.0MM, (+) 18.0M, (+) 25.0M, (+) 35.0M, & (+) 39.0M /41.0M. The BC bay floor at EL (+) 0.00 M would house LP/HP dosing system equipment, condensate polishing unit, and fire fighting (inert gas) cylinders and Central Lube Oil system. Turbine driven boiler feed pumps are located at EL (+) 0.0 M. The LP / HP heaters are to be located at EL (+) 9.0M, 18.0M& 25.0M. The floor at EL (+) 25.0M has been planned for Auxiliary Steam Pressure Reducing De-super-heating Station and Deaerator. One (1) number Electrically Operated Traveling (EOT) crane is envisaged in BC-bay of turbine hall for handling turbine & motor driven BFP's. The main hook capacity of crane is considered to be 10 % over and above the heaviest component/ equipment (including lifting beam and slings etc.) to be handled in BC-bay of TG hall or at least 25 Tonnes (approx..).
4.03.04	Boiler Area

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Boiler, SCR, Air pre-heater, ID/FD/PA fans, ESP, mills and chimney are located with tentative dimensions as indicated in layout drawing. Mills have been located on the side of the Boiler. Passage ways have also been identified between Boiler & ESP and between ESP & ID fans. Distance of 12 M between Crow (last row of powerhouse columns) and D-row (1st row of Boiler columns), has been kept to facilitate the movement during Critical piping from Boiler to TG set. Two elevators - one for passengers and one for passenger cum goods have been envisaged for the Boiler.

The ESP control room for ESPs along with MCC, air conditioning & ventilation equipment for the same & I/O cabinet for ESP area are envisaged to be located in ESP Control Room. ESP control Rooms have been located at side of ESP.

Ash handling facilities such as Hydrobin, HSCD pump house, Ash Silos, Ash Water pump house, TAC pump house, Control Room for Ash handling area, Transformers & Switchgear Room and ash silo control room are located near the ESP in north direction.

For Fly Ash handling either Vacuum pump or Extraction air compressor shall be provided. In case of Vacuum pump the same shall be provided at the inlet side of the ESP and MCC, I/O cabinets & Transformers for the same shall be located inside one of the main plant coal TPs. In case of Extraction air compressor the same along with its MCC & Transformers shall be located adjacent to ash handling facilities near the ESP.

4.03.05 Air Compressor and CPU

Air Compressor house for instrument air and service air requirement has been envisaged in the Transformer Yard. Similarly, one (1) no. CPU regeneration building has been provided near the boiler area.

4.03.06 ELECTRICAL AREAS

A-B-C Bay: Electrical switchgears and MCCs of the unit are located in the electrical annexe located in A-B-C bay. The 11 kV/ 3.3 kV switchgear is located at (+) 4.0 M floor elevation. Electrical Batteries are located inside electrical annexe at (+/-) 0.0M at (+) 4.0 M floor elevation. 415 V switchgears, MCC are to be located at (+) 12.5 M floor elevation of the electrical annexe. Since all the switchgears are envisaged to have bottom entry cable, two cable spreader rooms have been envisaged, from EL (+/-)0.0 M to (+) 4.0 M and other from EL (+) 9.0 M to (+) 12.5 M. Boiler MCC have been located in B-C bay at EL (+) 39.0 M with a provision of cable spreader room at EL (+) 35.0M.

4.03.07

Transformer Yard/Bus Ducts/MCCs

Potential Transformer & Surge Protection cubical and Excitation transformers if applicable shall be located in A-B bay near A-row at EL 5.0M. Excitation room shall be located at EL 18.0M adjacent to TG Deck.

Three (3) single phase Generator Transformers (GT) including One (1) number of spare Generator Transformer, along with two (2) Unit Transformers (UT), two (2) Unit Auxiliary Transformers (UAT) for the unit are located in front of A-row in the transformer yard as shown in layout drawing.

In addition to this, if Station Transformer Scheme is opted, two number Station Transformers are provided with the unit as shown in layout drawing. However, if GCB scheme is opted, in place of Two number Station transformer one Standby Transformer shall be located in the Transformer Yard.

Necessary rail tracks have been provided outside A-row for the transformer movement. Separate rail tracks have been envisaged for handling GTs and STs. Bus ducts have been considered for connecting Unit and Station Transformers to respective 11 kV switchgears. The bus duct from the Unit Auxiliary and Station Transformers to the switchgears inside electrical annexes would be supported below the floor at EL (+) 9.0M and would drop down to the switchgears from above. Stator handling can be accomplished without disturbing the transformers. DG sets are located in transformer yard. The unit shall have one DG set and one stand by DG set.

4.03.08

Control Tower

The Control Room for the unit has been envisaged in B-C-Dx bay at operating floor level at EL (+) 18.0 M. The control room houses the unit control desk along with LVS, programmer & PC room area. Control Equipment Rooms are unitized and located in C-Dx-Ex_Fx Bay at operating floor level and in B-C & Ex-Fx bay at mezzanine floor level. UPS & 24V Battery Chargers, and C&I Batteries shall be in C-Dx-Ex bays at mezzanine floor level. Cable Vault for common control room & CER is located in B-C-Dx-Ex-Fx Bay at El 14.0 M & for UPS & 24V battery charger in B-C-Dx-Ex-Fx Bay at EL 8.5M.

Air conditioning system along with its MCC room has been located in D-Ex-Fx bay at EL (+) 0.0M.

Necessary cable shafts have been provided at B-row/C-row for routing of cables in the Electrical Bay and Control Equipment area. Control room. Control equipment room. SWAS and other offsite control rooms / RIO room / PLC room shall be air conditioned. All battery room shall be air ventilated.

CHAPTER – 5
PLANT SYSTEMS (CIVIL)

PLANT LAYOUT- CIVIL

5.01.00 LAND DEVELOPMENT

The topographical survey work was carried out during Stage-I execution. Based on the levels of Stage-I, the finished floor level (FFL) of various facilities/structures for Stage-II has been considered at RL (+) 144.5. Based on available contour mark, filling is envisaged for most of the main plant area with maximum 4 M of filling in the proposed switchyard area, whereas cutting of about -1 M is envisaged in the proposed cooling tower area.

The roads and drain network facilities of Stage-II shall be extended connecting existing roads and drains network of Stage-I.

Also, a Nala exists in the northern end to main plant block running from east to west direction, the same was diverted by owner.

5.02.00 GEOTECHNICAL DATA & FOUNDATION SYSTEM

Geotechnical investigation report pertaining to Stage-II area has been made available by SCCL.

Based on the bore log data, the sub soil is characterized by stiff to very stiff clay / clayey silt followed by hard silty clay / clayey silt. Below this, there is moderately dense to dense silty sand layer underlain by a very dense silty sand layer. After that weathered rock layer is present and that continues upto the terminating depth of all the boreholes. The ground water table is present at an average depth of about 2.6m below existing ground level.

Based on available geotechnical investigation data and proposed formation levels, open foundation is envisaged for Main Plant including Boiler, Electro Static Precipitator (ESP), Chimney, Coal Handling Plant, (CHP), Ash Silos & Switchyard.

The net allowable bearing pressure for open foundation is furnished in table-1.

TABLE-1

Location	Dr below FGL(M)	Width of Foundation (m)	NSBC (t/sqm)	NABC(t/sqm)			Remarks
				S=25mm	S=40mm	S=75mm	
	1			Filled up soil:6t/sqm			
	2	1-4	12.92	6	10	--	
		5	12.69	5	8	--	
		6	12.53	4	7	9	
		10	12.22	5	8	8	
	3	1-4	16.24	14	16	--	
		5	15.82	15	15	--	

TG. Boiler (BH-11 TO 16)	4	6	15.54	15	15	15	FGL considered RL(+) 144.000M
		10	14.98	14	14	14	
		1-4	16.98	16	16	--	
		5	16.42	16	16	--	
		6	16.05	16	16	16	
	5	10	15.31	15	15	15	
		1-10	51.55	30	45	45	
		6	63.25	40	45	45	
	7.50	1-10	120.95	45	45	--	
		>10	132.45	45	45	45	

For Open foundations, the total permissible settlement and differential settlement shall be governed by IS: 1904/IS: 13063 and from functional requirements whichever is more stringent. However, total settlement shall be restricted to the following:

Isolated (Main Plant Footings)	- 25mm
Isolated & Strip (Other than main plant)	- 40mm
Raft (Widths Greater than 6 m)	- 75mm
Foundations in Weathered Rock/Rock	- 12mm

Foundation System for all the structures/ buildings/machines.

For DPR purpose, Ordinary Portland Pozzolana Cement (PPC) has been considered for foundations. The grade of concrete for foundations shall be M25. A minimum slope of 1V:1.5H for deep excavation is to be considered and water table shall be lowered upto 0.5m below the bottom level of footing.

5.03.00 MAIN PLANT BUILDING

5.03.01 Foundation System

- All major foundations of equipment and structure shall be supported on open foundations
- Turbo Generator (TG), shall be supported on a RCC top deck, which shall rest on steel helical spring units and viscous dampers.

For TG foundation, steel helical spring units & viscous dampers shall be supported on an RCC, framed sub-structure. The sub-structure shall be supported on a base-mat. Turbine driven Boiler Feed pump (TDBFP) and Motor driven Boiler Feed pump (MDBFP) shall be supported on RCC deck, which shall rest on steel helical springs and viscous dampers, which in turn shall be supported on steel beams resting on main power house columns and auxiliary columns. Alternately, TDBFP/MDBFP foundation may be located at ground floor of Main Plant Power House, designed as block foundation.

5.03.02
Structural System
1. Main Power House

The building shall be multi span framed structures consisting of structural steel columns, beams and trusses. This shall be braced in longitudinal direction and moment resistant in transverse direction. Main power house building shall comprise of turbo generator (AB) bay and multi-level heater (BC) bay. All platforms and floors shall be supported on structural steel.

2. Control Tower

Control tower shall be of RCC structural framing. It shall be a separate building near gable end in CD Bay of the main power house of Unit-III.

3. Mill / Bunker Building

Mill/bunker building shall be single span multi-storey framed structure consisting of structural steel beams, columns and bunkers. The building shall have floors at feeder location and tripper location. Mill and bunker building shall be braced in longitudinal as well as in transverse direction. Hoppers shall be made of mild steel with stainless steel liner. The bunker shall be of Mild Steel.

Requirement of lining shall be finalized after Coal Flowability Study Report.

4. Conveyor Galleries and Transfer Points

Overhead conveyor galleries in the main plant (boiler area) shall be of structural steel frame with cladding and roofing. Transfer points and intermediate supporting trestles shall be made of braced steel framed structures. The staircase shall be of external type.

5. Cable and Pipe Racks

- 1). Structural steel trestles and galleries with provision of walkway with grating shall be provided for supporting overhead cables and pipes in the main plant and outlying areas. However, for below ground routing, RCC trench with removable pre-cast concrete covers / box culverts shall be provided.

5.03.03

Civil Concepts

- 2). Pipes and cables running along the boiler structure, mill & bunker buildings and ESP structures etc. shall be supported on steel girders resting on the steel bracket fixed to the boiler/ ESP / mill & bunker building structures.
- 3). Pipes between boiler and C-row will be supported on the steel girders resting on the steel brackets at the boiler & C-row columns. These steel girders shall have sliding joint on main powerhouse and fixed / hinged on boiler structure.

6. Other Buildings

ESP control, DG set, air washer, compressor house and other similar buildings located in power block shall be of framed structure.

Roof of TG hall shall be provided with color-coated metal deck sheet over which a RCC layer shall be laid. Further, Skylight shall be provided for natural light.

Roof of other buildings i.e., Deaerator, TPs etc., shall be provided with the metal deck sheet and / or RCC depending upon the clear height of the roof.

The roof of bunker building shall consist of Insulated double layer metal sheet with slope in one direction.

Intermediate floors of all buildings including main powerhouse building shall be provided with cast-in-situ RCC slab. External cladding of all buildings shall have combination of brick work, metal cladding, aluminum composite panel & structural glazing.

For main plant building, initial height of 3 m along A-row and C-row and gable ends shall be provided with brick wall followed by color-coated metal cladding and structural glazing except for the Generator-Transformer area near 'A-row' where 6m high RCC Fire wall is provided in A-Row along followed by metal cladding.

Control room area shall have brick wall on external face.

Internal partitions shall be provided with brick wall /decorated veneer in aluminum framework. However, control room internal partitions shall be provided with single or double glazing in aluminium framework.

Roof shall be provided with elastomeric membrane or other suitable water proofing treatment.

Windows shall generally be of aluminum. Doors of control room and office area shall be of aluminium frame with glazing or particle board panels. All fire exits shall be provided with fire proof doors. Hollow metal doors shall be provided for switch-gear room, cable vaults etc.

Entire area from transformer yard to chimney shall be provided with paving in combination with interlocking concrete blocks and high wearing resistant concrete.

5.03.04 Architectural Concepts

- a) Keeping in view the functional requirements of a thermal power plant, overall layout of the plant shall merge harmonically with an aesthetic appeal. Power Plant Buildings shall be architecturally treated in such a way that they retain a monumental scale, yet present a pleasing composition of mass and void. The overall impact of the buildings shall be one of aesthetically unified architectural compositions having a comprehensible scale, blending tonal values with the surroundings and taking full consideration of the climatic conditions, and the building orientation.
- b) All buildings and structures shall be architecturally treated in such a way so as to be in complete harmony with the main plant building, surrounding structures and environment. Due considerations shall be given to landscape design, and interior design. All finishes for floors, walls, ceiling, structural elements, partitions for offices and industrial areas shall be suitable for their aesthetics, durability and functional requirements and shall include the latest building material & technology, with a view of fast track construction.
- c) Overall color scheme of the Main plant building and other buildings shall be designed judiciously and in a comprehensive manner taking into account the mass and void of buildings, its facade, equipment, exposed structural elements, piping, trestles, bus ducts, and other service elements. For natural & uniform distribution of natural light, buildings shall be oriented to take advantage of uninterrupted natural light from North, through sky lights and structural glazing.
- d) For adequate light and ventilation, National Building Code recommendations shall be followed.

- e) All the buildings shall be architecturally designed to meet the National Building Code requirement.
- f) During design stage, Technical specification as prepared shall govern the finishes as well as quantity.
- g) Human safety factors shall form firm basis of design criteria.
- h) Due consideration shall be given to preserve and protect the existing Landscape during the construction, reduce air pollution during construction and provide for minimum level of sanitation and safety for construction workers.
- i) All public buildings shall be designed on the principles of providing barrier free environment for physically disabled persons.
- j) Landscape shall be designed as a part of overall development, incorporating existing water resources. All the buildings shall be designed to taken care of Rain Water Harvesting & Ground Water Recharging.
- k) All the power plant buildings shall be designed so as to provide for installation of solar panels on rooftop.

5.04.00

CHIMNEY

Single-flue steel lined reinforced concrete chimney with cladding of Titanium/C-276 alloy/ Borosilicate Glass block on mild steel liner shall be provided for the 1x800 MW unit of the project. The flue gas emission point shall be 150 meters above the plant grade level. The RCC for the chimney shell and other super structure shall be of M-30 grade and for foundation & grade level slab it shall be of M-25 grade.

The flue liner shall essentially be constructed from structural steel and shall be of the hung type (with multiple point liner support system). The flue liner shall be provided with resin bonded wool type thermal insulation. . The portion of the flue projecting above the chimney roof/top, few meters of flue liner, however, shall be constructed of acid & heat resistant material like shaped acid resisting bricks, stainless steel etc. Brick liner shall be protected by a reinforced concrete mini-shell also constructed from the roof slab. Suitable expansion joints shall be provided between the steel and the brick liner. Internal platforms shall be provided for enabling access to various elevations of the stack and of the stack including aviation warning lights and to provide support to the steel liner. There shall be at least one meter working space around the flues. External platforms, staircase & lift shall also be provided. The structural steel transition inlet ducting shall be bottom

supported. This transition ducting shall be suitably profiled from a rectangular shape at the chimney inlet to a circular shape up inside the chimney where it shall be connected to the suspended circular steel liner through suitable (non-metallic) fluoroelastomeric fabric expansion joints. Transition ducting shall also be thermally insulated.

Internal platforms shall be of structural steel construction. The chimney roof shall, however, comprise of a reinforced concrete slab supported over a grid of structural steel beams. The external platforms shall be of reinforced concrete construction grade of M-30.

An internal structural steel staircase, supported from the shell wall, shall be provided for full height of the stack. Suitable embedment shall be provided in the shell wall for this purpose.

An internal ladder shall be provided having its support from the concrete shell inside the chimney and shall be provided for a small height, over the last staircase landing, to access the chimney roof through a roof access hatch. External ladders shall be provided on each of the mini-shell(s) over the roof.

The flooring panels of the platforms and treads of the staircase shall be of chequered plate construction. Handrails for platforms and staircase shall be of tubular construction.

The external portion of the wind shield shall be coated with alternate bands of red and white colors to meet the aviation safety requirements. The mini-shells and the top few meters of the internal surface of the windshield shall be painted for acid and heat protection with bituminous paint.

The other components of the chimney include cast iron caps over mini-shell(s), liner test ports (for continuous pollution monitoring), liner hatches, reinforced concrete roof slab protected for acid and heat protection, grade level slab of reinforced concrete with a metallic hardener floor finish, a large electrically operated grill type roll-up door (with only the bottom small portion of the curtain of solid shutter type) at grade level and personnel access metallic doors at grade level and at all floors, a personnel access hatch in the roof slab, rain water drainage system, flue liner drainage system, roof drain basin, louvers with bird screens for ventilation openings and all gaps in the wind shield, mild steel discrete strakes, painting of chimney shell surfaces and painting/coating of all structural steel work and miscellaneous ferrous components (for a maintenance free life of at least ten years), all finishing works, electrical power, distribution boards, lighting panels, power and control cabling and wiring systems, cable conduits, stair and platform lighting, socket outlets, lightning protection and grounding system, aviation obstruction lighting, communication system and a rack and pinion elevator.

			SCCL
		The chimney shall have a suitable foundation. Lightening protection and aviation obstruction lighting shall be provided during construction phase also.	
5.05.00	FLUE GAS DESULPHURIZATION SYSTEM (FGD)		
	Wet limestone FGD system shall be installed to limit the SO _x emission upto 100 mg/Nm ³ (at 12% CO ₂ on dry gas basis). Associated civil & structural systems shall be provided.		
5.06.00	DM PLANT, PT PLANT, ETP, CW CHEMICAL TREATMENT AND CPU REGENERATION CIVIL WORKS		
	Complete water retaining/conveying RCC structures for PT plant, DM plant, ETP, CW Chemical Treatment and CPU regeneration system shall be of RCC grade M30. Other structures shall be or RCC M25 grade. All shed shall be generally steel superstructure with sloping MS roof sheeting.		
5.07.00	CW & MAKE UP WATER SYSTEM		
5.07.01	CW System civil works		
	CW system for the project consists of CWPH including fore-bay, intake RCC channels, steel lined concrete encased supply and discharge ducts. The CW pump houses for the project shall house either vertical turbine pumps or concrete/metallic volute pumps. Substructure of the pump house shall be of RCC grade M-30.		
	The CW pumps shall pump cold water to condensers and hot water from the condensers to cooling towers through steel lined concrete encased CW ducts. The cold water from cooling towers shall flow by gravity to the CW pump house through RCC open channel. Grade of concrete for RCC channel shall be M-30.		
	Induced Draught Cooling Tower shall be a RCC structure.		
5.07.02	Makeup		
	Water System civil works		
	Make-up water for stage-II (1X800 MW) of the project shall be drawn from existing conveyance system of Stage-I. A new PT plant is envisaged for the proposed new unit of 1x800 MW. Tapping of water from existing pipeline shall be made at locations upstream of existing system. For drawl of water from existing pipe line, provision shall be made at the outlet of reservoir-1 chamber. 1m dia spirally welded pipe along with butterfly valve shall be		
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provided upto make-up water pump house. The pipe line to be encased with RCC.

Raw water pump house including switchgear building, control room and transformers etc. shall be provided near the reservoir adjacent (east side as mentioned in layout) to the existing raw water pump house. The raw water pump house shall house 5 nos. of pumps (3 for Pre-Treatment & 2 for Ash Handling) which shall pump water from reservoir into plant. Substructure of the raw water pump house shall be of RCC grade M-30. The RWPH shall be open to sky and there will be no structural steel super-structure.

5.08.00 COAL HANDLING SYSTEM

5.08.01 Wagon Tippler

2 no. of Wagon tippler has been envisaged for the stage-II, 1X800MW unit. Wagon tippler hoppers shall be underground RCC structure with suitable waterproofing system. Waterproofing treatment shall comprise of chemical injection grouting & polymer modified cementitious coating. Inclined surfaces of hopper shall have 50mm thick shotcreting. Shed shall be provided over wagon tipplers.

5.08.02 Crusher House

Crusher house shall be of structural steel with permanently color coated steel sheet cladding. Floor slabs shall be of RCC. Crushers shall be supported on RCC deck slab which in turn will rest on vibration isolation system consisting of springs & dampers. Ironite flooring has been considered for floors.

5.08.03 Transfer Points

Transfer points shall be of structural steel with RCC floors and shall have permanently color coated steel sheet cladding. Floors shall be provided with ironite finish.

5.08.04 Conveyor Galleries

Conveyor galleries shall be of structural steel with trestles at regular intervals. These shall have permanently color coated steel sheets as side & roof cladding.

5.08.05 Stacker/Reclaimer Foundations

The stacker/reclaimer rails shall be supported on RCC longitudinal beams which in turn will be supported on open foundation.

5.08.06

Pent House, CHP Control Room, WT Control Room, Pump House & MCC Rooms

These shall be structural steel buildings with brick wall/ concrete block work enclosures.

Track line and uploading header facility of Stage-I shall be utilized for Stage-II also".

5.09.00

FUEL OIL HANDLING SYSTEM

The civil works for the following are to be provided for fuel oil handling system as mentioned below:

- a) Foundation for 2 nos. LDO tank (1000KL)
- b) Containment wall around the tank area for all tanks.
- c) Miscellaneous foundations for pumps, pipe racks, pipelines etc. miscellaneous drains.
- d) Paving and drains around tanks.

5.10.00

ASH HANDLING SYSTEM & RECIRCULATION SYSTEM

The Civil works involved in Ash handling & Ash water recirculation systems are as follows:

1. Ash Water Pump House.
2. Ash Slurry Pump House
3. HCSD Pump House
4. Switch gear/MCC and Control Room for all buildings
5. Silo area utility building
6. Fly Ash Silo foundation & supporting structure
7. B A Slurry Trench
8. HCSD Silo foundation & supporting structure & Hydrobin area.
9. Transport air Compressor and Equipment Air Compressor house
10. Steel Trestles for supporting Ash Slurry Piping within plant area and dry fly ash transportation pipe pedestals upto silos near plant boundary.
11. RCC pedestals for supporting bottom ash disposal pipes & HCSD pipes including garlanding of ash dykes.

12. RCC pedestals for supporting ash water recirculation pipe.
 13. Miscellaneous works like Transformer Foundation, Fencing, Paving etc.
 14. Miscellaneous structures including Foundation for settling tank, surge tank, etc.
 15. Maintenance road
- All pump houses & compressor houses shall have RCC framed structural arrangement with brick cladding & metal deck roofing filled with RCC. However, switchgear room, RIO rooms, disaster management room, etc. shall have RCC slab as roof. All Control room shall be air-conditioned area with false ceiling. For routing of the ash pipes at road/nallah crossing, culverts/bridges shall be provided as per site conditions.
- All equipment related to dry ash handling (including silos, buffer hopper, and collector tank) and bottom ash handling are included in mechanical package. However, their supporting structure is included in this package.

5.11.00 RAILWAY SIDING

The envisaged mode of coal transportation from coal mines to the power plant is by Indian railway system in bottom open/BOXN wagons. The rakes with bottom open will be unloaded into existing track hopper of stage-I and rakes with BOXN wagon will be unloaded by proposed Wagon Tippler for stage-II. New railway tracks are proposed for the two (2) nos wagon tipping and BOX-N rakes.

2 nos. of Loco are envisaged and 2 no. of Loco shed along with workshop are also envisaged.

5.12.00 ROADS & DRAINS

Double Lane Roads

All double lane roads are proposed as concrete road with 7.5m width with shoulders of 2.25m on both side.

Single Lane Roads

All access roads to all buildings/facilities/structures shall be single lane roads 6.75m wide with 3.75m wide concrete road and 1.5m wide shoulders on both sides of roads.

Patrol Roads

All patrol roads (insider or outsider or both) along the boundary wall shall be single lane roads with 3.75m wide bituminous pavement and 1.5m wide shoulder on one side of the road.

Drains

Drains shall be constructed on both sides of double lane and single lane roads. Patrol road along boundary wall shall have one side drain. These all drains shall be connected to the trunk drain suitably, which finally gets connected to the drains outside plant boundary or drain of Stage-I. All drains shall be of RCC with rectangular section.

5.13.00 SWITCHYARD CIVIL/STRUCTURAL WORKS

The civil and structural work for switchyard bays shall be provided as per switchyard single line diagram.

5.14.00 ASH DISPOSAL AREA

The plant shall have two different systems for ash disposal - conventional wet bottom ash slurry disposal system with dewatering bin to utilize bottom ash and High Concentration Slurry Disposal (HCSD) for fly ash. HCSD system will require less quantity of water and there will be no effluent from the fly ash disposal site. High concentration slurry shall be disposed in HCSD Dyke. For disposal of fly ash and bottom ash generated from 1X800MW unit will be disposed of in stage -I dyke.

Maximum height of outer dyke for HCSD will be about 8.0m and will be constructed on existing ground along the periphery of the HCSD area (In two phases: in first phase, 4.0m high dyke will be constructed using earth as main construction material & after this dyke is filled upto freeboard level, in phase-II, 4.0m high raising will be done using pond ash).

5.15.00 TOWNSHIP

Township is being developed for Stage-I and same shall be adequate to accommodate the staff for Stage-II with provision of few residential units & allied facilities.

CHAPTER – 6

PLANT SYSTEMS (MECHANICAL)

PLANT LAYOUT- MECHANICAL

6.01.00 STEAM GENERATOR AND AUXILIARIES

6.01.01 General

The steam generators shall be Super-Critical, once through, water tube, 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.

The steam Generator and its auxiliaries shall be designed for firing coal identified for this project.

Steam Generator Design shall be suitable for variable pressure operation from 30% to 100% Boiler Maximum Continuous Rating (BMCR).

The main parameters at 100% BMCR will be as follows:

1.	Main steam flow at Super Heater (SH) outlet	2690 T/Hr
2.	Pressure at Super Heater outlet	281 kg/cm ² (a)
3.	Temperature at SH outlet	603°C
4.	Steam flow to reheater	2114 T/Hr
5.	Steam temperature at reheater outlet	603°C
6.	Feed water temperature at economizer inlet	306.8°C

6.01.02 Furnace

The furnace will be radiant, dry bottom type with tangential or opposed wall firing and enclosed by water cooled and all welded membrane walls. The furnace bottom shall be suitable both for installation of water impounded bottom ash system and submerged scrapper chain conveying system and also for dry type of bottom ash handling system. Spray type atomizer is envisaged to control the superheater and reheater outlet temperature for varying loads. The superheater and reheater tubes will be a combination of radiation and convection type. Economizer will be non-steaming type and shall be of modular construction.

6.01.03 Steam Generator Star-up Circulation System

The steam generator startup system envisages boiler startup with SG start up drain circulation pump. Provision shall also be made in the startup system of Steam Generator in case of non-availability of start-up drain recirculation pump. Separator(s) will be used during startup for separating the steam water mixture upto a load of 30% BMCR, above which it will be running dry.

	Lower part of furnace / water wall will consist of vertical plain/rifle tubes or wrap around /helical tubes.		
6.01.04	Air and Flue Gas System A balanced draft system will be provided. There will be two (2) axial type FD fans and two (2) axial type ID fans. Two (2) pairs of Regenerative rotary type air pre-heaters. One pair of air pre-heater will be used for primary air system & second pair for secondary air system. The configuration of air heaters can either be two (2) tri-sector air heaters or four (4) bisector air heaters [two (2) nos. bisector air heaters for secondary air system and two (2) nos. bisector air heaters for primary air system]. Two (02) numbers of steam coil air pre-heaters (in case of tri-sector APH) or four (4) numbers of steam coil air pre-heaters- two on primary and two on secondary air system will be provided for start-up, low load operation or abnormal conditions when an increased air inlet temperature is considered desirable to minimize the cold end corrosion of regenerative air pre-heaters.		
6.01.05	Fuel Oil Burning System Start-up, warm up and low load support shall be done by Heavy Fuel Oil (HFO/Heavy Petroleum Stock (HPS)/Low Sulphur Heavy Stock (LSHS). Boiler will be so designed that oil firing for flame stabilization will not be required beyond 40% BMCR. HFO system shall be sized for 30% BMCR capacity of one (01) boiler by providing necessary pumps, filters and heaters. There will be Light Diesel Oil (LDO) firing at least in one burner elevation having a minimum capacity of 7.5% BMCR to facilitate cold start-up of the unit, when no auxiliary steam is available for HFO heating and atomization. LDO system shall be sized for 7.5% BMCR capacity of one (01) boiler. Ignition of fuel oil shall be directly by high energy arc igniters.		
6.01.06	Coal Burning System The coal burning system will comprise of coal mills of vertical spindle type which include either: a) Bowl Mills, b) Roller Mills and c) Balls & Race Mills or any approved equivalent/ High and Power The number and capacities of the mills shall be so selected that while firing the worst and design coals at BMCR/TMCR, the following spare capacities shall be ensured: a) With 90% mill loading of the working mills, no spare at 100% BMCR while firing the worst coal. b) With 90% mill loading of the working mills, at least one mill will be spare while firing the design coal at 100% BMCR.		
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c) With 90% loading of the working mills, at least one mill will be spare at 100% TMCR load with worst coal firing.

Coal from raw coal bunkers will be fed into the mills by belt driven gravimetric coal feeders suitable for handling moist coal. There will be two (2) numbers Seal Air Fans will be used for fulfilling the sealing air requirement of all the mills.

NOx Control System

The steam generator shall be designed to limit the NOx formation up to 100 mg/Nm³(at 12% CO₂ on dry gas basis) by adopting the appropriate low NOx burners/combustion system along with the Selective Catalytic Reduction (SCR) system.

6.01.07

Soot Blowing System

Fully automatic, sequentially controlled, microprocessor based steam soot blowing system, complete with provision for individual operation of any soot blower pair, operation and facility to by-pass any soot blower, will be provided. The system will have short retractable rotary wall blowers for the furnace and long retractable rotary blowers for the superheater, reheater and economizer. Soot blower for regenerative air pre-heater will have sweep action blowers. Future provision for Soot blowers for SCR of NOx control system shall also be installed.

6.01.08

Auxiliary Steam System

The unit will be provided with two auxiliary Pressure Reducing & De-superheating Stations (PRDS) i.e., high capacity and low capacity PRDS taking their steam tap-offs from Main Stream line and Cold Re-heat CRH line respectively. The high capacity auxiliary PRDS will be designed for a minimum capacity of 190 T/hr. a Low capacity auxiliary PRDS will be sized for a minimum capacity of 35 T/hr and will be operated during the normal operation of the unit.

Auto-change over between the low and high capacity aux. PRDS stations depending on the station auxiliary steam requirement is also envisaged. Unit will have its own auxiliary steam headers whereas for station services station auxiliary steam headers taking its tap off from the unit auxiliary PRD stations will also be provided.

6.01.09

Elevators

One (1) number passenger cum goods elevator of capacity 3000 kgs & one (1) number passenger elevator of capacity 1088 kgs shall be provided for steam generator.

6.01.10

Electrostatic Precipitator

Further, one (1) number passenger elevator having capacity of carrying 8 persons shall be provided for ESP control room.

It is proposed to install adequately designed/sized, high efficiency electrostatic precipitator having an efficiency that limits the outlet emission to 50mg/Nm³, while firing worst coal having maximum ash content, with one(1) field in each ESP pass out operation at full load. Outlet emission shall be restricted to 30 mg/Nm³ with all ESP fields are in service. The electrostatic precipitators will have six (6) parallel gas streams, isolated from each other on the electrical as well as gas side and will be provided with gas tight Gates at inlets and outlets of each stream, so as to allow maintenance to be carried out safely on the faulty stream, while the unit is working. ESP specific collection area shall not be less than 260 m²/m³/sec at 100% TMCR. Electrostatic precipitator will be provided with microprocessor based programmable type rapper control system and ESP management system to ensure safe and optimum operation of ESP.

Electrostatic precipitator will be provided with transformer rectifier sets, microprocessor based programmable type rapper control system and ESP management system to ensure safe and optimum operation of ESP.

All dust collection hoppers of ESP shall have minimum storage capacity of eight (8) hours. The hoppers will have heating arrangements to prevent ash sticking to the sloping sides and down pipes. Level indicators to indicate ash levels in the hoppers and trip the ESP in case of high ash levels in the ash hoppers are also envisaged to ensure safety of ESP.

6.01.11

Flue Gas Desulphurizing system (FGD)

Wet limestone FGD system shall be installed to limit the SO_x emission upto 100 mg/Nm³ (at 12% CO₂ on dry gas basis). It will take suction from flue gas duct after ESP and feed the de-sulphurised flue gases back to the chimney. The FGD system shall be necessarily based on Wet Lime Stone Forced Oxidation process technology to reduce the emissions of Sulphur Dioxide in flue gas produced by coal being fired in boiler to the limits specified. The common limestone milling system of Singareni TPP Stage-I (2x600 MW) shall also cater the requirement of Singareni TPP Stage-II (1x800 MW) including limestone storage silo and day silo and slurry preparation tank. Two nos. limestone slurry pumps for stage-II shall be installed in the space provision already kept in stage-I.

An auxiliary absorbent tank, for storage of absorber slurry shall be installed. All ducting, dampers, pumps, valves, supports, etc. as required for completeness of system of absorbers shall also be installed. Clean gas from the absorber shall be taken to the GGH through two stage mist eliminators.

Treated and reheated flue gas from the absorber shall be discharged through a 150 M high stack. Necessary lining in duct and chimney shall be provided for protection of duct and chimney from low temperature acidic corrosion. Provision shall be made for isolation of the flue gas flow through the absorber and also for bypass of the absorber, to allow maintenance of the absorber with the unit in operation. Limestone to the absorbers shall be supplied by a wet limestone grinding in slurry form. The classified limestone slurry from the mills shall be stored in two (2 no) limestone slurry storage tank kept in Stage-I scope, from where the slurry shall be pumped to the absorbers by dedicated limestone slurry pumps. The gypsum bleed coming from the absorber (stage-II) shall be fed to the common primary hydro cyclone Tank of Stage-I.

The primary hydrocyclone & equipment coming in downstream of primary hydrocyclone i.e secondary waste water hydrocyclone, waste water tank, lime solution tank and other items coming under waste water treatment system for Singareni TPP Stage-II (1x800 MW) shall be installed. These items pertaining to stg-II shall be in the scope stage II Bidder. The additional space for primary hydrocyclone & equipments coming in downstream of primary hydrocyclone i.e secondary waste water hydrocyclone, waste water tank, lime solution tank and other items coming under waste water treatment system etc. for Singareni TPP Stage-II (1x800 MW) shall be provided in the gypsum dewatering building of Stage-I.

Further the provision of connecting underflow of Stage-II primary hydrocyclone to the vacuum belt filter of Stage-I to be provided so that the belt of Stage-I can take care the requirement of Stage-II also.

The waste water from the system shall be collected and neutralized using lime and neutralized effluent shall be pumped to Ash slurry sump. Washed and dewatered gypsum from the dewatering system shall be fed to a belt conveyor. The filtrate water from belt filter dewatering and washing system and the over flow from the secondary hydro-cyclone shall be taken to a filtrate water tank and further to absorber tank.

6.01.12
Provision of installation of Flue Gas SCR DeNO_x System

Flue Gas SCR DeNO_x system and its auxiliaries for steam generators shall be installed. For NO_x emission limit will be below to 100 mg/m³ (norm) dry as per new environmental norms. The SCR System shall be planned, designed to perform and demonstrate to meet the environmental norms of MOEF. The SCR reactor shall be flown through from top to the bottom and arranged in the flue gas pass of the steam generator between economizer and air heater. The reagent will be ammonia/air mixture. The overall design of the SCR shall be done under consideration of all operating conditions (e.g. higher and lower temperature), minimization of ammonia consumption and slip, prevention of formation of ammonium hydrogen sulphate and other ammonia components, which deactivate or plug up the

catalysts, minimization of SO₃-conversion, prevention of disturbances in downstream equipment, prevention of plugging by ash particles, especially "popcorn ash". The catalyst layers shall be installed in maximum two layers on horizontally arranged support frames. Furthermore one reserve layer (without catalysts) shall be designed. The SCR reactor considerably consisting of Reactor housing, Inlet and outlet hood with guiding vanes, connecting nozzles for media (e.g. flue gas, steam, pressurized air, etc.), grid measurement with adapters, fixture for soot blower connection per catalyst layer and bearing beams for catalyst. Soot blowers shall be installed for three catalyst layers for removal of ash deposits on the catalyst. Initially only 2 catalyst levels are filled with catalyst. A 3rd catalyst layer serves as spare for future filling (already equipped with the soot blowing system). The entire SCR plant e.g. reactor, ammonia injection shall be equipped with a sufficient number and size of platforms for inspection, maintenance and sampling. Storage and supply of ammonia shall be delivered by truck tanks as liquid-pressurized form to the Power Plant. The storage capacity of ammonia shall be sufficient to accommodate 14 days demand for Power Plant at maximum consumption corresponding to SCR worst case. Ammonia injection system considerably consisting of Nozzle lances, one control fitting with lockable flow rate gauge, complete piping for the distribution of the ammonia/air mixture, connection to ammonia piping from ammonia supply system, protection for the control fittings mixer in the flue gas duct. Soot blowing shall be carried out with steam.

6.01.13

Mercury abatement as co-benefit of reduction of NO_x, SO₂ and dust:

Mercury content in Indian coal ranges between 0.01 ppm to 1.1 ppm. Average mercury content in coal found in India to be 0.272ppm as per CPCB. A typical power plant emits 90% of its mercury into air and 10% to land. The main reason for such high rate of emissions is that mercury boils at operating temperatures of power plant. Mercury exists in three forms in coal fired thermal power plants flue gas:

- (i) Elemental Hg (0)
- (ii) Oxidized Hg (2+)
- (iii) Particle bound Hg (P)

Hg(2+) and Hg(P) are relatively easy to remove from flue gas using typical air pollution control devices such as ESP and wet FGD.

Mercury emissions from coal-fired boilers can be controlled through proposed measures for removing particulate matter (PM), Sulphur dioxide (SO₂) and Nitrogen oxides (NO_x). The Hg(P) fraction is typically removed by ESP, particulate control device. The Hg(2+) portion is water soluble and

therefore a relatively high percentage can be captured by wet flue gas desulphurization (FGD) system. The Hg(O) fraction is generally not captured by proposed air pollution control device. However, the proposed SCR for controlling NOx emissions will promote oxidation of Hg(O) to Hg(2+) and enhance Hg capture in downstream FGD.

6.01.14

Environmental and Efficiency Considerations

In order to meet the environment norms and maintain the sustained efficiency of ESP, it shall be adequately designed with sufficient margins for all operating conditions. The Electrostatic Precipitator Management System (EPMS) in conjunction with opacity monitor shall continuously monitor and maintain the optimum energy level to achieve higher efficiency of ESP. The steam generator shall be designed for low NOx formation by adopting the appropriate burners/combustion system. The steam generator shall meet the requirement of sustained high efficiency and availability, high efficiency at part load, flexibility to burn coal within the range specified, quick startup and two shift operation. Furnace shall be sized for burning high ash coal and low flue gas velocities to minimize erosion.

6.02.00

TURBINE AND ITS AUXILIARIES

The scope of each TG unit of 800 MW shall broadly cover the Steam Turbine along with its integral systems and auxiliaries like lube oil system, control-fluid system, air cooled condensers, condenser air evacuation system, HP & LP Bypass system, complete regenerative feed heating system, condensate pumps along with their drives, boiler feed water pumps along with their drives, automatic turbine run-up system, instrumentation and control devices, turbine supervisory instruments, turbine protection and interlock system, automatic turbine testing system and turbine hall EOT cranes.

6.02.01

Steam Turbine

The steam turbine shall be tandem compound, single reheat, regenerative, condensing, multi-cylinder design with separate HP, separate IP and separate LP casing(s) or combined HP-IP and separate LP casing(s), directly coupled with the generator suitable for indoor installation. The plant would be designed to operate as a base load station. However, continuous operation under two-shift and cyclic modes during certain periods of the year is also envisaged. The turbine design shall cover adequate provision for quick start-up and loading of the units to full load at a fast rate.

The turbine shall be capable of operating on variable pressure mode as well as modified sliding pressure mode. The turbine shall be provided with suitable margins for Valves Wide Open (VWO) flow.

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

S.N.	Particulars	Design and Duty conditions
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i)	Output under Economic Maximum Continuous Rating (EMCR) at Generator terminals with Cycle make up of 3% of throttle steam flow and 196mmHg condenser pressure.	800 MW (In case of static excitation system, the EMCR output at generator terminals shall be 800 MW plus excitation power requirement at EMCR).
	Output under VWO at Generator terminals with Cycle make up of 3% of throttle steam flow and 196mmHg condenser pressure (Guaranteed output)	840 MW (In case of static excitation system, the EMCR output at generator terminals shall be 800 MW plus excitation power requirement at EMCR).
ii)	Turbine throttle steam pressure	270 kg/cm ² (abs)
iii)	Turbine throttle Main steam/ Reheat Steam temperature.	600 °C/600 °C
iv)	Variations in rated Steam temperature & pressure	Generally as per IEC-45.
v)	Pressure drop in reheat circuit i.e. between High Pressure Turbine Exhaust & Intermediate Pressure Turbine inlet.	10% of HPT exhaust pressure (maximum).
vi)	Condenser pressure	77 mm of Hg(abs)
vii)	Turbine speed	3000 RPM
viii)	Frequency variation range from rated frequency of 50 Hz	(+) 3% to (-5%) (47.5HZ to 51.5HZ)
ix)	DM Water make up to thermal cycle under EMCR condition.	3% of throttle steam flow
x)	Final feed water temperature at 100 % TMCR & at EMCR condition.	302.5 (+/-) 2.5°C
xi)	Turbine protection against water induction.	As per ASME-TDP-1(latest)
xii)	No. of extractions for regenerative feed water heating	3(High Pressure Heater) HPH, 1 D/A, 3 LPH) 3 HPH, 1 D/A, 3 Low Pressure Heater (LPH)

6.02.02

Condenser

Single pass or double pass condenser with stainless steel tubes of welded type as per ASTM-A-249-TP304, shall be adopted. The condenser shall be

with divided water box construction. It shall be horizontal, surface type with integral air cooling section. Condenser hot-well shall be sized for three (3) minutes storage capacity (between normal and low-low level) of total design flow with the turbine operating at V.W.O condition, 3% make-up, design back pressure. The condenser shall be adequately sized to cater to all the conditions of turbine operation including the abnormal operating conditions such that condenser would not be a bottleneck at any stage of operation. The exact condenser parameters shall be optimized on the basis of site data and most economical combination of cooling surface and circulating water quantity. The condenser shall be designed, manufactured and tested in accordance with the latest applicable requirements of the Heat Exchange Institute (HEI), USA. Provision of separate sponge rubber ball type condenser on-load tube cleaning system for each half of the condenser including ball circulation pumps, strainer, ball monitoring system etc. shall be made.

