PRE-FEASIBILITY REPORT

By

Prakash Industries Limited

[Augmentation of Power Generation Capacity though WHRB (attached to DRI) from 100 MW to 150 MW, New Iron Ore Beneficiation Plant of Capacity 0.75 MTPA (throughput) and New Pellet Plant of capacity 2 x 1.5 MTPA (Phase manner) for Backward Integration in the existing plant premises]

AT

Village: Hathneora, Champa
District: Janjgir - Champa
Chhattisgarh
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Chapter –1: EXECUTIVE SUMMARY

1.1 SALIENT FEATURES OF THE PROJECT

Prakash Industries Limited (PIL) is existing Integrated Steel Plant located at Hathneora, Champa Villages, Janjigir-Champa District, Chhattisgarh. Existing plant has obtained Environment Clearance from MoEF&CC vide No. J-11011/522/2008-IA II (I) dated 03.11.2010. Accordingly obtained Consent to Establishment and Consent to Operate from the Chhattisgarh Environment Conservation Board (CECB) for few units and same are under operation.

Since the validity of Environment Clearance is for 7 years, as per the EIA notification 2006 and its subsequent amendments, we have applied for EC validity extension to MoEF&CC and same was discussed in 22nd EAC meeting (Industry – 1) held during 11th – 13th September 2017 and accordingly after detailed deliberations, the committee has recommended for extension of validity for Environment Clearance for further period of 3 years i.e. upto 02.11.2020.

The details of units in existing EC dated 03.11.2010, capacity installed and in operation, capacity under installation and balance capacity yet to be installed & commissioned are given in Table - 1 below:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Details of Unit</th>
<th>Capacity as per EC Dt. 03.11.10</th>
<th>Capacity in operation</th>
<th>Capacity under installation</th>
<th>Balance capacity to be installed &amp; commissioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sponge Iron</td>
<td>2.0 MTPA</td>
<td>1.0 MTPA</td>
<td>0.4 MTPA</td>
<td>0.6 MTPA</td>
</tr>
<tr>
<td>2</td>
<td>Captive Power Plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Co-generation Power Plant (WHRB)</td>
<td>100 MW</td>
<td>47 MW</td>
<td>20 MW</td>
<td>33 MW</td>
</tr>
<tr>
<td></td>
<td>Coal based power plant</td>
<td>187.5 MW</td>
<td>162.5 MW</td>
<td>25 MW</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>BF gas based power plant</td>
<td>20 MW</td>
<td>0</td>
<td>0</td>
<td>20 MW</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>307.5 MW</td>
<td>209.5 MW</td>
<td>45 MW</td>
<td>53 MW</td>
</tr>
<tr>
<td>3</td>
<td>Ingots/Billets/Bloomers</td>
<td>2.0 MTPA</td>
<td>0.94 MTPA</td>
<td>0.06 MTPA</td>
<td>1.00 MTPA</td>
</tr>
<tr>
<td>4</td>
<td>TMT/Wire Rod Mill</td>
<td>0.6 MTPA</td>
<td>0</td>
<td>0</td>
<td>0.6 MTPA</td>
</tr>
<tr>
<td>5</td>
<td>Blast Furnace</td>
<td>1.0 MTPA</td>
<td>0</td>
<td>0</td>
<td>1.0 MTPA</td>
</tr>
</tbody>
</table>
Now, as part of expansion, company has proposed following:

i. Augmentation to enhance power generation capacity of the Co-generation captive power plant through WHRB attached with the Sponge Iron Kilns from 100 MW power (10 MW/Kiln) to 150 MW (15 MW/ Kiln) from the flue gases emanating from the Sponge Iron Kilns as per the details given in the Table – 2 below:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Details of Unit</th>
<th>Capacity as per EC Dt. 03.11.10</th>
<th>Capacity in operation</th>
<th>Capacity under installation</th>
<th>Balance capacity to be installed &amp; commissioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Ferro Alloys Plant</td>
<td>9 X 7.5 MVA</td>
<td>9 X 7.5 MVA</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Sinter Plant</td>
<td>1.45 MTPA</td>
<td>0</td>
<td>0.2 (2x 0.1) MTPA</td>
<td>1.35 MTPA</td>
</tr>
<tr>
<td>8</td>
<td>Oxygen Plant</td>
<td>800 TPD</td>
<td>0</td>
<td>8.4 (2x4.2) TPD</td>
<td>791.6 TPD</td>
</tr>
</tbody>
</table>

Hence, we will be able to enhance power generation to the extent of 150 MW from 10 Kilns instead of 100 MW.

ii. Installation of Iron Ore Beneficiation Plant of Capacity 0.75 MTPA (throughput)

iii. Installation of Captive Palletisation plant of 3 Million Ton capacity in 2 phases of 1.5 Million ton each as a step towards backward integration to fulfill Pellet requirement for DRI Kilns, as a substitute of Iron Ore.
Chapter – 2: INTRODUCTION OF THE PROJECT / BACKGROUND INFORMATION

2.1 IDENTIFICATION OF PROJECT PROPONENT

Prakash Industries Ltd (PIL) established in the year 1980. Company has rich experience in steel making and is presently operating an integrated steel plant at Champa in the state of Chhattisgarh. With focused vision in the core competence areas of Mining, Steel and Power, PIL is rapidly carving its niche in the Indian steel industry. A fully integrated approach, strong financial foundation, understanding of market needs and the rich experience in the core strength areas have contributed to the steady growth of the company. PIL, one of the leading steel makers in the country is a dynamic organization having business establishments at various places.

Being one of the key factors in higher value addition, PIL has always emphasized on backward integrated to ensure the uninterrupted supply of quality raw materials. Company has been allotted iron ore mines at Sirkagutu in the state of Odisha over an area of 19.53 Ha which is in advance stage to start operation with modern methods of mining resulting in operational excellence. In Sirkagutu mines, Mining Lease has already been executed in Jan 17. Env clearance also obtained. We expect start of operations of Sirkagutu mines by April 18.

Apart from Sirkagutu mines in the state of Odisha, we have also been recommended Kawardha Iron ore deposits in the state of Chhattisgarh over an area of 274.89 Ha for which prior approval u/s 5(1) of MMDR Act has been granted on 07.09.15 by Ministry Of Mines, Govt of India. We are in process to obtain other statutory clearances and expects to start the mines by Dec 19.

We have also received coal linkages for our existing capacity of Sponge Iron of 1.0 MTPA and for captive power plant for capacity of 162.5 MW from Coal India Ltd.

In integrated steel plant, PIL has installed latest technology equipments ensuring maximum efficiency with lowest cost of production. Co-generation power plant with Waste Heat Recovery Boilers (WHRB) attached with DRI Kilns was the first boiler installed in the country for harnessing energy from waste heat resources.
Rolling Mill facilities are set up at Raipur towards forward integration approach to manufacture Wire Rods, TMT, HB wire and Steel Structural. PIL has always emphasized on the complete integration approach for the highest value addition and has setup production facilities for quality sponge Iron, Power generation, Steel Billets / Blooms / Ingots, Ferro Alloys and Steel Structural, Wire Rods, TMT and HB Wire.