6.02.03
Air Extraction System

The unit shall comprise of {2x100%} vacuum pumps along with all accessories and instrumentation for condenser air evacuation. The vacuum pumps and accessories shall be used to create vacuum by removing air and non-condensable gases from steam condenser during plant operation. Vacuum pumps shall be of single/two stage liquid ring type with both stages (if two stage pump is selected) mounted on a common shaft. Vacuum pumps shall be sized as per latest HEI requirements.

In case of multi condenser 2x 100% vacuum pumps per condenser shall be provided.

6.02.04
Lube Oil System

Each turbine generator shall have a complete self-contained lubrication oil system. The system shall cater to the lubrication requirements of the bearings, requirements of turbine turning gear during start-up and shutdown and jacking oil requirement during turning gear operation. In addition, it shall also supply oil to the generator seals under emergency condition

The system shall specifically include the following:

- (a) Centrifugal/gear type, Main oil pump (MOP) directly driven by the turbine as per Bidder's standard practice with capacity to cater lube oil for bearings & emergency seal oil requirement (if applicable for bidder design). Further, 2 x 100% AC aux. oil pumps for start-up, shutdown of TG unit and as standby to MOP and each other for automatic operation to cater lube oil, jacking oil & turning gear oil requirement.

OR

2x100% AC oil pumps as per Bidder's standard practice with capacity to cater lube oil for bearings & emergency seal oil requirement. Each pump shall also be capable of startup, shut down of TG unit normal operation and stand by to each other for automatic operation to cater lube oil, jacking oil & turning gear oil requirement. In case of complete power failure including DC supply, Turbine Generator set shall be capable of safe casting down

- (b) 1x100% DC emergency oil pump for meeting lube oil requirements of bearings during emergency, with automatic starting on low lube oil pressure preset value.
- (c) 1x100% each AC and DC motor operated jacking oil pumps shall be provided to lift the rotor at the bearing during turning gear operation.
- (d) Each unit shall be provided with an oil tank of sufficient capacity to allow 5 to 8 oil changes per hour (at normal operating level), fitted with non-corrodable strainers, level indicators & necessary manholes. 2x100% duty vapour extraction fans driven by motors shall also be provided.
- (e) 2x100% capacity oil coolers shall be provided for cooling the lubricating oil. The cooling medium shall be DM water (condensate quality).
- (f) A lube oil purification unit shall be permanently connected to the piping system for each TG unit for purifying 20% of the total oil charge in the system per hour on a continuous basis.
- (g) A centralized lube oil storage and purification system consisting of a central purifier (capacity and type same as unit purifier), two central oil tanks (each with capacity one half times the capacity of one unit oil tank), one unloading tank, two transfer pumps (for dirty and clean oil) shall be provided. This is for storing and purifying oil from unit oil tanks and also for adding new oil to the system and also for transferring the fresh oil to the unit oil tanks. In case of maintenance of the unit purification system, this system shall serve as a backup system.
- (h) All the piping, fittings, valves, Main Oil Tank and complete strainers including body and element shall be stainless steel. Further all the parts of lube oil coolers (tubular or plate type) which are coming in contact of lube oil shall be of stainless steel.

6.02.05

Turbine Control Fluid System

For the governing and control system of the turbine a complete self-contained control fluid system shall be provided. Fire resistant fluid shall be employed to minimize fire hazards. The system will comprise of :

- i) A control fluid reservoir of adequate capacity to ensure fluid supply of acceptable purity.

- ii) 2x100% AC motor driven pumps to pump the fire resistant fluid from the fluid reservoir through the system.
- iii) 2x100% capacity control fluid coolers designed for service with DM water (condensate quality). Bidder may offer 2x100% air cooled coolers depending upon standard practice of the manufacturer.

A control fluid purifying unit shall be provided for each turbo-set permanently connected to the piping system for purifying at least 2% of the total fluid charge in the system per hour on a continuous bypass basis. 2x100% capacity AC motor driven purification pumps to circulate oil through purification system are envisaged. Necessary heaters, filters, strainers, piping, fittings, valves and instruments shall be provided. All the components including piping which are coming in contact with the control fluid shall be of stainless steel.

6.02.06**Gland Steam Sealing System**

A fully automatic gland sealing steam supply system shall be provided for the TG set & the turbine drives for BFPs. HP and IP turbine shaft glands will be sealed to prevent escape of steam into the atmosphere and the LP turbine glands will be sealed for preventing leakage of atmospheric air into the turbine. Steam will be used for sealing these spring backed labyrinth glands.

During startup and low loads (say up to 40% load), seal steam will be supplied to the turbine glands from the auxiliary steam header through a seal steam regulating valve. During normal operation (say above 40% load), the HP and IP turbines will be of self-sealing type and under that condition the auxiliary steam source will be cut off and the leak-off steam from HP and IP glands will be used for sealing the LP glands. The excess leak-off steam will go to the condenser. A gland steam condenser will be provided to condense and return to the cycle, all gland leak off steam including that from BFP turbines. 2x100% capacity vapour exhausters shall be provided to remove non-condensable gases from the gland steam condenser. The exhaust gases shall be left above the TG Hall roof level.

6.02.07**Governing / Regulation System**

The turbine will have throttle or nozzle controlled type governing. Steam turbine governing and protection system shall be complete with electro hydraulic governor with suitable back up as per standard practice of the manufacturer. The governing system shall be highly reliable and operationally safe and it shall be capable of controlling with stability the speed of the turbine at all power outputs between zero and the specified maximum power output when the unit is operating isolated or the energy input to the steam turbine which the unit is operating in parallel with the other units. The turbine governing system shall be designed for high accuracy, speed and sensitivity of response. The governing system shall limit the over speed of the turbine on loss of full load to a value less than over

6.02.08

HP/LP Bypass

speed trip set point. The dead band at rated speed and at any power output within the rated output shall not exceed 0.06% of the rated speed.

HP and LP bypass stations shall be capable of meeting the following requirements:

- Quick startup of the steam generator from cold, warm & hot conditions.
- Parallel operation of the bypass with turbine in the event of large load throw off.
- House load operation followed by large load throw-off.
- To keep the steam generator in operation so as to avoid a fire out in the steam generator following full load rejection.

The HP/LP Bypass system shall be sized for about 65% of BMCR steam flow (exact capacity shall be decided later) with rated main steam parameters at upstream of valves. The LP bypass will be sized for steam inlet conditions (pressure and temperature) of HRH line corresponding to about 60% TMCR.

6.02.09

Regenerative Feed Heating Cycle

Regenerative feed heating plant shall be designed for all operating conditions including transients like sudden load throw-off, HP-LP Bypass in Operation, one or two heaters going out of service etc. The condensate from the condenser shall be pumped by the condensate extraction pumps and condensate booster pumps through the train of LP heaters to the deaerator. In deaerator, the condensate shall be heated to saturation temperature and fed to the boiler feed pump, which increases the feed water pressure to suit the steam generator requirements.

Feed water then passes through two trains of 50% capacity HP heaters which raise the feed water temperature to nearly 302 (+/-) 2.5°C (tentative). Finally, the feed water is fed to boiler.

6.02.10

HP & LP Heaters

Regenerative feed heating cycle shall consist of LP heaters, one drain cooler, deaerator and HP heaters. The number of LP & HP heaters shall be based on the optimisation of feed heating cycle. However, the bidder has to provide minimum 3 LP, 1 deaerator and 3 HP heaters.

Feed water shall be heated by uncontrolled turbine extraction steam from turbine inter-stage tap-off and cold reheat line in feed water heaters, depending on optimisation of cycle. The deaerator shall normally operate under variable pressure on extraction steam from the turbine. Each feed water heater shall be capable of handling the drips from the preceding heater under operating conditions of the unit.

Heaters shall be arranged for removal from service and bypassing of condensate flow around each heater individually excepting for HPHs. Each train of HPH can be isolated & bypassed and not the individual heater.

The equipment shall be designed in accordance with latest applicable standard/codes of Heat Exchanger Institute, ASME, IBR etc. The feed water heaters shall be of U-tube with all welded stainless steel tubes, surface type, horizontal with integral condensing and drain cooling zones. The HP heaters shall also have de-superheating zone.

6.02.11

Deaerator

Horizontal/Vertical, direct contact spray or spray cum tray type deaerator with a horizontal feed water storage tank shall be provided. The deaerator shall be capable of deaerating all the incoming condensate and HP heater drains. It shall effectively remove the dissolved oxygen in condensate and completely remove the traces of carbon dioxide. The minimum capacity of feed water storage tank shall be 6 minutes of BMCR flow between normal operating level and low-low level with a filling factor of 0.66. The deaerator shall operate without any vibration and water hammer during any transients, loss of full load followed by HP-LP bypass coming into operation and at any steady load from 0% to 110% of rated capacity. The deaerator shall be designed to give a dissolved oxygen content not greater than 0.005ml/litre in feed water at the deaerator outlet under all operating conditions.

6.02.12

Boiler Feed Pumps

It is proposed to have 2x50% turbine driven and 1x30% motor driven boiler feed pumps per unit with the booster pumps mounted on the shaft. Each pump shall be designed to give parameters to suit the steam generator requirements such that two Turbine driven feed pumps shall be capable of meeting the full requirement of the boiler turbine unit with the Motor driven feed pumps as a standby. The feed pump shall be able to handle feed water of pH 8.5 to 9.5 and of temperature of about 210°C (tentative). Turbine driven boiler feed pumps and the motor driven pumps shall be located on 0.00M and both shall be accessible to BFP in BC bay EOT crane for erection and maintenance.

The boiler feed pumps shall be of horizontal, centrifugal type with stiff shaft design. The boiler feed pumps outer casing shall be of barrel type with end removal. The inner pump assembly comprising of shaft, impellers, stage casings shall be capable of being removed and replaced as a unit without disturbing the feed piping. Each feed pump shall be provided with ON-OFF recirculation control valve to protect the pump under low flow condition. The boiler feed water system shall be designed to operate primarily in an automatic mode over the range of system design loads. The arrangement will provide automatic start-up of the standby Motor driven feed pump under

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	conditions like tripping of running of TDBFP's, discharge header pressure low etc. The feed flow shall be controlled by throttling the control valve of drive turbine in case of turbine driven pumps whereas hydraulic coupling shall be utilized to achieve speed control of motor driven pumps. Provisions will be made for warm-up of stand by pump, if required.		
6.02.13	Condensate Pumps The unit shall have 3 x 50% capacity motor driven condensate extraction pumps (two operating and one standby). The condensate pumps shall be vertical canister type, multistage, centrifugal diffuser design with a double suction first stage designed for condensate extraction service having low suction head requirement. The pumps shall be capable of handling the condensate from the condenser together with feed heater drains when the machine is operating at maximum unit output with HP Heaters out with 3% make-up and discharging this quantity through the gland steam condenser, condensate polishing unit and LP heaters to Deaerator. The pump shall have adequate margins on capacity and head to cater for most adverse conditions of operation such as: i) HP&LP bypass in operation. ii) HP heaters out of service and unit operating at its maximum load during an under frequency operation (i.e. at 47.5 Hz).		
6.02.14	Turbine Hall EOT Cranes One number of electrically operated overhead travelling cranes with associated auxiliaries, along with electrical equipment, control & instrumentation as required and specified shall be provided in the turbine hall for erection and maintenance of turbo-generators and their auxiliaries. For calculating capacity of the crane following shall be considered: The crane shall be capable of lifting at least 105% of the weight of single heaviest component/equipment, HP and IP turbine assembly (except generator stator), including lifting beam and slings etc. (as applicable) to be handled in TG hall for erection as well as maintenance of the equipment provided in AB bay. The auxiliary hook capacity shall not be less than 20 Ton. The generator stator shall be handled by the bidder by separate portal cranes/strand jack arrangement.		
6.02.15	EOT Crane for BFP One (1) number pendant type EOT crane is envisaged in the BFP area for erection and maintenance of TDBFP and MDBFP and their auxiliaries.		
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The capacity of each crane shall be 25 Ton or 10% over and above the heaviest component/equipment (including lifting beam and slings etc. as applicable) to be handled in the BFP area during erection and maintenance, whichever is higher.

6.03.00

COAL TRANSPORTATION AND HANDLING SYSTEM

6.03.01

Coal Transportation

The daily coal requirement for 1x800 MW units shall be about 12340 tonnes based on gross calorific value of 3500 Kcal/kg, and 2250 Kcal/kWh unit station heat rate considering 100% PLF.

The envisaged mode of coal transportation from the coal mines to the power plant is by Indian Railways rakes. The rakes shall be unloaded at the track hopper/wagon tippler terminal as the case may be. Track hopper has already available for Stage-I units. The same is proposed to be used for Stage-II also. Necessary interconnection of coal flow from and to the Stages-I & II is envisaged.

6.03.02

Coal Handling System

The capacity of the CHP has been worked out to meet the peak daily coal requirement and interconnection with existing conveyors of Stage-I.

The overall operating hours of the coal handling plant shall be 16 hours spread over two shifts per day leaving third shift exclusively for routine inspection and maintenance. The proposed CHP shall cater to the peak daily requirement of coal for all units in two bunker filling cycles in 12 hrs effective operation.

The coal handling plant shall be 1400 MTPH rated capacity (keeping in view the interconnection with existing stage) with parallel double stream (one working and one standby) belt conveyors along with facilities for receiving and stacking/reclaiming the coal to/from crushed coal stockyards.

Coal received in BOX-N wagons will be unloaded in underground RCC hoppers by wagon tipplers. Two (2) Nos. Wagon Tipplers have been proposed for unloading of coal.

Coal received at power plant shall be conveyed to the crusher house for sizing of coal to (-) 20mm.

From crusher house the crushed coal can either be conveyed directly to the coal bunkers through a series of conveyors or stacked on to the crushed coal stockpiles by means of stacker-reclaimer. Motorized travelling trippers shall be provided to feed crushed coal into the raw coal bunkers of the boilers.

It is proposed that uncrushed coal from existing track hopper of Stage-I shall be fed into stage-II crusher house and uncrushed coal from wagon tipplers of stage-II shall be fed into Stage-I existing crusher house by interconnecting the conveyors with necessary provisions of TPs.

One Rail mounted, travelling reversible stacker-reclaimer, bucket wheel type has been proposed for coal stockyard management. Coal stockyards proposed shall have crushed coal storage equivalent to 15 days coal consumption at 100% PLF.

2 Nos. Online coal analyzers envisaged for continuous monitoring of as fired coal. Dust suppression and service water system shall be provided throughout the coal handling plant.

A centralized main CHP control room (DDCMIS based) shall be provided to control and monitor the operations of the entire coal handling system. The receiving and unloading of BOX-N rakes shall be controlled and monitored from wagon tippler control room located adjacent to the wagon tippler. Communication and data sharing between Stage-I and stage-II CHP system for information and monitoring shall be taken care with necessary hardware and software.

Skid steer un-loader considered to take care of boulders over Wagon tippler grating.

6.04.00 FUEL OIL STORAGE SYSTEM

For storage of LDO, two (2) nos. of fixed roof type storage tank of 1000 KL capacity shall be provided. This tank shall be interconnected with Stage-I LDO tank. No HFO tank is envisaged for stage-II. HFO tank for Stage-I shall cater for requirement of Stage-II.

A set of pressurizing pumps shall draw the oil from the storage tanks for pumping the oil to the steam generator units. Oil shall be drawn from the LDO storage tanks for feeding to steam generator.

6.05.00 ASH HANDLING SYSTEM AND ASH WATER RECIRCULATION SYSTEM

6.05.01 Ash Handling System

The bottom ash, economizer ash and air pre-heater ash shall be extracted and disposed-off in wet form. The fly ash shall be conveyed in dry form from the electrostatic precipitator hoppers. This dry ash is taken to buffer hoppers for its onward transportation in dry form to FA storage silos for utilization through dumper loading as well as for rail container loading. In case of non-utilization, fly ash shall be disposed-off as high concentration slurry to ash disposal area.

6.05.02 Bottom, ECO and APH Ash Handling System

Bottom ash along with economizer and air pre heater ash is extracted by intermittently operating jet pumps in conjunction with a water impounded hopper.

In intermittently operating jet pump system, the jet pumps would convey the bottom ash slurry from water impounded BA hoppers to the slurry sump of

	bottom ash slurry pump house from where the bottom ash, economizer ash and APH ash slurry will further transported to either the dewatering storage bins (Hydrobins) or Ash Dyke at Ash disposal area by means of bottom ash slurry pumps and pipe lines. Bottom ash from BA hopper shall be evacuated twice in a shift of 8 hrs. The bottom ash and economizer ash from the dewatering storage bins will be further disposed into trucks. Total time for evacuating the four-hour production of bottom ash, economizer ash and APH ash shall be 90 minute.	
6.05.03	Fly Ash Handling System. Pneumatic conveying system (either vacuum system or pressure system) shall be employed for conveying of fly ash from the electrostatic precipitator hoppers in dry form. This dry ash shall be taken to buffer hoppers. Six vacuum conveying stream (one for each ESP pass) is considered. Total twelve nos. (6W+6S) buffer hoppers shall be provided. The dry ash buffer hoppers shall be located adjacent to the ESP. Dry ash from buffer hoppers shall be transported either to HCSD ash silos or FA storage silos.	
6.05.04	Ash Slurry Disposal system	
6.05.04.1	Bottom ash, Eco and Air pre-heater ash slurry disposal From the Bottom ash slurry disposal pump house, BA, Eco & air pre-heater ash slurry shall be pumped to the ash dyke by BA slurry duty pumps. There shall be one (1) working stream and two (2) standby stream (one maintenance standby and one operating standby). All the pumping streams shall be provided with its individual disposal pipes. One stream shall be in operation when bottom ash along with economizer ash and air pre-heater ash shall be removed. One stream will be standby and one stream will be in maintenance.	
6.05.04.2	Fly ash slurry disposal The fly ash collected in HCSD silos shall be mixed with water in an agitator/mixing tank at controlled rate to obtain the desired high concentration. There shall be Four (4) no of HCSD pumps, four silos with all accessories for disposal of FA to ash dyke. Two pumping system will take full load, one pumping system will be operating standby and One (1) no. of maintenance standby.	
6.06.00	WATER SYSTEM AND PLANT UTILITIES	
6.06.01	Source of Water Water for the project will be drawn from Pranahita located at a distance of about 43.5 Km from project site. Secretary to Government, Govt. of AP vide G.O.Rt.No.474 dated 19-07-2010 has conveyed commitment for water supply	
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			SCCL
	for the stage-I. Same quantity of water is sufficient for both operating units as well as proposed Unit of 1x 800MW.		
6.06.02	Type of Circulating Water System	Present environmental regulations stipulate that the power project to be commissioned after 1.06.99 shall install cooling tower. Therefore, re-circulating type CW system with induced draft cooling towers has been envisaged for the project.	
6.06.03	Water Consumption	Makeup water requirement for this project would be about 2000 Cu.M/hr with ash water recirculation system and about 2650 Cu.M/hr with once through ash water system. Water balance diagram is enclosed as Exhibit-6. This project is based on zero liquid discharge concept in line with the Gazette of India dated 07/12/2015.	
6.06.04	Make-up Water System	At Singareni TPP reservoir for 25 Lakh Cum. Capacity was constructed for Stage-I (2x600MW) and shall be utilized for this Stage-II (1X800MW) also. An open raw water pump house shall be provided near the reservoir to supply water to PT plant and Ash Handling System (AHP). Five numbers of raw water pumps (Three (2W+1S) for PT plant, two (1W+1S) for AHP) shall be provided in the raw water pump house. Gantry crane of suitable capacity in Raw Water pump house to meet the maintenance requirements of pumps and associated equipment.	
6.06.05	Circulating Water System	a) For the re-circulating type CW system, it is proposed to supply clarified water as makeup. Clarified water shall be pumped from the Water Pre-treatment plant to the cold water channel. Water from cold water channel will enter the CW pump house through bar screens/trash racks at low velocity to filter out debris. Stop log gates shall be provided after the screens to facilitate maintenance. b) The total water requirement for the condenser and auxiliary cooling is estimated to be about 90,000 Cu.m/hr. The temperature rise of recirculating water in the condenser shall be about 10-11°C. A suitable CW chemical treatment program shall be adopted for CW system. The CW System shall be designed considering a design COC of about 5. To enable operation of CW System at this COC of 5 shall require provision of CW chemical treatment program by using acid & Scale and /or corrosion inhibitors apart from chlorination. Hence,	
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required tanks and dosing equipment shall be provided near CW pump house.

- c) It is proposed to provide one Circulating Water pump house for the unit. Two numbers of working pumps shall be provided for unit. One standby pump has been envisaged as per the prevailing practice. CW pump can be of vertical wet pit or Concrete/metallic Volute type. Accordingly, three (3) numbers of CW pumps (2W+1S) shall be provided. CW System blowdown would be drawn from the discharge of CW pumps.
- d) For carrying circulating water from CW pump house to TG area and from TG area to cooling tower, steel lined concrete duct would be provided. For interconnecting C.W. duct with CW pump, condenser and cooling towers, steel pipes would be used.
- e) Gantry crane of suitable capacity shall be provided in CW pump house to meet the maintenance requirement of CW pumps, associated equipment's. Monorail hoist shall be provided in gantry crane for maintenance requirement of bar/trash screens and gates of CW pump house.
- f) The CW system shall be provided with required instrumentation, interlocks, controls, control panels to facilitate safe & reliable operation.
- g) One (1) number of induced draft cooling tower cooling towers with splash type fill is proposed for unit.

6.06.06

Equipment Cooling Water (ECW) System

- a) Closed circuit cooling water system would be adopted for unit auxiliaries of steam generator and turbine generator. 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 secondary circuit cooling water would be tapped from the CW pipe at the upstream of condenser and the return water from the circuit would be led to the CW discharge pipe after condenser. Re-cooled water after cooling tower will be led to the CW pump house through the cold water channel by gravity. As the pressure required for coolers of SG auxiliaries and TG auxiliaries are different, it is proposed to provide two independent primary circuits i.e one for SG auxiliaries and one for TG auxiliaries. However, a common secondary cooling water circuit shall be provided.
- b) Make up to the primary side closed loop would be from unit DM make up system through overhead tanks.

6.06.07

- c) For station auxiliaries such as Air compressors, compressors of ash handling plant and condensing water requirement of AC plant, an independent cooling water circuit shall be provided for their respective location (independent system for each auxiliaries) which comprise pumps, piping network and a cooling tower. The make-up water for these systems shall be provided from Clarified water chamber through a set of pumps.

Miscellaneous Water Systems

- a) A pipe network for distribution of potable water for plant shall be provided from the overhead storage tanks. In addition, potable water requirement for the colony (if applicable) shall be met from the existing water treatment plant.
- b) A pipe network spread over the entire plant area would be provided for cleaning of main plant area and other buildings. Required number of service water pumps shall be provided which shall draw water from the service water tank.
- c) In addition to the above, DM water make up system, boiler fill pumping system, Air-preheater wash water system and HVAC make up system shall also be provided as per requirement and requirement quantity of pumps (if required) for these services and their parameters shall be finalized as per final plant layout and requirements of the main plant equipment.

6.06.08

Water Treatment Systems

The water treatment system of the project comprises of Water Pre-treatment Plant, Water Demineralising Plant, Chlorination Plants, Condensate Polishing Plant, CW Treatment Plant as described below:

6.06.09

Water Pre-treatment Plant

- i) The pretreatment plant would be designed to remove suspended/colloidal matter in the raw water. Pre-treatment(PT-ACW) plant shall be provided for meeting the CW system and other requirement. A chemical house shall be provided to store chemicals such as chlorine, lime, alum & coagulant aid and respective lime, alum and coagulant dosing equipment such as tanks, pumps etc. for all the PT systems.
- ii) The Water PT plant for CW system (PT-ACW) shall consist of three (3) clarifiers of reactor type, of 2000 Cu. M/hr capacity. Clarifier shall be provided with a stilling chamber cum aerator and provision for dosing of alum, lime, coagulant aid and chlorine.
- iii) Water from the clarifiers shall be led to clarified water storage tank. Water from the clarified water storage tank shall be pumped to the HVAC make up system (if required). For CW system, make up water shall be supplied through pumps.

	SCCL iv) Required hoists, cranes and weighing scales shall be provided for handling pumps, chemicals, chlorine ton containers etc. v) The Water pre-treatment plants shall be provided with required instrumentation, interlocks, controls, control panels to facilitate safe & reliable operation.		
6.06.10	Water Demineralization Plant The DM plant shall be sized to meet the makeup water requirement of the steam cycle, make up to closed circuit auxiliary system, hydrogen generation plant, and stator water cooling system. It is proposed to adopt a service cycle of 12 hrs for DM Plant. The D.M. plant shall consist of one (1) streams of 90 Cu.M/hr and stream shall comprise of Activated carbon filter, Cation exchangers, degasser system (comprising of degasser tower, degassed water tank, degassed water pumps and degasser blowers etc.), anion exchangers and mixed bed exchanger in the existing DM plant area. The cation resins shall be regenerated with hydrochloric acid and the anion resins with sodium hydroxide. The regeneration facilities shall consist of the bulk acid & alkali storage tanks, alkali solution preparation system, acid & alkali measuring tanks and dosing ejectors etc. The plant shall be designed for semi-automatic operation with PLC based control. One (1) D.M. water storage tank (16.0m x (Dia)X 10.5 m (HT) capacity will be provided to store DM water in Existing DM plant area and interconnecting with the existing DM Water tanks.		
6.06.11	RO system for ZERO liquid discharge concept The Reverse Osmosis (RO) plant is proposed to produce 800 cum/hr permeate. Cooling tower blow down (CTBD) water shall be used as feed water to RO plant. The purpose of RO system is to remove the dissolved solids from the water to produce specified quantity of CW make up and DM plant feed. Reject water from RO trains shall be led to CHP dust suppression tank/ Ash handling system.		
6.06.12	Chlorination Plant Chlorination plant shall be provided for chlorine dosing in the ACW system to avoid the growth of algae and bacteria. Common Chlorination plant shall be provided for water PT plant and CW system. Chlorination system would consist of two/three (decide later) number of chlorinator-evaporator sets of required capacity. Chlorination system shall be provided with required chlorine ton containers, instrumentation, panels, chlorine leak detectors etc. Complete chlorination plant shall be located indoor. Chlorine leak absorption system as plant emergency measure shall be provided for Chlorination plant to neutralize chlorine leakage from the plant.		
6.06.13	Condensate Polishing Plant For maintaining the feed water purity condensate polishing plant shall be provided in the feed water cycle at the downstream of condensate extraction		
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pumps as per the existing practice. The condensate polishing plant shall be of full flow, deep mixed resin bed type consisting of 3 x 33% capacity service vessels for unit. The resins to be used would be strongly acidic cation and strongly basic anion type, appropriate for condensate polishing system. An external regeneration facility shall be provided along with one additional Mixed Resin Storage vessel. The exhausted charge of resins from the service vessel shall be hydraulically transferred to the resin separation/cation regeneration vessel for regeneration and reuse. One (1) additional charge of resin shall be procured for use during start up of both the units. Acid, Alkali & DM Water Storage for regeneration, and Wastewater Neutralization facilities with one additional mixed resin storage vessel shall be provided separately for the external regeneration facility.

6.06.14**CW Treatment System**

It is proposed to provide suitable chemical treatment programme of acid dosing and scale cum corrosion inhibitor for the CW system for control of CW system water chemistry. It is proposed to provide acid & Chemical storage tanks and respective dosing pumps shall as a part of CW treatment system. The plant shall be provided with neutralization pits, disposal pumps with required corrosion measurement rack, instrumentation for interlocks and controls, control panels etc. to facilitate safe & reliable operation.

6.06.15**Effluent Treatment System**

The liquid effluents shall be collected and treated / recycled generally as per the following design philosophy.

- i) The sludge from clarifiers of Water PT plant shall be collected and sent to ash slurry sump for disposal to ash dyke.
- ii) The waste effluents from neutralization pits of Condensate Polishing Plant shall be collected in the neutralization pits and neutralized before pumping to ash slurry sump or to the central monitoring basin before final disposal.
- iii) The Power cycle effluents sent to CW make up with the help of pumps.
- iv) CW system blow down would be used for coal dust suppression system and Ash handling Plant, Service water system. Excess CW blow down shall pass through RO system for reuse. Permeate water after RO system shall be sent to CW makeup & DM plant feed.
- v) A coal settling pond shall be provided to remove coal particles from coal handling plant waste. Decanted water shall be pumped back to the coal dust suppression system.
- vi) Service water effluent drains from various areas shall be separately routed to a sump. From the sump the service water shall be pumped up to lamella clarifier for treatment of suspended solids. Treated service water shall be sent back to service water tank to the extent possible for re-use.

6.07.00

- vii) All the plant liquid effluents shall be mixed in CMB (if RO system is not working) and finally disposed off from central monitoring basin up to the final disposal point using carbon steel pipe and three numbers of 2 x 100% capacity pumps.

FIRE DETECTION & PROTECTION SYSTEM

A comprehensive fire detection and protection system is envisaged for the complete power station. This system shall generally be as per the recommendations of Tariff Advisory Committee (INDIA)/ IS: 3034 & NFPA-850/equivalent standard.

The following protection systems are envisaged:

- i) Existing Fire water tanks with pumping system of stage-I shall be used for supply of fire water for stage-II. The water required for hydrant and spray system shall be handled by separate tap-off from existing network of stage-I. Boosters pumps are envisaged for hydrant as well as spray system of stage-II. These pumps shall be located in the Booster pump house and horizontal centrifugal pumps shall be installed in the pump house for hydrant and spray system and the same shall be driven by electric motor and diesel engines as per the regulations of Tariff Advisory Committee. Entire Hydrant and spray network of stage-II shall be pressurized with booster pumps of stage-II and main pumps of stage-I with suitable tap-offs. Existing foam system of stage-I shall be used for fixed foam protection of LDO tanks of stage-II.
- ii) Hydrant system for complete power plant covering main plant building, boiler area, turbine and its auxiliaries, coal handling plant, all pump houses and miscellaneous buildings of the plant. The system shall be complete with piping, valves, instrumentation, hoses, nozzles, hose boxes/stations etc.
- iii) Automatic high velocity water spray system for all transformers located in transformer yard and transformers having oil capacity of 2000 liters and above located within the boundary limits of plant, Main and unit turbine oil tanks and purifier, Oil canal, generator seal oil system, lube oil system for turbine driven boiler feed pumps, boiler burner fronts, fuel oil station in boiler, etc. This system shall consist of QB detectors, deluge valves, projectors, valves, piping & instrumentation.
- iv) Automatic medium velocity water spray system for cable vaults and cable galleries of main plant, switchyard control room and ESP control room consisting of smoke detectors, linear heat sensing cable detectors, deluge valves, isolation valves, piping, instrumentation, etc.
- v) Automatic medium velocity water spray system for coal conveyors, crusher house, transfer points, Stacker reclaimer consisting of QB detectors, linear heat sensing cables, deluge valves, nozzles, piping, instrumentation, etc.

- vi) Automatic medium velocity water spray system for un-insulated fuel oil tanks storing fuel oil having flash point 65 °C and below consisting of QB detectors, deluge valves, nozzles piping, Instrumentation, etc.
- vii) For protection of Central control room, Control equipment room, Programmer room, UPS room, etc. Inert Gas extinguishing system as per NFPA-2001 would be opted.
- viii) The clean agent (Novec-1230) automatic direct/indirect low pressure extinguishing system shall be provided for electrical panels in switchgear room of make-up water pump house and electrical house of stacker-reclaimer machines.
- ix) Fire detection and alarm system - Microprocessor based analogue, addressable type Fire detection and Alarm system shall be provided to cover the complete power plant. Following types of fire detection shall be employed.

Multi-sensor type smoke detection system

- 1) Linear heat sensing cable detector.
- 2) Quartzoid bulb heat detection system.
- 3) Infra red type heat detectors (for selected coal conveyors)
- x) Portable and mobile extinguishers, such as pressurized water type, carbon-dioxide type, foam type, dry chemical powder type, shall be provided at strategic locations throughout the plant.
- xi) Complete Instrumentation and Control System for the entire fire detection and protection system shall be provided for safe operation of the complete system.

6.08.00

PLANT & INSTRUMENT AIR SYSTEM

- i) For meeting the instrument air and service air requirement of main plant and auxiliaries, required numbers of air compressors & Air Drying Plants (ADP) shall be provided. For instrument air requirement, the capacity of compressors and ADP shall be decided based on the requirements of main plant supplier (especially Steam Generator vendor) and other auxiliary plant and data need to be obtained. However, for FR purpose it is proposed to provide five (5) numbers oil free screw/centrifugal type air compressors each of capacity of 70 NM³/min along with three (3) numbers of Air Drying Plants of identical capacity for meeting the instrument air requirement. The discharge pressure of the compressors shall be such that a delivery pressure of 7.5 kg/cm² (g) is available at the outlet of ADP. The compressors shall be of oil free screw/centrifugal type and shall provide moisture and oil free air. These compressors shall be provided with all the accessories such as suction filters, inter coolers, after coolers, air receivers etc.

- ii) The air drying plants shall be capable of achieving a dew point of (-) 40°C at atmospheric pressure. Individual air receiver shall be provided near each air compressor and further unit air receivers shall be provided near main plant.
- iii) Service air requirements for various systems shall be obtained before project implementation stage to identify the number & capacity of Plant air compressors. However, for FR purpose, it is proposed to provide Two (2) numbers of compressors of capacity 70 NM³/min. The compressors shall be same type as that of instrument air compressors.

6.09.0

AIR CONDITIONING SYSTEM

- i) Air conditioning system shall be provided for all those areas which require close control of environment conditions and shall cover the following areas.
 - a) Control tower areas including Control Rooms, Control Equipment Rooms, Computer and Programmers Rooms, UPS /Battery Charger Rooms, Conference Room, Shift Charge Engineer's Room, Steam & Water Analysis Rooms (SWAS), etc.
 - b) ESP control rooms.
 - c) Water System Control Rooms.
- ii) One (1) No. of chilled water type air conditioning plant shall be provided for air conditioning requirement of main power house. A/C plant shall cater the air conditioning requirement of units. A/C plant shall consist of three (3) Nos. of 100 TR capacity screw type chillers units (2 working + 1 standby), chilled water pumps, condenser water pumps and cooling towers for meeting the A/C requirement of central control room, control equipment rooms, UPS/Battery charger rooms. Chilled water shall be pumped to each area from A/C plant and each area shall be air-conditioned through dedicated air handling units located locally. Air handling units shall be provided with variable frequency drives (VFD).
- iii) A dedicated centralized A/C system shall be provided for ESP control rooms of the unit consisting of two (2) Nos. (1W+1S/B) of 50 TR capacity Air cooled.
- iv) For other areas, where air conditioning heat load is in the range of 5-15 TR, Non-ductable ceiling mounted (cassette type) or wall mounted (high wall type) split air-conditioners of suitable capacity along with adequate redundancy shall be provided. Ductable split/package type A/Cs shall be provided for control rooms where the load varies in the range 15-25 TR. For Air- conditioning areas where the load is in the range of 25-60 TR, central air conditioning system comprising of air cooled chiller/ condensing units shall be provided.

- v) In determining air conditioning load (TR), equipment load, heat load due to solar heat gain, occupancy, lighting and transmission gain shall be considered as per established design practice.
- vi) All air conditioned space shall be maintained at 24°C +/- (plus or minus) 1°C 50% +/- (plus or minus) 5% RH.
- vii) Further critical areas like Control room, Programmer room etc., which are required to be air conditioned even during failure of normal power supply shall be air conditioned whose drives along with applicable fresh air fans, chilled water pumps, condenser water pumps, cooling tower and AHU shall operate on emergency Diesel Generator sets.
- viii) All air conditioned areas shall be supplied with filtered air. Both re-circulated and fresh air shall be filtered separately.

6.10.00

VENTILATION SYSTEM

- i) Ventilation system shall be designed to supply fresh outdoor air and shall be selected for maintaining inside conditions for those areas where close control of temperature is not required, but nevertheless have a stipulated maximum temperature.
- ii) Basically two types of ventilation systems, namely Evaporative Cooling System (i.e. air washer system) and dry mechanical system, shall be employed in various areas of the plant for the purpose of ventilation.
- iii) The areas to be ventilated by Evaporative Cooling System shall be as follows:
 - a) All floors of turbine hall including "BC Bay" other than the area which are air- conditioned.
 - b) Switchgear rooms and cable galleries of main plant.
 - c) Non air-conditioned area of ESP control room.
 - d) Non air-conditioned areas of ESP building shall be ventilated by Unitary Air Filtration System.
- iv) All other buildings /areas such as switchgear rooms, pump houses and toilets etc shall be ventilated by mechanical ventilation process using combination of supply air fans and roof exhausters or wall mounted exhaust fans.
- v) All evaporating cooling system shall be designed based on 90% saturation efficiency of air washer. Air quantity shall be selected in such a way so as to maintain an inside temperature of minimum 3°C below design ambient during summer or a minimum air change rate of 6 to 8 per hour whichever is higher.
- vi) All mechanically ventilated areas shall be designed to a maximum inside temperature of 3°C above design ambient during summer or 20 air change rate per hour (for general area) and 30 air changes rate per hour for switchgear rooms, battery room whichever is higher.
- vii) All ventilation system shall work on 100% fresh filtered air.

6.11.00

viii) Turbine hall and electrical switchgear / control rooms shall be designed for positive pressure ventilation, which shall be achieved with the assistance of roof extractors besides air washer by sizing the exhausters to extract 60-75% of total air delivered by supply air fans. All fuel oil pump houses, battery rooms, kitchens, toilets shall be designed for negative pressure ventilation.

HYDROGEN GENERATION PLANT

A hydrogen generation plant for stage -I will cater the requirement of Stage II.

CHAPTER - 7
PLANT SYSTEMS (ELECTRICAL)

PLANT SYSTEMS (ELECTRICAL)

7.00.00

ELECTRICAL SYSTEM

Electrical system in the power plant comprises of Generating unit, Power Evacuation system, Auxiliary Power Supply system, Emergency Power Supply system, DC Power Supply system, Uninterrupted Power Supply system and associated Transformers, Switchgears and other equipment. This section covers aspects of this Electrical system/equipment of Power Plant.

7.01.00

GENERAL DESCRIPTION

The system consists of one number STG of 800MW rating and the Generation voltage being 22kV or manufacturer's standard voltage. The Generator will be connected to the 400 kV Switchyard through Step-up Generator transformer. The generated power from the project shall be stepped up to evacuation voltage level through suitably rated generator transformers and evacuated through transmission lines emanating from the project. The start-up power shall be derived from 400kV switchyard.

Three voltage levels i.e. 11 kV, 3.3 kV & 0.415 kV are adopted for feeding the plant auxiliaries. The voltage rating of the drives indicated above is for basic guideline. Minor variations can be accepted on case-to-case basis based on techno-economic considerations of the various sub-systems. It shall be designed to limit voltage variations as given below under worst operating condition:

- | | |
|----------------------|--------------|
| a) 11KV/3.3KV | +/- 6% |
| b) 415 V/240 V | +/- 10% |
| c) 220V/110V/48 V DC | -15% to +10% |

The designed fault levels for 11 KV & 3.3 KV systems shall be restricted to 40 kA rms for 1 second and 50 kA rms for 1 second for 415 V systems.

The design concept of electrical system as a whole is based on the requirements for safe and reliable performance of steam turbine generator set and the interconnected electrical system with provision for easy maintenance and reliability.

The design principle and standards for all the equipment, material and systems shall, in general, conform to the latest edition of relevant National and International Codes & Standards, especially the Indian Statutory Regulations.

For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% shall be considered.

7.02.00
POWER EVACUATION/ START UP POWER

The proposed 800 MW capacity expansion shall be erected adjacent to existing 2X600MW units as Stage-II. Stage-I (2x600 MW) units are commissioned, and power is evacuated through the existing 400 KV Switchyard. Two nos. 400 kV double circuit lines-1&2 to Gajwel, two nos. 400 kV double circuit lines-3&4 to Nirmal substation are in operation for evacuation of power of the existing generation by M/s SCCL. Additionally, another 2nos of 400 kV double circuit lines to Annaram are in construction by SCCL. Space for the same is kept in the switchyard layout. As such, these transmission lines will be adequate to evacuate the power from the proposed 800 MW (Stage-II) extension unit. However, the scheme will be decided based on the Load flow study and other parameters, to be carried out by Transmission Corporation of Telangana (TSTRANSCO). Presently one (1) no. 63MVAR Bus Shunt Reactor is installed in Stage-I. Further one (1) no. 125 MVAR Shunt Reactor is proposed for Stage-II switchyard. The total power generated from the proposed power unit will be 800 MW.

7.03.00
ELECTRICAL SCHEME

The basic switchyard electrical scheme is indicated in the key Single Line Diagram with Station Transformers along with Plant Auxiliary electrical scheme is enclosed at **Exhibit no.-07A as Option-I** and with Generator Circuit Breaker (GCB) and Standby Transformer along with Plant Auxiliary electrical scheme is enclosed at **Exhibit - 07B as Option-II**. Further Single Line Diagram of 400kV switchyard with two (2) nos. Station Transformers is enclosed at **Exhibit no.-08A as Option-I** and with Generator Circuit Breaker (GCB)& Standby Transformer is enclosed at **Exhibit - 08B as Option-II**.

One of the above electrical system will be provided. The option of adopting generator circuit breaker scheme vis-a-vis the Station Transformer Scheme shall be evaluated subsequently based on techno-economic considerations for single 800 MW unit.

7.04.00
GENERATOR

The Generator winding will be wye connected with the phase & neutral terminals brought out for connection to isolated phase bus duct. The star point will be connected to earth through a transformer having the secondary shunted by a resistor.

The stator winding of the Generator shall be close loop & hydrogen cooled or by means of de-mineralized water, passing through hollow stator conductor. The Stator core and rotor shall be cooled by hydrogen which in turn shall be cooled in hydrogen coolers designed for DM water. Generator auxiliary system like stator water system, hydrogen cooling system, seal oil system and gas system complete with all accessories shall also be provided.

The excitation system shall be static / brushless type with DVR.

Besides the other electrical protections, the Generator shall have the additional protections/monitoring like Alkaliser unit and End winding vibration monitor.

- | | |
|-------------------------------|---|
| a) Nominal rating | 800 MW |
| b) Rated output | 942 MVA |
| c) Power factor and Frequency | Between 0.85 Lagging and 0.95 leading with +3% to -5% frequency variation |
| d) Rated voltage | As per manufacturer's Standard (in the range of 22 -27 kV) |
| e) Speed | 3000 rpm |
| f) Short circuit ratio | Not less than 0.48 |

7.05.00

BUSDUCT

The connection between the generator and generator transformers/unit transformers shall be through isolated phase busducts. The busduct shall be continuous enclosure, self-cooled type and shall be equipped with air-pressurization system to prevent dust ingress. The tap off and neutral connection shall also be of isolated phase construction. The busduct will have on all aluminium construction. The degree of protection shall be IP-55.

Necessary current and voltage transformers shall be provided in the busduct for generator excitation control, performance testing, metering, protection and synchronization. Surge protection equipment and a generator neutral grounding cubicle with distribution transformer and secondary resistor, will also be provided.

Segregated phase bus ducts are envisaged for connecting between unit/station transformers and unit /station switchgears. The busduct will have all aluminium construction. The busduct shall be natural air cooled. The degree of protection shall be IP-55.