PIL has been certified for ISO 9001 Quality Management System, ISO14001, Environment Management System and OHSAS 18001 Occupational Health Management System, which shows the commitment of the management towards the supply of quality products to its customers and towards the environmental protection responsibility in the interest of its employees and the society. Company has also been awarded ISO: 50001 Energy Management System certifications towards the company’s approach for conservation of energy in the plant by using energy efficient equipments and practices. Champa plant is the first integrated steel plant in the country achieving this certification.

Company has planned augmentation to enhance power generation capacity of the Co-generation captive power plant through WHRB attached with the Sponge Iron Kilns from 100 MW power (10 MW/Kiln) to 150 MW (15 MW/Kiln) from the flue gases emanating from the Sponge Iron Kilns.

Other than this, company has also planned installation of New Iron Ore Beneficiation Plant of Capacity 0.75 MTPA (throughput) and captive Palletisation plant of 3 Million Ton capacity in 2 phases of 1.5 Million ton each as a step towards backward integration to fulfill Pallet requirement for DRI Kilns, as a substitute of Iron Ore.

2.2 BRIEF DESCRIPTION OF THE NATURE OF THE PROJECT

Prakash Industries Limited (PIL) is existing Integrated Steel Plant located at Hathneora & Champa Villages, Janjgir-Champa District, Chhattisgarh.

Now, as part of expansion, company has proposed following:

i. Augmentation to enhance power generation capacity of the Co-generation captive power plant through WHRB attached with the Sponge Iron Kilns from 100 MW power (10 MW/Kiln) to 150 MW (15 MW/Kiln) from the flue gases emanating from the Sponge Iron Kilns as per the details given in the Table – 3 below:
Table - 3

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Modifications / Changes proposed for Augmentation</th>
<th>Additional Power Generation/ Kiln</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>More steam generation in WHRB by injecting Bag Filter dust in ABC / DSC of Kiln</td>
<td>2 MW</td>
</tr>
<tr>
<td>2</td>
<td>Installation of efficient TG set for consuming lesser specific Steam</td>
<td>3 MW</td>
</tr>
<tr>
<td></td>
<td><strong>Total / Kiln</strong></td>
<td><strong>5 MW</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total for 10 Kilns</strong></td>
<td><strong>50 MW</strong></td>
</tr>
</tbody>
</table>

Hence, we will be able to enhance power generation to the extent of 150 MW from 10 Kilns instead of 100 MW.

ii. Installation Iron Ore Beneficiation Plant of Capacity 0.75 MTPA (throughput)

iii. Installation of Captive Palletisation plant of 3 Million Ton capacity in 2 phases of 1.5 Million ton each as a step towards backward integration to fulfill Pellet requirement for DRI Kilns, as a substitute of Iron Ore.

2.3  NEED FOR THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY AND OR REGION

**Augmentation of WHRB Power**

With improved technology over the years, extra power can be generated in the Captive Co-Generation Power plant through WHRB.

**Pelletisation Plant & It’s Need:**

Presently, company is procuring Iron Ore from Odisha and Pellets from nearby Pellets Plants to operate the Sponge iron Kilns. Availability of Iron Ore in future particularly after 2020 is a big concern as Mining Leases of the existing iron ore mines are going to expire in 2020 and further development of Iron Ore mines by next successful bidders will take considerable time. Therefore considering the volatility in the market, it may also be difficult to get Pellets on reasonable prices in the long run. It is therefore required to make sure availability of Pellets for uninterrupted operation of the Sponge Iron Kilns.

We have therefore planned for installation of 3 Million Ton (2 x 1.5 Million ton) Per Annum capacity Pelletization Plant in 2 Phases of 1.5 Million Ton each as a step towards backward integration, which will ensure availability of quality Pellet as a substitute of Iron ore.
2.4 DEMAND AND SUPPLY GAP
Demand for steel is high and as soon as they are processed they will be supplied to nearby industries.

2.5 EXPORT POSSIBILITY
Nil

2.6 DOMESTIC/EXPORT MARKETS
While the demand for steel will continue to grow in traditional sectors such as infrastructure, construction, housing automotive, steel tubes and pipes, consumer durables, packaging, and ground transportation, specialized steel will be increasingly used in hi-tech engineering industries such as power generation, petrochemicals, fertilizers, etc. The new airports and railway metro projects will require a large amount of steel. Hence the domestic and export markets for steel sector will rise.

2.7 EMPLOYMENT GENERATION (DIRECT AND INDIRECT) DUE TO THE PROJECT
Manpower requirement for Dust Injection system will be:

- 3 supervisor & 3 shift engineers (Total 6 persons /Dust Injection System)
- Total manpower requirement for 5 Dust injection systems – 30 Nos.

Manpower requirement for the proposed Iron ore Beneficiation & Pellet Plant will be:

<table>
<thead>
<tr>
<th>Types</th>
<th>Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executives (Technical &amp; Operational Manager)</td>
<td>7</td>
</tr>
<tr>
<td>Non-executives</td>
<td>8</td>
</tr>
<tr>
<td>Technical &amp; Operational Manager</td>
<td>56</td>
</tr>
<tr>
<td>Skilled &amp; Unskilled Labour</td>
<td>234</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>305</strong></td>
</tr>
</tbody>
</table>

Hence total man power requirement for the proposed expansion wil be $36 + 305 = 341$ nos.
Chapter – 3 : PROJECT DESCRIPTION

3.1 TYPE OF THE PROJECT
As part of expansion, company has proposed following:

i. Augmentation to enhance power generation capacity of the Co-generation captive power plant through WHRB attached with the Sponge Iron Kilns from 100 MW power (10 MW/Kiln) to 150 MW (15 MW/ Kiln) from the flue gases emanating from the Sponge Iron Kilns

ii. Installation of Iron Ore Beneficiation Plant of Capacity 0.75 MTPA (throughput)

iii. Installation of Captive Palletisation plant of 3 Million Ton capacity in 2 phases of 1.5 Million ton each as a step towards backward integration to fulfill Pellet requirement for DRI Kilns, as a substitute of Iron Ore.

Proposed expansion will be carried out in the existing plant premises only.

3.2 LOCATION OF THE PROJECT
• Existing plant is located at Village: Hathneora, Champa, District: Janjgir – Champa Chhattisgarh.

• Existing plant is located in 601.47 acres / 243.4 Ha. of land.

• Proposed expansion will be taken up in the Existing plant only.