Non-segregated phase bus ducts are envisaged for connecting between LV service Transformer and 415 V PCC/MCC. The busduct will have all aluminium construction. The busduct shall be natural air cooled. The degree of protection shall be IP-55.

7.06.00

GENERATOR CIRCUIT BREAKER (IF APPLICABLE)

The continuous rating of the Generator Circuit Breaker shall be such that a maximum continuous peak output of the steam turbine unit under VWO/ HP heater out condition etc. at any ambient temperature between 0 deg C and 50 deg. C can be delivered at the rated power factors and allowable generator voltage variations without exceeding the permissible temperature rise limits. The Generator Circuit Breaker shall have interrupting capability conforming to IEEE std C37.013 under most onerous fault i.e. system source or Generator source for the offered unit configuration.

7.07.00

GENERATOR TRANSFORMER

The 800 MW unit shall have three (3) single phase transformers with combined rating of 945 MVA for the Generator Transformers. These would be OFAF cooled, with an OFF circuit tap changer. One additional single-phase transformer as spare is also considered.

7.08.00

TRANSFORMERS

All the transformers shall be sized based on the maximum load expected to be fed under most onerous conditions or as per the rating indicated in the Single Line Diagram Drawing No: CW-EN-9757-G-E-101. Rev.0.

All transformers, except Generator Transformer (GT), Station Transformer (ST), Standby Transformer (SBT), Unit Transformers (UT) and Reactors are classified as Auxiliary Transformers.

7.08.01

In Case of Station Transformer Scheme:

The unit shall have two (2) numbers of unit transformers and (2) two numbers of station transformers as indicated in the SLD. In addition to meeting the requirement of station power supply system, this Station Transformers shall provide backup to unit power supply system during unit startup, shutdown, HP- LP bypass condition and outage of unit transformers.

UNIT TRANSFORMER

Connection to each Unit Transformer is teed-off from main connections of the Generator to the Generator Transformer. Two (02) numbers two winding unit transformers with delta connected HV winding, and star connected LV winding and having ONAN/ONAF cooling shall be provided with unit. The transformer will have on load tap changer. These transformers would be sized to meet the loads corresponding to auxiliaries required to meet the peak load requirements of the unit. Further, the unit transformers shall be able to withstand over voltages up to 140% for 5 seconds.

Each unit transformer shall be sized for loads of a set of unit auxiliaries including FGD loads corresponding to 60% BMCR operation plus loads due to outage of largest transformer connected to the bus plus 5% margin on the aforesaid mentioned sum including no load voltage correction factor.

STATION TRANSFORMER

The Station Transformers will be fed from 400kV switchyard. The Transformer will be 3-phase, 3-windings type, mineral oil filled, ONAN/ONAF/OFAF cooled & provided with on load tap changer. The station load shall be distributed in such a manner that the two LV windings shall be equally rated. The HV winding rating of Station transformer shall be equal to the sum of LV winding ratings.

Each Station transformer shall be sized to meet the requirements of the worst case of following contingencies:

Case I: Outage of One Unit transformer

Loads served by fully loaded Unit transformer as defined above plus MDBFP load for one unit, (including future MDBFP) plus meeting the station loads distributed on the respective station boards plus loads due to outage of largest transformer/outgoing feeder (except station to unit/station tie feeders) connected to the bus plus loads of FGD system on each of the Station Transformer plus 5% margin on the aforesaid mentioned sum including no load voltage correction factor

Case II: Outage of any one of the Station Transformer and all the connected loads on the set of Station boards are fed from other available Station transformer.

Meeting loads of one unit operating under HP-LP bypass mode plus MDBFP load for one unit (including future MDBFP) plus meeting full connected station auxiliary loads plus loads of FGD system on each of the Station Transformer plus 5% margin on the aforesaid mentioned sum including no load voltage correction factor.

7.08.02

In Case Of Generator Circuit Breaker (GCB) Scheme:

The unit shall have two numbers of Unit Transformers and one number Generator Circuit Breaker as indicated in the SLD. In addition to this, one number standby transformer shall be provided. The standby transformers shall provide backup for the unit Transformers and Station loads.

UNIT TRANSFORMER

Connection to each Unit Transformer is teed-off from main connections of the Generator to the Generator Transformer. Two (02) numbers two winding unit transformers with delta connected HV winding, and star connected LV winding and having ONAN/ONAF cooling shall be provided with each unit. The transformer will have on load tap changer. These transformers would be sized to meet the loads corresponding to auxiliaries required to meet the peak load requirements of the unit. Further, the unit transformers shall be able to withstand over voltages up to 140% for 5 seconds.

Each unit transformer shall be sized for the loads of a set of unit auxiliaries (including future MDBFP) corresponding to 60% BMCR operation plus connected station load plus FGD load in each of the Unit at 11 KV Unit Bus and loads due to outage of largest rated outgoing transformer/outgoing feeder on other bus plus 5% margin on the aforesaid mentioned sum including no load voltage correction factor.

STANDBY TRANSFORMER

The Standby Transformers will be fed from 400 kV switchyard. The rating and details of these transformers are shown in the single line diagrams. The Transformer will be 3-phase, 3-windings type, mineral oil filled, ONAN/ONAF/OFAF cooled & provided with on load tap changer. The station load shall be distributed in such a manner that the two LV windings shall be equally rated. The HV winding rating of Station transformer shall be equal to the sum of LV winding ratings.

The Standby transformer shall be sized to cater outage of two fully loaded Unit transformers PLUS any other loads connected on each winding / station bus. However, simultaneous outage of two-unit transformers fed from one winding of the Standby transformer shall not be considered. A margin of 5 % and no-load voltage correction factor shall be considered.

7.09.00**AUXILIARY TRANSFORMERS**

Adequate number of auxiliary transformers shall be provided to meet the demand on 3.3KV and 415V systems under most onerous conditions, with the criteria that each 3.3KV / 415 V switchgear / MCC / DB shall be fed by 2x100% or 3 X 50 % transformers / feeders, and these shall be rated to carry the maximum load including owner's load (if applicable) expected to be imposed.

In case of ESP boards, a common standby transformer having rating equivalent to Main ESP load of one pass plus ESP AC & emergency etc requirement, shall be provided for maximum of three ESP passes.

All Auxiliary transformers shall be sized so as to have 10% margin at design ambient conditions after considering final load requirements at peak load conditions and the No Load Voltage Correction Factor.

All these transformers will be delta connected on the HT side and star connected on the LT side. The LT star point will be solidly earthed. These transformers shall be mineral oil filled for outdoor installation and epoxy cast resin/resin encapsulated type in case of indoor installation.

The transformers rated below 1000 kVA will be connected with the respective switchgears by the LT Cables. However, the transformers rated 1000 kVA and above will be connected with the respective switchgears by the LT busducts.

7.10.00**NEUTRAL GROUNDING ARRANGEMENT**

High resistance neutral grounding with distribution transformer and secondary resistance shall be adopted for neutral grounding of generator.

7.11.00

HT systems feeding to motor loads shall be low resistance, non-effectively earthed to limit the earth fault current upto 600 Amps. The resistor shall be rated to carry this current at least for 10 seconds. 415V system shall be solidly earthed.

220V DC system shall be kept ungrounded. However, 48V PLCC DC system shall be grounded type.

Diesel generator shall also be kept ungrounded (earthing through PT).

MOTORS

The voltage level for motors shall be as follows:

- a) Upto 0.2 KW : Single phase 240V AC / 3 phase 415V AC
- b) Above 0.2 KW and upto 200 KW : 3 phase, 415V AC
- c) Above 200 KW and upto 1500 KW : 3 phase, 3.3 kV AC
- d) Above 1500 KW : 11 kV

For CHP conveyor motor's rating above 160 kW, 3.3 KV, three phase AC supply is to be used.

Motors shall have IP 54 degree of protection for Indoor motors location and IP-55 for Outdoor location. The All motors including CW motors shall be either totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. TETV/ CACA type shall be provided with shaft mounted fans only. However, Motors rated 3000KW or above can be Closed air circuit water cooled (CACW). Motors and EPB located in hazardous areas shall have flame proof enclosures. The continuous duty LT motors upto 160 KW Output rating (at 50 deg. C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. The Crane duty motors shall be slip ring/ squirrel cage Induction motor. The DC Motors shall be Shunt wound.

7.12.00

H.T. SWITCHGEAR

Switchgears shall be indoor, metal clad draw out type with vacuum breakers. Contractors cum fuse units may be used for auxiliaries such as coal conveyors/crushers; ash handling motors, which require comparatively frequent switching. The switchgears shall have Communicable Numerical Relay system for protection, Control, metering, and monitoring of the Switchgears. All the relays shall be networked to a dedicated HMI through data concentrator for Monitoring and Supervision of all the breaker panels. All such data shall be linked to DDCMIS as well. The inbuilt feature of numerical relays shall be used for energy metering and trend analysis as per metering regulation requirements.

7.13.00

415 VOLT SWITCHGEAR

The LT transformers shall feed power to the 415V switchgears, which in-turn would distribute power to various MCC's located at load centres. The 415V

system will have duplicate incomer and bus coupling arrangements so that a changeover can be made from either of the two step down transformers to restore power in case of failure of one of the above two transformers. The 415 Volts switch boards shall be indoor, draw out type compartmentalized with air break circuit breakers. The distribution boards, clarifloculator's MCCS, if any, will be with fixed construction.

Adequate numbers of AC & DC Distribution Boards are also envisaged for feeding to various loads. All LT motors above 110 KW up to 200 KW shall be breaker controlled and below 110 KW shall be contactor controlled. Microprocessor based MCCBS shall be used for feeder rating of 250 A to 630 A and the feeder rating below 250 A shall be of switch fuse unit type.

The LV switchgears shall have Communicable Numerical relay system for protection, Control, metering, and monitoring of the Switchgears. All the relays shall be integrated with HT network for common HMI through data concentrator for Monitoring and Supervision of all the breaker panels. All such data shall be linked to DDCMIS as well. The inbuilt feature of numerical relays shall be used for energy accounting and audit meters as per notified metering regulations.

7.14.00**DC SYSTEM**

Unit 220V DC system comprising of two nos. of Ni-Cad/ Lead acid Plante batteries, and two nos. of float cum boost chargers to supply power to DC emergency pumps, emergency lighting, protection, annunciation, indications, and control etc. The required level of redundancy would be achieved with the interconnections between these two batteries and chargers. Each of the unit batteries shall be sized for supplying the total DC load of the unit for a period of 30 minutes under a complete black out condition. CHP and other system away from main plant shall have separate DC systems as indicated in Bill of Quantity. 220 V and 48 V DC batteries shall be provided for new Switchyard and PLCC. Switchyard and PLCC batteries shall be rated for providing backup for 3 hours as per CEA regulation 2010.

7.15.00**EMERGENCY POWER SUPPLY SYSTEM**

For the safe shutdown of the plant under emergency condition and in case of total power failure, diesel generating sets shall be installed for feeding certain essential applications like battery chargers, emergency lighting, essential air conditioning/ventilation and all auxiliaries necessary for barring operation of main and BFP turbines etc. The unit emergency switchgear section shall be fed by one diesel generator of adequate capacity.

One No. Diesel Generator (DG) set alongwith one standby DG set shall be provided as indicated in the single line diagram. Cable interconnection shall be provided from DG to respective unit emergency switchgear.

7.16.00

PROTECTIVE RELAYING

The necessary protective relaying system according to established norms shall be provided for EHV switchyards, overhead lines, generators, transformers, motors, auxiliary system etc., to minimize damage to equipment in case of fault and abnormal conditions. The summary of protection details to be provided for the equipment is given below:

7.16.01

Generator

1. Duplicated Generator differential protection, 3-pole (87G & 87 G2) high impedance or biased type having operating time of 25 milli second or lower at 5 times the current setting.
2. 87GT- Overall differential covering generator, generator transformers and unit auxiliary transformers.
3. Excitation transformer instantaneous and time delayed over current protection on HV side of excitation transformer, if applicable.
4. Accidental back energization protection closure/flash over of EHV breaker or EHV isolator (96).
5. Stator earth fault protection covering 100% of winding (64G1) working on the principle of low frequency injection method.
6. Stator standby earth fault protection covering 95% of winding (trip) (64G2) with adjustable time delay.
7. Inter-turn fault protection.
8. Duplicated loss of field protection (40G1&40G2) with under voltage check feature.
9. Backup impedance protection, 3-pole (21G).
10. Negative sequence current protection (alarm) with $I_2^2 t$ element for trip (46G).
11. Duplicated low-forward power interlock for generator (37G1&37G2).
12. Two stage rotor earth fault protection (alarm and trip) working on principle of continuously monitoring rotor insulation value even during machine shutdown period (64 F).
13. Definite time delayed over voltage protection (59G) for alarm and trip.
14. Over fluxing protection (99G&99T) having inverse time characteristic suitable for matching generator/generator transformer over fluxing capability. Separate relays on either side of generator circuit breaker to be provided.
15. Generator under frequency protection with alarm and stage trippings (81G).
16. Local breaker back up (or breaker failure protection).
17. Trip Circuit and DC supply supervision relays for Generator Circuit Breaker.

18. Pole slipping protection (98)

19. Monitoring of generator VT fuses.

In addition, the generator would have winding temperature recorders and instruments for measuring coolant temperature, flow, pressure, conductivity, and purity, with alarm and trip contacts as necessary. The protection against stator overheating would be provided by the generator temperature monitoring system. Limiters for stator current, V/f, Rotor current and under excitation would be included in Automatic Voltage Regulator.

One Disturbance/fault recorder (DFR) – microprocessor based shall be provided for each generator. It shall have the facility of fast scan as well as slow scan to record transient as well as dynamic performance of the system.

7.16.02

Generator Transformer and Overhead Connection

- 1 Generator-transformer differential protection for individual phase (87T) bias type having instantaneous high set over current elements.
- 2 Overhead line connection differential protection (87HV) covering overhead connections between generator transformer & 400 KV breaker including HV winding of generator transformer.
- 3 Back-up earth fault protection on generator transformer HV neutral (51NGT).
- 4 Buchholz relay, winding temperature, oil temperature and oil level alarm and trip.
- 5 Fire protection to trip EHV generator / breaker, exciter field breaker and unit incoming breaker.

7.16.03

Unit Transformer

- 1 Unit transformer differential protection 3-pole (87UT).
- 2 Unit transformer back up over current protection (51UT).
- 3 Unit transformer L.V. Restricted earth fault and standby earth fault protection (64 RUT & 51NUT).
- 4 Buchholz relay, winding temperature, oil temperature and oil level alarm and trip.
- 5 Fire protection to trip EHV breaker, exciter field breaker and 11kV unit incoming breaker.

7.16.04

Station Transformer

- 1 Transformer differential protection 3-pole (87T).
- 2 Back-up over current protection on HV and LV side (51 ST) for ST only.
- 3 Restricted earth fault protection (64R) on HV& LV side

- 4 Back-up earth fault protection on LV side (51 N) for ST only.
- 5 Buchholz relay, winding temperature, oil temperature and oil level alarm and trip.
- 6 Fire protection to trip it's HV side breaker
- 7 Local breaker back up (or breaker failure) protection for the breaker on HV side of station transformer
- 8 Over fluxing protection (99T)

7.17.00

ELECTRICAL CONTROL CONCEPT

Central Control Room (CCR)

The complete control of generators and auxiliary system shall be provided in the DDCMIS system covered under "control and Instrumentation" having large video screens. On the operation desk CRT's/Keyboard shall be provided so that operator can control all the breakers via DDCMIS.

The Switchgears shall have Communicable Numerical relay system for protection, Controls, metering, and monitoring of the Switchgears. All the relays shall be networked to a dedicated HMI through data concentrator for Monitoring and supervision of all the breaker panels. All such data flow shall be linked to DDCMIS as well.

In addition to the above, the Substation Automation System LAN shall be extended upto Main Plant Control Room to facilitate control of switchyard bay equipment from Main Plant Control Room. A separate workstation shall be provided for this purpose in the Main Plant Control Room. All the data related to switchyard such as line /transformer loadings, alarms and annunciations etc. shall be available on this workstation.

Further, the exchange of SOE data between Generator Relay Panels (GRP) and DDCMIS shall be through a communication gateway, eliminating the need of hardwiring of protection signals between GRP and DDCMIS.

In addition, to the above control for synchronizing breakers along with other associated devices like incoming/running voltmeter and frequency meters, synchroscope, indicating lamps etc required for synchronization shall be located in a draw out portion on Unit Control Desk. Synchronization facility for generator breakers shall be kept disabled from OWS/LVS.

Hardware required for synchronization namely synchro-check and guard devices auxiliary PTs, auxiliary relays etc shall be provided as necessary in a back-end panel located in CER.

PLC based control system wherever envisaged shall be provided with 100% redundancy i.e. hot standby.

7.18.00

CABLES

For HT cable, single core and three core XLPE insulated cables with aluminium conductor would be employed. For 415 V and DC systems, single core XLPE insulated cables with aluminium conductor would generally be used for higher current ratings and multicore XLPE/PVC insulated cables with aluminium conductor would be used for lower ratings.

All control cables would be multicore, PVC insulated with copper conductors.

The cables shall be laid overhead/ in trenches or directly buried. Inter plant cabling for main routes shall be laid on overhead trestles/pipe racks.

The cables laid in EHV switchyards, transformers yards, CHP and AHP and those buried in earth would be armoured. All other cables would generally be unarmored. These cables would have FRLS properties.

7.19.00

STATION GROUNDING

Buried grounding mats employing suitable dia MS rods, shall be provided for EHV switchyards, main plant area, pump house etc, for keeping the step and touch potential within safe limits. All the connections above the ground would be of galvanized steel. Adequate lightning protection would be provided for EHV switchyards, transformers yards, all buildings, and chimneys etc.

The earthing system for plant and switchyard shall be designed for a life expectancy of at least forty (40) years, for a system fault current of 50 kA for 1.0 sec. The minimum rate of corrosion of steel for selection of earthing conductor shall be 0.12mm per year.

Grounding and lightning protection for the entire power plant, switchyard and other areas or buildings covered in the specification shall be provided in accordance with IS 3043, IS 2309, IEEE 80 and IEEE 665.

7.20.00

LIGHTING SYSTEM

Adequate lighting arrangement shall be made for the entire power plant employing lighting distribution boards, panels, LED Luminaires for the lighting of all the indoor & outdoor areas. However, for DC lighting, hazardous areas & aviation lighting etc. conventional type luminaires shall be used.

Normal lighting of the plant will operate with the station AC supply. About 20% of these fixtures will also have arrangement for being fed from diesel generators on failure of station AC supply. Emergency DC lighting, which will normally be off, would be provided for all strategic locations. 24 V AC supply network in both boiler and turbine areas shall be provided for safe lighting inside enclosed space for maintenance purpose.

7.21.00

SWITCHYARD

7.20.01

Type: Conventional Outdoor

Conventional outdoor switchyard has been considered for the project. The proposed arrangements for the project have been shown as per the single line diagram.

7.21.02

Bus Switching Scheme:

It is proposed to adopt the standard breaker and half switching scheme for the 400 KV switchyard complete in all respect including SAS, protection and control and for following bays.

1. Generator Bay – 1 no.
2. Reactor Bay – 1 no.
3. Station Transformer Bay – 2 nos. (One no. Standby Transformer bay in case of GCB scheme)
4. Bus Section – 0 nos.

7.21.03

Salient Features of Main Equipments

1 Insulation Coordination

The 400 kV systems is being designed to limit the switching surge overvoltage to 2.3 p.u. and power frequency over-voltage to 1.5 p.u. The breakers associated with bus/line reactor shall be suitable for controlled switching. Also, to restrict the reactor switching overvoltage, the lightning arrestors associated with reactors shall be of 336 KV. All the materials/equipment shall perform all its functions satisfactorily without undue strain under such overvoltage conditions. Consistent with these values and protective levels provided by the lightning arrestor, the proposed insulation levels for the various voltage systems are as follows:

S. No.	Description	Voltage Level (400 kV)
i)	Lightning impulse withstand voltage	400 kVp
ii)	Switching impulse withstand voltage	1425 kVp
iii)	Maximum fault current	50 kA
iv)	Duration of fault	1 sec

2 Switchyard Equipments

(a) Circuit Breakers

Circuit Breaker shall in general conform to latest edition of IEC 62271-100 and shall be SF6 type. The circuit breakers shall comprise of three single pole units complete in all respects with all fittings and wiring.

The 400 kV circuit breakers (as applicable) shall be provided with pre-insertion resistors of minimum value of 300 ohms per pole with 8 milli sec pre-inspection time to limit the switching surges.

The 400 kV circuit breakers (as applicable) shall be provided with pre-insertion resistors of minimum value of 400 ohms per pole to limit the switching surges values less than 2.3 p.u. with 8 mille sec pre-insertion time to limit the switching surges for transmission lines longer than 200 kms.

400KV breakers associated with Generator transformer, Interconnecting transformers and reactors shall be provided with control switching facility to contain overvoltage and in rush magnetizing current in reactor and generator transformer respectively.

(b) Isolators

Isolators will in general conform to IEC: 60129 /62271-102 and shall be of horizontal center break type.

Isolators and earth switches will be capable of with-standing short circuit current of the system in their closed position. Isolators and earth switches will be properly interlocked, and these will be of failsafe type.

(c) Current Transformers

Current transformers shall comply with IEC-60044. Different ratios of the current transformers shall be achieved by secondary taps for the 5 secondaries (4 for protection and 1 for metering). The accuracy of the protection cores shall be class PS and for metering cores it shall be 0.2. Current transformer characteristic shall be such as to provide satisfactory performance for burdens ranging from 25% to 100% of rated burden over a range of 1% to 120% of rated current in case of metering CT's and upto the accuracy limit factor/knee point voltage in case of relaying CTs.

(d) Voltage Transformers

Voltage transformers shall be capacitance voltage divider with electromagnetic units and shall be suitable for carrier coupling for line feeders. They shall in general conform to IEC 60044-5. CVTs shall be used for protection and metering with accuracy of class of 3p and 0.2 respectively. The minimum output burden of 400 kV system shall be 75 VA. The capacitance of CVT shall be 4400/6600/8800pF depending on PLCC requirements.

(e) Lightning Arrestors

Lightning Arrestors shall conform to IEC-60099. They shall be of metal oxide (gapless) heavy duty station class type. They shall be capable of discharging over voltage occurring during switching of unloaded transformers. Lightning arrestors shall be provided near line entrances

and transformers so as to achieve proper insulation co-ordination for the whole substation.

These shall be provided with pressure relief devices and diverting ports suitable for preventing shattering of porcelain housings providing path for the flow of rated currents in the event of arrestor's failure.

(f) Reactor

Reactors shall be connected to the 765 kV or 400Kv (as applicable) systems at generation switchyard for reactive load compensation and shall be capable of controlling the dynamic overvoltage occurring in the system due to load rejection. Reactors shall be capable of operating continuously at a voltage of 5% higher than their rated voltage. Shunt reactors shall also limit the power frequency over voltage to the specified limit.

3 Protection of Switchyard Equipment & Outgoing Lines

The EHV switchyard protection system shall be provided with numerical relays comprising the Bay Protection Units (BPU). The details of EHV protections are as follows:

(a) Busbar Protection

Each EHV busbar shall be provided with duplicated decentralized high speed bus bar protection scheme.

(b) Breaker Failure Protection

All circuit breakers shall be provided with breaker failure protection to take care of stuck breaker condition. If in the event of fault, a breaker fails to trip on receipt of a trip command, the breaker failure protection shall de-energize that particular bus to which the faulty breaker is connected and also send trip impulse to the remote end breaker to isolate the fault.

(c) TEE Differential Protection

Duplicated numerical differential Protection shall be provided for each "TEE" zone of the bus switching scheme having one and half breaker scheme. The duplicated numerical differential protection shall operate on two different principle i.e. high impedance and low impedance for having better reliability and security.

(d) Digital Fault Disturbance Recorder (DFDR)

Digital Fault Disturbance recorder as standalone/built- in function of Numerical relays shall be provided for each EHV 400 KV bay. The Digital Fault Disturbance Recorder (DFDR) system will be a complete automatic digital recording system capable of sensing, acquiring, and recording the data, printing and transmitting disturbance records to the analysis units and centrally at Engineering workstation provided in the Substation Automation System. The DFDR having above features can also be inbuilt feature of respective feeder protection numerical relay.

Standalone DR shall be provided at generator terminal.

(e) Metering System

0.2s accuracy energy meters suitable for ABT requirement along with metering Master Station and software for export & import of active and reactive energy meters shall be provided for each outgoing line, generator, Station transformer feeders. In addition to this, static energy meters of 0.2 Accuracy class have been considered for active energy measurement at other locations of Station Board for energy accounting/trend analysis. All ABT type meters shall be fed from accuracy class 0.2s CT and accuracy class 0.2 CVT/VT/PT. The MVARH meters shall have accuracy class of 0.5 or better.

The metering system shall have microprocessor-based and provision for downloading of data through an optical port and /or through RS 232/485/ Ethernet port. Further these meters shall be networked using Modbus protocol and connected to the Metering Master Station (MMS), provided for the ABT meters.

For metering, dedicated CT's, CVT's should be provided for GT-3 & ST-3.

(f) Phasor Measurement Unit (PMU)

Presently the Indian Grid is synchronously interconnected with all regional grids forming a common grid. The Indian grid being very vast, the power industry requires better situational awareness of the grid at the control center for real time system operation. Synchrophasor measurement using over wide area facilitate dynamic real time measurement and visualization of power system and are useful in monitoring safety and security of the grid as well enable in taking control/corrective actions in the new regime of grid management. Installation of PMUs at generating switchyard beyond 2014-15-time frame shall be undertaken by Generator themselves. Hence suitable provision has been kept in DPR associated with generating switchyard. The communication system for PMU shall be based on Fibre optic and shall have physical route redundancy. The sampling rates for the PMU shall be 25 samples per second but should have provision for 50 samples per second. Each measurement is to be time stamped to a common time reference for a comprehensive view of common Indian Grid.

4 CONTROL PHILOSOPHY FOR SWITCHYARD

The control, protection and data acquisition including SOE data for 400kV switchyard bays shall be accomplished by Substation Automation System with Distributed Architecture comprising of Bay Control Units, Bay protection Units, Operators Workstation, Large Screen (LVS) etc.

The Bay Control Units and Bay Protection Units shall be located suitably in bay kiosks. The adoption of Distributed Architecture shall help in reducing the cost by reduction of cables, cabling and related civil works and shall also provide better tariff accuracy. The SA system will be based on standard communication protocol IEC 61850. The Substation Automation System shall facilitate following functionality: Dynamic display of switchyard mimic, real time measurement values, etc.

- a. Monitoring display of switchyard mimic, real time measurement values etc.
- b. Monitoring ON/OFF status and remote closing/ synchronizing of circuit breakers, isolators, and earth switches.
- c. Display of Switchyard alarms, events, and trends
- d. Interlocking functions
- e. Sequential Event Recording
- f. Communicating with protection relay IEDs for settings and Disturbance Recording functions
- g. System self supervision
- h. Hard copy printing and other network functions

As already described in control philosophy for CCR, it is also proposed to provide two numbers of OPC compliant gateways in the station level network such that desired interface with main plant DCS can be achieved. Two (2) more redundant gateways along with associated RTU and modems shall be provided in the station level network for sharing information with SLDCs through PLCC link. These two would communicate through IEC: 60870:5:101 standard protocol.

Separate control room for Stage-II (1X800MW) has been envisaged to accommodate all the control and protection equipment including DC system, LT Boards etc. However, accommodating these equipment in existing switchyard control room in the available free space and or extension of existing facilities/building shall be explored during detail engineering. Such option shall be kept in the tender document.

7.22.00
CONSTRUCTION POWER

Existing Construction power system for Stage - I is distributed by overhead line at 3.3 kV voltage level. The distribution substation 3.3 kV /0.44 KV are provided at various location of Stage- I. The requirement of the construction power supply for Stage - II would be met from existing construction power supply network by either using the existing substations or by providing new substations by extending the 3.3 kV overhead line by tapping from the existing 3.3 kV overhead line.

7.23.00
BLACK START FACILITY

The arrangement to get the black start-up power from the Grid shall be as per the RLDC's startup procedure of the region. Hence, no separate dedicated black start facility is being envisaged for this project.

7.24.00
ELECTRICAL LAB EQUIPMENT

The electrical lab equipment facility of Stage-I shall be utilized and hence no lab equipment is envisaged.

7.25.01

The Solar Photo Voltaic (PV) installation on Rooftop of various buildings of Thermal Power Plant shall be carried out preferably on shadow free area in such a way that the generation is maximized on each building Rooftop suitable for installation of Solar PV power plants.

List of facilities/buildings of (1X800MW) identified for installation of rooftop Solar PV power are as follow.

- Main Powerhouse
- ESP Control Room
- CHP Control Room
- Ash System Buildings
- Fuel Oil buildings

The final plant capacity shall be as per detailed approved engineering design of each of the buildings. The final plant capacity shall be as per detailed approved engineering design of each of the buildings.

CHAPTER – 8
PLANT SYSTEMS (C&I)

PLANT SYSTEMS - CONTROL AND INSTRUMENTATION

8.01.00

GENERAL

The function of the Control & Instrumentation System would be to aid the operator in achieving safe and efficient operation of the unit, resulting in cost effective power generation with minimum fuel consumption and reduced emission levels. The C&I system would be of the type which normally relieves the operator of continuous duties and would take pre-planned corrective actions in case of drift in process or if unsafe trends or conditions develop in any regime of operation viz. startup, shutdown, normal working and emergency conditions. The design of C&I system would be such as to permit on-line localization, isolation and rectification of fault in the minimum possible time.

8.02.00

CONTROL ROOM CONFIGURATION & LAYOUT

It is proposed to have air-conditioned Common Control Room for the units at operating floor along with Programmer's Room. The boiler, turbine and generator along with their associated auxiliaries would be controlled and monitored from the Common Control Room. The control system cabinets would be located in air-conditioned unitized Control Equipment Room (CER) at operating floor and at intermediate floor. UPS, 24V DC Modular Power Supply System would be located at intermediate floor in the air conditioned environment. Batteries for UPS & 24 V modular power supply shall be located at intermediate floor in air-ventilated environment.

For offsite DDCMIS such as AHP and Water system including DM Plant, PT Plant, CW Chlorination, CPU Regeneration and Raw Water pumps, it is proposed to have air-conditioned Centralized Offsite Control Room adjacent to Unit Control Room. The control system cabinets and equipment of these areas would be located in respective Control Equipment Room (CER) near respective MCC.

For offsite DDCMIS such as CHP and Make-up water system (if applicable), it is proposed to have air-conditioned control room in their respective areas. The control system cabinets and equipment of these areas would be located in respective control rooms.

It is proposed to locate the Steam and water Analysis System (SWAS) at SWAS Room, +0.0 meters in an air conditioned environment.

The exact locations of these items shall be finalized according to the main plant layout.

8.03.00

CONTROL & MONITORING PHILOSOPHY

As per the currently used practices for main plant control, Large Video Screens (LVS), OWS would be provided for all regimes of operation. Unit

	THE SINGARENI COLLIERIES COMPANY LIMITED		
	Control Desk (UCD) for mounting monitors / Keyboards (KBDs) would also be provided for each unit. For operation during disturbed/emergency operating conditions in the plant, very few back-up conventional devices / instruments like hardwired push button stations, switches, indicators etc. would also be provided on the UCD itself in draw-out sections. The control, monitoring & operation of the off-site areas such as AHP System, Water System including DM Plant, PT Plant, CW Chlorination, CPU Regeneration, Raw Water pumps shall be carried out from Centralized Offsite Control room. Large scale integration of control systems, unification of various control areas shall be attempted to economize on number of operation and maintenance staffs, inventory etc. In line with recent practices, remote operation with LVS, OWS as well as GIU based local operation facility shall also be provided depending on the layout of the control room. For system with PLC based control systems (i.e. stacker reclaimers, coal sampling units, wagon tripler, automatic sprinkler system etc. as per requirements) links shall generally be provided for exchange of data in the main plant control room for the information of unit-in-charge/shift-in-charge etc. through Station Wide LAN.		
8.04.00	MEASURING INSTRUMENTS (PRIMARY & SECONDARY) Primary measuring instruments for the measurement of parameters like pressure, temperature, level, flow etc., would be used. For PT/DPT/TT, fieldbus based instruments are envisaged. Measurements like coal bunker level, coal feeder speed etc., and all other measurement systems required to ensure complete and satisfactory operation would also be included. Microprocessor based vibration monitoring system for monitoring of vibration of major equipment's would also be provided. In view of the all-round stress on clean environment, environmental monitoring instruments such as SO₂, NO_x, CO₂, CO, dust emission, Flow Meter and Mercury Analyzer shall also be provided at Chimney. Further O₂ analyzers at different locations of Boiler Flue Gas Path and any other analyzer required to meet the environmental norms shall be provided. Ambient Air Quality Monitoring Stations (AAQMS) shall also be provided at different locations if required. Analyzers like COD, BOD, OIW, TSS, pH, Conductivity etc. for measuring liquid effluent quality as per latest requirements of CPCB/SPCB or other regulatory/statutory body shall be provided at Effluent treatment plant discharge.		
8.05.00	DISTRIBUTED DIGITAL CONTROL, MONITORING & INFORMATION SYSTEM (DDCMIS) Microprocessor based Distributed Digital Control Monitoring & Information System (DDCMIS) would be provided for the safe, reliable and efficient operation of Steam Generator (SG), Turbine Generator (TG), Balance of Plant (BOP) including all auxiliaries and common facilities (i.e. offsite plants).		
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DDCMIS shall be provided for offsite areas also and facility of inter domain operation shall be provided. For this purpose, for each Sub-area/equipment, a primary operating point and secondary operating point shall be defined based on the process requirements.

It is proposed to use optimum number of Large Video Screen (LVS) and OWS for the purpose of control, information and alarm monitoring as mentioned above. The LVS/OWS would provide complete control, monitoring, supervisory and display functions for control system variables and control system status. Changes in system configuration, tuning constants and similar engineering and maintenance functions would be done from Engineer/Programmer console.

Adequate numbers of printers would be provided for logs, reports and alarms. In addition to this, historical data storage and retrieval system would be provided.

Alarm Annunciation System and Sequence of Events Recording System (SERS) will be envisaged to be performed in DDCMIS itself. It is envisaged to provide alarm analysis system for the project. For effective trip analysis, power replay software shall be provided as part of DDCMIS.

Advanced software tools, which result in improving the controllability of critical operating parameters of the units thereby improving efficiency of power plant operations such as, heat rate, combustion efficiency etc., would be provided as per requirement.

Master and slave clock system would be provided to ensure uniform time indication throughout the plant and also for time synchronization among various DDCMIS.

8.05.01

Hart Management System integrated with AI modules in DDCMIS is envisaged for centralized configuration, maintenance, diagnostics & record-keeping for all electronic transmitters, temperature transmitters and analyzers would also be provided for main plant unit system.

8.05.02**Fieldbus and Wireless Technology Based Systems**

Fieldbus (Profibus/Foundation fieldbus) and wireless technology based systems are being envisaged to harness the various advantages of latest technology. DDCMIS system shall be primarily Fieldbus based. However, in some critical applications like MFT, TPS/TCS, TDBFP and critical closed loop controls of power plant conventional (hardwired 4-20mA AI/AO/DI/DO) measurement and control system shall be provided.

Fieldbus based instruments (PT/DPT/TT), Non-intrusive Electrical actuators and pneumatic positioners are being envisaged for all applications which shall be connected to the fieldbus based control system. Fieldbus based control system shall be complying with IEC 61158 and various other latest industry standards. The protocol of fieldbus, (Foundation Fieldbus, Profibus

or mix of both protocols), shall be finalized during detailed engineering based on DDCMIS vendor and various other DDCMIS performance parameters. Accordingly, protocol for non-intrusive electric actuators, instruments and positioner shall be finalized matching with fieldbus protocol of DDCMIS.

For monitoring of Boiler SH/RH metal temperature & Generator Core/ Slot temperature measurements, Field Bus Compatible temperature transmitters or Wireless temperature transmitters are being envisaged.

8.05.03
SG-C&I SYSTEM

The SG -C&I system would generally include the following:

1. Furnace Safeguard Supervisory System for Boiler
2. Secondary Air Damper Control
3. Auxiliary PRDS Control
4. Soot Blower Control
5. Coal Feeder Control, etc.
6. Boiler Metal temp, Boiler Drains & Vents including Start up Drains & Vents.
7. Acoustic Pyrometer.
8. Acoustic Steam Leak Detection System
9. Flame Monitoring System and flame detector testing kit
10. NOx Control System
11. Other miscellaneous SG related controls including FGD (Flue Gas Desulphurization) and SCR (Selective Catalytic Reduction) Systems

8.05.04
TG-C&I System

The TG -C&I system would generally include the following:

1. EHG Control System
2. Automatic Turbine Run Up System (ATRS)
3. HP-LP Bypass Control System
4. Main Turbine Stress Control System (TSCS)
5. Automatic Turbine Testing System (ATT)
6. Turbine Protection System
7. Main & BFP Turbine Supervisory system (TSS) including Vibration analysis and its remote monitoring.
8. Generator Auxiliaries Control System

8.05.05

9. OLCS & CLCS controls of TD BFP(s), their respective drive Turbine including all auxiliaries.

10. Other miscellaneous TG related controls

BALANCE OF PLANT (BOP) C&I SYSTEM

The balance of plant C&I system would generally include the following as a minimum:

1. Modulating Control of the Steam Generator
2. Modulating Control of the Feed Water/Condensate Cycle
3. Binary Control of the Auxiliaries of the Steam-Generator (SG)
4. Binary Control of the Auxiliaries of the Turbine-Generator (TG)
5. Control of Electrical System Breakers and Balance Equipment
6. Other miscellaneous controls for common / off-site areas.

8.05.06

ASH HANDLING SYSTEM DDCMIS: -

Ash Handling Control System comprising of binary and modulating controls of dry and wet ash handling system, bottom ash handling system, ash slurry pumps, ash water recirculation system etc.

8.05.07

COAL HANDLING SYSTEM DDCMIS: -

Coal Handling Control System comprising of binary controls of crushers, conveyers, dust suppression systems etc.

8.05.08

WATER SYSTEM DDCMIS: -

Water System Control System comprises the binary and modulating controls of DM, CW Treatment & Pretreatment Plant including Chlorination system, Liquid Effluent Treatment system, Zero Liquid discharge, air conditioning of water system control equipment room, raw water pumps etc.

8.05.09

MAKE-UP WATER SYSTEM DDCMIS: -

Make up Water Control System comprises of binary and modulating controls of Make-up water pumps, Raw water pumps etc.

8.05.10

FLUE GAS DE SULPHURISATION (FGD) DDCMIS

FGD System comprising of binary and modulating controls of complete Flue gas desulphurization system, material handling systems etc. shall be implemented in this DDCMIS.

FOPH DDCMIS

FOPH Control system comprises of Fuel oil temperature control, Fuel oil discharge pressure control, Controls related to Fuel oil unloading system, etc.

8.05.11
Other Common System DDCMIS: -

A Stand-alone common system shall be provided for control and monitoring of some common system plant like Compressor, CW system, Air conditioning System of Main plant and Water System control room area, Cooling tower, Ventilation system, etc. and for some station level controls / supervisory functions.

8.05.12
Switchgear DDCMIS:

Switchgear system comprising of monitoring and data acquisition of all MV & LV circuit breakers / MV Vacuum contactors on IEC-61850 protocol. The Goose protocol used in Switchgear Relay network shall not be taken in Switchgear DDCMIS. 20 Signals (both Analog & Digital) from each relay shall be communicated to DDCMIS on IEC 61850 protocol.

8.06.00
CONTROL AND INSTRUMENTATION FOR PLANT AUXILIARY PACKAGES.

Programmable Logic Control (PLC)/ Micro PLC based complete and independent Control and Instrumentation System, HMI System with all accessories, auxiliaries and associated equipment and cables would be provided for the safe, efficient and reliable operation of systems not covered above like Hydrogen system, Air conditioning systems of important buildings coal sampling unit, stacker reclaimer, wagon tripler, automatic sprinkler system etc., depending upon the requirement of the project.

Microprocessor based addressable Analog Fire Alarm system along with intelligent detectors, Repeater panel, 24V DC power supply for 24 hrs backup under normal conditions and 30 minutes backup in case of alarm, Centralized monitoring station with A4 size color laser printer and associated cables and accessories. PLC based control and instrumentation systems along with 24V DC power supplies for Fire water pump house, Foam system pump house and Hydrant Booster pump house.

For plant information of Fire Protection, Hydrogen Generation etc. links shall be provided for exchange of data in the main plant control room for the information of unit-in charge/shift-in charge etc. through Station Wide LAN.

8.07.00
STEAM & WATER ANALYSIS SYSTEM (SWAS)

Water chemistry is life line of the power plant and considering which a comprehensive Steam and Water Analysis System (SWAS) is envisaged for on line analysis of chemical parameters at all critical points in condensate, feed water and steam cycle.

8.08.00
POWER SUPPLY SYSTEM (UPS & DC SYSTEM)

To provide AC & DC power supplies to various C&I systems under SG, TG & BOP C&I systems, following power supply has been envisaged in line with present practices.

	Uninterrupted Power Supply (UPS) system to feed AC load like Human Machine Interface (HMI) of BOP C&I DDCMIS and SG/TG DDCMIS system and offsite areas. Independent 24V DC modular DC power supply systems shall be provided for independent control systems for SG C&I, TG C&I, BOP C&I(related to Main Plant), CW system and other offsite Control Systems like AHP, CHP, Water System, Make-up Water System, etc. Remote I/O cabinets wherever feasible shall be powered from the nearest power supply system to the extent possible, considering the voltage drop requirements. Wherever not feasible, 24V DC Chargers shall be provided for Remote I/O cabinets. Intelligent Battery health management system (BHMS) shall be provided for each system of 24VDC power supply system and UPS batteries.
8.09.00	CONTROL VALVES, ACTUATORS & ACCESSORIES Control valves and dampers would be pneumatically operated in most of the applications. However, for few applications electric/hydraulic actuators would be employed. Microprocessor based positioners shall be provided for pneumatic control valves and dampers.
8.10.00	INSTRUMENTATION / COMMUNICATION / CONTROL / POWER CABLES All instrumentation/communication cables of different types such as multi-pair cables, T/C extension cables, OFC/UTP etc shall be provided for different area as per requirement. Power and Control cable of various sizes shall be provided for powering various 24V DC and AC loads of the control system as well as for earthing and grounding of the C&I system.
8.11.00	PUBLIC ADDRESS SYSTEM IP based Public Address (PA) system would be used to provide proper communication throughout the plant (including Coal Handling Plant/Coal Unloading Area) with the help of call stations, loudspeakers, portable handset stations etc. Redundant Server shall be located in Unit Control Room and CHP Control Room.
8.12.00	CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM IP based Close Circuit Television (CCTV) system would be provided for security and surveillance of different operating areas in the plant as an aid to operators, adequate number of dome type cameras with facilities like zoom, pan, tilt etc. would be provided at various operating areas. The monitors would be located at control locations such as central control room, operation in-charge room etc. CCTV System shall be interfaced with LVS to portray plant images.
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CHAPTER – 9

ENVIRONMENTAL ASPECTS

8.13.00
PROCESS CONNECTION & PIPING

Impulse pipes, Instrument air/ Service air headers and pipes shall be provided on as required basis along with all supports.

All process transmitters devices would be installed in Local Instrument Enclosures (LIE) in boiler area and in Local Instruments Racks (LIR) in turbine area and indoor area. For offsite areas LIE/LIR will be provided as per requirement.

8.14.00
MAINTENANCE & CALIBRATION EQUIPMENT

One set of maintenance and calibration equipment has been envisaged. It would consist of calibration equipment's required for maintenance of C&I system /devices used in the plant.

8.15.00
PLANT PERFORMANCE ANALYSIS, DIAGNOSIS & OPTIMIZATION SOFTWARE (PADO)

PC based online plant Performance Analysis, Diagnosis & Optimization (PADO) system for the station shall be provided. The PADO shall incorporate the complete thermal design model of the unit. The system shall use the measured data from the Distributed Digital Control, Monitoring & Information System (DDCMIS) through appropriate interface.

8.16.00
WIRELESS LINKS

Wireless links shall be provided for operation of distant plants like make-up Water, Ash Water Re-Circulation System (AWRS), etc. as per requirements.

ENVIRONMENTAL ASPECTS

9.01.00

INTRODUCTION

The proposed Singareni TPP Stage-II (1x800 MW) is an expansion project. The land requirement has been optimized to meet CEA guidelines. The land identified is already available with Singareni Thermal Power Station (STPP).

There are no metropolitan cities within 25 km. from the proposed site and the site is more than 500 m away from National highway-63 connecting Nizamabad (TS)-Mancherial (TS)-Jagdalpur (CG). The nearest major railway station is Mancherial at a distance of about 15 km on Delhi-Secunderabad Railway Line. There is no national parks or wild life sanctuaries within 15 km of the identified site. No forest land is envisaged for the plant. However, there are some mango trees within the plant boundary. River Godavari flows at approx. 6 km from project. There are no archaeological, historical, cultural, and defense installations within 10 km of the project site.

9.02.01

Pollution Control Measures

Various environmental improvement measures, pollution control systems and mitigation measures proposed to be adopted for the 1x800 MW SCCL, Stage-II TPP are as follows:

9.02.01.1

Air Pollution

High efficiency electrostatic precipitators (ESPs) will be installed to limit the particulate emission to 30mg/Nm³.

To facilitate wider dispersion of pollutants, one stack with single flue of height 150m above plant grade level is envisaged for this project. The chimney shall be provided with personal access doors and sampling ports for monitoring. Wet limestone FGD system shall be installed to limit the SO_x emission upto 100 mg/NM³. It will take suction from flue gas duct after ESP and feed the de-sulphurised flue gases back to the chimney. The flow rate in the flue gas is to be maintained with minimum velocity of 22 m/sec.

The steam generator shall be designed to limit the NO_x formation upto 100 mg/Nm³ by adopting the appropriate burners/combustion system along with Selective Catalytic Reduction (SCR) system.

Mercury emission in air shall be limited to 0.03 mg/Nm³.

For control of fugitive dust emissions within and around the coal handling plant, dust extraction/suppression systems would be provided. Dust suppression system shall also be provided in the coal stockyard. Similarly, ash handling plant would be equipped with dust extraction/suppression systems to prevent fugitive emissions.

	appropriately to the existing drainage system. The feasibility for zero discharge will be explored. The sewage from Unit-3 of stage-II, Unit-1 & 2 of Stage-I and township shall be treated in a Sewage Treatment Plant already provided in Stage-I. The treated sewage conforming to prescribed standards shall be utilized for plantation and green belt, except monsoon season. During monsoon, the balance effluent shall be discharged appropriately.				
9.02.01.3	Noise Pollution The major noise generating sources are the turbines, turbo-generators, compressors, pumps, fans, coal handling plant etc. from where noise is continuously generated. Acoustic treatment/ equipment design shall be done to control the noise level below 85 dB (A). The equipment would be designed so that the noise levels are restricted within the specified limits. Wherever required, especially in high noise areas, the workers shall be provided with protective equipment such as ear plugs/ ear muffs. A green belt would be developed along the plant boundary, wherever space is available & feasible, which will act as a noise barrier.				
9.02.01.4	Solid Waste Management Ash will be the major solid waste generated from the power project. An ash management scheme shall be implemented consisting of dry collection of fly ash, supply of ash to entrepreneurs for utilization and promoting ash utilization to maximum extent and safe disposal of unused ash. The plant shall have two different systems for ash disposal – conventional Wet Ash Slurry Disposal System with Ash Water Re-Circulation System for bottom Ash and High Concentration Slurry Disposal (HCSD) for fly ash. HCSD system will require less quantity of water. The domestic solid waste generated from plant will be disposed as per statutory rules and regulations.				
9.02.01.5	Afforestation and Green Belt A green belt is envisaged around the main plant area except the switchyard side, wherever space is available and feasible. In addition, large scale afforestation and green belt development activities shall be implemented within the main plant areas and around project, wherever space is available and feasible. Further, avenue tree plantation will be undertaken along roads in Plant areas, wherever space is available and feasible.				
9.03.00	STATUTORY CLEARANCES				
<table><tr><td>DETAILED PROJECT REPORT SCCL TFP Stage-II (1X800MW)</td><td>Doc. No.: CW-EN-11159-DPR-002</td><td>CHAPTER-9 ENVIRONMENTAL ASPECTS</td><td>Page 3 of 5</td></tr></table>		DETAILED PROJECT REPORT SCCL TFP Stage-II (1X800MW)	Doc. No.: CW-EN-11159-DPR-002	CHAPTER-9 ENVIRONMENTAL ASPECTS	Page 3 of 5
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9.02.01.2
Water Pollution

The raw water shall be treated suitably before use in various plant systems. An effluent management scheme, consisting of collection, treatment, recirculation and disposal of effluents shall be implemented in order to optimize the make up water requirement as well as liquid effluent generation.

The liquid effluents shall be collected and treated/ recycled as per the following design philosophy:

- The filter backwash water of PT Plant shall be collected and recycled back to the DM system clarifier.
- The sludge from clarifiers of PT Plant shall be collected in a sump/ pit and shall be pumped to bottom ash slurry sump for disposal to bottom ash dyke.
- The waste effluents from neutralization pits of DM Plant and Condensate Polishing Plant shall be collected in the respective neutralization pits and neutralized before pumping to the Central Monitoring Basin before final disposal.
- The sludge from clarifier/ tube settler shall be disposed-off in bottom ash dyke along with bottom ash slurry.
- A coal settling pond shall be provided to remove coal particles from coal handling plant waste. Decanted water shall be pumped back to the coal dust suppression system.
- Service water effluent collected from plant drains shall be led to a sump. From the sump, the service water shall be pumped upto tube settler/ clarifier for treatment of suspended solids. Treated service water shall be sent back to service water tank to the extent possible for re-use.
- For oily wastes, oil water separators shall be provided. The separated oil shall be removed from the top, the water at the bottom shall be recycled or led to the plant effluent drain depending upon its quantity.
- All the plant liquid effluents shall be mixed in Central Monitoring Basin (CMB) and finally disposed-off to the final disposal point.
- An independent plant effluent drainage system shall be constructed so as to ensure that plant effluents do not mix with storm water drainage.
- The plant shall have two different systems for ash disposal - conventional Wet Slurry Disposal System with Ash Water Re-Circulation System (AWRS) for Bottom Ash and High Concentration Slurry Disposal (HCSD) for fly ash. HCSD system will require less quantity of water and there will be no effluent from the fly ash disposal site.

Efficient operation of various treatment schemes shall be ensured, so that the quality of treated effluent from CMB conforms to relevant standards, prescribed by regulatory agencies. The treated effluents shall be released

Environmental Impact Assessment study was carried out for the proposed project. Public Hearing was conducted on 07.03.2018 at the project site. The issues raised during the public hearing were addressed adequately and action plan to implement public hearing concerns was submitted to the concerned authority. The proposal for Environmental Clearance was appraised by Environmental Appraisal Committee (EAC) of MoEF&CC, Ministry of Environment, Forest and Climate Change (MoEF&CC), GOI, vide ref. no. J-13012/08/2015-IA. II (T) dated 18 Dec 2019, accorded Environmental Clearance (EC) to the project.

9.04.00

ASH UTILISATION

Singareni Collieries Company Limited – a socially conscious power generator considers utilization of ash produced at its coal based power station as a thrust area of its activities. Singareni TPP Stage-II (1X800MW) planned to be set up shall generate about 5000 ton of ash per day i.e. about 1.65 million ton ash per annum in the power generation process, out of which 80% is the fly ash and 20% is the bottom ash.

1. SCCL shall provide system for 100% extraction of dry fly ash along with suitable storage facilities. Provision shall also be kept for segregation of coarse and fine ash, loading this ash it to closed/open trucks and also for loading of rail wagons. This will ensure availability of dry fly ash required for manufacture of Fly Ash based Portland Pozzolana Cement (FAPPC), for cement plants and Ready Mix Concrete plants located in the vicinity of proposed project & also for fly ash traders/exporters.
2. Pneumatic conveying system will be deployed for conveying of fly ash from the electrostatic precipitator hoppers in dry form. This dry ash will be taken to buffer hoppers. There will be four HCSD Pumps, four silos with all accessories for disposal of fly ash to ash dyke. Two pumping system will take full load; one pumping system will be standby and one system maintenance standby.
3. Ash generated in the proposed plant shall be utilized in the cement and brick manufacturing.
4. SCCL shall make efforts to motivate and encourage entrepreneurs to set up ash based building products such as fly ash bricks, blocks tiles and other fly ash based products from proposed power plant.
5. To promote use of ash in agriculture/ low lying areas/wasteland development – show case project shall be taken up in the vicinity of proposed thermal power station.
6. SCCL is also exploring the option of backfilling in Mines. The unutilized ash disposed in the existing ash pond. Bottom ash shall be used for stowing in underground mines, in place of river sand and for earthen embankment and road construction.

7. All government/ private agencies responsible for construction / design of buildings, development of low lying areas, and construction of road embankments etc. within 100 km of the plant area shall be persuaded to use ash and ash based products in compliance of MoEF's Notification on fly ash.

With all the efforts mentioned above, it is expected that fly ash generated at proposed TPP shall be utilized in the areas of cement, concrete and building products manufacturing road embankment construction, land development, mine filling, agriculture etc. However, in order to prepare realistic road map for 100% ash utilization, a detailed market study shall be carried out. Based on recommendations of the study, detailed Road Map for achieving 100% Ash Utilization in the line with MoEF&CC's Gazette Notification on fly ash shall be prepared.

9.05.00 REHABILITATION & RESETTLEMENT, CORPORATE SOCIAL RESPONSIBILITY AND INITIAL COMMUNITY DEVELOPMENT

All the R&R issues have been taken care during execution of Stage-I.

9.06.00 POST OPERATIONAL MONITORING PROGRAMME

Regular monitoring of pollutants in different environmental disciplines like ambient air, stack emissions, treated wastewater, etc. shall be conducted and the data shall be submitted to Telangana State Pollution Control Board regularly. The monitoring locations will be finalized in consultation with State Pollution Control Board. The plant will be equipped with all necessary equipment and manpower for ensuring effective monitoring.

9.07.00 INSTITUTIONAL SET-UP

The post operational monitoring programme will be under the supervision of the Environmental Management Group (EMG) at the project site. The station will be equipped with all necessary instrumentation/ equipment and manpower required for ensuring effective monitoring. The EMG at site will interact with State Pollution Control Board, Regional Offices of Central Pollution Control Board and MoEF&CC, for environmental issues during operation of the station.

9.08.00 ENVIRONMENTAL COST

A cost provision of approximately 12353.36 crores has been kept towards providing environmental measures.

CHAPTER – 10

TECHNICAL DATA AND BILL OF QUANTITY

TECHNICAL DATA AND BILL OF QUANTITIES
10.01.00 PRELIMINARY & CIVIL WORKS

S. No.	DESCRIPTION	UNIT	QTY
1	Land Requirement		
a	Main Plant, BOP & CHP & Misc. Facilities	Acres	Land already acquired during Stage-I
b	Ash disposal area	Acres	
c	Green belt	Acres	
d	Land (Township)	Acres	
f	Misc. Facilities	Acres	
	Total		
g	Land required for Railway Corridor	Acres	
h	Land to be acquired for Make-Up Water Pump house near Upper Ganga Canal & Right of Way for pipe line	Acres	
2	Site Leveling	Lac m ³	2.5 Lac M ³
3	Roads & Drains		
a	Roads		
i	Double Lane Concrete Roads with raised shoulder (Inside Plant)	kms	3.5
ii	Single Lane Concrete Roads with flat shoulders (Inside Plant)	kms	4.5
b	Drains in Main Plant		
i	Rectangular concrete (RCC) Trunk drains (Inside plant & upto drain Outlet)	kms	2.0

S. No.	DESCRIPTION	UNIT	QTY
ii	Rectangular concrete (RCC) Catch drains (Inside Plant)	Kms	16.0
4	PVC Chain Link Fencing	kms	1.0
5	Structural Steel – Main plant		
a	Fabrication & erection of Misc. Structural Steel for Main power house A-B-C bay, Control towers, structure around TG, Mill/ Bunker building, Conveyor Galleries etc.	Lot	Lot
b	Structural steel (supply, fabrication & erection)	MT	29370
c	Electro Forged Gratings	MT	468
d	Stainless steel (ASTM A240 type 304 Stainless steel)	MT	100
e	MS Black Foundation Bolts & Nuts	MT	246
6	Foundation		
a	All foundations like TG, Boiler, BFP, PA, FD/ID fans, coal mills etc.	LOT	01
7	General Civil Works		

S. No.	DESCRIPTION	UNIT	QTY
	This includes civil and architectural works coming in the Main Plant area comprising of : TG Bay hall, Electrical/ Control bay, Control Tower, BC & CD bays, Mill/Bunker building, Conveyor Galleries & Transfer points, Cable & pipe rack & Ancillary Buildings: a) Air washer room b) Compressor house c) D.G. set building d) ESP control room buildings	LOT	01
a	Chimney		
	150 m high Single flue steel lined RCC chimney with staircase and elevator	No.	01
b	Enabling Works		
i	Watch Towers (each 36 sqm)	Nos	05
ii	O & M Store	Sqm	01
c	Coal Handling Plant		
	CHP civil works related to Wagon Tippler, Pent House, Crusher House, Transfer points, Stacker Reclaimer, conveyor galleries and control room building etc for 1X800MW Unit.	LOT	01
d	Ash Handling System	LOT	01
	Ash Handling System-Civil works consists of following 1. Ash Water Pump House.	LOT	01
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	S. No.	DESCRIPTION	UNIT	QTY
		2. Ash Slurry Pump House 3. HCSD Pump House 4. Switch gear/MCC and Control Room for all buildings 5. Silo area utility building 6. Fly Ash Silo foundation & supporting structure 7. B A Slurry Trench 8. HCSD Silo foundation & supporting structure 9. Transport & Equipment air Compressor house 10. Steel Trestles for supporting Ash Slurry Piping within plant area and dry fly ash transportation pipe pedestals upto silos near plant boundary. 11. RCC pedestals for supporting bottom ash disposal pipes & HCSD pipes including garlanding of ash dykes. 12. RCC pedestals for supporting ash water recirculation pipe. 13. Miscellaneous works like Transformer Foundation, Fencing and Paving etc. 14. Miscellaneous structures including Foundation for settling tank, surge tank, etc. 15. Maintenance road		
	e	CW System		
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S. No.	DESCRIPTION	UNIT	QTY
	Includes CWPB including Forebay, maintenance Bay, CW Channel and duct, RWPH including SWGR, Control Room and Transformer Foundation	LOT	01
f	Water Treatment Plant		
	Construction of DM Water Pump House, DM plant building, Regeneration building, Chlorination plant building, Neutralizing pit, DM Water and Condensate water tank foundations, pipe rack foundations, Chemical house of PT plant & other associated works	LOT	
g	Switchyard Civil/ Structural Works		
	Towers & equipment foundations for 1X800MW Unit	LOT	01

S. No.	DESCRIPTION	UNIT	QTY	REMARKS
8	Permanent Township			
a	Dwelling Units			
i	HOP Bungalow (including servant qtr and garage)	No.	02	295.00 sqm
ii	Type - MA	No.	12	244.00sqm
iii	Type - MB	No.	60	144.00sqm
iv	Type- MC	NO	28	
9	CISF Accommodation			
a	Club for CISF	No.	1	

10	Non-residential Buildings			
a	Community Center	LS	1	
b	Shopping Complex	LS	1	
c	Sports Complex	LS	1	
d	Swimming Pool	LS	1	
e	Recreation Center	LS	1	
f	Development of Parks	LS	1	
g	Guest House with 10 suits	LS	1	
h	Misc Facilities/works	LS	1	
i	Roads, Drains, Water tank, Electricals, sub-stations	LS	1	
j	Gate Complex for Township	LS	1	
k	Civil and Electrical Maintenance office	LS	1	
l	School and Training center	LS	1	
m	Hospital	LS	1	
n	Stadium	LS	1	

CHAPTER 10B
TECHNICAL DATA AND BILL OF QUANTITIES

10.02.00 MECHANICAL SYSTEMS

S. NO.	DESCRIPTION	QTY	UNIT	TECH. PARAMETERS
10.02.00	MECHANICAL SYSTEMS			
10.01.00	STEAM GENERATOR & ASSOCIATED AUXILIARIES	01	Set	Supercritical Boiler
a	Type:			Supercritical with Single Pass (tower)/Double Pass arrangement
b	Circulation : Drum/Once through			Once through
c	Draft: Balanced/Forced			Balanced Draft
d	Furnace bottom: Dry/Wet			Dry Bottom
10.01.01	Major Steam Generator Parameters at 100% BMCR			
a	Maximum continuous rating			2690 TPH
b	Pressure at superheater outlet			281kg/cm ² (abs)
c	Temperature at superheater outlet			603 °C
d	Temperature at reheater outlet			603 °C
e	Exit Flue gas Temp. at chimney inlet			Later
f	Efficiency based on performance coal at TG rating			Later
10.01.02	Description/Quantity/S pec. (For Set of SG)			

4	Seal Air Fan	02	Nos.	Seal Air Fans: 2x100% Common for all Pulverisers
g	Coal and Oil Burners with HEA igniters		Lot	
h	Draft plant including:			
1	ID fans axial type with drive motor and accessories.	02	Nos.	2x60% Variable Pitch Axial fans with drive motor.
2	FD fan axial type with drive motor and accessories.	02	Nos.	2x60% Variable Pitch Axial fans with drive motor.
i	ESP & accessories with control system		Lot	Inlet dust burden - later Outlet dust burden - 50 mg/Nm ³ (Worst Coal firing and one field in ESP pass out of operation) & 30 mg/Nm ³ (Worst Coal firing & all fields in service).
j	Passenger cum goods elevators with all controls for Steam Generator	02	Nos.	Capacity: 1 No. 3000 kg and 1 No. 1088 kg.
k	ESP Control Room Elevator	01	Nos.	Capacity: 8 persons
l	Ducting, dampers, expansion joints etc.	01	Lot	
m	Refractory, insulation and cladding		Lot	
n	FSSS with SADC system		Lot	
o	HFO and LDO Pressurization System with heaters, tracing steam network, condensate flash tank and other accessories including interconnection.		Lot	

p	Valves i.e. Main steam stop valves, Safety valves, Aux. PRDS valves, SH/RH attemperator valves, drain, vent root valves etc.		Lot	
q	Furnace Maintenance Platform		Lot	
r	Hoists for material handling		Lot	
s	Miscellaneous			
1	Spares		Lot	
2	Maintenance Tools & Tackles		Lot	
u	Selective Catalytic Reduction System	01	Lot	
v	Flue Gas Desulphurization System	01	Lot	Limestone Handling system and Gypsum handling system has been considered in Stage I (2x600 MW) – FGD System

10.02.00		TURBINE, GENERATOR, EXCITER AND AUXILIARIES			
10.02.01	a	Turbine, Generator, Exciter and Auxiliaries	01	Set	EMCR power output 800 MW (In case excitation is other than brushless type, the EMCR output at generator terminal shall be 800 MW plus excitation power requirement at EMC)

	b	Turbine Throttle Steam Pressure			270 kg/cm ² (abs)
	c	Turbine MS & HRH Temperature			600deg C/600 deg C
	d	Final feed water temperature at 100 % TMCR heat rate (HR) & at EMCR condition.			302.5 (+/-)2.5 deg C
	e	Condenser pressure			77 mm Hg abs
10.02.02		Boiler feed pump with booster pumps couplings, drives and accessories			
	a	Turbine Driven Boiler Feed Pumps	02	Nos.	2x50% Capacity
10.02.03		Motor Driven Boiler Feed Pumps	01	Nos.	(1x30%) capacity MDBFP is kept for future provision
10.02.04		Condensate Extraction Pump	03	Nos.	3x50% capacity
10.02.05		HP/LP Bypass System	01	Lot	Capacity of the HP/LP bypass system shall be 65% of BMCR steam flow.
10.02.06		Condenser Air Evacuation Pump	02	Nos.	2x100% capacity for holding operation.
10.02.07		Deaerator	01	Nos.	Storage Tank capacity of 6 minutes of BMCR Flow between normal operating level and low low level.

10.02.08		Regenerative Feed Heating System (HP & LP heaters)	01	Lot	Number of HP&LP heaters shall be based on optimization of feed heating cycle. Minimum three(3) LPHs and minimum three (03) HPHs.
10.02.09		EOT Crane for BFP	01	Nos.	The capacity of crane shall be 25 Ton or 10% over and above the heaviest component/equipment (including lifting beam and slings etc as applicable) to be handled in the BFP area during erection and maintenance, whichever is higher.
10.02.10		Central lube oil purification system.	01	Lot	Clean and dirty oil tank capacity 1.5 times the capacity of MOT. Purifying capacity same as unit turbine oil purifier.
10.02.11		Turbine hall EOT Crane.	01	Nos.	One number of electrically operated overhead travelling cranes with associated auxiliaries, along with electrical equipment, control & instrumentation as required and specified shall be provided in the turbine hall for erection and maintenance of turbo-generators and their auxiliaries, The Crane shall be capable of lifting at least 105% of the weight of single heaviest component/equipment/HP and IP turbine assembly (except generator stator),

					including lifting beam and slings etc. (as applicable) to be handled in TG hall for erection as well as maintenance of the equipment provided in AB bay. The auxiliary hook capacity shall not be less than 20 Ton. The generator stator shall be handled by the bidder by separate portal cranes/strand jack arrangement.
10.02.12		ELEVATORS			
	a	Typical conventional type passenger elevator having a capacity of 13 persons (884 kg.) for TG Building along with VVVF control	01	Nos.	
10.03.00		PIPING			
	1	Power Cycle Piping including pipes, valves, fittings, expansion joints, Hanger/supports along with necessary Aux. Structure, thermal insulation, spares, flash tanks etc. for main steam, hot reheat, cold reheat, HP/LP Bypass,		Lot	

		condensate, extraction, Aux. Steam, feed water, Spray to SHA and RHA, Spray to aux. PRDS and HP Bypass, heater drains & vents, safety valve exhaust and steam drains, vents etc. along with chemical dosing system.			
	2	Station piping with valves, fittings etc.		Lot	

10.04.00		COAL HANDLING AND COAL TRANSPORTATION SYSTEM			
10.04.01		CONVEYORS AND ACCESSORIES			
	a	Belting	4100	Mtr.	Belt Rating: 1400mm wide synthetic, cover thick 5/2 mm, av. Belt strength 2000/5 FR Grade
			3700	Mtr.	Belt Rating: 1400mm wide synthetic, cover thick 5/2 mm, av. Belt strength 1600/4 FR Grade
			6000	Mtr.	Belt Rating: 1400mm wide synthetic, cover thick 5/2 mm, av. Belt strength 800/4 FR Grade
	b	Carrying Idlers (Including SAC)	11800	Nos.	35 deg. Trough., 3 roll, 152 mm dia 4 mm thick, 2 deg. Tilt
	c	Impact Idlers	470	Nos.	35 deg. Trough., 3 roll, 152 mm dia 4 mm thick, 2 deg. Tilt

					along with rubber discs
	d	Return Idlers(including SAR)	4700	Nos.	Double roll 10" trough 152 mm dia, 4 mm shell thick
	e	Short support	900	Te	a) MS Fabricated
			50	Te	b) Chute work 20 mm Thk TISCAL
					c)
			250	Mtr.	d) 90 lb/yd rail for each Tripper
			600	Mtr.	e) 105 lb/yd rail for stacker reclaimer
	f	Pulleys			
	i)	Drive Pulleys	28	Nos.	M.S. Fabricated, 1600 mm face width, dia 800 mm dia
	ii)	Other pulleys, (Tail, snub, tripper, bend & take-up)	130	Nos.	M.S. fabricated, 1600 mm av. Dia 630 mm
	g	Drive Motors for Conveyor system			
	i)	HT Motors	11	Nos.	
	ii)	LT motors	17	Nos.	
	h	Reduction Gears	28	Nos.	Helical type with integral hold backs for drives in SL. No. (g) above
	i	High speed coupling	Scoop-11	Nos.	Fluid couplings for drives in sl.no. (g) above
			Traction-17	Nos.	Fluid couplings for drives in sl.no. (g) above
	j	Low speed coupling	28	Nos.	Full geared type for drives in Sl No. (g) above
	k	Brakes	19	Nos.	Electro-hydraulic thruster

					type for drives in SI.No.(g)
	l	Belt cleaners			
	i)	Internal	28	Nos.	V-plough type
	ii)	External	62	Nos.	Double bladed spring loaded segmented Type
	m	Flap Gates	32	Nos.	Motorized, M.S. fabricated
	n	Rack & Pinion gates	06	Nos.	MS fabricated, motorized
	o	Rod Gates	06	Nos.	Manually operated, MS fabricated
	p	Safety switches	Lot		Pull cord, belt sway, zero speed (Typical)
	q	Sump pumps	10	Nos.	50 m ³ /hr 30 MWC, vertical pump
	r	Belt scales	04	Nos.	Electronic type for continuous weighing for 1400 TPH
	s	In Line Magnetic Separator	04	Nos.	Inline type, 1000 gauss (for 1400 TPH Conveyor)
	t	Suspended Magnets	04	Nos.	1000 gauss (for 1400 TPH Conveyor)
	u	Metal Detector	04	Nos.	For 1400 TPH Conveyor
	v	Coal Sampler Unit	02	Nos.	For Raw Coal (-)250mm (and for crushed coal (-) 20 mm
	w	Travelling Trippers	02	Nos.	For 1400 TPH (rated capacity)
	x	Monorails & hoists		Lot	Electrical operated hoists, Manual hoists and Chain Pulley Block
	y	Coal crusher with complete drive unit	04	Nos.	770 TPH ring granulators
	z	Vibrating Grizzly screen with all accessories	04	Nos.	770TPH
	Aa	Vibro Feeders	02	Nos.	50T

	bb.	Vulcanizing Machine	01	Nos.	
	cc.	Passenger cum goods Elevator	02	Nos.	1 T (Conventional type)
	dd.	Stacker-cum-Reclaimer machine	01	Nos.	Bucket wheel type, boom length 41 m, 1750 TPH (Reclaim)
	ee.	Dust Suppression system		Lot	Dry Fog and Plain water Dust Suppression
	ff.	Vent. System and Package AC		Lot	Typical
	gg.	Service water system, Potable Water System and Cooling Water System		Lot	Typical
	hh.	Mandatory spares		Lot	Typical
	ii.	Special tools & tackles		Lot	Typical
	jj.	Vibration Monitoring System	04	Nos.	For Crusher house
	kk.	Side discharge wagon tippler with side arm charger along with shed	02	Nos.	25 trips per hour
	ll	Apron Feeder with VVF drive unit	02	Nos.	1400 TPH
	mm	Dozers	02	Nos.	300HP
	nn.	CHP Electrical and Controls		Lot	
	oo.	Online Coal analyzer	02	Nos.	
10.04.02		Coal Transportation System			
	a	Locomotives	02		WDG-3A

	b	Track	05	Km	
	c	Signaling and Telecom		Lot	Typical
	d	Locomotive Shed	01	Nos	Typical
	e	In-motion weigh bridge	01	Nos.	Pitless type
	F	Rail Track at Srirampur end	04	KM	

10.05.00
FUEL OIL UNLOADING SYSTEM

	a	HFO storage tanks complete with suction heater, floor coil heater, insulation, cladding, accessories, instruments etc.	nil	Nos.	
	b	LDO storage tanks complete with all instruments and accessories	02	Nos.	MS, fixed roof type, 1000 Cu M capacity

10.06.00
ASH HANDLING SYSTEM

A		BOTTOM ASH HANDLING SYSTEM			
		ALT-JET PUMP SYSTEM			
	a)	Water impounded hoppers complete with six (6) nos. hydraulically operated gates, refractory, cooling arrangement, stainless steel trough etc., along with supporting steel structure and accessories.	01	Nos.	780 CU.M
	b)	Air oil converter tank	06	Nos.	MS
	c)	Clinker Grinders with drive motor, fluid coupling gear	06	Nos.	92 TPH

		reducer and accessories			
d)		Jet Pumps	06	Nos.	92 TPH
e)		Bottom ash slurry transportation pipes along with couplings	2000	Mtr.	350NB ID, MS basalt lined
f)		Alloy CI/Basalt lined fittings		Lot	350NB ID
g)		Pneumatic operated jet pump water inlet valve	06	Nos.	350NB
		OR			
		ALT-II - SUBMERGED SCRAPER CONVEYOR SYSTEM			
a)		Dry type bottom ash hopper complete with electric motor operated or hydraulic cylinder operated gates, stainless steel seal trough, refractory lining etc., along with supporting steel structure, platforms, staircases etc.	01	Nos.	500CU.M
b)		Submerged scraper chain conveyor with hydraulic drive	04	Nos.	41 TPH
c)		Clinker grinder complete with drive motor, fluid coupling, gear reducer and accessories.	04	Nos.	41 TPH
d)		Horizontal bottom ash slurry transportation pumps complete with drive and accessories	03	Nos.	355 M ³ /hr, 25 MWC, 75KW
e)		Bottom ash slurry pipes along with coupling	2000	Mtr.	300 NB MS basalt lined
f)		Vertical drain pumps along with drive motor	02	Nos.	10 M ³ /hr, 10 MWC
g)		Basalt lined fittings		Lot	300 NB
h)		Pneumatically actuated knife edge gate valve for suction & discharge of BA slurry pumps	06	Nos.	300 NB
i)		Pneumatically operated valve	01	Nos.	150NB

		for BA sump make up			
B		BOTTOM ASH HOPPER WATER OVERFLOW TREATMENT SYSTEM			
	a)	Settling tank-Mild steel 10 mm thk along with supporting steel structure	01	Nos.	20 M dia
	b)	Surge tank along with supporting steel structure	01	Nos.	15 M dia
	c)	Sludge pump with drive	02	Nos.	50 M ³ /hr, 30 MWC
	d)	BA overflow pumps with fluid coupling & drive Motor along with pipe, fitting etc.	02	Nos.	725 M ³ /hr, 30 MWC, 110 KW
C		ECONOMISER SYSTEM			
	a)	Chute isolation valves	07	Nos.	300NB
	b)	Expansion joints - Water seal type	07	Nos.	
	c)	Flushing apparatus	07	Nos.	2.5 TPH
	d)	Economizer slurry line MS 9.5mm thick	300	Mtr.	200 NB
	e)	Trench Liner		Lot	CI
D		APH System			
	a)	Chute isolation valves	07	Nos.	300 NB
	b)	Expansion joints - Water seal type	07	Nos.	
	c)	Flushing apparatus	07	Nos.	2.5 TPH
	d)	APH slurry line MS 9.5mm thick	300	Mtr.	500NB
	e)	Trench Liner		Lot	CI
E		ASH WATER SYSTEM			
	a)	Bottom Ash HP Water Pumps with Drive Motor & Accessories	02	Nos.	760M ³ /hr, 85 MWC, 320KW
	b)	Bottom Ash LP water pumps	02	Nos.	940 M ³ /hr, 40 MWC, 190

		with Drive Motor and accessories.			KW
c)		Fly Ash HP Water Pumps with Drive Motor & Accessories	02	Nos.	320 M ³ /hr, 80 MWC, 150 KW
d)		ECO Water Pumps with Drive Motor & Accessories	02	Nos.	180 M ³ /hr, 140 MWC, 130 KW
e)		seal water pumps along with drive motor and accessories for combined ash slurry pump house	02	Nos.	50 M ³ /hr, 90 MWC, 37 KW
f)		Flushing water pump along with drive motor & accessories	01	Nos.	1520 M ³ /hr, 10 MWC, 75 KW
g)		Wash water pump along with drive motor & accessories	02	Nos.	20 M ³ /hr, 25 MWC, 5 KW
h)		Fly ash conditioner booster water pump along with drive motor & accessories	002	Nos.	45 M ³ /hr, 85 MWC, 20 KW
i)		Flushing water pump for HCSD lines along with drive motor & accessories	01	Nos.	1400 M ³ /hr, 20 MWC, 110 KW
j)		Piping	01	Lot	
k)		Water & air piping		Lot	MS
l)		Valves		Lot	
m)		Pendant controlled overhead traveling crane for ash water pump house	01	Nos.	5 Tons
F		BA ASH SLURRY DISPOSAL SYSTEM			
a)		BA Slurry duty pumps with Drive Motor, Fluid Coupling for 1 st stage pumps & belt drive for balance stages, Gear Box etc.	02	Nos.	1520 M ³ /hr, 39 MWC, 380 KW, Horizontal, Centrifugal
b)		Vertical sump drainage pumps	02	Nos.	80 M ³ /hr, 20 MWC, 20 KW
c)		Slurry disposal pipe lines with Basalt lined bends, couplings	12	KM	500 NB
d)		Suction valve-pneumatic	02	Nos.	500 NB, Knife gate type

		operated			
	e)	Discharge valve -pneumatic operated	02	Nos.	500 NB, Knife gate type
	f)	Sump Isolation valve	02	Nos.	600 NB
	g)	Sump liner	Lot		CI
	h)	Dyke end valve	06	Nos.	500 NB, Plate Type
	i)	Pendant controlled overhead traveling crane	01	Nos.	7.5 Tonnes
	j)	Dewatering Bin	03	Nos.	800 Ton
G		FLY ASH HANDLING SYSTEM			
		ALT-1 - VACUUM SYSTEM			
	a)	Chute Isolation Valves-CI	118	Nos.	300 NB
	b)	Material handling valve-pneumatic operated-alloy CI	118	Nos.	300 NB
	c)	Segregating valve-pneumatic operated, alloy CI	84	Nos.	250 NB
	d)	Extraction pipe as per IS:1536/BS1211 Class D with sleeve couplings and fittings.	1500	Mtr.	250 NB
	e)	Liquid seal ring vacuum pump with drive and accessories	12	Nos.	4500 M ³ /hr, 16" Hg, 110 KW
	f)	Instrument air compressor with drive and accessories	04	Nos.	1200 M ³ /hr., 8 Kg/cm ² 150 KW, Horizontal, reciprocating
	g)	Air drying plant with accessories.	04	Nos.	1200 M ³ /hr., Blower regenerated type.
	h)	Buffer hopper fluidizing air blowers along with drive and accessories	02	Nos.	450 M ³ /hr, 6 MWC Twin lobe type
	i)	Air receiver for instrument air	04	Nos.	2.5 M ³
		OR			
H		ALT-2 - PRESSURE EXTRACTION SYSTEM			
	i)	Chute isolation valves-alloy CI	118	Nos.	300 NB
	ii)	Material handling valve -	118	Nos.	300 NB

		pneumatic operated (dome/cone/plate/butterfly)			
iii)		Ash discharge valve - pneumatic operated	118	Nos.	300 NB
iv)		Segregating valve - pneumatic operated	84	Nos.	250 NB
v)		Air lock/pump tanks MS 10 mm thk shell	118	Nos.	0.75 M ³
vi)		Extraction pipe, MS	1500	Mtr.	200 NB
vii)		Extraction air compressors alongwith drives and accessories	04	Nos.	3500 M ³ /hr, 2 Kg/cm ² 300 KW
viii)		Air Dryer - refrigerant type	04	Nos.	3500 M ³ /hr
ix)		IA compressor	03	Nos.	1200 M ³ /hr., 8Kg/cm ² 150 KW
x)		Air drying plant with accessories.	03	Nos.	1200 M ³ /hr., Blower regenerated type
xi)		Expansion joints	118	Nos.	Metallic bellows -SS
xii)		Air receiver			
		For instrument air	04	Nos.	2.5 M ³
		For extraction	06	Nos.	1 M ³
xiv)		Pendant controlled overhead traveling crane for compressor house	01	Nos.	7.5 T
I		DRY FLY ASH TRANSPORTATION SYSTEM			
i)		Buffer hopper with alloy CI liners, supporting structure, platform etc.	12	Nos.	45 M ³
ii)		Target Box	12	Nos.	
iii)		Bag filter with pulsing arrangement	12	Nos.	4500 M ³ /hr
iv)		Pressure/vacuum relief valve	12	Nos.	
v)		Transport air compressor for first stage with drive and accessories	04	Nos.	6000 M ³ /hr, 4.0 Kg/cm ² 500 KW
vi)		Transport Air dryer -	04	Nos.	6000 M ³ /hr

		refrigerant type for first stage			
vii)	Air lock/pump tank	28	Nos.	1.5 M ³	
viii)	Rotary Slide gate with pneumatic cylinder	68	Nos.	300 NB	
ix)	Equalizer valve with pneumatic cylinder	68	Nos.	100 NB	
x)	Chute isolation valve (manual)	34	Nos.	300 NB, CI	
xi)	Chute isolation valve for silo	11	Nos.	300 NB, CI	
xii)	Transport air receiver MS 10 mm thk shell	04	Nos.	2 M ³	
xiii)	Structural steel silo complete with staircase, structure, platforms etc.	03	Nos.	2000 Te	
xiv)	Silo aeration blower along with drive and accessories for main silo	03	Nos.	500 M ³ /hr, 0.5 KG/cm ² 30 KW	
xv)	Bag filter with pulsing arrangement	05	Nos.	6000 M ³ /hr	
xvi)	Silo vent fan	05	Nos.	25000 M ³ /hr, 30 MMWC	
xvii)	Dust conditioner with drive	02	Nos.	100 TPH, 55 KW	
xviii)	Rotary feeder with variable frequency drive	02	Nos.	100 TPH	
xxiii)	Telescopic chute with motorized winch	2	Nos.	100 TPH	
xxiv)	Sump drain pump for silo area along with drive motor	02	Nos.	80 M ³ /hr, 50 MWC, 30 KW	
xxv)	Semi EOT crane for silo utility building	01	Nos.	5 Tonnes	
xxvi)	Transport air line with fittings	05.7	KM	350 NB, CI, BS:1211, Class-D	
xviii)	Pneumatic operated knife gate valve for line isolation	20	Nos.	300 NB, CI	
xxix)	Semi EOT crane for compressor house for Stage-I	01	Nos.	10 Tonnes	
xxx)	Semi EOT crane for compressor house for Stage-II	01	Nos.	10 Tonnes	
xxxi)	Dumpers/Trucks	05	Nos	15 Tonnes	

	xxxii)	Loader for ash loading to trucks	01	Nos	
J		HCSD System			
	i)	HCSD Pumps complete with drives VVVF Controls & other accessories	04	Nos.	210 M3/hr., 60 bar, 580 KW
	ii)	Seamless MS pipe-12.7 mm thick	10	KM.	200 NB
	iii)	Agitator tank for HCSD pumps	04	Nos.	110 M3, 75 kw
	iv)	HCSD booster pump	04	Nos.	220 M3/hr, 2.5 bar, 75 kw
	v)	Structural steel silo complete with staircase, structure, platforms etc.for HCSD system	04	Nos.	625 Te
	vi)	Silo Aeration Blower	04	Nos.	120 M3/hr, 0.5 Kg/cm ² 11 kw
	vii)	Heater for Blower	04	Nos.	8 KW
	viii)	Sump Drainage pump	02	Nos.	50 M3/hr, 20 MWC, 11 KW
	ix)	Rotary feeder	08		160 TPH
	x)	Telescopic Chute	04		100 TPH
	xi)	Chute isolation Valve	16		300 NB, CI
	xii)	Pneumatic operated Knife gate valve	48		300 NB, CI
K		INSTRUMENTATION		Lot	