• Khasra nos. of total land area are enclosed as Annexure - 1

• Coordinates of the project site are shown in Table – 5 below:

<table>
<thead>
<tr>
<th>Point No.</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22° 0'58.14&quot;N 82°39'52.32&quot;E</td>
</tr>
<tr>
<td>2</td>
<td>22° 0'53.30&quot;N 82°40'6.92&quot;E</td>
</tr>
<tr>
<td>3</td>
<td>22° 0'50.75&quot;N 82°40'23.52&quot;E</td>
</tr>
<tr>
<td>4</td>
<td>22° 0'28.93&quot;N 82°40'23.53&quot;E</td>
</tr>
<tr>
<td>5</td>
<td>22° 0'15.75&quot;N 82°40'37.04&quot;E</td>
</tr>
<tr>
<td>6</td>
<td>22° 0'3.89&quot;N 82°40'35.67&quot;E</td>
</tr>
<tr>
<td>7</td>
<td>22° 0'4.36&quot;N 82°40'47.84&quot;E</td>
</tr>
<tr>
<td>8</td>
<td>21°59'51.89&quot;N 82°40'49.53&quot;E</td>
</tr>
<tr>
<td>9</td>
<td>21°59'47.99&quot;N 82°40'29.26&quot;E</td>
</tr>
<tr>
<td>10</td>
<td>21°59'40.61&quot;N 82°40'5.87&quot;E</td>
</tr>
<tr>
<td>11</td>
<td>21°59'54.41&quot;N 82°40'1.92&quot;E</td>
</tr>
<tr>
<td>12</td>
<td>22° 0'28.18&quot;N 82°39'44.04&quot;E</td>
</tr>
</tbody>
</table>

• The entire project area will fall in the Survey of India topo sheet no. 64 J/12
Figure – 1: Google Earth Map showing boundary of the project site
Figure – 2: General Location map

Map not to Scale

Copyright © 2014 www.mapsofindia.com
(Updated on 19th June 2014)
Figure 3: Topographical Map (10 Km. radius)
Figure – 4: Plant Layout
3.3 DETAILS OF THE ALTERNATE SITES

No alternative site has been considered, as the proposed expansion will be taken up in the existing plant premises only.

3.4 SIZE OR MAGNITUDE OF OPERATION

Following Table - 6 depicts the Plant configuration and Production capacity:

Table - 6

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Unit</th>
<th>Capacity for which EC obtained on Nov. 2010</th>
<th>Proposed Expansion</th>
<th>Total after proposed expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Iron ore beneficiation Plant</td>
<td>---</td>
<td>0.75 MTPA</td>
<td>0.75 MTPA</td>
</tr>
<tr>
<td>2.</td>
<td>Pellet Plant</td>
<td>---</td>
<td>2 x 1.5 MTPA</td>
<td>2 x 1.5 MTPA</td>
</tr>
<tr>
<td>3.</td>
<td>Sponge Iron Plant</td>
<td>2.0 MTPA</td>
<td>---</td>
<td>2.0 MTPA</td>
</tr>
<tr>
<td>4.</td>
<td>Ingots / Billets / Blooms</td>
<td>2.0 MTPA</td>
<td>---</td>
<td>2.0 MTPA</td>
</tr>
<tr>
<td>5.</td>
<td>TMT / Wire rod mill</td>
<td>0.6 MTPA</td>
<td>---</td>
<td>0.6 MTPA</td>
</tr>
<tr>
<td>6.</td>
<td>Blast Furnace</td>
<td>1.0 MTPA (4 x 350 M³)</td>
<td>---</td>
<td>1.0 MTPA (4 x 350 M³)</td>
</tr>
<tr>
<td>7.</td>
<td>Ferro Alloys</td>
<td>1,15,000 TPA (9 x 7.5 MVA)</td>
<td>---</td>
<td>1,15,000 TPA (9 x 7.5 MVA)</td>
</tr>
<tr>
<td>8.</td>
<td>Sinter Plant</td>
<td>1.45 MTPA</td>
<td>---</td>
<td>1.45 MTPA</td>
</tr>
<tr>
<td>9.</td>
<td>Oxygen Plant</td>
<td>800 TPD</td>
<td>---</td>
<td>800 TPD</td>
</tr>
<tr>
<td>10.</td>
<td>Captive Power Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WHRB Power Plant</td>
<td>307.5 MW</td>
<td>50 MW</td>
<td>150 MW</td>
</tr>
<tr>
<td></td>
<td>FBC Power Plant</td>
<td>187.5 MW</td>
<td>187.5 MW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BF Gas based power plant</td>
<td>20 MW</td>
<td>---</td>
<td>20 MW</td>
</tr>
</tbody>
</table>

3.5 MANUFACTURING PROCESS

3.5.1 AUGMENTATION OF CAPACITY OF COGENERATION CAPTIVE POWER PLANT (WHRB BASED)

PRESENT SCENARIO

We have been granted EC for total 100 MW Co-Generation of power from WHRB attached with Kilns. Following are the details of the capacity already installed and in operation, capacity under installation and balance capacity yet to be installed:

Capacity as per EC dated 03.11.10 - 100 MW
Already installed & in operation - 47 MW
Under installation - 20 MW (2 WHRB attached with 2 Kilns)
Yet to be installed & Commissioned - 33 MW
PROPOSED CHANGES

With improved technology over the years we can generate extra power in the captive Co-Generation Power plant through WHRB. For augmentation in the power generation in Co-Gen power plant we have planned following additional modifications:

a) More steam generation in WHRB by injecting Bag Filter dust in ABC / DSC of Kiln.

b) Installation of efficient TG set for consuming lesser specific Steam.

By implementing these modifications, we will be able to generate 15 MW in place of 10 MW from each Kiln and accordingly there will be 150 MW power generation in place of 100 MW from 10 Kilns.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity as per EC dated 03.11.10</td>
<td>100 MW</td>
</tr>
<tr>
<td>Augmentation planned</td>
<td>50 MW</td>
</tr>
<tr>
<td><strong>Ultimate capacity</strong></td>
<td><strong>150 MW from 10 Kilns @ 15 MW / Kiln</strong></td>
</tr>
</tbody>
</table>

3.5.1.1 DETAILS OF DUST INJECTION SYSTEM

INSTALLATION OF DUST INJECTION SYSTEM IN KILNS

For augmentation in steam generation in WHRB and subsequently power generation, we have planned Dust injection in DSC / ABC of the Sponge Iron Kilns. Presently the dust collected in the Bag Filters is not usable in Kilns or coal based power plants due to low GCV (1850 -2000). However we have planned a Dust Injection system to utilise this dust in more steam generation in WHRB boilers. As a new concept this dust will be accumulated in a separate bin and will be injected in Dust settling chamber or After burning chamber. As this dust is having adequate GCV, after burning it in ABC/DSC, we have planned to increases the flue gas temperature resulting extra steam generation and subsequently more power generation through WHRB.

SPONGE IRON KILNS – MANUFACTURING PROCESS

The manufacturing process converts lump iron ore into highly metallized, passivated iron product (DRI). The product is in the form of lumps and contains a variable and controlled percentage of carbon. This is an ideal feed material for quality steel making in Induction furnace. The presence of Fe3C assures that the product is passivated i.e. non-pyrophoric even without briquetting and allows easy, safe handling and transport.
When the temperature reaches a value of about 500 - 600 °C, the hematite (Fe₂O₃), in presence of CO, begins to transform itself into magnetite (Fe₃O₄). When the burden reaches the lower zone of the kiln and comes in contact with hotter and richer gas, the magnetite is reduced to wustite (FeO). The reduction of wustite to metallic iron is the slowest stage of the whole reduction process. It requires high temperatures and gas with high reduction potential and these conditions are reached in the reducing gas injection zone.

MATERIAL BALANCE

The material balance of Sponge Iron Kilns is shown below in Table – 7

<table>
<thead>
<tr>
<th>S.No.</th>
<th>INPUT MATERIAL</th>
<th>INPUT QUANTITY, TPA</th>
<th>OUTPUT MATERIAL</th>
<th>OUTPUT QUANTITY, TPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 Kiln</td>
<td>10 Kilns</td>
<td>1 Kiln</td>
</tr>
<tr>
<td>1.</td>
<td>Iron Ore</td>
<td>346500 @1.73 T/T</td>
<td>DRI</td>
<td>200000</td>
</tr>
<tr>
<td>2.</td>
<td>Coal</td>
<td>281490 @1.4 T/T</td>
<td>LOI (Flue Gases)</td>
<td>323107</td>
</tr>
<tr>
<td>3.</td>
<td>Dolomite</td>
<td>7920 @0.039 T/T</td>
<td>Dust &amp; fines</td>
<td>57692</td>
</tr>
</tbody>
</table>

|       |                | 79200               | Char            | 55110               | 551100             |
|       |                | 635910              | 6359100         | 635909              | 6359090            |

WASTE GAS SYSTEM

The waste gases emanating from the rotary Kiln have following characteristics --

- Temperature,
- Dust content,
- Combustible constituents,
- Contaminates

Due to having very high temperature at Kiln outlet, the waste flue gases are passed through ABC and DSC before using in the WHRB for power generation. The waste gas treatment generally applied can be subdivided into three major groups:-

- After burning system
- Gas cooling system
- Gas cleaning system
The combustible constituents of the waste gases such as carbon, soot particles and combustible gases are burnt out to a large extent fixed carbon in an after burning chamber – ABC.

The hydrocarbons and the carbon monoxide are converted into carbon dioxide and water vapour, all sulphur compounds into sulphur dioxide.

The after burning chamber is especially designed for adequate conditioning of the dust-laden Kiln off-gas.

It is only by the proper elimination of the soot and carbon under controlled temperature conditions that optimum functioning of the waste heat recovery system and the ESP can be guaranteed without the risk of malfunctioning.

Before the gases enter the combustion area of the after-combustion chamber, the waste gases from the rotary Kiln pass through a horizontal dust chamber which is part of the after burning chamber.

The dust chamber has three functions:-

- Compensation of pressure fluctuations.
- Achievement of uniformity of the waste gases with regard to temperature and concentration of combustibles.
- Reduction of waste gas velocity and removal of large dust particles by gravity.

At the end of the dust chamber, the waste gases change their direction of flow and stream upwards into the combustion area of the after burning chamber. A water nozzle controls the inlet temperature of the gas.

The combustion takes place in two sections of the ABC by air injection. The combustion takes place in a narrow and controlled temperature range between 950 and 1000°C.

The temperatures of the waste gases leaving their chamber are controlled automatically by water injection at a temperature of approx. 1000°C. On top of the ABC, an emergency flap is arranged, which opens automatically if, for instance, the temperature of the waste gases entering the waste gas cleaning system is too high or in case the waste gas fan trips.

Waste gas measurements are also carried out with gas probes for ABC – operation. As a result, ABC – operation can be optimized to such an extent that the gas leaving the chamber has no traces of any hydrocarbons, carbon monoxide, soots or tar compounds at an oxygen content of approximately 0.2 – 0.5% only.

The waste gas leaving the after burning chamber will be cooled in a WHRB to a temperature of around 200°C.
TECHNICAL DETAILS OF PROPOSED DUST INJECTION SYSTEM

Each Dust injection system will inject dust in 02 DRI Kilns. Dust from following areas will be conveyed and stored in Dust Storage Silo (DSS):

1. The coal dust from various Bag filters in the coal circuit.
2. The char fines dust from PSB
3. The dust collected in Cooler Discharge Bag Filter

Dust collected from above sources in each Kiln will be about 3600 -4000 Kg/hr, having calorific value of 1850-2000 Kcal/Kg. This dust collected in DSS can be injected into ABC/ DSC of the Kiln. This dust will burn to produce additional heat and same will be recovered in WHRB to produce additional steam. The quantity of dust, which can be injected into the system, has to be established by feeding controlled quantity of dust and increasing the dust quantity over period of time.

BAG FILTER DUST GENERATION IN KILNS

Dust generation is measured for each Kiln at site for designing the Dust Injection system and the average measurement results for each Kiln are shown in Table - 8:

<table>
<thead>
<tr>
<th>Bag Filter No.</th>
<th>Inlet Dust (Mg/M3)</th>
<th>Air Flow (M3/Hr)</th>
<th>Dust Qty (T/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10050</td>
<td>74541</td>
<td>10050x74541/1000000000 = 0.75</td>
</tr>
<tr>
<td>2</td>
<td>19045</td>
<td>11292</td>
<td>19045x11292/1000000000 = 0.22</td>
</tr>
<tr>
<td>3</td>
<td>39020</td>
<td>71893</td>
<td>39020x71893/1000000000 = 2.80</td>
</tr>
<tr>
<td>Total</td>
<td>68115</td>
<td>157726</td>
<td>3.77</td>
</tr>
</tbody>
</table>

The dust generation may vary as per process parameters and raw material i.e coal grade, coal size, iron ore, pellets, kiln condition etc.

ADDITIONAL POWER GENERATION

Additional power generation in each Kiln due to augmentation of steam in WHRB by injecting dust in ABC/DSC of Kiln will be as follows-

GCV required for generation of 1 MW power - 3200 Kcal/Kg
GCV of the dust to be injected - 1850 -2000 Kcal/Kg
Quantity of Dust available - 3.77 Ton / Hr / Kiln
Hence power generation \[\frac{1850 \times 3.77}{3200} = 2.1 \text{ MW}\]
(Say 2 MW / Kiln)

Thus there will be 20 MW extra generation in 10 Kilns by using the Dust Injection System.