10.07.00	WATER SYSTEM			
1	RAW WATER SYSTEM			
	a. Raw Water Pumps (PT) in plant (near Reservoir)	03	Nos.	Each of 1000 Cu. m/hr& 30 mWC (2W+1S) Motor rating: 125 KW
	b. Raw Water Pumps (AHP) in plant (near Reservoir)	02	Nos.	Each of 700 Cu. m/hr& 45 mWC Motor rating: 120 KW
	c. Discharge Butterfly Valves	03	Nos.	400 mm dia- Electric Motor actuator
	d. Discharge Butterfly Valves	02	Nos.	350 mm dia- Electric Motor actuator
	e. Recirculation Butter Valves	01	Nos.	250 mm NB dia- Electric Motor actuator
		01	Nos.	200 mm NB dia- Electric Motor actuator
	f. Gantry Crane for Raw water pump house	01	Nos.	10 Tonne Capacity
2	COOLING WATER SYSTEM			
	a. CW pumps & drives	03	Nos.	Capacity: 45000 M ³ /hr& 29.0 MWC; Motor rating : 4500 KW
	b. Butterfly valves	03	Nos.	Electro hydraulically operated; Each of size 2850 NB
	c. Rubber Expansion joints	03	Nos.	Each of 2850 NB
	d. CW discharge pipes	50	Mtr.	MS pipe; 2850 NB & 28 mm thick
	e. CW recirculation pipe line	100	Mtr.	MS pipe; 1600 mm dia& 28 mm thick
	f. Recirculation Valve	01	Nos.	Butterfly Valve 1600 NB- Motor operated
	g. Gantry Crane	01	Nos.	60 tonne capacity Main hoist & 5 T monorail hoist
	h. Cooling Towers (Main CW system)	01	Nos.	Induced Draft Cooling Towers; Capacity of 90, 000 M ³ /hr; Range of 10° C inlet WBT- 27.7deg C, approach of 5.0°C Power consumption: 3200 KW
	i. Monorail hoists	02	Nos.	02 Ton
3	EQUIPMENT COOLING WATER SYSTEM			
	a. Aux. Cooling Water booster pumps	03	Nos.	Horiz. Centri; Each of 3500 M ³ /hr& 20 MWC Motor rating: 260 KW

	b.	DM cooling water pumps (TG)	03	Nos.	Horiz, Centri; Each of 2800 M ³ /hr & 48 MWC Motor rating: 500 KW
	c.	DM cooling water pumps (SG)	02	Nos.	Horiz, Centri; Each of 1200 M ³ /hr & 70 MWC Motor rating: 320 KW
	d.	Plate type heat exchangers (TG)	03	Nos.	3x 50% for unit. (With SS plates)
	e.	Plate type heat exchangers (SG)	02	Nos.	2x 100% for unit. (With SS plates)
	f.	Chemical storage equipment and dosing system (SG/TG)	02	Set	
4		MISCELLANEOUS PUMPS			
	a.	DM water transfer pumps	01	Nos.	Horiz, Centri; 100 M ³ /hr & 80 MWC Motor rating: 25 KW
	b.	Condensate transfer pumps	02	Nos.	Horiz, Centri; 360 M ³ /hr & 70 MWC Motor rating: 100 KW
	c.	Service water pumps	02	Nos.	Horiz, Centri; 150 M ³ /hr & 110 MWC Motor rating: 90 KW
	d.	CW make-up pumps	03	Nos.	Hor, Centf 1000 M ³ /hr & 20 MWC Motor rating: 80 KW
	e.	Sump pumps	03	Nos.	Horiz, Centri; 40 M ³ /hr & 20 MWC
	f.	Drainage pumps	03	Nos.	Horiz, Centri; 40 M ³ /hr & 20 MWC
5		CHEMICAL TREATMENT PROGRAMME			
	a.	Chemical treatment programme		Lot	
	b.	Acid storage tanks	01	Nos.	100 Cu.M Capacity
	c.	Acid unloading, dosing pumps, measuring tanks etc.		Lot	
6		WATER PRE TREATMENT PLANT			
	a.	Clarifiers (CW system)	01	Nos.	Reactor type; Capacity 2000 M ³ /hr
	b.	Clarified water storage tank	01	Nos.	RCC 500 M ³
	c.	Service water storage tank	01	Nos.	RCC 250 M ³
	d.	Filtered water pumps for DM plant.	01	Nos.	Vert. Centr. Capacity 100 M ³ /hr & 60 MWC Motor rating: 25 KW
	e.	Accessories such as stilling chamber, sludge disposal sys, chemical dosing systems, piping, hoists, weighing scale, controls etc		Lot	
7		DEMINERALISATION PLANT			
	a.	DM systems	01	Stream	Stream of capacity 90 M ³ /hr consisting of AC filters, Cation exchangers, degasser systems, anion exchangers, mixed bed exchangers

	b.	DM water storage tank	01	Nos.	Carbon steel, vertical, cylindrical type of capacity 16.0 M(Dia) X 10.5 M (Ht)
8		CONDENSATE POLISHING PLANT			
	a.	Condensate polisher vessels	01	Set	Set consisting of 3 x 33% capacity vessel for unit
	b.	Complete regeneration system including resins, acid/alkali storage/day/measuring tanks, dosing pumps, interconnecting piping, instrumentation, panels neutralizing pit, etc.		Lot	-----
9		CHLORINATION PLANT			
	a.	Chlorination plant with all accessories (CW system)	02	Set	Each set of Chlorinator & evaporators of capacity 150 Kg/hr piping, instrumentation, panels etc.
	b.	Chlorine leak absorption system for Chlorination plant (CW System)		Lot	
10		EFFLUENT TREATMENT SYSTEM (including civil works)			
	a.	Coag settling ponds	02	Nos.	Each of 40 M x 8 M x 3 M (deep)
	b.	Sump pumps for settling pond	02	Nos.	Each of 200 M ³ /hr & 15 MWC Motor rating: 15 KW
	c.	LETP clarifier	01	Nos.	Each of 250 M ³ /hr
	d.	Treated water pump	02	Nos.	Each of 200 M ³ /hr & 10 MWC Motor rating: 10 KW
	e.	Final disposal piping	3000	Mtr.	300 mm MS pipe
	f.	Final disposal pumps	02	Nos.	Each of 150 M ³ /hr & 60 MWC Motor rating: 40 KW
	g.	Interconnection piping, valves, monitoring instrumentation, control panels etc.		Lot	

11	RO SYSTEM FOR ZERO DISCHARGE (PEREMATE 800 CUM/HR)			
	MECHANICAL SCOPE OF SUPPLY			
1.	STILLING CHAMBER- RCC	01	Nos.	2.5 M (L) X 2.5 M (W) X 4.5 M (HT)
2.	HIGH RATE SOLID CONTACT CLARIFIER- RCC	01	Nos.	22 M (DIA.) X 4.5 M (HT.)
3.	SLUDGE SUMP- RCC	01	Nos.	6.0 M (L) X 6.0 M (W) X 3.0 M (HT)
4.	SLUDGE PUMP- CI	02. (1W+1S)	Nos.	60 M ³ /HR @ 40 MWC, 10 KW
5.	LIME DOSING TANK- RCC	02	Nos.	2.5 M (L) X 2.5 M (W) X 3.0 M (HT)
6.	LIME DOSING PUMP- CI	02 (1W+1S)	Nos.	40 M ³ /HR @ 20 MWC, 3KW
7.	AGITATOR FOR LIME TANK- CI	01	Nos.	4.0 KW
8.	ALUM DOSING TANK- RCC	01	Nos.	2.0M X 2.0M X 1.5M (HT.)
9.	ALUM DOSING PUMP- PP	02 (1W+1S)	Nos.	500 LPH @ 20 MWC, 1KW
10.	AGITATOR FOR ALUM TANK- CSRL	01	Nos.	4.0 KW
11.	POLYELECTROLYTE DOSING TANK- FRP	01	Nos.	2.0M (DIA.) X 2.5M (HT.)
12.	POLYELECTROLYTE DOSING PUMP- PP	02 (1W+1S)	Nos.	500 LPH @ 20 MWC, 2KW
13.	AGITATOR FOR POLYELECTROLYTE TANK- CSRL	01	Nos.	4.0KW
14.	CLARIFIED WATER STORAGE TANK- RCC	01	Nos.	12.0 M (L) X 10 M (W) X 5.0 M (HT)
15.	CLARIFIED WATER PUMP- CI	03 (2W+1S)	Nos.	350 M ³ /HR @ 50 MWC, 60KW
16.	HORIZONTAL DUAL MEDIA FILTER- MSRL	03 (2W+1S)	Nos.	4.0 M (DIA.) X 11.0 M (LOS)
17.	BLOWER FOR THE DMF- CI	02 (1W+1S)	Nos.	1300 M ³ /HR @ 4 MWC, 22KW
18.	OVERHEAD BACKWASH TANK- RCC	01	Nos.	5.0 M (L) X 5.5 M (W) X 3.0 M (HT)

19.		GAS CHLORINATOR	02	Nos.	6KG/HR
20.		BASKET STRAINER- SS	03 (2W+1S)	Nos.	350 CU.M/HR
21.		BACKWASH COLLECTION TANK- RCC	1	Nos.	10 M (L) X 10 M (W) X 4.5 M (HT)
22.		BACKWASH WATER TRANSFER PUMP- CI	03 (2W+1S)	Nos.	100.0 M ³ /HR @ 30 MWC, 10KW
23.		BACK FLUSH PUMP- CI	02 (1W+1S)	Nos.	425.0 M ³ /HR @ 30 MWC, 50KW
24.		ULTRA FILTERS- MSRL	03 (2W+1S)	Set	325 M ³ /HR
25.		NAOH DOSING TANK- MSRL	01	Nos.	1.0 M (DIA.) X 1.5M (HT)
26.		NAOH DOSING PUMP- PP	02 (1W + 1S)	Nos.	650 LPH @ 20 MWC, 1KW
27.		HCL DOSING TANK- FRP	01	Nos.	1.0 M (DIA.) X 2.5M (HT)
28.		HCL DOSING PUMP- PP	02 (1W + 1S)	Nos.	650 LPH @ 20 MWC, 1KW
29.		UF PERMEATE STORAGE TANK- MSEP	01	Nos.	15.0 M (L) X 15.0 M (W) X 4.5 M (HT)
30.		UF CIP TANK- FRP	01	Nos.	3.0M(DIA.) X 3.2 M(HT)
31.		BWRO FEED PUMP FOR CATRIDGE FILTER- SS316	03 (2W+1S)	Nos.	250.0 M ³ /HR @ 30 MWC, 30KW
32.		CARTRIDGE FILTER-SS 316	03	Nos.	300.0 M ³ /HR
33.		HIGH PRESSURE PUMP FOR RO - SS316	03	Nos.	300.0 M ³ /HR @150MWC, 160KW
34.		RO MEMBRANE UNIT/TRAINS	03	Nos.	250 M ³ /HR
35.		Capacity of each RO train/unit shall be 250 cu.m/hr of permeate flow with the following design criteria:			
	a	Inlet TDS			: 1800 PPM

	b	Outlet TDS			: 50 PPM
	c	Plant Availability			: 98%
	d	Guaranteed Recovery			: Minimum 80% without membrane replacement for three years operation.
36.		DEGASSER TOWER- MSRL	01	Nos.	3.5 M (DIA.) X 3.5 M (HT)
37.		DEGASSER BLOWER- CI	02 (1W+1S)	Nos.	9000 NM3/HR @ 100 MMWC
38.		DEGASSED WATER STORAGE TANK- RCC	01	Nos.	10.0 M (L) X 8.0 M (W) X 4.0 M (HT)
39.		RO PERMEATE WATER STORAGE TANK- MSEP	01	Nos.	9.5 M (DIA.) X 10.0 M (HT)
40.		CIP PUMP- SS316	02 (1W+1S)	Nos.	300 M3/HR @ 35 MWC, 50KW
41.		ANTISCALANT DOSING TANK- FRP	02	Nos.	1000 LTRS
42.		ANTISCALANT DOSING PUMPS- PP	02 (1W + 1S)	Nos.	60 LPH@30MWC, 2KW
43.		SBS DOSING TANK- FRP	01	Nos.	1.0 M (DIA.) X 1.5M (HT)
44.		SBS DOSING PUMPS- PP	02 (1W + 1S)	Nos.	25 LPH@15MWC, 1KW
45.		ACID DOSING TANK- MSRL	01	Nos.	40 M3
46.		ACID DOSING PUMPS- PP	02 (1W + 1S)	Nos.	1600 LPH, 30 MWC, 1KW
47.		BULK ACID STORAGE TANK- MSRL	02	Nos.	3.0MX10.0(LOS) M
48.		BULK ALKALI STORAGE TANK- MSRL	02	Nos.	2.0MX3.1 (LOS)M
49.		BULK PE TANK- MSRL	02 (1W + 1S)	Nos.	3.00MX6.00M
50.		PERMEATE DM FEED TRANSFER PUMP- SS	03 (2W + 1S)	Nos.	200 M3/HR @ 25 MWC, 20KW
51.		PERMEATE CW MAKEUP PUMP- SS	02 (1W + 1S)	Nos.	250 M3/HR @ 25 MWC, 20KW
52.		PIPE FROM PERMEATE WATER TANK TO FILTER	700	Mtr.	250 NB

	WATER SUMP - MSRL			
53.	PIPE FROM PERMEATE WATER TANK TO CW INLET CHANNEL - MSRL	400	Mtr.	250 NB
54.	REJECT TANK- MSEP	01	Nos.	3.0 M (DIA.) X 4.5M (HT)
55.	REJECT DISPOSAL PUMP- SS	03 (2W + 1S)	Nos.	50 M3/HR @ 50 MWC, 10KW
56.	REJECT DISPOSAL PIPE- MSRL	800	Mtr.	100NB
57.	INTERCONNECTING PIPING AND VALVES	01	Lot	FOR RO SYSTEM
	Note: Associated Civil, Electrical & C&I quantity may be considered on lump sum basis.			

10.08.00	FIRE DETECTION & PROTECTION SYSTEM			
1	Electric motor driven booster spray pumps along with drives and other accessories.	01	Nos.	410 M3/hr& 50 MWC Disch. Pr.
2	Diesel engine driven booster spray pumps along with drives and other accessories	01	Nos.	410 M3/hr& 50 MWC Disch. Pr.
3	Motor driven hydrant Booster pumps with drives and other accessories for hydrant system	01	Nos.	171 m3/hr& 45 MWC Disch. Pr.
4	Diesel engine driven hydrant booster pumps with drives and other accessories for hydrant system	01	Nos.	171 m3/hr& 45 MWC Disch. Pr.
5	Hydrant & spray system mains piping, indoor & outdoor hydrants, hoses, hose boxes, couplings etc.		Lot	

6		HVW Spray system for various equipments (Transformers, Oil equipments, Boiler Burner Fronts, etc.)		Lot	-----
7		MVW Spray system for coal handling plant (Coal conveyors, TPs & Stacker - Reclaimer Machines)		Lot	-----
8		MVW Spray system for cable galleries		Lot	-----
9		MVW Spray system for fuel oil tanks, Fuel oil pump houses, DG set oil tanks, etc.	01	Lot	-----
10		Inert Gas Extinguishing system for Control/Control equipment rooms		Lot	-----
11		Automatic Direct/indirect low pressure fire suppression system employing linear heat detection system to protect electrical panels of MCC of Stacker-Reclaimer.		Lot	-----
12		Analogue addressable fire detection and alarm system including Fire alarm panels, PLC panels, Remote I/O panels, cables, etc.		Lot	-----
13		Fire Extinguishers (Portable & mobile type)		Lot	-----
14		Monorail electric hoist for Fire water booster pump house	01	Nos.	5 Tonne
15		Fire Tender	02	Nos	

10.09.00		COMPRESSED AIR SYSTEM			
	a	Air compressors with control panels, instrumentation & all accessories like piping, valves etc	05	Nos.	Screw/centrifugal type compressors;each of capacity70 Nm ³ /min &disch. Pressure of 8 kg/cm ² (g).
	b	ADP with panels, instrumentation, all accessories like piping, valves & electronic dew point meters	03	Set	Each of capacity 70Nm ³ /min & design outlet dew point of (-) 40°C
	c	Air receivers	05	Nos.	Nominal Capacity : 10 m ³
	d	EOT crane	01	Nos.	8 Tonne

10.10.00		AIR CONDITIONING SYSTEM			
10.10.01		Air Conditioning plant for Main Power House			
	i	A/C Plant for Main plant building (CCR, CER, UPS room, SWAS, Static excitation control room etc.)	01	Lot	Central, chilled water type A/C plant mainly comprising of : 3 Nos. 100 Ton screw type chillers.
	ii	Condenser cooling water pumps	03	Nos.	90 m ³ /hr at 35 MWC
	iii	Chilled water pumps	03	Nos.	70 m ³ /hr at 45 MWC
	iv	AHUs (VFD driven) for control tower area, SWAS, ESP& ESP control room		Lot	-----
	v	Cooling towers with accessories, etc.	03	Nos.	100 m ³ /hr

10.10.02	Air Conditioning System for ESP Control Room			
	i	A/C Plant for ESP Control Room	Lot	Air Cooled (D-X) unit of capacity 50 TR (1W+1s/b) for unit.
10.10.03	Air conditioning stem for water System Control Room			
	i	A/C Plant for water system control building	Lot	Air Cooled (D-X) unit of capacity 25 TR (1W+1s/b)

10.11.00	VENTILATION SYSTEM			
	a.	Modular Air Washer (sheet metal construction) for TG building	04	Nos. 250,000m ³ /hr capacity
	b.	Air washers (sheet metal construction) for boiler MCC	02	Nos. 50,000 m ³ /hr capacity.
	c.	DIDW fans for TG area	04	Nos. 250,000 m ³ /hr cap.at 60 mmWC.
	d.	DIDW fans for Boiler MCC	02	Nos. 50,000 m ³ /hr cap.at 60 mmWC.
	e.	Circulating water pumps	02	Nos. 100 m ³ /hr at 30 MWC
	f.	Circulating water pumps	02	Nos. 150 m ³ /hr at 30 MWC
	g.	Accessories such as piping, ducting, grills, dampers, valves, diffusers instrumentation, panels etc for TG building.		Lot -----
	h.	Unitary air filtration units (sheet metal construction) for ESP building	01	Nos. 75,000 m ³ /hr capacity
	i.	DIDW centrifugal fans for ESP building	01	Nos. 75,000 m ³ /hr capacity at 40 mm WC
	j.	Circulating water pumps	01	Nos. 50 m ³ /hr& 30 MWC
	k.	Accessories such as piping, ducting, grills, dampers, valves diffusers, dampers, instrumentation, panels etc for ESP building.		Lot -----

	1.	Ventilation System for Misc. Areas comprising of supply & exhaust air fans, roof extractor fans, gravity dampers, etc.		Lot	-----
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CHAPTER-10C
TECHNICAL DATA AND BILL OF QUANTITIES

10.3.00 **BOQ OF ELECTRICAL SYSTEMS (Option – 1: With Station Transformer)**

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS/ Remarks
10.3.01	Generator Bus duct and Associated Equipment	01	Set	
1.	Isolated phase bus duct			
a.	26,000Amp, main run			
b.	15,000 Amps, Delta run			
c.	2,250 Amps, tap off run			
2.	VT and SP cubicles			
3.	NG equipment and CTs			
4.	Support steel structure			
10.3.02	Power Transformers			
1.	Generator Transformer	04	Nos.	315 MVA, Gen Voltage 400kV/3 Single phases with off ckt. Tap changer
2.	Bus Reactor	01	No.	125 MVAR, 3-Phase, 400 kV
3.	Station Transformer	02	No.	130/65/65 MVA 400kV/11.5/11.5KV with OLTC+/- 10%
4.	Unit transformers	2	No.	63MVA Gen V /11.5 kV with OLTC +/-10%
10.04.00	Auxiliary Transformers			

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS/ Remarks
A	11/3.45kV Class			
1.	Unit auxiliary transformers	2	Nos.	16 MVA
2.	Ash handling transformers	2	Nos.	7.5 MVA
3.	CHP transformers	2	Nos.	10 MVA
4.	FGD Transformers	2	No.	12MVA
10.05.00	L.T. transformers			
1.	Indoor type-11/.415 kV	6	Nos.	2500 kVA
2.	Indoor type-3.3/.415 kV	1	No.	750 KVA
3.	Outdoor type - 11/0.415 kV			
a.	2500 kVA	2	Nos.	
b.	2000 kVA	7	Nos.	
c.	1600 kVA	20	Nos.	
d.	1000 kVA	15	Nos.	
e.	630 kVA	2	Nos.	
10.06.00	Neutral grounding resistor	1	Lot	
10.07.00	H.T. Switchgear (With numerical relays, networking and metering)			
10.07.01	3000 Amp. 50 KA	1	Lot	
1.	Unit Switchgears			
2.	Station Switchgears			
10.07.02	3.3KV, 3000/2000 Amp., 40 KA	1	Lot	
1.	Unit aux. Service Switchgear			
2.	Ash handling Switchgear			

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS/ Remarks
3.	CHP Switchgear			
4.	FGD Switchgear			
10.08.00	L.T. switchgears and non-segregated Phase Bus Ducts with support structure	1	Lot	
10.09.00	11 kV Phase Segregated Bus Ducts with support structure	1	Lot	3350/2500A,
10.10.00	3.3 KV Phase Segregated Bus Ducts with support structure	1	Lot	2750A.
10.11.00	ELECTRICAL EQUIPMENT SUPPLY			
10.11.01	D.C. battery-Ni-Cd/(Lead Acid)			
1.	220V unit batteries 990 AH/(1500AH Lead Acid)	2	Nos.	
2.	220V, 410AH switchyard battery/(625AH Lead Acid)	2	Nos.	
3.	220V, 150AH CHP/AHP battery/(250AH Lead Acid)	4	Nos.	
4.	48V, 390AH NI-Cd PLCC battery (425 AH Lead Acid)	2	Nos.	
5.	110V 40 AH Make up Water (60 AH Lead Acid)	2	Nos.	
10.11.02	Battery chargers (float cum boost)			
1.	Unit Batteries, 220V, 800A	2	Nos.	
2.	Swyd. Batteries, 220V, 100A	2	Nos.	
3.	CHP/AHP 220V, 60A	4	Nos.	
4.	PLCC batteries, 48V, 100A	2	Nos.	
5.	220/110V, 40 AH (Make up Water)	2	Nos.	

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS/ Remarks
10.12.00	Power and Control Cables			
1.	11 kV grade cable	1	Lot	
2.	3.3 KV grade cable	1	Lot	
3.	1.1KV power cables	1	Lot	
4.	1.1KV control cables	1	Lot	
10.13.00	MISC ELECTRICAL			
1.	Diesel generator sets	2	Nos.	2000 KVA, 415 V
2.	Cabling, earthing& lightning Protection system	1	Lot	
3.	Lighting system	1	Lot	
10.14.00	Construction power – Extension of existing stage-I			
1.	1000kVA, 11 kV / 0.415 kV Pocket Substations	2	Sets	
2.	11kV O/H line.	4	Km.	
10.15.00	Roof Top grid connected Solar Photovoltaic System	1	Lot	
10.16.00	Switchyard Equipment:- 400 kV Switchyard 3000A, 50 KA Air Insulated switchyard complete in all respect with one & half ckt breaker scheme shall be complete in all respect including SAS, protection and control.			
10.16.01	Outdoor Equipment like CBs, Isolators, Earth switch, CTs, PTs etc. for following bays.			
1.	Line Bay	0	Nos.	Already Line bay erection is in progress by SCCL.

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS/ Remarks
2.	Generator Bay	1	No.	
3.	Reactor Bay	1	Nos.	As per the mail from SCCL on 12-02-2022.
4.	Station Transformer Bay	2	Nos.	
5.	Bus Section Bay	0	No.	As per the mail from SCCL on 12-02-2022.
6.	Bus VTs	0	Nos.	
10.16.02	Substation Automation System (SAS) of 400 kV System.	1	Lot.	
1.	Panel mounted Bay Control Units (BCUs), Bay Protection Units (BPUs) Line Bays Disturbance Recorder, GPS, Router etc.			
2.	Decentralized Busbar Protection			Separate CU is not required.
3.	Energy Metering System with Energy Meters, Metering Master Station, Meter Reading Instrument, Networking accessories and software.			
4.	Panel mounted BPUs for Generator, GT, Excitation transformers and UT (GRP) with numerical relays and non ABT type energy meters for each UT.			
5.	Standalone DR for Generator			
6.	SAS Main & Standby Network Controller with software			Separate SAS is not considered.
7.	Fiber Optic cable and Communication cable for SCADA.			

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS/ Remarks
8.	Gate ways (OPC Complaint) for interface with main plant DDCMIS.			
9.	Air Conditioned Kiosk with duplicated AC and Illumination system and fire detection system for control and relay panels)			

BOQ OF ELECTRICAL SYSTEMS (Option – 2 : With GCB Scheme)

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS
10.01.00	Generator Bus duct and Associated Equipment	01	Set	
1.	Isolated phase bus duct			
a.	26,000Amp, main run			
b.	15,000 Amps, Delta run			
c.	2,250 Amps, tap off run			
2.	VT and SP cubicles			
3.	NG equipment and CTs			
4.	Support steel structure			
10.02.00	Power Transformers			
1.	Generator Transformer	04	Nos.	315 MVA, Gen Voltage 400kV/3 Single phases with off ckt. Tap changer
2.	Bus Reactor	01	No.	125 MVAR , 3-Phase, 400 kV

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS
3.	Standby Transformer	01	No.	130/65/65 MVA 400kV/11.5/11.5K V with OLTC+/- 10%
4.	Unit transformers	2	No.	63MVA Gen V /11.5 kV with OLTC +/-10%
10.03.00	Generator Circuit Breakers (GCB)	1	Set.	22500 A, 27 kV, 50 KA for 1 Sec.
10.04.00	Auxiliary Transformers			
A	11/3.45kV Class			
1.	Unit auxiliary transformers	2	Nos.	16 MVA
2.	Ash handling transformers	2	Nos.	7.5 MVA
3.	CHP transformers	2	Nos.	10 MVA
4.	FGD Transformers	2	No.	12MVA
10.05.00	L.T. transformers			
1.	Indoor type-11/.415 kV	6	Nos.	2500 kVA
2.	Indoor type-3.3/.415 kV	1	No.	750 KVA
3.	Outdoor type - 11/0.415 kV			
a.	2500 kVA	2	Nos.	
b.	2000 kVA	7	Nos.	
c.	1600 kVA	20	Nos.	
d.	1000 kVA	15	Nos.	
e.	630 kVA	2	Nos.	
10.06.00	Neutral grounding resistor	1	Lot	
10.07.00	H.T. Switchgear (With numerical relays, networking and metering)			

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS
10.07.01	11 KV, 3600/3000 Amp. 50 KA	1	Lot	
1.	Unit Switchgears			
2.	Station Switchgears			
10.07.02	3.3KV, 3000/2000 Amp., 40 KA	1	Lot	
1.	Unit aux. Service Switchgear			
2.	Ash handling Switchgear			
3.	CHP Switchgear			
4.	FGD Switchgear			
10.08.00	L.T. switchgears and non-segregated Phase Bus Ducts with support structure	1	Lot	
10.09.00	11 kV Phase Segregated Bus Ducts with support structure	1	Lot	3350/2500A.
10.10.00	3.3 KV Phase Segregated Bus Ducts with support structure	1	Lot	2750A.
10.11.00	ELECTRICAL EQUIPMENT SUPPLY			
10.11.01	D.C. battery-Ni-Cd/(Lead Acid)			
1.	220V unit batteries 990 AH/(1500AH Lead Acid)	2	Nos.	
2.	220V, 410AH switchyard battery/(625AH Lead Acid)	2	Nos.	
3.	220V, 150AH CHP/AHP battery/(250AH Lead Acid)	4	Nos.	
4.	48V, 390AH NI-Cd PLCC battery (425 AH Lead Acid)	2	Nos.	
5.	110V 40 AH Make up Water (60 AH Lead Acid)	2	Nos.	

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS
10.11.02	Battery chargers (float cum boost)			
1.	Unit Batteries, 220V, 800A	2	Nos.	
2.	Swyd. Batteries, 220V, 100A	2	Nos.	
3.	CHP/AHP 220V, 60A	4	Nos.	
4.	PLCC batteries, 48V, 100A	2	Nos.	
5.	220/110V, 40 AH (Make up Water)	2	Nos.	
10.12.00	Power and Control Cables			
1.	11 kV grade cable	1	Lot	
2.	3.3 KV grade cable	1	Lot	
3.	1.1KV power cables	1	Lot	
4.	1.1KV control cables	1	Lot	
10.13.00	MISC ELECTRICAL			
1.	Diesel generator sets	2	Nos.	2000 KVA, 415 V
2.	Cabling, earthing & lightning Protection system	1	Lot	
3.	Lighting system	1	Lot	
10.14.00	Construction power – Extension of existing stage-I			
1.	1000kVA, 11 kV / 0.415 kV Pocket Substations	2	Sets	
2.	11kV O/H line.	4	Km.	
10.15.00	Roof Top grid connected Solar Photovoltaic System	1	Lot	

S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS
10.16.00	Switchyard Equipment:- 400 kV Switchyard 3000A, 50 KA Air Insulated switchyard complete in all respect with one & half ckt breaker scheme shall be complete in all respect including SAS, protection and control.			
10.16.01	Outdoor Equipment like CBs, Isolators, Earth switch, CTs, PTs etc. for following bays.			
1.	Line Bay	0	Nos.	
2.	Generator Bay	1	No.	
3.	Reactor Bay	1	Nos.	As per the mail from SCCL on 12-02-2022.
4.	Standby Transformer Bay	1	No.	
5.	Bus Section Bay	0	No.	As per the mail from SCCL on 12-02-2022.
6.	Bus VTs	2	Nos.	
10.16.02	Substation Automation System (SAS)of 400 kV System.	1	Lot.	
1.	Panel mounted Bay Control Units (BCUs), Bay Protection Units (BPUs) Line Bays Disturbance Recorder, GPS, Router etc.			
2.	Decentralized Busbar Protection			
3.	Energy Metering System with Energy Meters, Metering Master Station, Meter Reading Instrument, Networking accessories and software.			
4.	Panel mounted BPUs for Generator, GT, Excitation transformers and UT (GRP) with numerical relays and non ABT type energy meters for each UT.			
5.	Standalone DR for Generator			
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S. NO	DESCRIPTION	QTY	UNIT	TECH. PARAMATERS
6.	SAS Main & Standby Network Controller with software			
7.	Fiber Optic cable and Communication cable for SCADA.			
8.	Gate ways (OPC Complaint) for interface with main plant DDCMIS.			
9.	Air Conditioned Kiosk with duplicated AC and Illumination system and fire detection system for control and relay panels)			

CHAPTER 10D
TECHNICAL DATA AND BILL OF QUANTITIES

10.04.00 CONTROL AND INSTRUMENTATION
10.04.00 CONTROL & INSTRUMENTATION
BOQ OF CONTROL AND INSTRUMENTATION SYSTEM (DCS) FOR SCCLTPP Stage-II (1X800MW)

Sl.no.	Area	Item description	Unit	Quantity /Remarks
I	DDCMIS			
1	Control System(s)			
	i	I/O Channel		
		AI Control (4-20 mA)	Nos	1142
		AI Control (4-20 mA) Hart	Nos	0
		AI Control (4-20 mA) Galvanic	Nos	2444
		AI Information (4-20 mA)	Nos	69
		AI Information (4-20 mA) Hart	Nos	214
		AI Information (4-20 mA) Galvanic	Nos	323
		AO (4-20 mA)	Nos	842
		AO (4-20 mA) Galvanic	Nos	584
		DI (COC)	Nos	1314
		DI (NO/NC)	Nos	1314
		DO (CONTACT)	Nos	4697
		DO (24V DC)	Nos	4872
		DI (SOE-Direct-NO/NC)	Nos	991
		DI (SOE-Calculated)	Nos	552(Refer Note-1)
	ii			0
		Contactors	Nos	234
		Relays	Nos	1742(Including cabinet for Station C&I Part)
		Relay required for EPB	Nos	20
		HART system(1 PC, 1 color inkjet printer, 1 cabinet with all necessary electronic modules, Software/licences)	Sets	1 Set
		Hand Held unit of HART	Nos	8
		Functional groups(minimum)	SET	31(Refer Note-2)
		RIO	Nos	12(Including cabinet)

		Control cabinets	Nos	51(Quantities are indicative only and shall be supplied on as required basis.)
		Marshalling cabinets	Nos	29(Quantities are indicative only and shall be supplied on as required basis.)
		Relay cabinets	Lot	9(Quantities are indicative only and shall be supplied on as required basis.)
2	HMI system(s)			
	i	OVS	Nos	18
		LVS control units/Workstations	Nos	15
		LVS	Nos	16(Two tier LVS envisaged)
		PC station	Nos	2
		Monitor	Nos	4
		Keyboard	Nos	4
		Mouse	Nos	4
		Laser Jet Colour printer (A4 Size)	Nos	9
		Line matrix Impact printer	Nos	2
		Colour Laser Printer (A3 Size)	Nos	1
		KVM Switch	Nos	5
		Matrix KVM switcher	Nos	3
		Engg Station/ Programming cum documentation station	Nos	10(If system documentation facility is not part of this station, separate workstations shall be provided for the same.)
		GIU	Nos	
		Other Hardware like Servers, network switch, cabinets, wireless connectivity equipment, software etc	SET	8(Refer Note-3)
		Suitable redundant interfaces and redundant links for connectivity between Unit LAN/ station wide LAN, and DDCMIS sub systems, unit/station PLCs, PC stations, PADO, Remote Service Centre as applicable.	SET	2(Each set will include +F53:F68components for respective remote I/O(as applicable) & FGs.)
	ii	Station LAN related equipment /Common Equipment		1 Lot as per requirement
		NMS Server	Nos	
		Test Server	Nos	

		Laptop	Nos	
		OWS	Nos	
		PC station	Nos	
		Laser Jet Colour printer (A4 Size)	Nos	
		Colour Laser Printer (A3 Size)	Nos	
		Other Hardware like Servers, network switch, cabinets, Firewall etc	SET	1 Lot as per requirement(Refer Note-3 and 4)
	iii	Master & Slave Clock System		1 Lot
		Slave Clocks	Nos	1 Lot as per requirement
		Master Clock and associated Hardware	SET	1 Lot as per requirement
	iv	Other Misc. Items		1 Lot
		Software for DDCMIS meeting requirements specified under item "SYSTEM SOFTWARE REQUIREMENTS", sub section DDCMIS, Part-B, Section-VI of Technical Specifications.	Lot	1 Lot as per requirement
		Control System Programming device including EPROM Writer/eraser etc. (if applicable)	Nos.	1 Lot as per requirement
		Note-1		
		In case, the contractor's system cannot use the internally calculated points for SOE monitoring, additional one no. Digital output and one no. SOE input for each calculated SOE point shall be provided within quoted price.		
		Note-2		
		Tentative list of components per functional group		
		1.Two nos. processor cards		
		2.Two nos. communication controller cards		
		3.Two nos.network interface cards		
		4.Two nos. cabinet power supply cards		
		5.two nos. I/O power supply cards		
		Note-3		
		a.Network IDS with station LAN switch		
		b. HOST IPS in each work station/server		
		c.VPN Connection for remote diagnostics		
		d.Network Management Software		
		e.Specialised Training in Network Security		
		f.Security audit during PG test and each year of		

AMC

Note-4

a.Multiport

b.IPS Module

c.VPN Capability

d.Failover Mode

BOQ OF CONTROL AND INSTRUMENTATION SYSTEM (NON DDCMIS)FOR SCCL TPP Stage-II (1X800MW)

S/no.	Area	Item description	Unit	Remarks
II	NON DDCMIS			
1	Measuring Instruments			
	i	Flue gas analysers		
		HT O ₂	Nos	2
		LT O ₂	Nos	14
		SO ₂ , NO _x , CO, CO ₂	SET	1
		Opacity Analyser	Nos	7
		Mercury Analyser	Nos	1
		Flowmeter (Ultrasonic time of transit type)	Nos	1
		CEMS PC STATION with Application software, mini UPS	Nos	
	ii	DPT		
		DP transmitters (Static Press >210 KSC)	No	67
		DP transmitters (Static Press <210 KSC, Process DP < 1500 mmwc)	No	200
		DP transmitters (Static Press <210 KSC, Process DP > 1500 mmwc)	No	63
	iii	PT		
		Pressure transmitters (Process Range upto 10 KSC)	No	248
		Pressure transmitters (Process Range upto 50 KSC)	No	92
		Pressure transmitters (Process Range upto 250 KSC)	No	22.44
		Pressure transmitters (Process Range upto 600 KSC)	No	44

iv	Bunker level monitoring system	Set	
v	Impact head type flow Elements	Set	2
vi	Transducer		
	Incoming voltage transducer	No	1
	Incoming Frequency transducer	No	1
	Running voltage transducer	No	1
	Running Frequency transducer	No	1
vii	Synchronising Relays		
	Check relays	nos	2
	Guard relays	nos	2
	Auxiliary relay	nos	1
	Aux PT 110/110 V	nos	2
	Aux PT 63.5/110 V	nos	2
	Relay required for electrical system	nos	33
viii	VMS		
	Contact Type Vibration Measurement point(vibration sensor comprising of associated vibration monitor, probe drivers (if applicable), prefab cables, prefab extension cables, mounting pads/brackets)	No	89 :Common Area: MUW (if applicable) :12 Nos., CW : 20 Nos., RW :20 Nos.
	Non Contact Type Vibration Measurement point (vibration sensor comprising of associated vibration monitors, probe drivers,probe drivers housings, prefab cables, prefab extension cables, mounting pads/brackets)	No	4
	Key Phasors (phase marker sensor comprising of associated probe drivers,probe drivers housings,prefab cables, prefab extension cables, mounting pads/brackets,monitors (if applicable))	No	8
	Junction boxes for contact type sensors	No	23
	Vibration Panel, electronic module, communication cables, accessories etc	set	2
ix	GWR		
	Radar type level transmitters	nos	23
x	AAQMS		
	SO ₂ Analyser	No	0
	NO _x Analyser	No	0
	CO Analyser	No	0
	Ozone Analyser	No	0
	Mercury Analyser	No	0
	SPM	No	0
	Sampling inlet Head	set	each set comprising 1 no. of PM10, PM2.5 and TSP each

		Multi Gas Calibration System	No	0
		PC based data logger	No	0
		PC based data logger with A4 printer	No	0
		Wind Speed Sensor	No	0
		WIND DIRECTION SENSOR	No	0
		AIR TEMPERATURE SENSOR	No	0
		RELATIVE HUMIDITY (RH) SENSOR	No	0
		SOLAR RADIATION SENSOR	No	0
		METEOROLOGICAL MAST	No	0
		RAIN GAUGE	No	0
		WINDOW A/C FOR EACH OF INDIVIDUAL AAQMS STATION (1.5 TONS EACH)	No	0
		UPS FOR EACH INDIVIDUAL AAQMS STATION	No	0
		UPS FOR PC BASED CENTRAL STATION	No	0
		All other items including sample handling system, AAQMS compressed air for purging, connectivity from central AAQMS station to individual stations through either wireless or Station wide LAN.	SET	0
	xi	Other Instruments		
		Thermocouples	Nos	430
		Metal Temperature Thermocouples	Nos	500: *Contains 550 Nos of Profibus Metal temperature T/C
		Resistance temperature Detectors	Nos	607
		E/P converters	Nos	33
		Air filter regulators	Nos	310
		Flow Transmitters	Nos	10
		Level Transmitters	Nos	33
		Single Input Head mounted temperature transmitters	Nos	0
		Single Input DIN-rail mounted Temperature Transmitter	Nos	954
		Dual-input Temperature Transmitter With Indicator	Nos	323
		Profibus/Field bus Temperature Transmitters (Considering 8 channel)	Nos	46: Suitable for Generator core & slot temperatures # For Boiler Metal Temperature considering 8 channel transmitter
		Solenoid Valve	Nos	300
		Pressure switch	Nos	40
		Temperature switch	Nos	30

		DPS	Nos	33
		PS	Nos	40
		Limit Switch	Nos	587
		Local Indicators like PI, TI, DPI, FI, LI	Nos	802
		Orifice plate	Nos	4
		Nozzle	Nos	9: ** including one venturi
		Load Transducer	Nos	3
2	Electrical Power supply system			
i		UPS System with Batteries		
		UPS-140 KVA	Nos of System	1 No 140KVA UPS: Each UPS System shall consist of 2 x 100% parallel redundant chargers and inverters with input isolation transformers, 1 x 100% Ni-Cd/Lead Acid Plante battery bank for one (1) hour, Bypass line transformers & voltage stabilizer, 2 x 100% ACDB, 1X100% Battery Health Monitoring system (BHMS)
		UPS System - 25 KVA	Nos of System	1 No. each of 25KVA,15KVA,10KVAUPS : Each UPS system shall consist of 1 x 100% charger and inverter, 1 x 100% Ni Cd Battery Bank for 1 hour, Bypass Line Transformers and Voltage
		UPS System - 15 KVA	Nos of System	
		UPS System - 10 KVA	Nos of System	

					Stabilizer, 2 x 100% ACDB, 1X100% Battery Health Monitoring system (BHMS)
			UPS-2KVA	Nos	10 No each of 2KVA & 1KVA UPS: Online UPS with remote monitoring having a battery backup of 30 mins.
			UPS-1KVA	Nos	
	ii		24V DC Charger system with Batteries		
			24 V DC Power Supply System for Unit DDCMIS (1000 Amp)	Nos of System	1No 24VDC (1000Amp) Power supply System :Each DC power supply system shall comprise of two sets, each set shall consist of 1 x 100%, modular rectifier banks, Controller -one for each rectifier bank, 1 x 100% Ni- Cd/Lead Acid Plante batteries for one (1) hour duty, 1 X 100% DCDB and 1x100% Battery Health Monitoring System (BHMS)-common for both the sets.
			24 V DC Power Supply System for Common system (350Amp)	Nos of System	Each DC power supply system shall comprise of two sets, each set shall consist of 1 x 100%, modular rectifier banks, Controller -one for each rectifier bank, 1 x 100% Ni- Cd batteries for one
			24 V DC Power Supply System for Common system (175Amp)	Nos of System	
			24 V DC Power Supply System for Unit Common system (275Amp)	Nos of System	
			24 V DC Power Supply System for Common system (125Amp)	Nos of System	
			24 V DC Power Supply System for Common system (75Amp)	Nos of System	

		24 V DC Power Supply System for Common systems (35 Ampere)	Nos of System	(1) hour duty, 1 X 100% DCDB and 1x100% Battery Health Monitoring System (BHMS)- common for both the sets,
		24 VDC Power supply for Unit DDCMIS (SG) (800 A)	Nos of System	
		24 VDC for Common systems (LDOPH) (50 A)	Nos of System	
		24 V DC for Aux. Boiler Control system (50A)	Nos of System	
		24 VDC Power supply for Unit DDCMIS (TG)[Rating : 400A]	Nos of System	
		24 V DC for CPU	Nos of System	
		24 VDC for Common systems (H ₂ plant (if applicable))	Sets (D)	(D) : set means redundant power supply system with min 30 min battery backup as per manufacturer standard
iii		Manual Discharge Resistance Bank		
		Manual Discharge Resistance Bank for UPS system	nos	
		Manual Discharge Resistance Bank for 24 VDC system	nos	
		Battery Accessories	SET	
iv		Power Distribution Boards (PDB)		
		PDB for UPS Power Distribution for HMI , illumination/ utility, LIE/LIR etc	SET	
		PDB for Employer's use	nos	
3	PCP			
i		LIEs-Non Purging Application		
		LIE, Type A	nos	9
		LIE, Type B	nos	12
		LIE, Type C	nos	13
ii		LIEs-Purging Application		
		LIE, Type A	nos	14
		LIE, Type B	nos	27
		LIE, Type C	nos	8
iii		LIRs		
		LIR, Type A	nos	16
		LIR, Type B	nos	14
		LIR, Type C	nos	27
iv		PCP for PT		
		PCP for PT of Piping Class A	set	1 Lot each

		PCP for PT of Piping Class B	set	
		PCP for PT of Piping Class S	set	
		PCP for PT of Piping Class D	set	
		PCP for PT of Piping Class E	set	
		PCP for PT of Piping Class F	set	
		PCP for PT of Piping Class G	set	
		PCP for PT of Piping Class M	set	
v		PCP for DPT		1 Lot Each
		PCP for DPT of Piping Class A	set	
		PCP for DPT of Piping Class B	set	
		PCP for DPT of Piping Class S	set	
		PCP for DPT of Piping Class D	set	
		PCP for DPT of Piping Class E	set	
		PCP for DPT of Piping Class F	set	
		PCP for DPT of Piping Class G	set	
		PCP for DPT of Piping Class M	set	
		PCP for DPT of Piping Class N	set	
vi		PCP Miscellaneous Items	set	
4		Cables and Accessories		
	i	Instrumentation cables (BOQ controlled)		
		A-2P 0.5 sq. mm	meter	12540
		B-2P 0.5 sq. mm	meter	2300
		C-2P 0.5 sq. mm	meter	1000
		F-2P 0.5 sq. mm	meter	2300
		F-4P 0.5 sq. mm	meter	181000
		F-8P 0.5 sq. mm	meter	40542
		F-12P 0.5 sq. mm	meter	8320
		F-16P 0.5 sq. mm	meter	2640
		F-24P 0.5 sq. mm	meter	2438
		G-2P 0.5 sq. mm	meter	5280
		G-4P 0.5 sq. mm	meter	263560
		G-8P 0.5 sq. mm	meter	41000
		G-12P 0.5 sq. mm	meter	33000
		G-16P 0.5 sq. mm	meter	17160
		G-24P 0.5 sq. mm	meter	7084
		G-48P 0.5 sq. mm	meter	2714
		Teflon coated 2 pair 0.5 sq. mm	meter	14190
		Teflon coated 4 pair 0.5 sq. mm	meter	1650
		Flame scanner shielded cables	meter	3300
	ii	Control Cables		
		2Cx2.5 sq. mm	meter	1 Lot of Each
		3Cx2.5 sq. mm	meter	Type of cable as
		Special teflon coated 5Cx1.5	meter	per requirement.