CHEMICAL PROPERTIES OF DUST

The chemical properties (proximate analysis) of bagfilter dust to be fed through Dust Injection System will be as mentioned below in Table - 9:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>PARAMETERS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Moisture</td>
<td>1.0</td>
</tr>
<tr>
<td>2.</td>
<td>V.M.</td>
<td>0.6</td>
</tr>
<tr>
<td>3.</td>
<td>ASH</td>
<td>80.3</td>
</tr>
<tr>
<td>4.</td>
<td>F.C.</td>
<td>19.1</td>
</tr>
<tr>
<td></td>
<td>GCV ( KCAL/KG)</td>
<td>1850</td>
</tr>
</tbody>
</table>

PHYSICAL PROPERTIES OF DUST

The physical properties of dust to be fed through Dust Injection System will be as mentioned below in Table - 10:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dust size</td>
<td>All particles less than 1 mm</td>
</tr>
<tr>
<td>2</td>
<td>Bulk Density of Dust</td>
<td>600 – 800 Kg/m3</td>
</tr>
<tr>
<td>3</td>
<td>Specific Gravity of Dust</td>
<td>1.1 – 1.2</td>
</tr>
</tbody>
</table>
Figure – 5 : PROCESS FLOW DIAGRAM OF DUST INJECTION SYSTEM
 TECHNICAL SPECIFICATIONS OF PNEUMATIC CONVEYING SYSTEM

Following are the details of the pneumatic conveying system to be installed for dust injection in ABC/ DSC of each Kiln in Table - 11:

Table - 11

<table>
<thead>
<tr>
<th>S.No.</th>
<th>DESCRIPTION</th>
<th>REMARKS /DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ROOTS BLOWER:</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Conveying Blower Type</td>
<td>Roots Blower</td>
</tr>
<tr>
<td>2</td>
<td>Capacity, m3/hr</td>
<td>During Detail Engg.</td>
</tr>
<tr>
<td>3</td>
<td>Pressure, mbar</td>
<td>During Detail Engg.</td>
</tr>
<tr>
<td>4</td>
<td>Medium</td>
<td>Air</td>
</tr>
<tr>
<td>5</td>
<td>Inlet Temperature</td>
<td>Ambient</td>
</tr>
<tr>
<td>6</td>
<td>Blower Speed</td>
<td>During Detail Engg.</td>
</tr>
<tr>
<td>7</td>
<td>Motor Rating</td>
<td>22kW/4P</td>
</tr>
<tr>
<td>8</td>
<td>Blower will be complete with following accessories:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Inlet Silence cum Filter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Outlet Silencer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. V- Belt &amp; Pulley (both Drive and Non Drive end)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Motor Slide Rails</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Base Frame</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Safety Valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Pressure Gauge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Flexible Connections</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Foundation Bolts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10. Non Return Valve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11. Anti-vibration Rubber Pads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12. First Fill of Oil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13. Oil Level Indicator</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14. Filter Chocking Indicator</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Y- PIECE:</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Location</td>
<td>Above Rotary Feeder</td>
</tr>
<tr>
<td>2</td>
<td>Size</td>
<td>200x200</td>
</tr>
<tr>
<td>3</td>
<td>Material of Construction</td>
<td>MS, 5 mm thk</td>
</tr>
<tr>
<td>4</td>
<td>Painting</td>
<td>Two coats of Finish Paint</td>
</tr>
<tr>
<td>C</td>
<td>SLIDE GATES:</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Isolation Slide Gate</td>
<td>MS, Manually Operated</td>
</tr>
<tr>
<td>2</td>
<td>Size</td>
<td>200 mm x 200 mm</td>
</tr>
<tr>
<td>3</td>
<td>No of Slide Gate Valve</td>
<td>2 No.</td>
</tr>
<tr>
<td>4</td>
<td>Material of Construction</td>
<td>MS</td>
</tr>
<tr>
<td>5</td>
<td>Painting</td>
<td>Two coats of Finish Paint</td>
</tr>
<tr>
<td>D</td>
<td>ROTARY FEEDER:</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Dust Loading by</td>
<td>Rotary Feeder</td>
</tr>
<tr>
<td>2</td>
<td>Size of Feeder</td>
<td>200x200</td>
</tr>
<tr>
<td>3</td>
<td>No of Feeders</td>
<td>1 No.</td>
</tr>
</tbody>
</table>
CONVEYING DISTANCE

New dust storage silo will be planned to locate near product storage bins. The dust from this silo will be fired in two Kilns. Conveying parameters as collected from Drawings are listed below in Table - 12:

Table - 12

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>DESCRIPTION</th>
<th>CONVEYING DISTANCE ( M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Horizontal, m</td>
<td>150 – 170</td>
</tr>
<tr>
<td>2</td>
<td>Vertical, m</td>
<td>10 – 15</td>
</tr>
<tr>
<td>3</td>
<td>Total, m</td>
<td>160-185</td>
</tr>
<tr>
<td>4</td>
<td>No of 90° Bends in System</td>
<td>4</td>
</tr>
</tbody>
</table>
OPERATING PROCEDURE

Presently the dust collected in the Bag Filters is not usable in Kilns or coal based power plants due to low GCV (1850 -2000). However we have planned a Dust Injection system to utilise this dust in more steam generation in WHRB boilers. As a new concept this dust will be accumulated in a separate bin and will be injected in Dust settling chamber or After burning chamber. After burning the dust in ABC / DSC it will produce additional heat and same will be recovered in WHRB to produce additional steam.

In ABC / DSC chamber, the unburnt hydrocarbons and carbon monoxides are converted into water vapors and carbon dioxide. This burning of residual carbon will increase air temperature and increases steam generation in WHRB. At ABC outlet temperatures are maintained at 1000 °C. The quantity of dust, which can be injected into the system, has to be established by feeding controlled quantity of dust and increasing the dust quantity over period of time.

3.5.1.2 INSTALLATION OF EFFICIENT TG SETS

INSTALLATION OF EFFICIENT TG SETS WITH LOWER SPECIFIC STEAM CONSUMPTION

Presently the TG sets attached with the Sponge Iron Kilns consumes 5 - 5.2 Ton / MW steam however now with change in technology, Efficient TG sets of much lesser steam consumption is available which consumes 3.9 -4 Ton / MW steam. We have therefore planned to install efficient TG sets of 30.5 MW to be connected with 02 Sponge Iron Kilns. Thus for 10 Kilns, we have planned installation of 5 TG sets of 30.5 MW capacity. Presently average power generation from each WHRB boiler is 10 MW. With installation of efficient TG set we will be able to generate 13 MW from each WHRB attached with the Kiln. Thus there will be additional 3 MW power generation from each WHRB by using efficient TG set and accordingly there will be 30 MW extra power generation from 10 Kilns by installation of efficient TG sets.

TECHNICAL DETAILS OF 30.5 MW EFFICIENT TG SET

Following are the technical details of the TG set:

LIST OF EQUIPMENTS:

- 01 No 30.5 MW Bleed Condensing steam turbine
  - Single casing turbine
  - Trip valve for live steam with built-in steam strainer (medium operated)
• Control valve(s) for live steam (hydraulic oil operated)
• Orientation of exhaust- Downward exhaust
• Jacket-type insulation for Turbine
• Turbine Drains with manual operated shut-off valves
• Delivered In completely assembled Condition
• Coupling
• Flexible coupling in between Turbine & Gearbox and flanged connection in between Gearbox & alternator

➢ Gearbox
  • Single reduction, double helical speed reducing gear box with “Service Factor: 1.4”

➢ Turning gear
  • Turning Gear placed on Gear Box with electric motor and with auto engage auto disengages arrangement with hand barring facility

➢ Base frame
  • Base frame only for turbine. Gearbox & alternator directly mounted on Foundation on sole plates