		5Cx2.5 sqmm	meter	(Refer Note-1)
		7C x 2.5 sq mm	meter	
		10C x 2.5 sq mm	meter	
		16C x 2.5 sq mm	meter	
		19C x 1.5 sq mm	meter	
		3Cx1.5 sq. mm	meter	
		4Cx1.5 sq. mm	meter	
		5Cx1.5 sq. mm	meter	
		7Cx1.5 sq. mm	meter	
		10Cx1.5 sq. mm	meter	
		12Cx1.5 sq. mm	meter	
		18Cx1.5 sq. mm	meter	
		24Cx1.5 sq. mm	meter	
		37Cx1.5 sq. mm	meter	
iii		Power Cables		
		1Cx630 sq. mm	meter	
		1Cx120 sq. mm	meter	
		2Cx120 sq. mm	meter	
		2Cx16 sq. mm	meter	
		1Cx35 sq. mm	meter	
		2Cx35 sq. mm	meter	
		2Cx6 sq. mm	meter	
		2Cx70 sq. mm	meter	
		3C x 16 sq mm Al. cond Power cables	meter	
iv		OFC		
		4 Core Multi mode OFC	meter	13773: Includes quantity required for IP based PA System and CCTV also.
		8 Core Multi mode OFC	meter	13604
		4 Core Single mode OFC	meter	66312
		8 Core Single mode OFC	meter	20123
		12 Core Single mode OFC	meter	7453
		LIUs	Lot	1 lot as per requirement
v		UTP		
		UTP/STP Cable	meter	1 lot as per requirement
vi		Conduits and Cable Trays		
		Rigid Conduit(1" 25 mm)	meter	1 lot as per requirement
		Rigid Conduit 2" (50mm)	meter	1 lot as per requirement
		Flexible Conduit 3/4" (18mm)	meter	1 lot as per requirement
		Flexible Conduit 1" (25mm)	meter	1 lot as per requirement
		Cable sub-tray 2" (50mm)	meter	1 lot as per requirement
		Cable sub-tray 4" (100mm)	meter	1 lot as per requirement
		Cable sub-tray 6" (150mm)	meter	1 lot as per requirement

	vii	Junction box		
		24 WAY	nos.	1 lot as per requirement
		36 WAY	nos.	1 lot as per requirement
		48 WAY	nos.	1 lot as per requirement
		64 WAY	nos.	1 lot as per requirement
		72 WAY	nos.	1 lot as per requirement
		96 WAY	nos.	1 lot as per requirement
		128 WAY	nos.	1 lot as per requirement
	viii	FMU		
		1024 WAYS	Nos	1 lot as per requirement
		512 WAYS	Nos	1 lot as per requirement
	vii	Other items like hardware for subtrays , fittings abd cable accessories for Instrumenation, OFC, UTP, Power, Control cables.	Lot	1 lot as per requirement
5	Control desk and panels			1 lot as per requirement
	i	Control Desk		
		Control Desk length for Control Room	meter	
		Control Desk for Unit In charge	meter	
	ii	UCD mounted Devices		
		3 PB+4 LEDs	nos	
		3PB + 3 LED'S	nos	
		2 PB+ 4 LEDs for Elecl breakers	nos	
		2 PB+ 3 LEDs for Elecl breakers	nos	
		2 PB+ 3 LEDs	nos	
		2 PB+ 2 LEDs	nos	
		2 LED	nos	
		3 LED	nos	
		6 LED	nos	
		1 LED	nos	
		1 PB+4 LED	nos	
		4 PB+ 4 LEDs	nos	
		Digital Indicators	nos	
		Analog Indicator	nos	
		Trip PB/Emergency Stop PB's	nos	
		Raise Lower PB	nos	
		Release PBs	nos	

		Acknowledge PBs	nos	
		Test PBs	nos	
		Single PB	nos	
		Hand Switches	nos	
		Mimic Tiles	nos	
		Voltmeters	nos	
		Frequency meters	nos	
		Synchroscope	nos	
		Stop PB	nos	
		Draw out for mosaic grids	nos	
iii		Furniture		
		Computer Table	Nos	
		Printer Table	Nos	
		Chair	Nos	
		Keypad	Nos	
		Locker Set	Nos	
		Almirahs	Nos	
		PC Rack for each location	Set	
		Server Rack for each location	Set	
		Workstation furniture for each location	Set	
		ECP along with TB and complete internal wiring	Set	
6	SWAS			
		Sp. Cond	Nos	5
		Cat. Cond	Nos	6
		pH	Nos	5
		DO2	Nos	3
		HYDRAZINE	Nos	2
		Silica	SETs	2
		Sodium	SETs	2
		Turbidity	Nos	1
		Chloride	Nos	0
		Phosphate	Nos	0
		SAMPLING STREAM WITH PRIMARY COOLER	SETs	4
		SAMPLING STREAM WITHOUT PRIMARY COOLER	SETs	3
		Sp. Cond for hotwell	SETs	6
		SAMPLE CONDITIONING PANEL (WET PANEL)	SETs	1
		ANALYSER PANEL (DRY PANEL)	SETs	1
		PRIMARY COOLER PIPING AND ACCESSORIES	SETs	1

		CHILLER SYSTEM	SETs	The Chiller system shall be designed, engineered and sized for all the units (each unit comprising of minimum 32 nos. analysers & 13 sets of Sampling Streams) and 25% additional capacity for future use.
7		PA system (IP Based)		
	i	CALL stations		
		Outdoor wall/column mounting type with amplifier	Nos	Common PA system Qty includes Qty for CHP PA system also
		Indoor desk top mounting type with amplifier	Nos	
	ii	Loudspeakers		
		Outdoor Industrial Horn type	Nos	
		Indoor wall mounted Cone type	Nos	
	iii	Amplifier		
		Standalone amplifier(50W)	Nos	
	iv	Portable call stations with network connection port		
		Network connection port	Nos	
		Portable call stations with minimum 2 meters connecting cable	Nos	
	v	Acoustic Hood	Nos	
	vi	Master Control Unit	Nos	
	vii	PA system cables, conduits, Server, Network Switches, layer-III switch/router, software(s) for PA system etc.	SET	Minimum one redundant server
	viii	PC Station	Nos.	
8		CCTV system		
		Cameras (PTZ)	Nos	complete CCTV system
		Cameras (PTZ)-HD	Nos	
		Fixed Camera(HD)	Nos	
		Explosion Proof Camera	Nos	
		Work station with monitor , Keyboard and Joystick	Nos	

		Work station with Keyboard and Joystick (without monitor)	Nos	
		Balance items including Servers, trunk cables, network switch, mini UPS, PDBs, Software etc	set	
9	Effluent Quality Monitoring System (EQMS)			
		pH Analyser	No	1
		Conductivity Analyser	No	1
		Chemical Oxygen Demand (COD) Analyser	No	1
		Biological Oxygen Demand (BOD) Analyser	No	1
		Total Suspended Solids (TSS) Analyser	No	1
		Oil In Water (OIW) Analyser	No	1
		Temperature Element (RTD)	No	1
		Temperature Transmitter	No	1
		Electronic Flow Meter	No	1
		Data Acquisition System	Set	1
		Data Communication System	No	1
		Power Supply Distribution Board (PDB)	No	1
10	H₂ Generation Plant (if applicable)			
		PLC including 2 OWS and all associated measuring instruments for H ₂ generation plant	Set	1 No. PLC with redundant cold stand by processor
11	PNEUMATICALLY OPERATED REGULATING TYPE CONTROL VALVE			
		SH,RH spray,SBPRV	No	8
		Aux PRDS	No	9
		SCAPH	No	12
		LDO/ATOM AIR	No	6
		LDOPH	No	0
		Pneumatic Control Valves with microprocessor based smart positioners & air filter regulator	Nos	30
12	PNEUMATICALLY OPERATED ACTUATORS(POWER CYLINDERS) FOR REGULATING TYPE DAMPERS			
		SADC	No	69
		CAG/HAG/CAD/HAD	No	26
		BURNER TILT	No	8
		MILL DISCH	No	53
		SEAL AIR TO MILL/FEEDER	No	20
		SCANNER,SEAL AIR	No	6
		FEEDER O/L	No	7
		FG LINE	No	6
13	SG MAIN EQUIPMENT RELATED CONTROL & INSTRUMENTATION SYSTEM			

		Flame Monitoring System and flame detector testing kit.	Set	1
		Coal-Feeder Control & Instrumentation system	No	6
		Coal Bunker Level Monitoring System	No	6
		Electromatic safety valves actuator	Set	6
		Furnace temperature probes.	No	2
		Acoustic Pyrometer.	Set	1
		Acoustic Steam Leak Detection System with 30 nos of sensors	Set	1
		Furnace and Flame Viewing System.	No	4
		Level switches Driplegs employing conductivity type probes.	No	6
		Mill & Air heater Fire Detection System.	Set	1
14	TG MAIN EQUIPMENT RELATED CONTROL & INSTRUMENTATION SYSTEM			
		Turbine supervisory system (TSS) including all sensors, processing electronics, cabinets, H/W and S/W for main Turbine and TDBFP	Set	1
		Turbine analysis system H/w /SW for Turbine and Main plant HT auxiliaries with requisite licenses for remote monitoring for main Turbine and TDBFP	Set	1
		S/W and H/W for remote monitoring of trurbine stress computation, fatigue analysis of TG components and residual life analys is including long term storage	Set	1
15	Remote Service provisions			
		Remote Service provisions	Lot	1
16	PADO			
		PADO	Set	1
17	Tools and Tackles			
		Tools and Tackles	set	1 Set as per requirement
18	M&C			
		Standard Maintenance & Calibration Items	Set	1 Set as per requirement
19	Electric actuators			
		Electric actuators with integral starters (conventional / field bus based)	Set	1 set : Areas covered: SG system, TG system, FOPH and CPU
20	PLCs for other auxiliary plants			

		PLCs for other auxiliary plants like Coal sampling units, Stacker Reclaimer, Wagon Tripler, Automatic Sprinkler system, AC system etc.	Set	1 Set as per requirement
21	Training			
		Training (DDCMIS + NON DDCMIS)	Mandays	Lump sum
22	AMC			
		AMC for DDCMIS	Years	Lump sum for 3 Years
		AMC for CEMS	Years	
		AMC for AAQMS (if applicable)	Years	
		AMC for CCTV	Years	
		AMC for PA System	Years	
		AMC for EQMS System	Years	
		AMC for DM/PT/CPU Analysers	Years	
		AMC for SWAS	Years	
		Note-1		
		Cable quantities excludes incomer cables from MCC to Various Chargers and UPS of Unit and Offsite areas.		

CHAPTER – 11

COST ESTIMATES AND FINANCIAL ANALYSIS

COST ESTIMATE & FINANCIAL ANALYSIS

11.01.00 FINACIAL APPRAISAL

The Current Project Cost estimate based on Non-Mega Status for Power Station and Facilities (**Annexure-1.1**) of Singareni TPP Stage-II (1X800MW) as of 4th Qtr-2025 is as follows:

The equity component is to be met out of the internal resources.

Project Cost		Rs in Cr
Project Cost excluding IDC	:	8600.79
Interest During Construction (IDC)	:	995.20
Project Cost Incl. IDC	:	9595.99
Cost /MW (Excl. WCM)		11.99
Working Capital Margin (WCM)	:	0
Project Cost including IDC & WCM	:	9595.99
Cost/MW (Incl. IDC & WCM)	:	11.99

11.02.00 BASIS OF COST ESTIMATE

11.02.01 Preliminary & Civil Works

Various items of packages covered in the cost estimates are based on the scope of work defined in Technical Data & Bill of Quantity. The cost estimates (**Annexure-1.1.1**) for most of the packages under this head are based on the awarded rates for various ongoing projects of NTPC and suitably updated to current price level.

11.02.02 Mechanical, Electrical & Coal Transportation

Cost estimates for the Mechanical & Electrical Equipment and Coal Transportation System (**Annexure-1.1.2, 1.1.3 & 1.1.4**) are based on the award/bid prices for various for ongoing projects of NTPC suitably updated to current price level. The taxes & duties are considered for Non-Mega Status of the project.

11.02.03 Others

The provision for Misc. Tools and Plants, Establishment including Audit & Accounts has been kept as INR 166.10 Cr respectively.

Pre-commissioning Charges have been kept as INR 63.12 Cr. To provide for any unforeseen expenditure, 1.0% of the civil works cost and equipment cost has been kept as Contingency.

CHAPTER – 12
PROJECT IMPLEMENTATION

PROJECT IMPLEMENTATION

12.01.00
PROJECT SCHEDULE

The commercial operation (COD) of the unit will be in 50 months from the date of investment approval.

The implementation schedule of Singareni Thermal Power Project-Stage-II (1x800 MW) is indicated in the **EXHIBIT-9** which shows optimum schedule for the project with different activities shown in bar chart. The zero date of the project has been reckoned from date of investment approval.

12.02.00
PROJECT MANAGEMENT

The major phases of the project during its implementation are classified as under: -

- Design and engineering phase
- Tendering and award phase
- Manufacturing
- Inspection and expediting
- Construction/erection phase, and
- Commissioning phase

The methodology adopted for executing the project is elaborated below.

12.02.01
Planning Phase
12.02.01.1
Contract Packaging

The entire project work shall be well-defined in to one EPC contract package. Major aspects considered in package are: -

The package formed will be compatible considering the prospective bidders, which ensure adequate competition in bidding and consequent procurement at optimum cost.

The package formed include such combinations of equipment and services that can be advantageously engineered for the preparation of specifications for bid document and subsequent product design including manufacture/construction drawings.

It shall be possible to clearly define the responsibility for the package to individual engineering coordinator.

The terminal points of the package shall be clearly defined and proper tie ups of these points in the package ensured.

12.02.01.2

Master Project Implementation Programme- Master Network (MNW)

The execution packages are developed before finalization of the Master Network programme of the project to ensure that Master Network heads are developed in accordance with the list of execution packages for better monitoring and control.

A Master Network (MNW), which is the overall programme of project implementation, shall be finalized by the Project Planning & Monitoring Group in consultation with Engineering, Contracts and Site. The MNW is based on project execution package and has about 300 activities. It identifies the key milestone dates for each activity in the areas of engineering, procurement, manufacturing, dispatch, construction, erection, testing and commissioning. The MNW forms the basis of all detailed physical scheduling for all execution packages.

12.02.02

Tendering, Award of Contract & Engineering Phase

12.02.02.1

Engineering, Planning, Monitoring and Control

The basic engineering studies shall be initiated as soon as Detailed Project Report is prepared and all major technical parameters of the project are finalized and documented as part of Revised Cost Estimates (RCE) along with the detailed estimates of cost and quantities.

The Owner's consultant shall plan and schedule the project engineering activities within the time frame specified for the engineering milestones in the finalized Master Network. The engineering programme at Level-2 accordingly shows the dates for data availability, tender drawing release, specification release, bid evaluation and construction drawing release, etc.

The schedule drawn up by each engineering discipline shall also take into consideration the assistance from external engineering consultants that can be advantageously supplemented to the internal resources depending upon the complexity of an equipment system, the need for inducting latest available technology, the large quantum of fairly simple engineering work, etc. The engineering manpower resources will be then allocated depending upon the priorities in the schedule of each engineering discipline.

Departmental reviews shall be conducted by Project Engineering Coordinators to evaluate the work actually performed vis-à-vis detailed schedules. Corrective actions within the scope of the discipline heads will be identified and the plans updated. The engineering status appraisal from the heads of different engineering disciplines is then reviewed to check the various areas of specification release, bid evaluation, drawing releases, etc. against the target level-2 programme dates. If any delay is expected to affect the schedule of other control centers, the corrective action to rectify the

12.02.02.2
Contracts Planning, Monitoring and Control

situation by either re-allocating priorities of internal resources or by seeking the assistance of external engineering agencies is resorted to.

Based on the key event dates identified in the Master Network, detailed plan for pre-award activity up to award of every contract is finalized and monitored vigorously.

When packages will be awarded, detailed programme in the form of networks shall be tied up with the contractor to clearly indicate the owner's obligation and the supplier's responsibilities. The owner's inputs in terms of land availability, construction power/water availability, civil fronts etc. while that of the contractor's in terms of drawing submission, manufacture, supply, transportation, erection and commissioning shall be clearly brought out in the programme.

Contract coordinators of the package evaluate the progress for each work package against the schedules drawn up. Such evaluation indicates the causes of delay, if any, in meeting the schedules and suggests actions to be taken for rectifying this delay. Monthly progress reports on identified reporting heads reflecting the corrective actions to be taken in areas of delay are regularly submitted.

12.02.03
Manufacturing, Inspection and Expediting Phase
12.02.03.1
Inspection and Expediting

To expedite supplies from the vendors, expeditors shall be posted at works of major equipment suppliers. Expediting visits shall also be arranged periodically to the works of other suppliers to ensure that the work progresses as per schedules. The manufacturing programme and the quality plans finalized at the time of contract award are utilized by the expeditors/inspectors for monitoring the manufacturing and quality status. Specified reports at regular intervals are submitted indicating the areas of schedule variances, if any, their likely impact on delivery schedules and any recommendations given to the contractor and/or suggestions for improvement in supply.

12.02.03.2
Quality Assurance

An independent Quality Assurance Group for ensuring the quality during the project engineering, procurement and manufacturing, as well as during material storage shall be organized in the Corporate Office/Owner's Consultant. Before the award of any contract, QA Department shall discuss with the prospective contractors and finalizes mutually acceptable inspection programme and detailed quality plans. In the post-contract stage, the

inspection reports generated by the inspectors are reviewed to evaluate the quality status with respect to the specified levels and necessary coordination of all actions necessary to ensure the achievement of the required quality levels.

The quality plans after discussions and finalization with the contractor shall form a part of the contract document.

There shall be a close inter-action amongst Engineering, Contract Services, Inspection, Expediting and Quality Assurance Group and the project site in arriving at the quality plan and manufacturing and delivery programme.

To ensure that only technically competent party is awarded the contract, including those for major civil works, a system of pre-qualification of contractors, based on their technical competence, financial capabilities, past performance shall be adopted. The enlistment of contractors would be of great help in executing projects in the desired manner and construction schedule shall generally be adhered to without much delay.

12.02.04 Construction Phase and Commissioning Phase

12.02.04.1 Construction Planning, Monitoring and Control

Site activities shall start progressively with the award of the package. As earlier mentioned, based on the Master Network schedule (Level-1 network), during the award, Level-2 networks are finalized, keeping in view the interface events needed to be realized. Execution group at site starts interaction with the contractor/vendor soon after the receipt of the Letter of Award to establish the site office. Based on the L-2 network, site Field Engineering Group also starts interaction with Central Engineering Group to get the required drawings in the sequence in which they are needed for continuous work for the next six months.

12.02.04.2 Project Review Team Meeting

A Project Review Team (PRT) headed by the project head with members from various departments at the head office and site will be constituted for the project to review the progress of project on a monthly basis. The meeting of the team shall be conducted every month. This will be chaired by the project head and attended by different departments of head office and site. The meeting reviews both pre-award and post-award progress of each package. In pre-award review the progress in award of packages is reviewed and corrective measures are identified. Decision to be taken to reduce/eliminate the effect of delay, wherever the award is delayed, so that project completion schedule is adhered to.

In post award progress review major problems such as non-availability of desired drawings, clarifications, documents from various disciplines of engineering group, non-receipt of required materials from various vendors, reasons for the same, remedial measures initiated, impact of such delays on the project progress and delay in placement of awards will be taken up for decision in the project review team meeting.

Interface problems among engineering, contracts and site affecting project execution will also be reviewed and appropriate decisions taken to expedite the release of drawings, materials and such other requirements.

Budgetary review will also be done during this meeting and shortfall, if any, identified and responsibility center fixed to get the commitment.

After every PRT meeting, the Chief Executive of the company is apprised of the critical issues that emerge during the PRT meeting by putting up an exception report. Chief Executive will also take a review meeting as per requirement based on criticality.

CHAPTER – 13

MANPOWER TRAINING AND PLACEMENT

MANPOWER TRAINING AND PLACEMENT

13.01.00 ORGANIZATION STRUCTURE

SCCL has adopted a two-tier organization structure consisting of Corporate Center and Project. Corporate Center focuses the attention mainly on the formulation of policies, guidelines, development of systems and procedures which need to be adopted by the various responsibility centers. At project level, focus is on operation and maintenance of power generation units.

13.02.00 TRAINING AND DEVELOPMENT

Since its inception SCCL has laid stress on Training and Development as one of the main measures for improving the performance of its employees. To achieve this, a string of modern and well equipped training institute shall be roped in for training of its personnel for thermal power project.

13.03.00 TYPE OF TRAINING

13.03.01 Pre-Employment Training

Pre-employment training aims at providing requisite skills and confidence to the personnel who enter the organization as fresh trainees at different induction levels. Four types of long-duration training schemes are proposed to take care of this aspect of training.

Name of Scheme Duration

- i) Engineering Executive Training Scheme 1-year
- ii) Finance & HR Executive Training Scheme 1-year
- iii) Executive Trainee Scheme (Chemistry) 1-year
- iv) Diploma/ ITI Trainees 1-year

13.03.02 Post-Employment Training

Post-employment training provides opportunities to personnel at various levels of the organization hierarchy to take up higher responsibility and skills and also to reorient them to keep pace with the advancement in thermal power technology. This package basically has three components viz. Management Development, Specialized Training and Employee Development.

13.03.03 Management Development

SCCL shall tie-up with pioneer management institute to develop management skills of its personnel.

13.03.04 Specialized Training Activities

The specialized training activities, besides providing special skills, also strive to acquaint the employees with the latest technology around the world. This package of training includes the following areas:

i) Orientation of Power Plant Operations

Large number of personnel to be inducted in the various areas of O&M have to be oriented in the operation & maintenance of 600MW units. These programs will include in-plant operation training in the power station and study visits to manufacturer's works.

ii) Training Under-Contract Packages

Training of the Company's personnel by the suppliers will have to be provided under different contractual agreements. Executives to be trained under this scheme to assimilate and build up in-house expertise in the contemporary technology intensive areas.

iii) Training of Erection Personnel to Switch Over to O&M

As a part of the total manpower strategy, 15 to 20% of the erection manpower will have to be switched over to operation and maintenance as and when the units come into the operation. These personnel, depending upon their level will be given appropriate training for their placement in the O & M position. The training apart from providing opportunities for career growth to individuals will go a long way involving the problem of erection personnel being rendered surplus, when project activities come to an end.

vi) Advanced Training Abroad

To provide necessary exposure on new developments in engineering and management fields, arrangements will have to be made for imparting specific need based training abroad in operations and maintenance to personnel down the line.

13.03.05 Employee Development Program

Short duration program to develop and upgrade skills and long duration program to attain higher levels to be formulated for the benefit of personnel at different levels.

CHAPTER – 14

OPERATION & MAINTENANCE PHILOSOPHY

OPERATION & MAINTENANCE PHILOSOPHY

14.01.00 GENERAL

The purpose of this section is to broadly outline the operation and maintenance philosophy to be adopted for this project. This will act as a useful input for basic as well as detailed engineering of the project so that all required provisions for optimum operation and maintenance of this plant are made during the engineering stage itself.

14.02.00 OPERATION PHILOSOPHY

14.02.01 OVERALL REQUIREMENT

14.02.01.1 Base Load Station

Singareni TPP Stage-II is a rail fed coal based station and will be basically designed to work as base load station.

14.02.01.2 Design

The design of Singareni TPP Stage-II will cover adequate provision for the following:

- a) Turbine shall be capable of operation on variable pressure mode during part load and startup operation.
- b) TG set shall be capable of being started from cold condition to full load operating conditions in as short time possible.

14.02.01.3 House Load Operation

The main plant, auxiliaries as well as all associated systems and controls will be designed to permit house load operation, without shutting down the unit in the event of sudden loss of load demand due to tripping of transmission lines or other grid disturbances. It should also be designed for part load operation on consistent basis.

14.02.01.4 Participation in Load Frequency Control

The design of main plant control systems will permit participation of variable pressure operation and two shift operation in load frequency control in the event of system disturbances.

14.02.02 DESIGN FOR HIGH UNIT AVAILABILITY

14.02.02.1 General

High availability of the unit and all associated auxiliaries and sub-systems is one of the main O&M objectives for ensuring high PLF and low partial

loading. This objective will be implemented by adopting the following principles: -

- a) Use of equipment and systems whose design performance and high availability has been fully established by a considerable record of successful operation for similar service conditions in coal fired utility power stations.
- b) Use of only field proven design concepts and conservative designs.
- c) Special consideration for proper approach, ease of operation and maintenance while selecting the equipment and while finalizing the location and layout plans.
- d) Strict implementation of quality assurance norms during design, manufacture as well as installation and commissioning stage.
- e) Strict compliance with SCCL/Owner's Consultant approved commissioning documentation, comprising of Standard Checklists, Testing Schedules and Commissioning Schedules etc., forming a part of commissioning documents for the project.
- f) Easy accessibility and maintainability of the equipment shall be the prime consideration during selection of the same.
- g) Approachability of equipment for easy operation shall be considered during detailed engineering stage.

14.02.02.2 Sizing of Critical Equipment-Margins & Standby

Provision of adequate margins will be made while sizing all-important auxiliaries and sub-systems to ensure operation of the unit under the worst conditions and after normal wear. The following aspects will be kept in view:

- a) The unit as a whole shall be able to generate at 105% of the name plate rating on a sustainable basis to meet the requirement of the grid.
- b) Each major equipment (fans, BFP's, CEP's, CC pumps, ECW pumps, CW pumps etc) will be capable of meeting 60% of Boiler MCR requirements. However, while sizing adequate range-ability and turndown capability will also be provided for proper operation of related control systems.
- c) The unit and equipment control system shall be designed in such a way that the unit will survive the loss of a major equipment and continue to operate at a lower load.
- d) The number and size of mills will be so selected that with worst coal also, BMCR load will be achieved. With worst coal at TMCR and also with design coal at BMCR one mill will be spare.

14.02.02.3
Coal Handling Plant

The design and sizing of coal handling plant has an important bearing on station plant load factor. Hence, the following steps will be taken while designing the coal handling plant so as to ensure high PLF for the stations:

- a) CHP shall be able to meet the daily coal requirement considering 100% PLF and design coal.
- b) Adequate standby capacity will be provided in the coal handling plant and for crushers so that outage of a single crusher or other equipment will have no effect at full load operation of station with worst coal.
- c) CHP evacuation rate shall match with coal transportation system unloading rate such that there is no detention of loaded coal rake at the wagon tippler.
- d) Adequate number of properly designed suspended magnets and online magnetic separators, Metal Detectors will be provided to segregate magnetic and non-magnetic materials respectively.
- e) To minimize the dust nuisance in CHP area, effective dust suppression system shall be provided in wagon tippler, bunker floor, transfer points and stockyard. Dust extraction system shall be provided in the crusher house.
- f) Effective provision shall be made for accurate and reliable measurement of incoming coal and coal consumed by the unit.
- g) In order to take care of unforeseen disruption in coal supplies, coal stockyard equal to 15 days full load requirement will be designed at station end.
- h) In order to avoid flooding of underground portions, all conveyor galleries shall be over-ground except wagon tippler and connected conveyors.
- i) Coal bunkers shall be designed to avoid choking /rat holing etc. after carrying out coal flowability studies.
- j) Provision of blending of different types of coal shall be kept while designing CHP so as to feed coal to bunkers within reasonable quality range.

14.03.00
DESIGN FOR EFFICIENT OPERATION

The basic and detailed engineering of the project will be done so as to help in achieving high standard of operational performance especially with respect to efficiency & Heat Rate. This may include the following key indices.

- a) Low auxiliary power consumption
- b) Low make-up water consumption
- c) No oil support above 40% MCR operation with adjacent mills and any combination of elevations.
- d) Optimum efficiency and heat rates for the units and their sub-system by achieving design parameters.

Provision will be made for accurate and reliable measurement of coal receipt, coal consumption per unit of electrical power, oil receipt and oil consumption per unit of electrical power, total D.M. Water production and make-up water consumption per unit, generator output, auxiliary power consumption, flue gas oxygen content etc. These values will be fed to Information System (IS) and daily reports regarding receipt, consumption and stock position will be prepared.

Adequate provision of sequence controls, safety interlocks and protection, automatic modulating controls and operator guidance messages through CRT will be made to assist the operators in safe and efficient operation of these units.

Provision will be made for on-line performance calculations for the unit and major sub-systems in DAS (Data Acquisition System). On line CRT display of heat rate penalties due to deviation of key parameters from the design values will be provided by HMI.

Provision shall be made to monitor power being exported from the station.

To achieve optimum efficiency, following provisions shall be made:

- i. Spray water for reheater steam shall be tapped from feedwater line after the high pressure heaters to take advantage of the gain due to feedwater heating. However, to compensate for the passing of spray control valves due to excess spray water pressure, multistage or equivalent valve shall be used before spray control valves.
- ii. Air preheaters and Milling system including hot air system shall be designed to achieve maximum permissible mill outlet temp. to achieve better pulverization and combustion.
- iii. Condenser shall have an online tube cleaning system. Provision shall also be made to supply condenser with clean & suitably chemically treated water to avoid fouling in condenser tubes and for proper functioning of the tube cleaning system.
- iv. High pressure feedwater heaters shall be designed for negative TTD to gain maximum heat from extraction steam.

- v. Optimum heat transfer in boiler shall be monitored and effected by installing a boiler cleanliness monitoring system. Intelligent soot blowing using the above should be a part of the system.
- vi. HP and IP turbine first few stage fixed & rotating blades shall be designed so as to have minimum erosion between Overhauls.
- vii. Turbine shall be provided with high and sustained efficiency seals, with proven record of satisfactory performance.
- viii. Large equipments like ID fans shall be provided with variable frequency drive (VFD) to reduce power consumption during part load operation.
- ix. Air Preheaters shall be provided with leakage control/minimizing system for on line seal adjustment.
- x. Care shall be taken not to use film type fills in CTs to avoid blockage and efficiency loss.
- xi. ESPs and associated Flue gas treatment equipments shall be designed to achieve parameters better than latest environmental norms for chimney gas without flue gas conditioning.

14.04.00

Instrumentation for efficiency monitoring

- a) Flue gas exit temperature measurement shall be done using multiple thermocouples sensing from different points of a grid in the cross section of duct.
- b) Pr. Helium Detector/Temperature measurement instruments at HP & IP turbine inlet and outlet, all extraction lines, drip lines and heater inlet/outlet feedwater line are required to be of very high accuracy to provide accurate temp. Press measurement for correct cylinder efficiency and heater performance calculations condenser performance with on line instruments. Condenser measurements to be accurate to :
 - η calculation
 - i. CW inlet/outlet
 - ii. Hotwell condensate temperature
 - iii. Air suction temp.
- c) Flue gas sampling provision at Air Pre-heater inlet and outlet shall be of multiple probe type for collecting samples from different points in a grid across the cross section.
- d) High temperature O₂ probes shall be provided at the furnace exit so as to monitor combustion efficiency. CO₂, SO_x, NO_x monitoring

14.04.01

instruments shall be provided.

Instrumentation for Reliability:

Main turbine/Generator, BFP-TD shall be having on line performance & vibration based diagnostic system.

Accuracy of the on-line instruments used for absolute pressure/differential pressure, temperature for determining cylinder efficiency, heater performance and condenser performance shall be of 0.2% class or equivalent.

14.05.00

DESIGN FOR ABT REQUIREMENT

Under ABT regime, following further operating conditions are required to be taken care of:

- a) There are 96 time blocks in a day of 15 mins each and there may be a requirement of changing Unit load with change in frequency in each block.
- b) Unit may have to be kept under reserve shut down and brought back fast as per grid demand.
- c) Very high availability target (> 85%) to be met for full fixed charge recovery.
- d) Minimum Partial Loading.

To meet such extended requirements, following design considerations are to be met:

- i. Unit should be designed for a faster ramp up/ Ramp down rate without effecting undue thermal stresses.
- ii. Mills shall be designed so that they can be started and loaded fast to meet the above requirement.
- iii. Unit shall be capable of meeting the requirement of fast start up and quick loading till full load.
- iv. Steam generator, Turbine generator and their auxiliaries shall be designed to run with satisfactory performance from one overhaul to another without requiring any major shutdown.

14.06.00

OPERATION MANAGEMENT SYSTEM (OMS)

The operation of this project will be optimized by implementing proper Operation Management System. This system covers clear definition of responsibilities of all key executives including shift-in-charge, AGM/DGM

14.07.00
OPERATION REVIEW TEAM (ORT) MEETINGS

The following important aspect will be covered during the monthly ORT meetings:

- a) Review of actual performance of the unit vis-a-vis targets and norms for key operating parameters like generation, availability and deviations on heat rate, specific coal/oil consumption, make-up water consumption, auxiliary power consumption etc.
- b) Review of specific O&M problems of the Unit and progress of corrective actions.
- c) Review of external constraints like coal supply problems, power evacuation problems and other related difficulties.
- d) Review of commercial and financial performance.
- e) Review of house keeping standard.

Proper implementation of OPMS and regular ORT meetings are expected to help in achievement of high standard of plant operation.

14.08.00
TRAINING OF O&M PERSONNEL

Since O&M cadre for this project is likely to be largely based on fresh engineering graduates, considerable importance has to be given to training of O&M personnel so that the required skills in various specialized disciplines could be created in the shortest possible time. It is therefore very important to ensure that training is imparted to all engineers meant for operation and maintenance of the unit so that it could become fully familiar with their area of work (O&M Deptt. is to be set up at least 24 months prior to synchronization of unit). This will be achieved by:

- a) Study of O&M Manuals and Drawings.
- b) Review / Preparation and finalization of commissioning documents.
- c) Supervision of pre-commissioning and commissioning activity.
- d) Preparation of documents for maintenance management system.
- e) Training at manufacturer's works in specialized areas/simulator/other utilities.

This on-the-job training activity will be coordinated by Head (O&M) and Project Coordinator.

			SCCL
14.08.01	Training in the areas of operation and maintenance of modern facilities shall also be organized. TRAINING OF OPERATION ENGINEERS a) Simulator Training The operation engineers will undergo extensive training on replica simulator at Simulator Training Institute. This training will be so designed as to fully equip the operators with the requisite know how and confidence to effectively handle all plant upsets and crisis situation which are likely to arise in a plant. b) Training at manufacturers Works and other Utilities The operation engineers will undergo extensive training at manufacturers work for familiarization and for design/testing aspects. They will also be imparted training in the running units of other utilities also where new technologies have already been adopted by these.		
14.08.02	TRAINING OF MAINTENANCE ENGINEERS Maintenance engineers will undergo extensive training at stations of other utilities. They will also be imparted training at manufacturers work for familiarization and for design/testing aspects.		
14.09.00	MAINTENANCE PHILOSOPHY		
14.09.01	MAINTENANCE MANAGEMENT SYSTEM The maintenance of this project will be carried out as per the maintenance management system of adopted by SCCL, which will be evolved in consultation with Owner's Consultants. This system aims at maximizing the availability of generating unit while ensuring minimum maintenance cost and safety of plant and personnel. The maintenance management system shall aim to have no break down from overhaul to overhaul. The maintenance management system covers organizational structures, preventive maintenance schedules, predictive maintenance detailed work specification covering all maintenance jobs, permit to work system, long term maintenance planning, safety aspects etc. This system provides for daily maintenance planning meeting for about 30 minutes for finalizing maintenance schedule for next 24 hours and resolution of interface problems between departments. These meetings are supplemented by meeting of HODs for half an hour daily to accelerate the decision-making process and to lay down the priorities and guidelines for maintenance work during the next 72 hours.		
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14.09.02
SPARE PARTS MANAGEMENT SYSTEM

The primary objective of spare part management system will be to ensure timely availability of proper spare parts for efficient maintenance of the plant without excessive build-up on non-moving inventory. The spare parts management system will cover the following aspects:

- a) Proper codification of all spares and consumable.
- b) Spare parts indenting and procurement policy.
- c) Criteria for ordering of mandatory and recommended spares.
- d) Judicious fixation of inventory levels and ordering levels for spare parts based on experience in similar projects.
- e) Development of indigenous sources/in house capability for imported spare parts.
- f) Development of more than one source wherever practicable.

14.09.03
AVAILABILITY OF O&M MANUALS

- a) All contracts will include provision of 8 sets of "DRAFT" O&M Manuals to be supplied by vendor within 12 months from the date of LOA.
- b) The draft O&M Manuals will be reviewed by project engineering group/Owner's Consultant to ensure completeness and proper coverage.
- c) Schematic diagrams, P&I diagrams, wiring diagrams, cable schedule, valve schedules, pipe schedule etc shall also be submitted by vendor.
- d) "FINAL" O&M Manuals (15 sets prints and 3 CD ROMs), which will be distributed to all concerned as per the approved distribution policy of the company, will be available to all concerned at least 18 months prior to synchronization of unit to avoid problems in preparation of commissioning document as well as proper installation & commissioning of equipment.

14.09.04
SPECIAL TOOLS AND TACKLES

All contracts will include the provision for supply of two unused sets of all special tools and tackles which are required for installation, Commissioning and proper maintenance of plant and equipment. These two sets of special tools and tackles will be handed over to O&M department within one (1) month of commissioning of the unit.

Suitable lifting tools and tackles shall be provided for carrying out maintenance with full safety.

	Quick erect scaffolding for boiler furnace and set of sky climber shall also be part of special tools and tackles. Pneumatic tools, roller support in turbine rotors shall also be arranged.				
14.10.00	COAL SUPPLY MANAGEMENT The minimum requirement of coal will be based on operating norms. However, the monthly requirements will be finalized through Coal Supply Agreements. In order to meet the actual requirements of the project, the mines will keep a provision for 10% increase or decrease in supplies from the agreed average level. The coal loading and handling plant at Mine and coal handling plant of SCCL will be designed to meet the peak requirement on daily basis with adequate reserve capacity to take care of normal breakdowns and maintenance requirements.				
14.11.00	ENERGY CONSERVATION ASPECTS				
14.11.01	INTRODUCTION All consumers of electricity, irrespective of their power demand, are required to become conscious about energy conservation and should think of ways and means to optimize their energy consumption. But it is all the more very important for a power plant, which happens to be one of the biggest consumers of electricity, to think of reducing its own power consumption. As a first step all major auxiliaries shall be provided with energy meters so as to monitor their energy consumption.				
14.11.02	SELECTION OF STEAM PARAMETERS AND FEED HEATING CYCLE Thermal efficiency of the Cycle can be improved by raising main steam parameters (pressure and temperature), introducing reheating of steam at a suitable stage of expansion, improving condenser Vacuum and optimizing regenerative feed water heating arrangement. Improvement in thermal efficiency means saving in fuel burnt in boiler and also significant saving in power consumption of plant auxiliary equipment in an effort towards energy conservation. The thermal cycle parameters shall be optimized for this range of unit rating by selecting parameters of Main steam temperature, pressure, reheat steam temperature and condenser pressure to provide an optimum thermal cycle. The boiler shall operate in super critical zone. The cycle employs regenerative feed water heaters thereby ensuring optimum turbine heat rate. The losses through flue gas have been kept to a minimum.				
<table><tr><td>DETAILED PROJECT REPORT SCCL TFP Stage-II (1X800MW)</td><td>Doc. No.: CW-EN-11159-DPR-002</td><td>CHAPTER-14 OPERATION AND MAINTENANCE</td><td>Page 10 of 13</td></tr></table>		DETAILED PROJECT REPORT SCCL TFP Stage-II (1X800MW)	Doc. No.: CW-EN-11159-DPR-002	CHAPTER-14 OPERATION AND MAINTENANCE	Page 10 of 13
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14.14.00
CHEMISTRY

Continuous monitoring and control of water and steam purity in the plant cycle will further improve the heat transfer rate in heat exchanger tubes. It can be achieved by the following chemistry control philosophy:

- a) The units are to be operated in Oxygenated treatment (OT) of feed water.
- b) The 100% Condensate to be treated in CPU in hydrogen cycle only. Therefore a standby 50% treatment facility shall be available all the time.
- c) The make up water should have the following characteristics:
 - (i) Conductivity less than 0.1 $\mu\text{S}/\text{cm}$,
 - (ii) Silica less than 5 ppb,
- d) The parameters to be monitored by on-line instruments and core parameters are indicated in Control room with alarm and the limit value. The total chemistry control and monitoring is done by Chemistry expert software to alert and inform operator for desired actions.
- e) Following parameters are to be monitored continuously on-line in water /steam cycle:

(i) Cation conductivity	:	at CEP discharge; CPU outlet; Feed water and Main steam
(ii) Conductivity	:	----do----
(iii) pH	:	at Feed water
(iv) Silica	:	at Feed water and main steam
(v) Dissolved Oxygen	:	at Condensate and Feed water
(vi) Sodium	:	at Main steam; CEP discharge and CPU
(vii) ORP	:	at CEP discharge and Feed water
- (vi) Adequate arrangements including nitrogen capping (for dry or wet preservation) shall be provided for proper lay up of the all the water and steam touched system when unit is under shut down.
- (vii) The chemical feeding (like ammonia and oxygen) shall be performed by automatic mode.
- vii) The WT plant shall be fully automated and to be designed for minimal manual interference. Utilization of Ozone for water disinfection; use of alternate chemicals such as PAC; and gas transfer membrane system for degasification of dematerialized water etc. to be considered.
- ix) Cooling water chemistry control to be done by PLC based operation and monitoring.

14.15.00

- x) Provision of Chemical laboratory to be made consisting of in climate controlled rooms having adequate instruments for water, coal, oil and gas analysis.

OPERATIONAL OPTIMIZATION

Automatic controllers are provided for plant optimization. The unit capacity controller shall set load demand keeping the safety of the equipment inherent.

The main controllers used for optimum performance of the whole plant are as follows:

- a) Unit Capacity Controller
 - i) Boiler Capacity Controller
 - ii) Turbine Capacity Controller
- b) Combustion Control
 - i) Coal flow
 - ii) Air flow
- c) SH/RH Steam temperature controller
- d) Chemical dosing controller
 - i) Hydrazine
 - ii) Ammonia
 - iii) Phosphate
- e) Main steam pressure controller
- f) FW flow Controller
 - i) Low range
 - ii) High range
- g) Deaerator level
- h) Hot well level
- i) HP/LP bypass
- j) PA header

In addition to above, HMI is programmed to carryout on-line performance calculation like unit/turbine gross/net heat rate and efficiencies of boilers/Turbines/all major auxiliaries and thus giving immediate feedback to the management for analysis by unit performance improvement & optimization.

CHAPTER – 15
MARKETING PHILOSOPHY

MARKETING PHILOSOPHY

15.01.00
ALLOCATION OF POWER

SCCL is establishing generating stations in Telengana State of the country for supply of power to state. SCCL Thermal Power Station Stage-II in the Mancherla, District of Telengana State is one such station being set up for supply of power to the beneficiary of Southern Region and State of Telengana. Project comprising One unit of 800 MW is being implemented at present.

SCCL informed that they had already obtained the formal consent from Telangana Discoms that they will enter into PPA with SCCL for the purchase of the power to be produced from this 800MW Plant.

S.No.	STATE/AGENCY	SHARE
01	TS TRANSCO	800MW

15.02.00
ARRANGEMENTS FOR DRAWAL OF POWER BY TS TRANSCO / UTILITIES

SCCL would supply the power generated from this station into the EHV grid at the 400 KV bus bars of the station. The transmission system of this project would be implemented by Telengana State Power Transmission Company (TSTRANSCO), which would be utilized and paid by Telengana state states for drawl of their allocated shares from this project and through their own/other STUs transmission systems.