➢ Combined Lube & Control Oil System
  • 1 no. Lube oil tank (Carbon steel tank)
  • 1 x 100% Gearbox or Turbine Shaft Driven Main oil pump
  • 1 x 100% AC motor Driven auxiliary oil pump
  • 1 x 30% DC motor Driven emergency lube oil pump
  • 2 x 100% AC motor Driven control oil pump
  • 1 x 100% AC motor Driven Jacking oil pump
  • 2 x 100% oil vapor extractor fan (mist eliminator)
  • Oil tank heating (electric heater)
  • 2 x 100 % lube oil cooler (Plate type) with manual changeover valve, Lube oil cooler plate Material shall be SS316 & Plate Thickness of 0.5 mm. 10% extra surface are to be provided
• 2 x 100% Control oil cooler (Plate type) with manual changeover valve, Control oil cooler plate Material shall be SS316 & Plate Thickness of 0.5 mm. 2 x 100% oil filters with manual transfer valve, Oil filters for lube oil (25 micron)
• 2 x 100% oil filters with manual transfer valve, Oil filter for Control oil (10 micron)
• Emergency overhead oil system with accessories
• Thermostatic valve in lube oil system

➢ Gland Steam Condenser

One number Gland steam condenser which includes:
• One number shell & tube type Gland Steam Condenser, where shell material is carbon steel and tube material is stainless steel, welded (SA249TP304)
• 1 X 100% AC motor Driven Exhaust Fans

➢ Surface Condenser

• One number Surface Type Water Cooled, Under-slung, Shell and Tube type, two pass condenser with divided water box and integral hotwell
• Material of Condenser Tubes shall be of stainless steel, welded (SA249 TP304), tube wall thickness is 0.711 mm (22 BWG)
• Cleanliness Factor - 85% & Plugging Margin 5%
• Hot well retention time – 1 min
• One number rupture disc
• One number Flash box and Stand pipe both are integral part of condenser

➢ Condensate System Auxiliaries

• 2 X 100 Condensate Extraction pump, Horizontal Type with Drive motor, Pit Mounted (Pit Elevation -3.5 meter) PIL insisted to provide VFD compatible Motor for CEP. VFD compatible motor for CEP shall be provided by Siemens. However, suitability of operating CEP Motor with VFD shall be check & confirm during detail Engineering
• Hot well Level control valve and recirculation flow control valve to ensure minimum flow to Condensate extraction pumps.
• Condenser Air Evacuation System
Steam jet air ejector unit suitable for (2x100% holding ejector & 1 x100% hogging ejector, 1 common inter-after condenser with Tube MOC of SA249 TP304) 70 % vacuum in 30 minutes

**Piping, Valves & Accessories**
- Manual valves & Control valve shall be as per P&IDs
- Reverse flow protection for bleeds loose supplied
- For Bleed line to Deaerator - One (1) number pneumatically assisted QCNRV
- For Bleed Line to LP heater - One (1) number Mechanical NRV
- Exhaust Hood Spray ON-Off Valve with piping
- Valves & de-superheated for Gland Sealing System
- Turbines Drain piping
- Interconnecting piping from gland sealing system to turbine glands & leak steam piping from turbine to Gland steam condenser
- Interconnecting oil piping from lube oil system to TG bearings
- Piping downstream of lube oil filter will be of stainless steel (SA 312 TP304).
- All other piping shall be of carbon steel (SA 106 Gr. B).
- Condensate piping up to outlet of “Hot well control valve”
- Insulation of applicable piping’s will be of Mineral Wool/Glass Wool material along with aluminum cladding
- Isolation valve & bypass Valve for GSC and isolation valve for SJAE shall be Manual Gate type instead Butterfly valve

**Anchoring for Turbine, Gear Box and Generator**
- Non-embedded Parts i.e. Foundation Bolt, Hex-Nut Lock-nut & Washer (for foundation bolt), Bottom Plates, Supporting Plates (Wedges), Leveling Plates (for Wedges), Leveling Plate Screws and Shims

**Electrical Scope of Supply**

**Generator**
- Three Phase Synchronous Generator cylindrical type, Four Pole 38.125MVA, 30.5MW, 11KV+/-10%, 50Hz+/-5%, Combined Voltage and Frequency Variation will be 10% (Absolute), 0.8p.f (lag) to 0.95 (lead) & reactance value & SCR as per OEM
• Brushless Excitation System with PMG
• Air-water-coolers (CACW), top mounted 4 X 33% with SA249TP304 cooler tubes with 5% plugging margin. Generator shall deliver 100 % output in case of one section of cooler is out of service
• PT100 type RTDs will be provided in the following locations for Generator
  • Stator winding – 2 per phase (Duplex type, Total 6 Nos.)
  • Stator core – Total 2 no’s (Duplex type)
  • Bearings – 1 No each for NDE and DE. (Duplex type)
  • Cold & Hot air circuits – 1 Nos per stream. (Duplex type)
  • End shield mounted sleeve bearings
  • Generator line and neutral terminals on bottom with neutral side CTs mounted in customer’s bus duct
  • Routine/Standstill Test shall be offered for Generator. Similar Type Test certificates will be provided for reference purpose
  • Anti-condensation heater & Water leakage detector
  • Design as per IEC 60034 & with degree of protection of IP54
  • Engineering for bus duct will be in Siemens scope

➲ Generator Control Panels
• Automatic Voltage regulators (AVR Panel) – ABB make UNITROL 1020
• Automatic Voltage Regulator (AVR Panel) with two Auto and two Manual mode for Generator Voltage/PF operation controlling
• Hardwired communication/Soft link for raise/lower & mode selection
• Generator Protection Panel & Metering panel
• Numerical multifunction relay (Redundant) - 7UM62 relay Siemens make.
• Interface with plant control system through Modbus communication port.
• Software for parameterization & fault record printout
• Digital meters for generator Voltage, Amperes, Frequency, Power Factor, Mega Watts(MW), MVA, MVAR
• Multifunction Meter (Secure make, Premier model considered customer to confirm the model number)
• Synchronization panel
- Auto synchronizer with in-built check synchroscope
- Standard mimic for following
- 4 (Four) Synchronization point control (Breaker by Purchaser)
- Neutral grounding controller (isolator/contactor)
- Generator control panels executed in free standing cubicle (control room)
- Floor mounted, vertical, metallic, non-mosaic
- Powder coated to paint shade RAL7035
- Panel Height of 2085mm including base channel of 75 mm & anti-vibration pad of 10 mm
- IP4X degree of protection
- Panel internal wiring with 1.1KV grade PVC insulated FR conductor of 1.5sqmm
- Panel thickness: 2 mm for load bearing surface & 1.5 mm for rest of the side, 3 mm gland plate

➤ Line Side Cubicle
- The Line Cubicle contains Lightning Arrester, Surge Capacitors, and Potential Transformer for Generator Protection
- Aluminum Bus bars
- 3 Nos. Lightning Arrester
- 3 Nos. Surge Capacitor
- Instrument transformers
- Executed in free standing cubicle (Ground floor)
- Floor mounted, vertical, metallic type
- Paint shade of RAL7035
- Degree of protection of IP54
- Panel internal wiring with 1.1KV grade PVC insulated FR conductor of 1.5sqmm