15.03.00
TARIFF

Tariff for SCCL Thermal Power Project Stage-II shall be determined by SERC or any other competent authority defined under Electricity Act 2003 or any other Act/ Regulation enacted by the Govt. of India from time to time and as per directives/guidelines/tariff policy issued by Government of Telengana. Through the tariff, SCCL would recover the Fixed Charges consisting of O&M charges, Secondary Fuel Oil cost, Depreciation, Interest on Loan, Return on Equity, Interest on Working Capital, Taxes, duties etc. if any, and the fuel charges as variable charges. The tariff would be applicable for the capacity and energy supplied at the EHV buses of the station, which would be fully

accounted for through the State Energy Accounts prepared by the State Power Committee/State Load Dispatch Center or any other competent authority as defined as per Electricity Act, 2003. The losses beyond the bus bars of the station would be shared by beneficiary to ensure that SCCL is paid for all its energy sent out as metered at bus bar of power station.

ANNEXURES

SUMMARY OF FINAL PROJECT CAPITAL COST

PROJECT: Capacity		MW		Non Mega		(Rs. in Crore)	800
Sl. No.	Item Description	Annexure No.	FC	IC	Total		
1.0	Preliminary & Civil Works						
1.1	Land & Civil Construction Works	Ann. No.1.1.1	0.00	1012.70	1012.70		
1.2	Environment Costs		0.00	10.00	10.00		
	Sub-Total 1.0		0.00	1022.70	1022.70		
2.0	Plant & Equipment						
2.1	Mechanical Equipment	Ann. No.1.1.2	0.00	5031.84	5031.84		
2.2	Electrical Equipment	Ann. No.1.1.3	0.00	471.97	471.97		
2.3	Coal Transportation System	Ann. No.1.1.4	0.00	216.30	216.30		
2.4	Spares		0.00	396.14	396.14		
2.4	Misc. Tools & Plants			0.00	0.00		
2.5	Customs Duty			0.00	0.00		
2.6	GST			1219.58	1219.58		
2.7	Central Sales Tax			0.00	0.00		
2.8	Physical Contingency		0.00	13.04	13.04		
	Sub-Total 2.0		0.00	7348.87	7348.87		
	Works Cost (1.0+2.0)		0.00	8371.57	8371.57		
3.0	Pre Commissioning Expenses			63.12	63.12		
4.0	Project Management						
4.1	Establishment incl. Consultancy, Audit & Accounts						
4.2	Training of O&M Staff			166.10	166.10		
4.3	Losses on Stocks						
4.4	Corporate Asset Allocation						
	Sub-Total 4.0			166.10	166.10		
	Project Cost excl. IDC (1 to 4)		0.00	8600.79	8600.79		
5.0	Interest During Construction (IDC)						
a)	Interest Charges		0.00	995.20	995.20		
b)	Financing Charges		0.00	991.20	991.20		
			0.00	4.00	4.00		
	Project Cost incl. IDC (1 to 5)		0.00	9595.99	9595.99		
	Cost/MW (Excl. WCM)						11.99
6.0	Working Capital Margin (WCM)			0.00	0.00		
	Project Cost incl. IDC. & WCM (1 to 6)		0.00	9595.99	9595.99		
	Cost/MW (Incl. IDC & WCM)						11.99

ABSTRACT COST ESTIMATE

		CIVIL WORKS			
			0.00		
			0.00		
PROJECT:	Singareni (1x800 MW)				(Rs. in Crore)
SL. No.	Item Description		FC	IC	Total
1.00	Survey & Soil Investigation		0.00	0.00	0.00
2.00	Land		0.00	0.00	0.00
3.00	Site Levelling		0.00	5.00	5.00
4.00	Permanent Township		0.00	84.13	84.13
5.00	Infrastructure facilities		0.00	48.10	48.10
6.00	Mainplant Civil works.		0.00	875.47	875.47
7.00	Chimney and Chimney elevator	included above	0.00	0.00	0.00
8.00	C. W. System & Makeup	included above	0.00	0.00	0.00
9.00	Ash Dyke- First 9 years	included above	0.00	0.00	0.00
TOTAL			0.00	1012.70	1012.70

ABSTRACT COST ESTIMATE

Mechanical Works						
(CURRENT COST)						
0.00						
PROJECT:	Singareni (1x800 MW)	(Rs. in Crore)				
Sl. No.	Item Description	FC IC Total				
1.00	SG with Associated aux.			2442.66		2442.66
2.00	Turbine Generator with assoc. aux.			751.94		751.94
3.00	Electrostatic Precipitator			175.46		175.46
4.00	Coal Handling System			694.20		694.20
5.00	C & I incl. DAS			167.42		167.42
6.00	Ash Handling System & AWRs			366.06		366.06
7.00	CW Pumps incl. Makeup water sys.			145.39		145.39
8.00	Cooling Towers incl. Civil Works			127.29		127.29
9.00	DM Plant & CW Treatment			80.66		80.66
10.00	Miscellaneous Pump			0.00		0.00
11.00	Station piping & FOH			16.41		0.00
12.00	Fire Detection and Protection System			22.87		0.00
13.00	Air Conditioning & Ventilation			41.49		41.49
14.00	Workshop & Lab. Equipment			0.00		0.00
15.00	Pre-treatment plant (incl in DM Plant)			0.00		0.00
TOTAL				5031.84		5031.84

ANNEXURE-1.1.3

ABSTRACT COST ESTIMATE				
Electrical Works				
(CURRENT COST)				
PROJECT:	Singareni (1x800 MW)			(Rs. in Crore)
Sl. No.	Item Description	FC	IC	Total
A	ELECTRICAL SYSTEM			
1.00	Generator Bus Duct & MV Bus Duct	0.00	13.88	13.88
2.00	Power Transformers	0.00	120.16	120.16
3.00	Outdoor & Indoor Transformers (Included in above)	0.00	0.00	0.00
4.00	H T Switchgear	0.00	50.40	50.40
5.00	L T Switchgear	0.00	39.48	39.48
6.00	H T Power Cables	0.00	68.54	68.54
7.00	L T Power and Control Cables (Included in above)	0.00	0.00	0.00
8.00	Cabling, Earthing & Stn. Lighting, Battery, DG sets & Indoor trf	0.00	82.44	82.44
	SUB TOTAL (A)	0.00	374.90	374.90
B	SWITCHYARD			
9.00	Switchyard	0.00	88.16	88.16
10.00	Reactor (incl. above)	0.00	0.00	0.00
12.00	Construction Power + 33KV line-bay + AWRS + Startup+Diversion of transmission line	0.00	8.91	8.91
	SUB TOTAL (B)	0.00	97.07	97.07
C	COMPUTER & SATELITE COMMUNICATION FACILITIES			
13.00	Computer Facilities	0.00	0.00	0.00
14.00	Satellite Communication System	0.00	0.00	0.00
15.00	Common Facilities	0.00	0.00	0.00
	SUB TOTAL (C)	0.00	0.00	0.00
	TOTAL	0.00	471.97	471.97

	ABSTRACT COST ESTIMATE			
	Coal Transportation System			
	(CURRENT COST)			
		0.00		
PROJECT:	Singareni (1x800 MW)			(Rs. in Crore)
		Cost		
Sl.	Item Description	FC	IC	Total
No.				
1.00	Railway Siding	0.00	188.86	188.86
2.00	Loco+shed	0.00	27.44	27.44
	TOTAL	0.00	216.30	216.30

Sub: Environment Expenditure pertaining to 1x800MW Expansion Unit at STPP - Reg.

Sl.No.	Description	Amount (Crores)	Remarks
	Forest Dept.Telangana State		
1	Allotment of 130 Ha for Degraded Forest land near to STPP	14.0661	Waiting for Demand Notice from DFO.MNCL
2	Wild life Management Plan	2.9	Waiting for fresh Demand Notice from DFO.MNCL
3	Obtaining CFE/CFO from TGPCB	1	Waiting for Demand Notice from TGPCB.NZB
4	CSR Expenditure	14.7	0.25% on project cost Rs 5879.62 Crores, i.e. Rs 14.7 Crores shall be earmarked for carrying out CER activities for developing infrastructure in the surrounding villages.
TOTAL		32.6661	

Note: 2% of profits of 3 preceeding years for St-1 & St-2 shall be reported for implementing CSR activities during operation phase of power plant.

Ch. Vidy

(Ch. Vasudeva Murthy)
DSH (Env) - STPP

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Item	2024-12	2024-11	2024-10	2024-09	2024-08	2024-07	2024-06	2024-05	2024-04	2024-03	2024-02	2024-01	2023-12	2023-11	2023-10	2023-09	2023-08	2023-07	2023-06	2023-05	2023-04	2023-03	2023-02	2023-01	2022-12	2022-11	2022-10	2022-09	2022-08	2022-07	2022-06	2022-05	2022-04	2022-03	2022-02	2022-01	2021-12	2021-11	2021-10	2021-09	2021-08	2021-07	2021-06	2021-05	2021-04	2021-03	2021-02	2021-01	2020-12	2020-11	2020-10	2020-09	2020-08	2020-07	2020-06	2020-05	2020-04	2020-03	2020-02	2020-01	2019-12	2019-11	2019-10	2019-09	2019-08	2019-07	2019-06	2019-05	2019-04	2019-03	2019-02	2019-01	2018-12	2018-11	2018-10	2018-09	2018-08	2018-07	2018-06	2018-05	2018-04	2018-03	2018-02	2018-01	2017-12	2017-11	2017-10	2017-09	2017-08	2017-07	2017-06	2017-05	2017-04	2017-03	2017-02	2017-01	2016-12	2016-11	2016-10	2016-09	2016-08	2016-07	2016-06	2016-05	2016-04	2016-03	2016-02	2016-01	2015-12	2015-11	2015-10	2015-09	2015-08	2015-07	2015-06	2015-05	2015-04	2015-03	2015-02	2015-01	2014-12	2014-11	2014-10	2014-09	2014-08	2014-07	2014-06	2014-05	2014-04	2014-03	2014-02	2014-01	2013-12	2013-11	2013-10	2013-09	2013-08	2013-07	2013-06	2013-05	2013-04	2013-03	2013-02	2013-01	2012-12	2012-11	2012-10	2012-09	2012-08	2012-07	2012-06	2012-05	2012-04	2012-03	2012-02	2012-01	2011-12	2011-11	2011-10	2011-09	2011-08	2011-07	2011-06	2011-05	2011-04	2011-03	2011-02	2011-01	2010-12	2010-11	2010-10	2010-09	2010-08	2010-07	2010-06	2010-05	2010-04	2010-03	2010-02	2010-01	2009-12	2009-11	2009-10	2009-09	2009-08	2009-07	2009-06	2009-05	2009-04	2009-03	2009-02	2009-01	2008-12	2008-11	2008-10	2008-09	2008-08	2008-07	2008-06	2008-05	2008-04	2008-03	2008-02	2008-01	2007-12	2007-11	2007-10	2007-09	2007-08	2007-07	2007-06	2007-05	2007-04	2007-03	2007-02	2007-01	2006-12	2006-11	2006-10	2006-09	2006-08	2006-07	2006-06	2006-05	2006-04	2006-03	2006-02	2006-01	2005-12	2005-11	2005-10	2005-09	2005-08	2005-07	2005-06	2005-05	2005-04	2005-03	2005-02	2005-01	2004-12	2004-11	2004-10	2004-09	2004-08	2004-07	2004-06	2004-05	2004-04	2004-03	2004-02	2004-01	2003-12	2003-11	2003-10	2003-09	2003-08	2003-07	2003-06	2003-05	2003-04	2003-03	2003-02	2003-01	2002-12	2002-11	2002-10	2002-09	2002-08	2002-07	2002-06	2002-05	2002-04	2002-03	2002-02	2002-01	2001-12	2001-11	2001-10	2001-09	2001-08	2001-07	2001-06	2001-05	2001-04	2001-03	2001-02	2001-01	2000-12	2000-11	2000-10	2000-09	2000-08	2000-07	2000-06	2000-05	2000-04	2000-03	2000-02	2000-01	1999-12	1999-11	1999-10	1999-09	1999-08	1999-07	1999-06	1999-05	1999-04	1999-03	1999-02	1999-01	1998-12	1998-11	1998-10	1998-09	1998-08	1998-07	1998-06	1998-05	1998-04	1998-03	1998-02	1998-01	1997-12	1997-11	1997-10	1997-09	1997-08	1997-07	1997-06	1997-05	1997-04	1997-03	1997-02	1997-01	1996-12	1996-11	1996-10	1996-09	1996-08	1996-07	1996-06	1996-05	1996-04	1996-03	1996-02	1996-01	1995-12	1995-11	1995-10	1995-09	1995-08	1995-07	1995-06	1995-05	1995-04	1995-03	1995-02	1995-01	1994-12	1994-11	1994-10	1994-09	1994-08	1994-07	1994-06	1994-05	1994-04	1994-03	1994-02	1994-01	1993-12	1993-11	1993-10	1993-09	1993-08	1993-07	1993-06	1993-05	1993-04	1993-03	1993-02	1993-01	1992-12	1992-11	1992-10	1992-09	1992-08	1992-07	1992-06	1992-05	1992-04	1992-03	1992-02	1992-01	1991-12	1991-11	1991-10	1991-09	1991-08	1991-07	1991-06	1991-05	1991-04	1991-03	1991-02	1991-01	1990-12	1990-11	1990-10	1990-09	1990-08	1990-07	1990-06	1990-05	1990-04	1990-03	1990-02	1990-01	1989-12	1989-11	1989-10	1989-09	1989-08	1989-07	1989-06	1989-05	1989-04	1989-03	1989-02	1989-01	1988-12	1988-11	1988-10	1988-09	1988-08	1988-07	1988-06	1988-05	1988-04	1988-03	1988-02	1988-01	1987-12	1987-11	1987-10	1987-09	1987-08	1987-07	1987-06	1987-05	1987-04	1987-03	1987-02	1987-01	1986-12	1986-11	1986-10	1986-09	1986-08	1986-07	1986-06	1986-05	1986-04	1986-03	1986-02	1986-01	1985-12	1985-11	1985-10	1985-09	1985-08	1985-07	1985-06	1985-05	1985-04	1985-03	1985-02	1985-01	1984-12	1984-11	1984-10	1984-09	1984-08	1984-07	1984-06	1984-05	1984-04	1984-03	1984-02	1984-01	1983-12	1983-11	1983-10	1983-09	1983-08	1983-07	1983-06	1983-05	1983-04	1983-03	1983-02	1983-01	1982-12	1982-11	1982-10	1982-09	1982-08	1982-07	1982-06	1982-05	1982-04	1982-03	1982-02	1982-01	1981-12	1981-11	1981-10	1981-09	1981-08	1981-07	1981-06	1981-05	1981-04	1981-03	1981-02	1981-01	1980-12	1980-11	1980-10	1980-09	1980-08	1980-07	1980-06	1980-05	1980-04	1980-03	1980-02	1980-01	1979-12	1979-11	1979-10	1979-09	1979-08	1979-07	1979-06	1979-05	1979-04	1979-03	1979-02	1979-01	1978-12	1978-11	1978-10	1978-09	1978-08	1978-07	1978-06	1978-05	1978-04	1978-03	1978-02	1978-01	1977-12	1977-11	1977-10	1977-09	1977-08	1977-07	1977-06	1977-05	1977-04	1977-03	1977-02	1977-01	1976-12	1976-11	1976-10	1976-09	1976-08	1976-07	1976-06	1976-05	1976-04	1976-03	1976-02	1976-01	1975-12	1975-11	1975-10	1975-09	1975-08	1975-07	1975-06	1975-05	1975-04	1975-03	1975-02	1975-01	1974-12	1974-11	1974-10	1974-09	1974-08	1974-07	1974-06	1974-05	1974-04	1974-03	1974-02	1974-01	1973-12	1973-11	1973-10	1973-09	1973-08	1973-07	1973-06	1973-05	1973-04	1973-03	1973-02	1973-01	1972-12	1972-11	1972-10	1972-09	1972-08	1972-07	1972-06	1972-05	1972-04	1972-03	1972-02	1972-01	1971-12	1971-11	1971-10	1971-09	1971-08	1971-07	1971-06	1971-05	1971-04	1971-03	1971-02	1971-01	1970-12	1970-11	1970-10	1970-09	1970-08	1970-07	1970-06	1970-05	1970-04	1970-03	1970-02	1970-01	1969-12	1969-11	1969-10	1969-09	1969-08	1969-07	1969-06	1969-05	1969-04	1969-03	1969-02	1969-01	1968-12	1968-11	1968-10	1968-09	1968-08	1968-07	1968-06	1968-05	1968-04	1968-03	1968-02	1968-01	1967-12	1967-11	1967-10	1967-09	1967-08	1967-07	1967-06	1967-05	1967-04	1967-03	1967-02	1967-01	1966-12	1966-11	1966-10	1966-09	1966-08	1966-07	1966-06	1966-05	1966-04	1966-03	1966-02	1966-01	1965-12	1965-11	1965-10	1965-09	1965-08	1965-07	1965-06	1965-05	1965-04	1965-03	1965-02	1965-01	1964-12	1964-11	1964-10	1964-09	1964-08	1964-07	1964-06	1964-05	1964-04	1964-03	1964-02	1964-01	1963-12	1963-11	1963-10	1963-09	1963-08	1963-07	1963-06	1963-05	1963-04	1963-03	1963-02	1963-01	1962-12	1962-11	1962-10	1962-09	1962-08	1962-07	1962-06	1962-05	1962-04	1962-03	1962-02	1962-01	1961-12	1961-11	1961-10	1961-09	1961-08	1961-07	1961-06	1961-05	1961-04	1961-03	1961-02	1961-01	1960-12	1960-11	1960-10	1960-09	1960-08	1960-07	1960-06	1960-05	1960-04	1960-03	1960-02	1960-01	1959-12	1959-11	1959-10	1959-09	1959-08	1959-07	1959-06	1959-05	1959-04	1959-03	1959-02	1959-01	1958-12	1958-11	1958-10	1958-09	1958-08	1958-07	1958-06	1958-05	1958-04	1958-03	1958-02	1958-01	1957-12	1957-11	1957-10	1957-09	1957-08	1957-07	1957-06	1957-05	1957-04	1957-03	1957-02	1957-01	1956-12	1956-11	1956-10	1956-09	1956-08	1956-07	1956-06	1956-05	1956-04	1956-03	1956-02	1956-01	1955-12	1955-11	1955-10	1955-09	1955-08	1955-07	1955-06	1955-05	1955-04	1955-03	1955-02	1955-01	1954-12	1954-11	1954-10	1954-09	1954-08	1954-07	1954-06	1954-05	1954-04	1954-03	1954-02	1954-01	1953-12	1953-11	1953-10	1953-09	1953-08	1953-07	1953-06	1953-05	1953-04	1953-03	1953-02	1953-01	1952-12	1952-11	1952-10	1952-09	1952-08	1952-07	1952-06	1952-05	1952-04	1952-03	1952-02	1952-01	1951-12	1951-11	1951-10	1951-09	1951-08	1951-07	1951-06	1951-05	1951-04	1951-03	1951-02	1951-01	1950-12	1950-11	1950-10	1950-09	1950-08	1950-07	1950-06	1950-05	1950-04	1950-03	1950-02	1950-01	1949-12	1949-11	1949-10	1949-09	1949-08	1949-07	1949-06	1949-05	1949-04	1949-03	1949-02	1949-01	1948-12	1948-11	1948-10	1948-09	1948-08	1948-07	1948-06	1948-05	1948-04	1948-03	1948-02	1948-01	1947-12	1947-11	1947-10	1947-09	1947-08	1947-07	1947-06	1947-05	1947-04	1947-03	1947-02	1947-01	1946-12	1946-11	1946-10	1946-09	1946-08	1946-07	1946-06	1946-05	1946-04	1946-03	1946-02	1946-01	1945-12	1945-11	1945-10	1945-09	1945-08	1945-07	1945-06	1945-05	1945-04	1945-03	1945-02	1945-01	1944-12	1944-11	1944-10	1944-09	1944-08	1944-07	1944-06	1944-05	1944-04	1944-03	1944-02	1944-01	1943-12	1943-11	1943-10	1943-09	1943-08	1943-07	1943-06	1943-05	1943-04	1943-03	1943-02	1943-01	1942-12	1942-11	1942-10	1942-09	1942-08	1942-07	1942-06	1942-05	1942-04	1942-03	1942-02	1942-01	1941-12	1941-11	1941-10	1941-09	1941-08	1941-07	1941-06	1941-05	1941-04	1941-03	1941-02	1941-01	1940-12	1940-11	1940-10	1940-09	1940-08	1940-07	1940-06	1940-05	1940-04	1940-03	1940-02	1940-01	1939-12	1939-11	1939-10	1939-09	1939-08	1939-07	1939-06	1939-05	1939-04	1939-03	1939-02	
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File No: J-13012/08/2015-IA. II (T)
Government of India
Ministry of Environment, Forest and Climate Change

Indira Paryavaran Bhawan,
3rd Floor, Vayu Wing
Jor Bagh Road,
Aliganj, New Delhi-110003

Dated: 18.12.2019

To

The Director (E&M)
M/s The Singareni Collieries Company Ltd.
PO: Kothagudem Collieries,
Bhadrachalam Road Rly. Station
Bhadrachalam Kothagudem District,
Telangana State, PIN- 507101.

Tel. No.08744 - 243059; Fax: 08744 -244115; E-mail: env_crp@scclmines.com

Sub: 1x800 MW Supercritical Coal based Singareni Thermal Power Plant (Expansion from 2x600 MW to 2000 MW) at Pegadapalli Village, Jaipur Mandal, Mancherla District, Telangana by M/s Singareni Collieries Company Ltd.- reg. Environmental Clearance.

Sir,

The undersigned is directed to refer your online application no. **IA/TG/THE/27094/2015** dated 03.11.2018 and the documents submitted vide your letters dated 15.2.2018, 16.7.2019 and 13.8.2019 for grant of Environmental Clearance.

2. It has been noted that you have proposed for establishing 800 MW Supercritical Coal based Thermal Power Plant within the premises of 2x600 MW power plant which is in operation.

3. It has noted that the Environmental Clearance for the 2x600 MW Thermal Power Plant has been issued vide Ministry's letter dated 27.12.2010. It has been informed that the existing power plant has been commissioned in December, 2016. The land used for existing power plant is 301 ha (744 acres). Coal requirement for 2x600 MW power plant is 4.784 MTPA (15,500 tonnes/day) which is brought from the M/s SCCL's own mines within 15 km radius. The project is located in the Coal belt of Ramagundam, Srirampur & Mancherla Region in which M/s SCCL has several mines. The coal transportation is done by rail for a distance of 21.2 km of connecting Srirampur Coal Handling Plant with Thermal Power Plant. The said Coal Handling Plant receives coal from various mines surrounded by it. The permission to transport coal both by road and rail (50% road & 50 rail) for temporarily up to 9.8.2019.

4. It has been noted that the land requirement for the existing project (2x600 MW) is 300.972 ha and for the proposed project (1x800 MW) is 127.31 ha. There are no biosphere reserves, national parks, wildlife sanctuaries, wetlands or other protected areas such as the Important Bird Areas (IBAs) within a distance of 10 Km from the

core area. But there are reserve forests, Godavari River, mango gardens; agroforests of Eucalyptus plantations, Singareni coal mines and residential areas within 10 Km.

5. The Coal requirement for the existing plant is 4.8 MTPA (642 TPH @ 80% PLF) and the coal requirement for the proposed project is 4.05 MTPA (514 TPH @90% PLF). Naini coal block was allocated for both existing and proposed power projects. Coal production from the Naini coal block is expected in 2020-21. Meanwhile MoC has granted bridge linkage for use of coal from SCCL mines. Gross Calorific Value of the Coal is expected to be 3500 kCal/Kg with Sulphur and Ash contents are 0.5% and 40% respectively. The Ministry of Coal vide letters dated 13.8.2015 and 19.7.2019 has granted the coal linkage of Naini Coal Block to the proposed power project.

6. The Environmental Clearance process for Naini Coal Block is at the stage of Terms of Reference (ToR). The EAC meeting for grant of ToR has been held on 22.10.2019. Application for diversion of forest land (Chhendipada Reserve Forest) of 783.275 ha for Naini Coal Block is under process by the State Forest Department. The transportation of coal from the Naini Block to the Power plant will be by rail mode only.

7. The envisaged mode of coal transportation from coal mines to the power plant is by Indian railway system in bottom open/BOXN wagons. The rakes with bottom open will be unloaded into existing track hopper of Stage-I and rakes with BOXN wagon will be unloaded by proposed Wagon Tippler for Stage-II. New railway tracks are proposed for the wagon tipping and BOX-N rakes.

8. The coal handling plant will be 1400 MTPH rated capacity (keeping in view the interconnection with existing stage) with parallel double stream (one working and one standby) belt conveyors along with facilities for receiving and stacking/reclaiming the coal to/from crushed coal stockyards.

9. Light diesel oil will be used for furnace light up and boiler start up while HFO will be used for flame stabilization. The total requirement of LDO and HFO is 12,088 KL/annum.

10. Water requirement for the existing plant is 88800 KLD (3700 m³/hr) and for the proposed project is 48000 KLD (2000 m³/hr). Water quantity of 1.05 TMC per annum (3233 m³/hr) during lean period from River Godavari and 2.0 TMC (6466 m³/hr) from River Pranahitha as main source sanctioned by State Government. As per GEC methodology and WALTA ACT2004, State Groundwater Department permitted vide Ir.no: 157/T/2008 dated 07-08-2008 to draw 18 MGD (1 TMC) of water through infiltration galleries from Godavari River, near Shettipalli village, for existing 2x600 MW which is located 8.6km south of the project. Further, State Irrigation & CAD department vide approval dated 19.7.2010 permitted to draw water of 2 TMC from Pranahitha River near Devulwada Village, Adilabad District.

11. Water Source and intake point of Proposed 1x800 MW will be located in River Pranahitha which is at a distance of about 43.5 Km (near Devulawada Village, Mancherial District) from project site. To draw water from Godavari River, a pipeline of 8.6 km has been laid to transport water to power plant. The existing water allocations would be sufficient to meet the requirement of existing and proposed power projects. For laying pipeline from Pranahitha River, an area of 2.99 ha of forest land is to be diverted for which Stage-I (In-principle) clearance and Stage-II (Formal approval)

clearance under Forest (Conservation) Act, 1980 have been obtained vide Ministry's letters dated 16.6.2016 and 7.5.2019.

12. The baseline terrestrial environmental survey was carried out during Post monsoon (Oct to Dec 2017) by covering the study area of 10 km radius from project boundary. Predominant Wind Direction during the study period is NE.

13. The Baseline air quality data has been collected from 10 locations. The 98 percentile values are PM_{10} : 56.8-83.5 $\mu\text{g}/\text{m}^3$ (Standard: 100 $\mu\text{g}/\text{m}^3$), $PM_{2.5}$: 32.9-45.0 $\mu\text{g}/\text{m}^3$ (Standard: 60 $\mu\text{g}/\text{m}^3$), SO_2 : 12.9-18.0 $\mu\text{g}/\text{m}^3$ (Standard: 60 $\mu\text{g}/\text{m}^3$), NO_x : 18.7-25.4 $\mu\text{g}/\text{m}^3$ (Standard: 60 $\mu\text{g}/\text{m}^3$), O_3 : 13.9-22.0 $\mu\text{g}/\text{m}^3$ (Standard: 100 $\mu\text{g}/\text{m}^3$), CO: 460-776 $\mu\text{g}/\text{m}^3$ (Standard: 2000 $\mu\text{g}/\text{m}^3$). Mercury levels are below detectable limits (0.001 $\mu\text{g}/\text{m}^3$). All the air quality data is within the Ambient Air Quality Standards. The maximum ground level concentrations for the worst case scenario are PM: 3524 $\mu\text{g}/\text{m}^3$ (Without ESP) and 1.7 $\mu\text{g}/\text{m}^3$ (with ESP), SO_2 : 33 $\mu\text{g}/\text{m}^3$ (Without FGD for both plants) and 3.4 $\mu\text{g}/\text{m}^3$ (with FGD) & NO_x : 8-21.6 $\mu\text{g}/\text{m}^3$.

14. The average day time and night time noise levels at different zones in the study area were found to be varying from 50.9 to 56.2 dB(A) and 40.7 to 43.8 dB(A) respectively and the values were found to be within the limits prescribed by CPCB for residential areas. Based on the Physico-chemical parameters and comparison with IS 10500-2012 drinking water standards, all ground water samples were found to be fit for drinking, however some of the parameters in a few water samples were exceeding the acceptable limits but were within permissible limits. Surface water samples have pH in the range of 6.9 to 7.1, BOD range of 5-14 mg/l, COD was observed to be in the range of 20-50 mg/l, DO was in the range of 5.5-6.2 mg/l. The pH of the soil ranged from 7.0 to 7.5 indicating that the soils are normal to saline in nature. The proposed power plant area is mostly covered by thick black and reddish soils, underlined by sand stones, shales and clay.

15. There are no Sanctuaries, National Parks, Tiger Reserves or Biosphere Reserves or Elephant Corridors or other protected areas within 15 Km of radius from core area. The vegetation in the study area shows the presence of three blocks of reserved forest namely: Kundaram RF 2.4 Km (East); Indaram RF 2.7 Km (West); Mittapalli RF 5.6 Km (North), Bellampalli RF 9.8 Km (N), Chinnur RF 10.8 Km (E), Ramagundam RF 11.3 Km (WSW) Pottial RF 13.9 Km (NE) and Nanial RF 15K m (NNE) of the project site. The forests come under the southern tropical dry deciduous and Southern dry scrub forests of Champion and Seth. They are highly degraded due to illegal felling and grazing. Among the mammals, Blackbuck (*Antelope cervicapra*) comes under the RET (Schedule-I) category. It was noticed to come out in to the open for drinking water in Godavari River during summer. The flow in river during non-monsoon season is very low and as there are many pools of water on the river bed, several common aquatic plants were found. As per the fish database, there are no RET species.

16. It was proposed to set up Closed circuit cooling water system for unit auxiliaries of steam generator and turbine generator. The CW System will be designed considering a design CoC of about 5. To enable operation of CW System at the CoC of 5 will require provision of CW chemical treatment programme by using acid and Scale and /or corrosion inhibitors apart from chlorination. The water treatment system comprises of water pre-treatment plant, water demineralizing plant, chlorination plant, condensate polishing plant, CW treatment plant.

17. The DM plant will be sized to meet the make-up water requirement of the steam cycle, make up to closed circuit auxiliary system and stator water cooling system. Considering the quality of water, it is proposed to adopt a service cycle of 12 hrs for DM Plant. The DM plant will consist of one (1) streams of 90 m³ /hr capacity and stream will comprise of activated carbon filter, cation exchangers, degasser system (comprising of degasser tower, degassed water tank, degassed water pumps and degasser blowers etc.), anion exchangers and mixed bed exchanger in the existing DM plant area. The RO plant is proposed to produce 500 cum/hr permeate. Cooling Tower Blow Down (CTBD) water will be used as feed water to RO plant. Efficient operation of various treatment schemes will be ensured, so that the quality of treated effluent from CMB conforms to relevant standards, prescribed by regulatory agencies. The treated effluents will be released appropriately to the existing drainage system. The feasibility for zero discharge will be explored.

18. The high efficiency Electrostatic Precipitator (ESP) will be installed to limit the particulate matters in flue gas to a maximum of 30 mg/Nm³ (at 12% CO₂ on dry gas basis). Single flue steel lined reinforced concrete chimney will be provided for the proposed project. The flue gas emission point with FGD will be 100/275m above the plant grade level.

19. Wet limestone FGD system will be installed to limit the SO_x emission up to 100mg/Nm³ (at 12% CO₂ on dry gas basis. It is proposed to install FGD system downstream of ID fans for 800 MW unit. FGD system is based on forced oxidation wet lime stone process with SO₂ removal efficiency will be $\approx$ / > 95%.

20. The steam generator will be designed to limit the NO_x formation up to 100 mg/Nm³ by adopting the appropriate burners/combustion system along with Selective Catalytic Reduction (SCR) system. Mercury emission in air will be limited to 0.03 mg/Nm³. For control of fugitive dust emissions within and around the coal handling plant, dust extraction/suppression systems would be provided. Dust suppression system will also be provided in the coal stockyard. Similarly, ash handling plant would be equipped with dust extraction/suppression systems to prevent fugitive emissions.

21. Approximately the ash generation from the proposed project is 5000 Tons/day (1.65 Million Tons per Annum) out of which 80% is the flyash and 20% is the bottom ash. It has been proposed to utilized the ash in the cement and brick manufacturing. The option of backfilling in mines is also being explored. The unutilized as will be disposed in the proposed ash pond having an area of 30 ha. The existing ash pond of 30 ha is available for the 2x600 MW. Further, new ash pond with an area of 30 ha has been proposed for the new project (1x800 MW). Permission to various users like Cement Industries, Ready Mixed Concrete (RMC) Units, Bricks manufactures, Block manufacturing units to utilise the available fly ash. Bottom ash is used for stowing in underground mines (In place of River sand) and for earthen/Road embankments.

22. Pneumatic conveying system (either vacuum system or pressure system) will be employed for conveying of fly ash from the electrostatic precipitator hoppers in dry form. This dry ash will be taken to buffer hoppers. Total twelve (6W+6S) buffer hoppers will be provided. Dry ash from buffer hoppers will be transported either to High Concentrated Slurry Disposal (HCSD) ash silos or fly ash storage silos. There will be four HCSD Pumps, four silos with all accessories for disposal of fly ash to ash dyke. Two pumping system will take full load; one pumping system will be standby and one system maintenance standby.

23. Risk assessment has been carried out for coal stack yard, LDO & HFO tanks and Chlorine & Hydrogen cylinders. The design and the location of these installation will be done in such a way that the risks are controlled. Further, emergency response plan is prepared along with all the facilities to control emergency situations.
24. Public Hearing has been conducted on 7.3.2018 at the project site which was presided by the District Collector, Mancheril. The issues raised during public hearing have been addressed adequately and an action plan to implement the public hearing concerns has been submitted.
25. Estimated Project Cost is Rs.5,879.62 Crores. Estimated Manpower is 550 persons (100 for existing and 400 for proposed project). Total of 3000 persons work force is expected to be deployed during construction period.
26. The Sub-committee conducted the site visit during 30th-31st May, 2019. The Regional Office of this Ministry, Chennai has submitted certified compliance reports vide dated 31.10.2017 and 20.9.2018.
27. It has been noted that stack emissions from the existing power plant for NO_x and SO₂ emissions are in the order of 275 mg/Nm³ (Standard: 200 mg/Nm³) and 1945.8 mg/Nm³ (Standard: 100 mg/Nm³). The Central Pollution Control Board issued vide letters no. CPCB Lr.No. 1, B-33014/07/2017-18/IPC-II/TPP/14682, Dt.11.12.2017, B-33014/07/2017-18/IPC-II/TPP/14853, Dt.07.01.2019 and letter dated July, 2019 directed M/s SCCL to installation of FGD by December, 2019 for Stage-1 (2x600MW) Power Plant.
28. It has been informed that M/s SCCL has already initiated action for installation of FGD system for 2x600MW, STPP and DPR was prepared by NTPC. The SCCL Board recommended the Detailed Project Report (DPR) for installing FGD with the expenditure Rs. 645.33 Crores to Government of Telangana and the same was approved vide letter No.499/PR.A1/2019 dated 14.06.2019. Pre-award consultancy services were issued to M/s NTPC for installation of FGD for 2x600 MW, STPP; vide PO No. 8900000996, dated 18.06.2019. The installation of FGD for the existing 2x600 MW STPP is scheduled to be completed by December, 2022. The timelines for installation of FGD has been submitted.
29. The proposal was appraised by Re-constituted EAC (Thermal) in its 23rd, 29th, 31st and 32nd meetings held on 30.11.2018, 26.6.2019, 25.7.2019 and 23.8.2019. The EAC has deliberated the Sub-committee site visit report, Ministry's Regional Office Compliance Reports dated 31.10.2017 and 20.9.2018. In acceptance of the recommendations of the Re-constituted EAC (Thermal Power) in its meeting held on 23.8.2019 and in view of the information, clarifications, documents submitted by you, **the Ministry hereby accords the Environmental Clearance** to the above project under Schedule 1(d) of the EIA Notification dated September 14, 2006 and subsequent amendments therein subject to compliance of the following conditions.
- i. The Power Generation in terms of Units (MWh/KWh), average Plant Load Factor, coal consumption during six months (April-September on or before 1st December & October-March on or before 1st June of each calendar year) shall be submitted as part of six monthly compliance report.
 - ii. Date of financial closure, commencement of construction activities, progress construction activities, expenditure made, commissioning of power plant shall be submitted till the power plant is achieved COD.

- iii. The land requirement for the proposed project shall not exceed 127.31 ha (Main plant, Equipment & CHP: 47.632 ha; Ash dyke: 30 ha; Greenbelt: 79.68 ha). All other facilities such as water reservoir, coal transportation and water lines are to be used from the existing plant. The land requirement for Phase-I Power plant is 300.972 ha and the total land requirement for phase-I and II shall be restricted to 428.28 ha.
- iv. Coal requirement for 1x800 MW Project shall not exceed 4.05 Million Metric Tonnes/annum and to be sourced from Naini coal block (Planned Production: 10 MTPA) located in Chhendipada, Village & Tehsil, Angul District, Odisha. The expected coal quality is 3500 kcal/kg with Sulphur and Ash contents 0.5% and 45%, respectively
- v. Coal transportation shall be done by rail only. No road transportation is permitted. In case of change in coal source and its location, a fresh reference is to be made to Ministry for seeking amendment in EC for assessing adequate impacts and stipulating pollution control measures.
- vi. The new emergency ash pond for proposed project (Phase-II: 800 MW) shall be restricted to 30 ha. The existing ash pond of 30 ha for (Phase-I: 2x600 MW) will be used for unutilised ash generated from Phase-I Power Plant. The remaining area of the 29.44 ha towards Pegadapalli Village shall not be used for ash pond and the area shall be developed with greenbelt.
- vii. The ash pond proposed for Phase-II (800 MW) shall have HDPE liner, Piezometric wells around the ash dyke, greenbelt around the periphery of the dyke, High Concentrated Slurry Disposal System with Ash Water Recirculation Unit be made functional.
- viii. Monthly generation of ash (Both flyash and Bottom ash, approximately 5000 Tons/day), utilisation, disposal into the ash pond shall be submitted as per the format being submitted to CPCB under Flyash Utilisation Notification. The efforts shall be made to utilise the 100% ash for cement, brick and tiles and other construction materials manufacturing, road construction. The unutilised ash shall be disposed in the abandoned/working Coal Mines of M/s SCCL in a range of 50 km as backfilling material or overburden dumps.
- ix. The water requirement for Phase-I plant (2x600 MW) and Phase-II Project (1x800 MW) shall not exceed is 88,800 m³/day and 48,000 m³/day (Total: 1,36,800 m³/day). The water withdrawal permissions from State Irrigation Department for drawing 1.05 TMC (77,592 m³/day) from Godavari River (8.65 km pipeline from Shetpalli village) during lean season and 2 TMC (1,55,184 m³/day) from Pranahita River (43.5 km pipeline from Devulawada village) were accorded. After all the facilities for water pumping, transportation and storage facilities are made ready, a final layout map showing co-ordinates of intake points in Godavari and Pranahita Rivers, pump house, pipeline route, water reservoir along with capacities and specifications shall be submitted.
- x. Monthly water drawl from Pranahita and Godavari rivers shall be submitted. The specific water consumption (monthly) shall be calculated based on total water consumption and total power generation against 3 m³/whr specified as per the Notification.
- xi. The progress of implementation of pollution control equipment to meet new emission norms dated 7.12.2015 for Phase-I Project shall be submitted as part of compliance report. The extension of timelines obtained from CPCB from time

- to time for installing FGD, De-NOX control systems shall be submitted to the Ministry.
- xii. The progress of implementation of pollution control equipment such as Electro Static Precipitator, Wet FGD, SCR & De-NO_x systems for Phase-II (800 MW) project shall also be submitted during construction phase or till its implementation.
 - xiii. The emissions of Flue gas such as PM, SO₂, NO_x, Mercury shall be connected online through analysers. The Minimum, Maximum and 98% percentile value of monthly flue gas emissions PM (Standard: 30 mg/Nm³), SO₂ (Standard: 100 mg/Nm³), NO_x (Standard: 100 mg/Nm³) and Mercury (Standard: 0.03 mg/Nm³) shall be submitted. In addition, the flow rate in the flue gas is to be maintained with minimum velocity of 22 m/sec. Continuous online measuring systems shall also be installed to monitor flue gas velocity so that effective plume height is maintained for dispersion of gases.
 - xiv. Stack height of 150 m is prescribed based on the 95% removal of Sulphur Dioxide through Wet Flue-gas Desulphurisation Unit and considering the operation of 2x600 MW Power Plant in the same complex.
 - xv. The compliance of forest clearance (Stage-II/Formal) issued vide dated 7.5.2019 including diversion of 2.99 ha forest land for laying pipeline for transporting water from Pranahita River shall be submitted.
 - xvi. As recommended by the CGWB in their report, the rooftop rainwater harvesting system with storage tanks and recharge pits shall be set up for the roof cover of 34,580 m² which can collect 10,652.1 m³/day of rainwater on any maximum rainy day. As recommended, storage tanks with volume of 1775 m³ and recharge pits with maximum volume of 8877 m³ shall be constructed.
 - xvii. As recommended by CGWB for construction check dams/percolation tanks on the upstream side of the project in Villages Jaipuram (2 locations), Mittapalli, Gudipalli and Adilpet villages, demand of Rs.1.65 Crores has been raised by Irrigation and CAD Department vide letter dated 27.7.2019. The demand note shall be paid to the Irrigation Department and the subsequent progress report of construction of check dams shall be obtained from Irrigation Department.
 - xviii. As and when, the Phase-II Power Plant is commissioned, augmentation of roof top structures and associated water collection and recharge systems for new buildings constructed under this phase shall be made. The assessment shall be done within 6 months from the date of commissioning.
 - xix. Wildlife Management Plan for conservation of Schedule-I Species Black Buck and Chousinga in Mancherial District vetted has already been submitted to Wildlife Department. A copy of the Wildlife Management Plan duly approved by the Chief Wildlife Warden along with activities and budget earmarked for conservation shall be submitted.
 - xx. Capital and Recurring Cost towards Environmental Management Plan and Protection measures shall be earmarked as Rs.1128.756 Crores and Rs. 67.901 Crores/annum (Table 9.9 of Chapter 9.7.3, page.518 of EIA report), respectively for implementation of ESP, Stack, FGD, SCR, Cooling towers, ash handling and ash water recycling, dust extraction systems, ETP, DM water treatment, STP, greenbelt development, rainwater harvesting structures, environmental monitoring, etc., and their maintenance.