➤ Neutral Side Cubicle
- Neutral side Cubicle (NGR Panel-11kv/v3) contains Neutral Grounding Resistor, current Transformer for Generator Protection
- Suitable to withstand 100A for 30 seconds
• Resistor material shall be Punched Steel grid type, AISI-304, non magnetic
• Instrument transformer
• Executed in free standing cubicle (Ground Floor)
• Paint shade of RAL7035
• IP52 for isolator section and IP33 for resistor section
• Panel internal wiring with 1.1KV grade PVC insulated FR conductor of 1.5sqmm

➢ Auxiliary Electrical Equipments
  • LT AC and DC motors
  • AC motors of IE-2 grade, TEFC type, IP55 enclosures & S1 duty
  • Starting method of DOL type.
  • DC motor will be IP54 & TESC
  • Starter panel for DC motor
  • 110 V DC, 2 Step Resistance Start method. Executed in free standing cubicle
  • Paint shade of RAL7035
  • IP4X protection
  • Panel internal wiring with 1.1KV grade PVC insulated FR conductor of 1.5sqmm
  • Earthing
  • Limited to stubs of SIEMENS supplied equipments.
  • Earthing inside supplied panels through flat/wires of suitable size

Control & Instrumentation Scope of Supply

➢ Turbine Supervisory Panel

This cubicle consists of:
  • Governor Controller, Over Speed Monitoring System, Vibration Monitoring System, Power supply distribution & Emergency trip push button
  • Woodward Governor : Simplex type with following Controls & Limiters
  • Speed
  • Load
  • Inlet pressure
  • Extraction/Back pressure (if applicable)
Vibration Monitoring System with rack & field measurements

- 16 Shaft Vibration (X-Y orthogonal direction per bearing)
- 2 Axial Probe
- Buffered output BNC connector
- Common trip output for X-Y probes-bearing with individual output signal
- Vibration monitoring system should have provision of individual analogue output signal for monitoring of vibration on DCS for trend & record purpose
- Over Speed Protection System
- Dedicated Electronic over speed module
- Tripping philosophy with 2 out of 3 voting logic
- Total 5 Speed Probes: 3 nos probes will be dedicated for electronic over speed module and 2 nos speed probes for electronic governor

Panels Executed In Free Standing Cubicle

- Floor mounted, vertical, metallic, non-mosaic, non glass, non Perspex
- Powder coated to paint shade RAL7035
- Panel with Height of 2000 mm including base channel of 100 mm & anti vibration pad of 15 mm, width of 800 mm and depth of 600 mm with front opening.
- IP4X degree of protection.
- Panel internal wiring with 1.1KV grade PVC insulated FR conductor of 1sqmm
- Panel thickness: 2 mm for load bearing surface & 1.5 mm for rest of the side, 3 mm gland plate

TG auxiliary control and protection cubicle

The system will be taking care of following controls with minimum requirement as listed below:

- Siemens T3000 with redundant controller & power supply with 25% spare I/O's.
- Turbine auxiliary related open loop and closed loop control other than governing
- Turbine protection other than OSP (Over speed protection) and vibration related protection
• Communication between the PLC and DCS will be through redundant Modbus TCP/IP, communication cables by purchaser
• One no. PC for operator station and one no. PC for operator cum engineering station with console shall be provided along with necessary software
• 5% spare IOs shall be provided
• Cables between PLC and operating station is excluded from Siemens scope of supply, also we have assumed that cable running distance between PLC panel and operator station is <100 meter.

➢ Field Instrumentation, Final Elements and Cables

• Field instruments (e.g. gauges, transmitters, sensors) & final control elements (e.g. valves, elements etc...) shall be as per P&IDs.
• Level transmitters shall be Differential pressure type & Level Gauges will be of Reflex type. Level switches for HI & Lo output potential free contact provision will be provided
• PT/DPT shall be HART compatible with integral LCD display.
• Temperature Transmitters (Field Mounted) will be provided as per P&IDs. For turbine, gearbox and generator (bearing, winding, hot /cold air), temperature elements shall be provided and shall be hooked directly to PLANT DCS.
• For duplex RTDs of Bearings, both elements shall be wired up to Junction Box.
• All temperature elements shall be duplex type.
• Instrument tagging shall be done as per ISA/KKS standards.
• Instrument/Signal cables up to field junction boxes for skid mounted instruments
• Special cables (Speed cables-300mtr) up to the Turbine supervisory panel.
• Cables shall be with AL/CU conductor, PVC insulated & FRLS type.
• Individual & overall shielded cables for Analog signals and Un-shielded cables for Digital signals.
• Field Junction box of Sheet steel material and RAL 7035 paint shade
• Instrument hook up (pipes, tubes & fittings) material as per operating pressure & temperature for Siemens supplied instruments.
Units of field instruments
- Temperature: °C
- Pressure: kg/cm² (gauge)
- All temperature transmitters would not be head mounted, separate temp. Transmitter & temp element to be provided by Siemens. Also all temp. Elements should be duplex type.

List of Accessories of 30.5 MW TG sets

- Mechanical Equipments / Accessories
  Following are the details of accessories of the TG set -
  - Piping and valves outside the turbo-generator set
  - De-aerator & Feed water storage tank
  - Boiler feed pump & motor.
  - Chemical dosing system & its associated piping, valves & instruments.
  - Flow elements in cooling water Lines.
  - Drain pipes from collection funnel, Drain tank and pump
  - Overhead oil tank structure
  - Oil centrifuge
  - First fill & flushing oil
  - LP heater & its accessories
  - Along with its condensate side I/L, O/L & Bypass Valve with associated instruments including pipeline as well as Bleed Steam Valve
  - Acoustic enclosure (Noise hood)
  - All items like Steel embedment,Templates, re-enforcements, civil inserts.
  - Steam blowing & Steam blowing arrangement (sacrificing valve, silencer, piping & supports)
  - Atmospheric flash tank with associated pipes & valves
  - Soil investigation, site survey, site levelling, grading and piling work
  - All civil work includes construction of turbine building, control/ electrical building, any other buildings, all foundations, roads, cable trenches, pipe pedestals, grouting, grouting cement etc. including design/ Drawings for the same
• Construction of workshop, store, laboratory, administrative office, construction water, power, equipment storage and security at site
• Slings, ropes or shackles for erection or transportation purposes. Spreader beam for lifting of the packages
• Any modifications/ dismantling/ revamping of existing system/ building/permanent /temporary, supporting structures/ piping etc
• Foundation calculations and Grouting of base frame with non shrinking material.
• Construction of any roads – approach road within the plant area
• Any rails/platforms/walkways, ladders, provision for approach for equipment etc
• Steel structure, auxiliary steel structure, ladders and access platforms
• Turbine mechanical run test at shop
• Fire alarm / Fire protection / Fire fighting systems including FW tank, pumps, hydrant network, fire tenders, fire extinguishers, Fire sealing for panels/ fire barrier etc. workshop Drawings
• Official approvals, operating permissions, statutory clearances/ approvals like IBR / Boiler Regulation Authority, Electrical Inspectorate / CEA etc., in the country of installation. However, necessary supporting technical documentation related to SIEMENS supply will be furnished by SIEMENS
• Provision of the operating crew, operating materials, loading resistors and connecting cables for performance tests
• Construction materials, cleaning agents and materials, fuels
• Supply of all utilities including, cooling water, compressed air, Nitrogen, Chemicals, additives, lubricants, auxiliary power
• Air conditioning and ventilation systems
• Freezing protection and electric trace heating equipment
• Emergency lighting system & Lightning protection of the system
• Raw Water System, water pre-treatment, DM water plant including pumps, piping, tanks Etc
• Transportation of any equipment
• EOT crane / hoists and erection of all equipment’s
• Mobile Crane for Unloading and Placement of Equipments on respective foundation at Site
• Hose Pipes with fittings for Service air & compressed air system