- xxi. Commitments made during Public Hearing held on 7.3.2018 and as part of EMP regarding primary health care facilities, skill training, employment to land losers in the Phase-I project, use of SCCL dispensary by villagers, periodic health camps through mobile medical van, provision of RO treated drinking water facilities, installation of Solar Power generation facilities shall be adhered and implemented in the surrounding affected villages.
- xxii. As proposed, the greenbelt development for the both phases shall be developed in an area of 202.46 ha (2,50,421 saplings) with budget of Rs.5.95 Crores which also includes existing 13.72 ha mango plantation and it shall not be disturbed. Additional amount of Rs.4.5 Crores has been earmarked for avenue plantation, grass development near the reservoir, green cover in 80 ha in surrounding villages, afforestation in 50 ha degraded forest land. Miyawaki system of greenbelt development will be taken up wherever feasible.
- xxiii. As per the Ministry's Office Memorandum dated 1.5.2018, the one time CER cost of 0.25% on project cost: Rs.5879.62 Crores, i.e. Rs. 14.7 Crores shall be earmarked for carrying out CER activities for developing infrastructure in the surrounding villages.
- xxiv. As part of CER/CSR activities, the infrastructure development activities on education sector such as construction of laboratories and instruments/equipment, construction of hostel, providing college bus, provision of drinking water treatment facilities at hostels shall be taken up at Kothagudem School of Mines. The budget shall be drawn from onetime CER cost of Rs.14.7 Crores. The progress of infrastructure development along with the financial allocations shall be submitted in the compliance report.
- xxv. The profits generated of every year from Phase-I and Phase-II Power Plants shall be reported. The amount of 2% of profits of three preceding years shall be reported for implementing CSR activities during operation phase of power plant. The amount earmarked and the expenditure along with activities in the surrounding villages during the Financial Year shall be submitted.
- xxvi. The Power Plant (Phase-I & II) should have an Environment Management Cell (EMC) comprising of atleast two professionals from Environmental Engineering/Science, one soil biologist/expert in forestry, one chemist/chemical engineer to implement environmental mitigation measures. The EMC should be headed by a professional in Environmental Engineering/Science and directly reporting to the Plant head, who would review the environmental compliance once in three months.
- xxvii. CO₂ and other GHG emissions emitted annually from the power plant shall be calculated due to coal consumption and power generation. The calculated values shall be verified through measurement of CO₂ flow and concentrations in the flue gas. Total quantity of CO₂ generated and number of power units generated, the specific emissions of CO₂ in terms of tonnes per MWhr shall be reported.

Statutory compliance:

- xxviii. Emission Standards for Thermal Power Plants as per Ministry's Notification S.O. 3305(E) dated 7.12.2015, G.S.R.593(E) dated 28.6.2018 and as amended from time to time shall be complied.

- xxix. MoEF&CC Notification G.S.R 02(E) dated 2.1.2014 as amended time to time regarding use of raw or blended or beneficiated/washed coal with ash content not exceeding 34% shall be complied with, as applicable.
- xxx. MoEF&CC Notifications on Fly Ash Utilization S.O. 763(E) dated 14.09.1999, S.O. 979(E) dated 27.08.2003, S.O. 2804(E) dated 3.11.2009, S.O. 254(E) dated 25.01.2016 as amended from time to time shall be complied.
- xxxi. As per the Ministry's Notification G.S.R.593(E) dated 28.6.2018, Thermal Power Plants other than the power plants located on coast and using sea water for cooling purposes, shall achieve specific water consumption of 3.0 m³/MWh and Zero effluent discharge.
- xxxii. The recommendation from Standing Committee of NBWL under the Wildlife (Protection) Act, 1972 should be obtained, if applicable.
- xxxiii. No Objection Certificate from Ministry of Civil Aviation be obtained for installation of requisite chimney height and its siting criteria for height clearance.
- xxxiv. Groundwater shall not be drawn during construction of the project. In case, groundwater is drawn during construction, necessary permission be obtained from CGWA.

Ash content/ mode of transportation of coal:

- xxxv. EC is given on the basis of assumption of 40% of ash content and approximately 900 km distance of transportation in rail mode from Naini Coal Block, Angul District to Power Plant Site. Any increase of % ash content by more than 1 percent, and/or any change in transportation mode or increase in the transport distance (except for rail) require application for modifications of EC conditions after conducting the 'incremental impact assessment' and proposal for mitigation measures.

Air quality monitoring and Management:

- xxxvi. Flue Gas Desulphurisation System shall be installed based on Lime/Ammonia dosing to capture Sulphur in the flue gases to meet the SO₂ emissions standard of 100 mg/Nm³.
- xxxvii. Selective Catalytic Reduction (SCR) system or the Selective Non-Catalytic Reduction (SNCR) system or Low NOX Burners with Over Fire Air (OFA) system shall be installed to achieve NO_x emission standard of 100 mg/Nm³.
- xxxviii. High efficiency Electrostatic Precipitators (ESPs) shall be installed in each unit to ensure that particulate matter (PM) emission to meet the stipulated standards of 30 mg/Nm³.
- xxxix. Stacks of prescribed height 150 m shall be provided with continuous online monitoring instruments for SO_x, NO_x and Particulate Matter as per extant rules.
- xl. Exit velocity of flue gases shall not be less than 20-25 m/s. Mercury emissions from stack shall also be monitored periodically.

- xli. Continuous Ambient Air Quality monitoring system shall be set up to monitor common/criteria pollutants from the flue gases such as PM₁₀, PM_{2.5}, SO₂, NO_x within the plant area at least at one location. The monitoring of other locations (at least three locations outside the plant area covering upwind and downwind directions at an angle of 120° each) shall be carried out manually.
- xlii. Adequate dust extraction/suppression system shall be installed in coal handling, ash handling areas and material transfer points to control fugitive emissions.
- xlili. Appropriate Air Pollution Control measures (DEs/DSs) be provided at all the dust generating sources including sufficient water sprinkling arrangements at various locations viz., roads, excavation sites, crusher plants, transfer points, loading and unloading areas, etc.

Noise pollution and its control measures:

- xliv. The Ambient Noise levels shall meet the standards prescribed as per the Noise Pollution (Regulation and Control) Rules, 2000.
- xlv. Persons exposed to high noise generating equipment shall use Personal Protective Equipment (PPE) like earplugs/ear muffs, etc.
- xlvi. Periodical medical examination on hearing loss shall be carried out for all the workers and maintain audiometric record and for treatment of any hearing loss including rotating to non-noisy/less noisy areas.

Human Health Environment:

- xlvii. Bi-annual Health check-up of all the workers is to be conducted. The study shall take into account of chronic exposure to noise which may lead to adverse effects like increase in heart rate and blood pressure, hypertension and peripheral vasoconstriction and thus increased peripheral vascular resistance. Similarly, the study shall also assess the health impacts due to air polluting agents.
- xlviil. Baseline health status within study area shall be assessed and report be prepared. Mitigation measures should be taken to address the endemic diseases.
- xliv. Impact of operation of power plant on agricultural crops, large water bodies (as applicable) once in two years by engaging an institute of repute. The study shall also include impact due to heavy metals associated with emission from power plant.
 - 1. Sewage Treatment Plant shall be provided for domestic wastewater.

Water quality monitoring and Management:

- li. Induced/Natural draft closed cycle wet cooling system including cooling towers shall be set up with minimum Cycles of Concentration (COC) of 5.0 or above for power plants using fresh water to achieve specific water consumption of 2.5 m³/MWhr. (Or) Induced/Natural draft open cycle cooling system shall be set up

- with minimum Cycles of Concentration (COC) of 1.5 or above for power plants using sea water.
- lii. In case of the water withdrawal from river, a minimum flow 15% of the average flow of 120 consecutive leanest days should be maintained for environmental flow whichever is higher, to be released during the lean season after water withdrawal for proposed power plant.
 - liii. Records pertaining to measurements of daily water withdrawal and river flows (obtained from Irrigation Department/Water Resources Department) immediately upstream and downstream of withdrawal site shall be maintained.
 - liv. Rainwater harvesting in and around the plant area be taken up to reduce drawl of fresh water. If possible, recharge of groundwater to be undertaken to improve the ground water table in the area.
 - lv. Regular (at least once in six months) monitoring of groundwater quality in and around the ash pond area including presence of heavy metals (Hg, Cr, As, Pb, etc.) shall be carried out as per CPCB guidelines. Surface water quality monitoring shall be undertaken for major surface water bodies as per the EMP. The data so obtained should be compared with the baseline data so as to ensure that the groundwater and surface water quality is not adversely impacted due to the project & its activities.
 - lvi. The treated effluents emanating from the different processes such as DM plant, boiler blow down, ash pond/dyke, sewage, etc. conforming to the prescribed standards shall be re-circulated and reused. Sludge / rejects will be disposed in accordance with the Hazardous Waste Management Rules.
 - lvii. Hot water dispensed from the condenser should be adequately cooled to ensure the temperature of the released surface water is not more than 5 degrees Celsius above the temperature of the intake water.
 - lviii. Based on the commitment made by the Project Proponent, Sewage Treatment Plants within the radius of 50 km from proposed project, the treated sewage of 'NIL' KLD from STP 'NIL' shall be used as an alternative to the fresh water source to minimize the fresh water drawl from surface water bodies.
 - lix. Wastewater generation of 444 m³/hr (from Cooling Tower Blowdown, DM Plant, Clarifier, Service water, ash handling systems, CHP and dust suppression) from various sources (viz. cooling tower blowdown, boiler blow down, wastewater from ash handling, etc) shall be treated to meet the standards of pH: 6.5-8.5; Total Suspended Solids: 100 mg/l; Oil & Grease: 20 mg/l; Copper: 1 mg/l; Iron: 1 mg/l; Free Chlorine: 0.5; Zinc: 1.0 mg/l; Total Chromium: 0.2 mg/l; Phosphate: 5.0 mg/l;
 - lx. Sewage will be treated by setting up 600 KLD Sewage Treatment plant to maintain the treated sewage characteristics of pH: 6.5-9.0; Bio-Chemical Oxygen Demand (BOD): 30 mg/l; Total Suspended Solids: 100 mg/l; Fecal Coliforms (Most Probable Number): <1000 per 100 ml.

Risk Mitigation and Disaster Management:

- lxi. Adequate safety measures and environmental safeguards shall be provided in the plant area to control spontaneous fires in coal yard, especially during dry and humid season.
- lxii. Storage facilities for auxiliary liquid fuel such as LDO and HFO/LSHS shall be made as per the extant rules in the plant area in accordance with the directives of Petroleum & Explosives Safety Organisation (PESO). Sulphur Content in the liquid fuel should not exceed 0.5%.
- lxiii. Ergonomic working conditions with First Aid and sanitation arrangements shall be made for the drivers and other contract workers during construction phase.
- lxiv. Safety management plan based on Risk Assessment shall be prepared to limit the risk exposure to the workers within the plant boundary.
- lxv. Regular mock drills for on-site emergency management plan and Integrated Emergency Response System shall be developed for all kind of possible disaster situations.

Green belt and Biodiversity conservation:

- lxvi. Green belt shall be developed in an area of 33% of the total project with indigenous native tree species in accordance with CPCB guidelines. The green belt shall inter-alia cover an entire periphery of the plant.
- lxvii. *In-situ/ex-situ* Conservation Plan for the conservation of flora and fauna should be prepared and implemented.
- lxviii. Suitable screens shall be placed across the intake channel to prevent entrainment of life forms including eggs, larvae, juvenile fish, etc., during extraction of seawater.

Waste management:

- lxix. Solid waste management should be planned in accordance with extant Solid Waste Management Rules, 2016.
- lxx. Toxicity Characteristic Leachate Procedure (TCLP) test shall be conducted for any substance, potential of leaching heavy metals into the surrounding areas as well as into the groundwater.
- lxxi. Ash pond shall be lined with impervious liner as per the soil conditions. Adequate dam/dyke safety measures shall also be implemented to protect the ash dyke from getting breached.
- lxxii. Fly ash shall be collected in dry form and ash generated shall be used in phased manner as per provisions of the Notification on Fly Ash Utilization issued by the Ministry and amendment thereto. By the end of 4th year, 100% fly ash utilization should be ensured. Unutilized ash shall be disposed off in the ash pond in the form of High Concentration Slurry. Mercury and other heavy metals (As, Hg, Cr, Pb, etc.) will be monitored in the bottom ash as also in the effluents emanating from the existing ash pond. Flyash utilization details shall be submitted to concerned Regional Office along with the six-monthly compliance reports and utilization data shall be published on company's website.

- lxxiii. Unutilized ash shall be disposed off in the ash pond in the form of High Concentration Slurry/Medium Concentration Slurry/Lean Concentration Slurry method. Ash water recycling system shall be set up to recover supernatant water.
- lxxiv. In case of waste-to-energy plant, major problems related with environment are fire smog in MSW dump site, foul smell and impacts to the surrounding populations. Therefore, the following measures are required to be taken up:
 - a. Water hydrant at all the dumpsites of MSW area to be provided so that the fire and smog could be controlled.
 - b. Sprayer like microbial consortia may be provided for arresting the foul smell emanating from MSW area.

Monitoring of compliance:

- lxxv. Environmental Audit of the project be taken up by the third party for preparation of Environmental Statement as per Form-V & Conditions stipulated in the EC and report be submitted to the Ministry.
- lxxvi. Resettlement & Rehabilitation Plan as per the extant rules of Govt. of India and respective State Govt. shall be followed, if applicable.
- lxxvii. Energy Conservation Plan to be implemented as envisaged in the EIA / EMP report. Renewable Energy Purchase Obligation as set by MoP/State Government shall be met either by establishing renewable energy power plant (such as solar, wind, etc.) or by purchasing Renewable Energy Certificates.
- lxxviii. Monitoring of Carbon Emissions from the existing power plant as well as for the proposed power project shall be carried out annually from a reputed institute and report be submitted to the Ministry's Regional Office.
- lxxix. Energy and Water Audit shall be conducted at least once in two years and recommendations arising out of the Report should be followed. A report in this regard shall be submitted to Ministry's Regional Office.
- lxxx. Environment Cell (EC) shall be constituted by taking members from different divisions, headed by a qualified person on the subject, who shall be reporting directly to the Head of the Project.
- lxxxi. The project proponent shall (Post-EC Monitoring):
 - a. send a copy of environmental clearance letter to the heads of Local Bodies, Panchayat, Municipal bodies and relevant offices of the Government;
 - b. upload the clearance letter on the web site of the company as a part of information to the general public.
 - c. inform the public through advertisement within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language that

the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the SPCB and may also be seen at Website of the Ministry of Environment, Forest and Climate Change (MoEF&CC) at <http://parviesh.nic.in>.

- d. upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same periodically;
- e. monitor the criteria pollutants level namely; PM (PM_{10} & $PM_{2.5}$ in case of ambient AAQ), SO_2 , NO_x (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the projects and display the same at a convenient location for disclosure to the public and put on the website of the company;
- f. submit six monthly reports on the status of the compliance of the stipulated environmental conditions including results of monitored data (both in hard copies as well as by e-mail) to the Regional Office of MoEF&CC, the respective Zonal Office of CPCB and the SPCB;
- g. submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company;
- h. inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project and the date of commencement of the land development work.

Corporate Environmental Responsibility (CER) activities:

lxxxii. CER activities will be carried out as per OM No. 22-65/2017-IA.II dated 01.05.2018 or as proposed by the PP in reference to Public Hearing or as earmarked in the EIA/EMP report along with the detailed schedule of implementation with appropriate budgeting.

30. An as built or as completed report on EMP to be submitted stating the scope/extent of work envisaged in the EIA along with estimated cost vis-à-vis the actual completed works and cost incurred. A certificate/completion certificate accordingly, shall have to be submitted before commissioning of the TPP.

31. The Ministry reserves the right to revoke the clearance if conditions stipulated are not implemented to the satisfaction. The Ministry may also impose additional environmental conditions or modify the existing ones, if necessary.

32. The environmental clearance accorded **shall be valid for a period of 7 years** from the date of issue of this letter to start operations by the power plant.

31. Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act,

1986.

33. In case of any deviation or alteration in the project proposed including coal transportation system from those submitted to this Ministry for clearance, a fresh reference should be made to the Ministry to assess the adequacy of the condition(s) imposed and to add additional environmental protection measures required, if any.

34. The above stipulations would be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and rules there under, Hazardous Wastes (Management, Handling & Transboundary Movement) Rules, 2008 and its amendments, the Public Liability Insurance Act, 1991 and its amendments.

35. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

This issues with the approval of the Competent Authority.

Yours faithfully,



(Dr. S. Kerketta)
Director, IA.I

Copy to:-

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
3. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032.
4. The Deputy Director General of Forests (C), Ministry of Environment, Forests and Climate Change, Regional Office, 1st & 2nd Floors, HEPC Building, 34, Cathedral Garden Road, Nungambakkam, Chennai- 600034.
5. The Principal Secretary, Department of Environment, Forests, Science and Technology, Govt. of Telangana, Telangana Secretariat, Tank Bund, Basheer Bagh, Near NTR Gardens, Hyderabad, Telangana-500022.
6. The Chairman, Telangana Pollution Control Board, Paryavaran Bhawan, A-3 Industrial Estate, Sanath Nagar, Hyderabad- 500 018.
7. The District Collector, Mancherial District, Govt. of Telangana- 504208.
8. Guard file/Monitoring file.
9. Website of MoEF&CC.

Director, IA.I

Government of India
Ministry of Coal
O/o the Nominated Authority

World Trade Tower, New Delhi

Office of the nominated authority constituted under section 6 of the Coal Mines (Special Provisions) Act, 2015.

Allotment order under clause (c) of sub-rule (2) of rule 7 and sub-rule (1) of rule 13

In re: **Naini Coal Mine** (the "mine") particulars of which is specified in **Annexure 1**

Order no.: 103/21/2015/NA

Date: August 13, 2015

In favour of: **The Singareni Collieries Company Limited** incorporated in India under the Companies Act, 1956 with corporate identity number U10102AP1920SCGC000571, whose registered office is at Kothagudem Collieries, Khammam-District, Andhra Pradesh-507101, India (the "Allottee").

For utilisation in: End Use Plant situated at Village: Pegadapally, Mandal: Jaipur, District: Adilabad, State: Telangana- 504216, as more particularly described below (the "End Use Plant")

S. No.	Name of Specified End Use Plant	Address	Configuration	Capacity
1	Singareni Thermal Power Project	Village: Pegadapally, Mandal: Jaipur, District: Adilabad, State: Telangana- 504216	3 X 600 MW	1800 MW

*MW stands for Mega Watt

WHEREAS, the nominated authority has, in accordance with the provisions the Coal Mines (Special Provisions) Act, 2015 (the "Act") and the Coal Mines (Special Provisions) Rules 2014 (the "rules") conducted the allotment of the relevant Schedule I coal mine;

AND WHEREAS the allottee is eligible to receive this allotment order with respect to the mine, including, inter-alia -

(a) the coal bearing land acquired by the prior allottee and the lands, in or adjacent to the coal mines used for coal mining operations acquired by the prior allottee; and

Handwritten signature
[Circular stamp of the Ministry of Coal, Government of India]

(b) any existing mine infrastructure as defined in clause (j) of sub-section (1) of section 3 of the Act;

AND WHEREAS the allottee has furnished a performance bank guarantee dated April 13, 2015 for an amount equal to INR 1,76,32,00,000 (Indian Rupees One Hundred Seventy Six Crore and Thirty Two Lakh), issued by State Bank of Hyderabad in accordance with the allotment document and in accordance with the provisions of sub-section (6) and sub-section (12) of section 8 of the Act;

AND WHEREAS the allottee has entered into an Allotment Agreement dated March 30, 2015 (as amended) with the nominated authority in accordance with the provisions of sub-rule (5) of rule 13.

NOW, THE NOMINATED AUTHORITY DOES ORDER:

1. On and from August 13, 2015 ("allotment date") and in accordance with sub-section (4) of section 8 read with sub-section (12) section 8 of the Act, with respect to the mine, the following shall stand fully and absolutely transferred and vested in the allottee, namely: -
 - (a) all the rights, title and interest of the prior allottee in and over the land and mine infrastructure free from all encumbrances;
 - (b) entitlement to a mining lease to be granted by the State Government with the terms and conditions of the Allotment Agreement forming a part of it on making an application;
 - (c) all statutory licences, permits, permissions, approvals or consents as per rules, required to undertake coal mining operations in the mine, if already issued by the Central Government, to the prior allottee on the same terms and conditions as were applicable to the prior allottee, as listed in the **Annexure 2**;
 - (d) entitlement to any statutory licence, permit, permission, approval or consent required to undertake coal mining operations in the mine, if already issued by the Central Government, to the prior allottee on making an application on the same terms and conditions as were applicable to the prior allottee, as listed in the **Annexure 3**;
 - (e) entitlement to any statutory licence, permit, permission, approval or consent required to undertake coal mining operations in the mine, if already issued by the State Government, to the prior allottee on making an application on the same terms and conditions as were applicable to the prior allottee, as listed in the **Annexure 4**;
 - (f) rights appurtenant to the approved mining plan of the prior allottee;
 - (g) any subsisting contract in relation to coal mining operations, to which the prior allottee was a party and which is assumed, adopted and continued by the Allottee and listed in the **Annexure 5** shall stand novated (by virtue of a deemed consent from the relevant party(ies)) in accordance with the



provisions of sub-section (1) of section 11 of the Act in favour of the allottee for the residual term or residual performance of such contract;

2. The Allottee may seek any change in the terms and conditions attached to such licence, permit, permission, approval or consent by making an application in accordance with applicable laws.
3. Hereinafter, the Allottee shall be entitled to take possession of the mine as specified in Annexure-1 without let or hindrance;
3. This allotment order is liable to be cancelled in accordance with the provisions of sub-rule (6) of rule 13.




(By the nominated authority)

Annexures

Annexure 1: Particulars of the mine

Part A - Description of the mine

Name of Coal Mine	Naini
Latitude	20° 48' 07" N to 21° 07' 07" N
Longitude	84° 52' 56" E to 84° 53' 06" E
Coalfield	Talcher
Tehsil/Taluka	Chendipada
District	Angul
State	Odisha



5-60

**TELANGANA STATE POWER COORDINATION COMMITTEE
VIDYUT SOUDHA: HYDERABAD**

From
The Chief Engineer/(Commercial)
TSPCC,
Vidyut Soudha,
Hyderabad – 500 082.

To
The Chief Coordinator (Power Projects),
Singareni Collieries Co.Ltd.,
Singareni Bhavan, Red Hills,
P.B.No.18,Lakdikapool,
Hyderabad-500 004.

Lr. No. CE/Comml/TSPCC/SE-IPC/DE-1/SCCL/D.No. 63 /17, dt. 5.12.17.

Sir,

Sub: TSPCC-IPC Wing -Your proposal for sale of Power to TSDISCOMs from 3rd Unit of 1x800 MW (stage-II) with self consumption of 150 MW for Captive use - Reg.

Ref: Your letter Ref. No.CMD/PS/H/248, dt.27.09.2017.

This has reference to the proposal made by you vide reference cited above, for sale of power to TSDISCOMs from proposed 3rd unit of 1X 800 MW (Stage-II) at Jaipur (M), Mancherla (district) with 150 MW sought for your Captive usage.

In this regard, it is to inform that TSDISCOMs are willing to enter into long term PPA with Singareni TPP for purchase of entire 800 MW Capacity proposed under Stage-II.

Hence, you may initiate further course of action accordingly.

Yours faithfully,

Chief Engineer/Comml

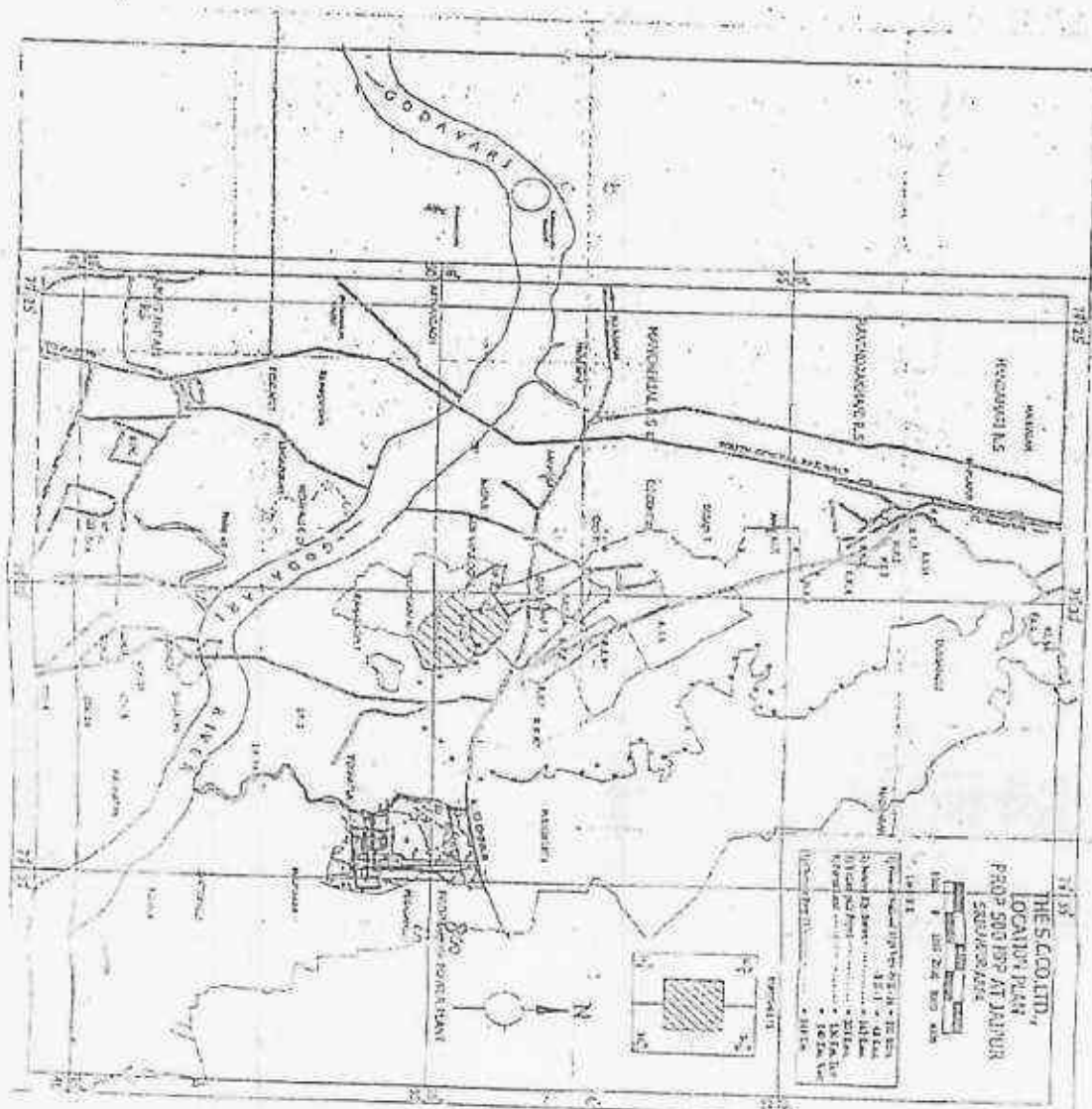
Copy to:

The PS to Chairman and Managing Director/TSTRANSCO/VS/Hyderabad.
PS to Joint Managing Director (Fin,Comml & HRD)/TSTRANSCO/VS/Hyderabad.
The PS to Chairman and Managing Director/TSSPDCL/Hyderabad.
The PS to Chairman and Managing Director/TSNPDCL/Warangal.

EXHIBITS

VICINITY PLAN

EXHIBIT-1



11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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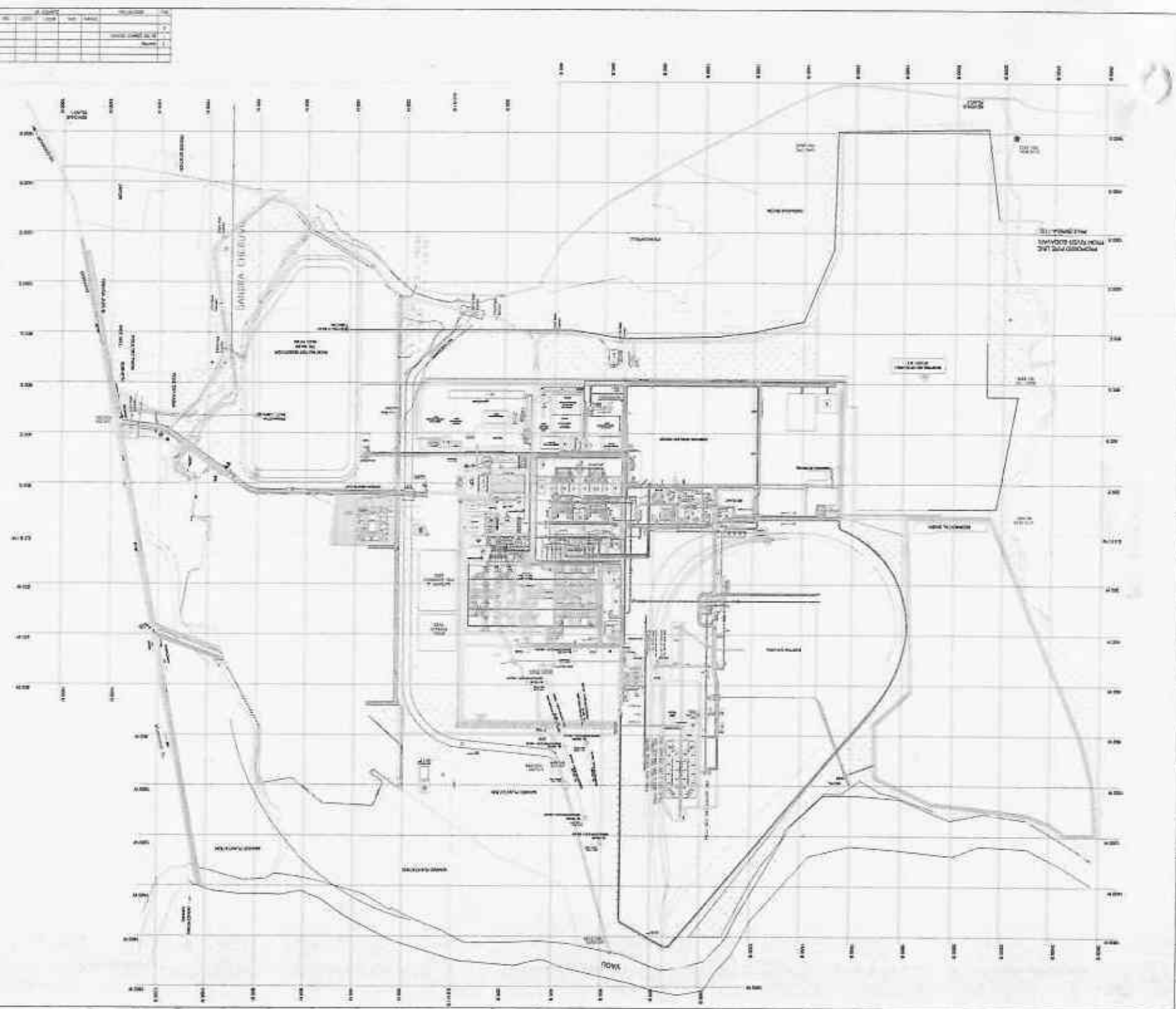
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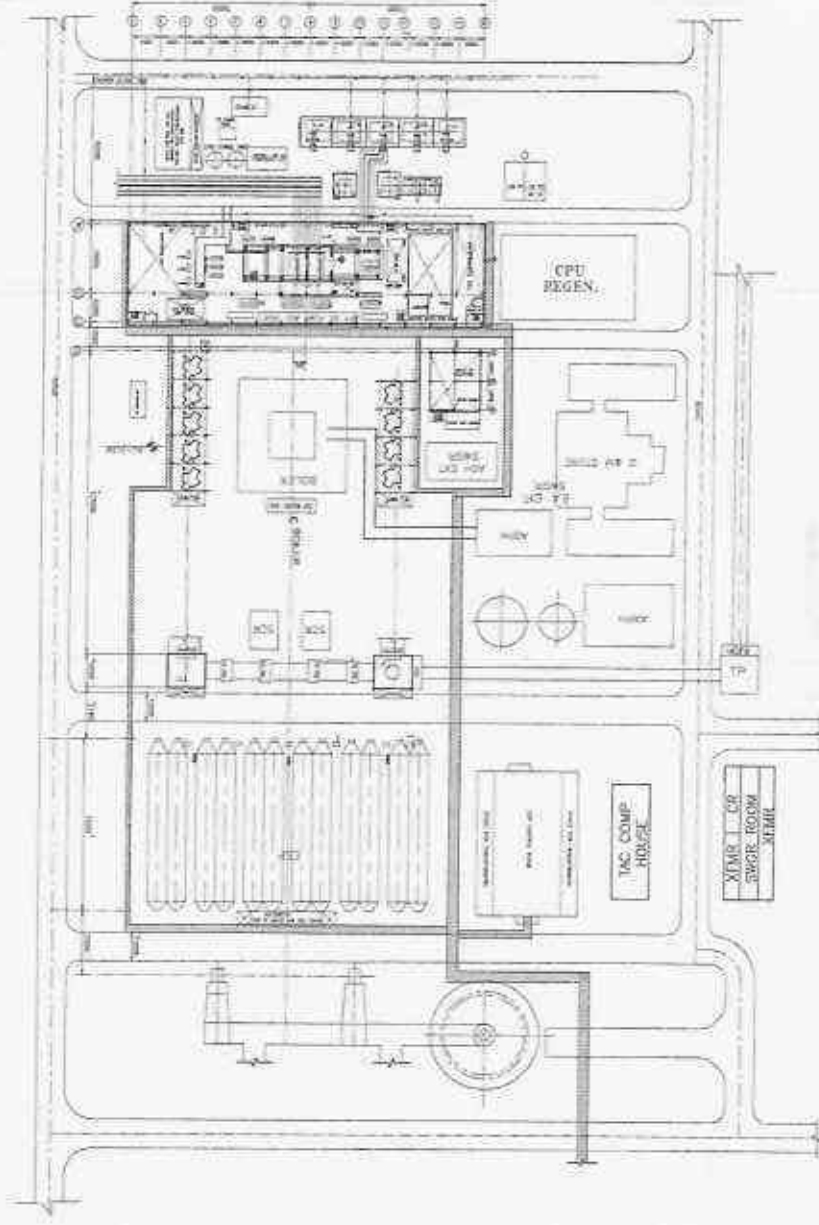
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NOTES:-

1. THE LOCATION OF EQUIPMENT SHALL BE INDICATED ONLY. THERE SHALL BE NO OTHER MARKING ON THE FLOOR PLAN.
2. EQUIPMENT SHALL BE INDICATED ONLY AND THE NAME SHALL BE INDICATED ON THE EQUIPMENT ONLY.
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EXHIBIT-3

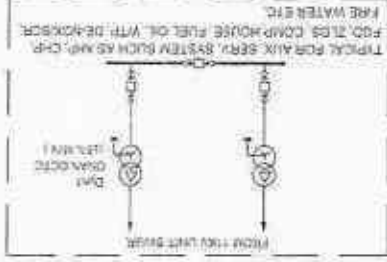
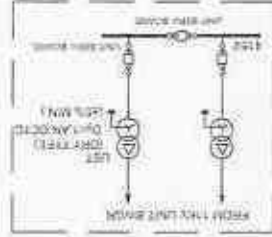
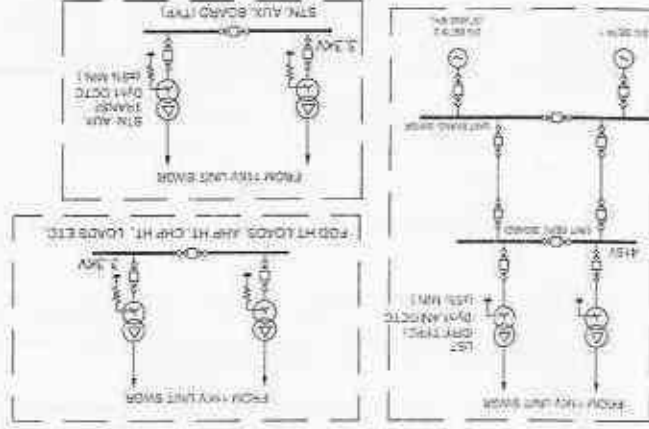
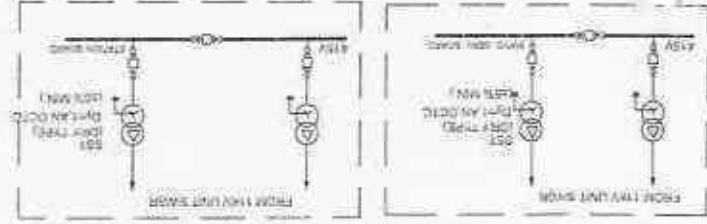
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OWNER	THE SINGAPORE COLLIERS COMPANY LTD.
CONSULTANT	NTPC Limited (A UNIT OF NTPC LIMITED)
PROJECT	SINGAPORE THERMAL POWER PROJECT (1200MW)
TITLE	EQUIPMENT LAYOUT PLAN AT EL 0.0M
NO.	CM-EN-8755-D-P-003

OWNER		CONSULTANT		PROJECT	SINGARENI THERMAL POWER PROJECT (XSO00001)	TITLE	KEY SINGLE LINE DIAGRAM (GCB SCHEME)	CR-EN-9757-G-E-101(B)
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LEGEND



FOR OWNER USE:

FOOT 1 TRANSFORMER SHALL BE MINIMUM 25 MVA.

FOOT 1 SWITCHGEAR SHALL HAVE TWO NUMBER

NUMBER BREAKER FEEDER ONE IN EACH SECTION

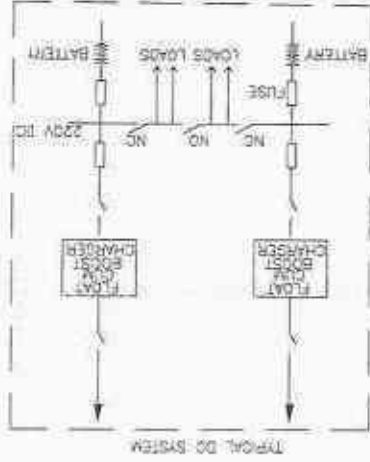
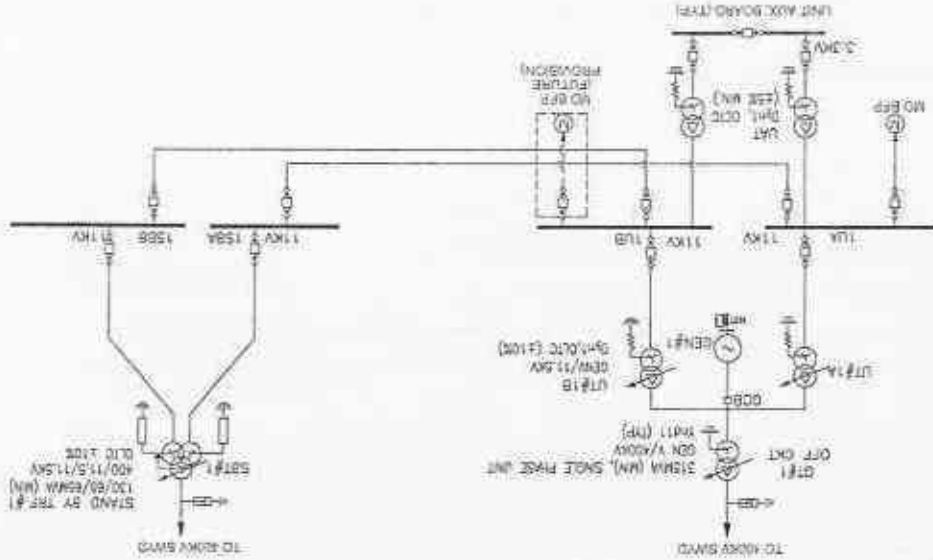


EXHIBIT - 78



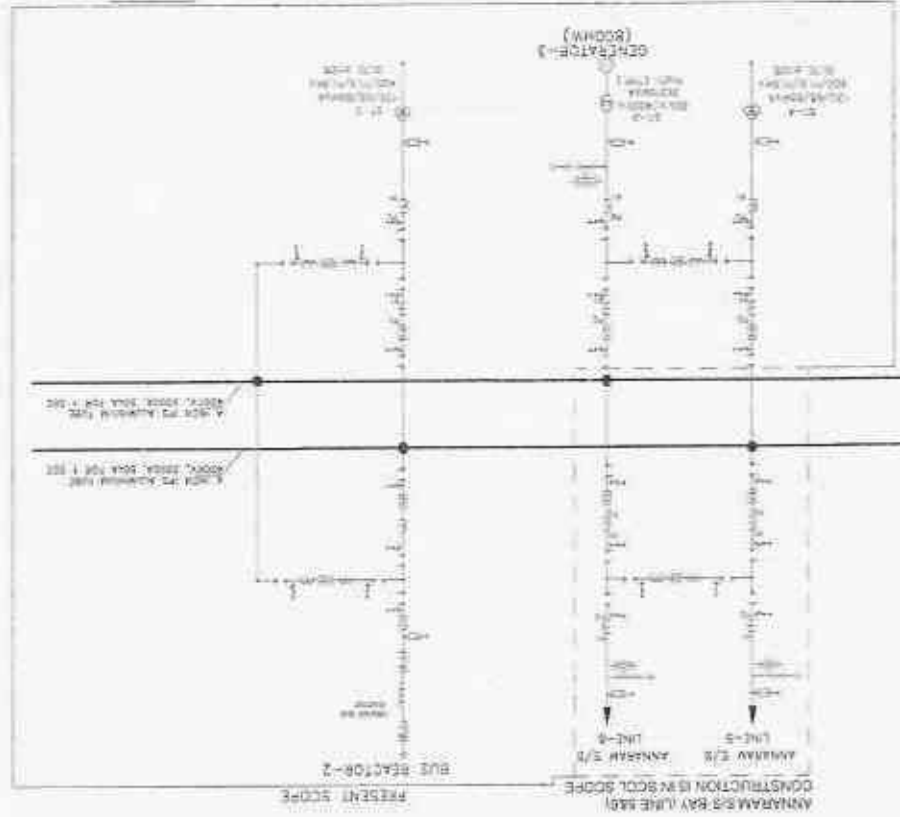
LEGEND

	GENERATOR
	CIRCUIT BREAKER-DRAWOUT TYPE
	TRANSFORMER

EXISTING FACTORS
PERCENT SCORE
FUTURE SCORE
7 NOV LINE BAYS
BY SOLT

[illegible]

FOR THE PURPOSE ONLY



OTHER		CONSULTANT	
THE SINGAPORE AIRLINES COMPANY LTD.		NTPC Limited 110, ROBINSON ROAD, SINGAPORE 068917	
		CONSULTANCY	
		PROJECT	SINGAPORE THERMAL POWER PROJECT (EXHIBIT)
		TITLE	SINGLE LINE DIAGRAM SINGAPORE AIRLINES 15TH FLOOR COMMON SERVICE
DATE	ISSUED	BY	REV. NO.
11	11	11	11

2007-08-01 10:00:00

EXHIBIT- 9																																																				
PROPOSED SCHEDULE FOR SINGARENI TPP Stage-II (1X800MW)																																																				
Activity Description	Duration in months	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
EPC Package AWARD	0																																																			
START OF CIVIL FDN	4																																																			
START OF BOILER ERECTION	12																																																			
BOILER PRESSURE PART ERECTION START	18																																																			
START OF CONDENSER ERECTION	24																																																			
START OF TG ERECTION	26																																																			
HYDRO TEST	32																																																			
BOILER LIGHT-UP	40																																																			
BOILER CHEMICAL CLEANING COMPLETION	41																																																			
TG BOX-UP	43																																																			
STEAM BLOWING START	44																																																			
TG ROLLING	46																																																			
TG ROLLING & SYNCHRONIZATION	47																																																			
COMMISSIONING (FULL LOAD) OF UNIT#1	49																																																			
COD - UNIT#1	50																																																			