➢ Electrical Equipment / Accessories
• Bus Duct (IPBD/ SPBD) on phase side and neutral side
• Generator Circuit Breaker
• Medium voltage switchgear
• Power transformer/Generator Transformer
• Unit auxiliary transformers / station service transformers
• MCC for TG integrals, PCC, Low Voltage switchgear and auxiliaries, etc
• UPS system and UPSDB.
• DC System including Batteries, Battery charger and distribution board along with related cables & accessories.
• Protection Relays for Generator Transformer, UAT, ST and over-all differential protection relay and Protections for MV / LT switchgear.
• No additional discrete/ bi-stable relays
• Separate PT fuse failure relays for the Voltage Transformers used in Synchronization & LAVT Panel
• Superior frequency or load control for parallel operation of several turbines
• Grid disconnection device including load shedding equipment Grid disconnection device including load shedding equipment, load sharing equipment and associated calculation
• Complete Earthing (above & below ground indoor / outdoor) earthing system from the SIEMENS supplied equipments up to earth pits including earth pits and lightning protection system
• Lighting Protection, Plant Lighting and communications equipment
• Grid calculations for investigation of transient responses in the event of dynamic transients in the grid
• Short circuit calculations based on the medium voltage grid fed by the generator
Prefeasibility Report

- Electricity meter including Check-meters (MWh) under statutory requirement from grid norms, ABT based revenue metering instruments, metering reading instrument & paperless/electronic/chart recorders
- Tools & tackles such as Relay test kit, Meter reading instruments, Tong Tester, Portable Cable Testing kit, Secondary injection etc
- All statutory clearances/approvals like Electrical Inspectorate etc., in the country of installation. (However, necessary supporting technical documentation related to SIEMENS supply will be furnished by SIEMENS).
- Complete HT Power & LT Power Cables & associated accessories
- Complete LT Control & Signal cables including Local Push Buttons, Cable trays, Cable lugs and associated accessories for purchaser’s equipment.
- CO2 fire fighting provisions & smoke detection sensors for the Generator & Electrical Panels
- Drawings (Layouts for Cable trays, trenches, Earthing) and cable routing
- Electrical Lab Instruments
- Local Control Panels & Local Push Buttons Stations
- Furniture
- Slings and beams required for rotor removal for Generator
- Assembly platform or additional supports for rotor insertion/removal
- Civil embedment’s except Generator sole plates, foundation bolts, panel base channels

- Instrumentation Equipment / Accessories
  - Main Plant DCS System & Unit Master/Unit co-ordination Controls along with Master Clock System, bypass control & protection
  - Instrument Cables, Cable trays and accessories beyond Field Junction Boxes
  - Barriers for Analogue Input (AI) / Analogue Output (AO) of Turbine Control System
  - Special cables up to the Turbine supervisory panel.
  - Turbine Control System synchronising/linking with the existing Plant Control Systems
- Central control room and its associated instrumentation, and alarm annunciation equipment
- Local Gauge Board
- Hard-wired Control & Back-Up Panels, local control panels
- 24/110/220 V DC Batteries and Chargers, UPS and its auxiliaries, DBs etc
- Data management for maintenance
- Engineering or Supply of I&C cable trays and conduits
- Any cabling outside cubicles, cable supporting structures, power supply cables and any interconnection control or interlocking cable.
- Turbine Special Condition Monitoring & Turbine Thermodynamic Calculations
- Online Computer Aided Microprocessor based Machinery Maintenance Management System (OCAMMMS)
- Temperature, Vibration Monitoring for Motors (all voltage levels) within the STG Island.
- Tele-metering to a Load Dispatch Centre or other foreign parties
- Factory acceptance test with a dynamic turbine simulator
- Turbo-set vibration analysis and diagnostic (except vibration measuring)
- Vibration Monitoring System Display (LCD/ Separate PC) with Display & Diagnostic Software and Temperature Module & Scanners
- Complete Electronic Earthing (including above ground, below ground and earth Mats (below ground indoor / outdoor)
- Instrumentation Lab Instruments and SWAS Panel including sampling points
- Hand held communicator for Calibration of Transmitters
- Furniture
- Equipment for synchronizing of the provided bus clock with an external signal (GPS or radio signal) or a plant master clock
- Protocol converters for Customer protocol suitability (host protocol)
- Explosion proof provision (Ex)
- Fire alarm and protection system
- Recalibration test certificates for instrumentation
LIST OF SPARES OF 30.5 MW TG SET

- LIST OF COMMISSIONING SPARES

Table - 13

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>LIST OF SPARES</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mechanical</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Oil piping gaskets</td>
<td>1 set</td>
</tr>
<tr>
<td>3.</td>
<td>ESV gaskets</td>
<td>1 set</td>
</tr>
<tr>
<td>4.</td>
<td>“O” rings (high speed coupling cover)</td>
<td>1 set</td>
</tr>
<tr>
<td>5.</td>
<td>Lube Oil filter elements</td>
<td>1 No.</td>
</tr>
<tr>
<td>6.</td>
<td>Control Oil filter elements</td>
<td>3 Nos.</td>
</tr>
</tbody>
</table>

- LIST OF OPERATION SPARES TO BE MAINTAINED

Table - 14

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of spares</th>
<th>Quantity (Unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Vibration sensor and cable</td>
<td>1 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Barring gear motor</td>
<td>1 No.</td>
</tr>
<tr>
<td>3.</td>
<td>AOP with Motor</td>
<td>1 No.</td>
</tr>
<tr>
<td>4.</td>
<td>Pressure Switch</td>
<td>1 No. of each type</td>
</tr>
<tr>
<td>5.</td>
<td>Pressure Gauge</td>
<td>5 Nos.</td>
</tr>
<tr>
<td>6.</td>
<td>Temperature Gauge</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>7.</td>
<td>Thermocouple (K-type)</td>
<td>1 No.</td>
</tr>
<tr>
<td>8.</td>
<td>I/P Converter</td>
<td>1 No.</td>
</tr>
<tr>
<td>10.</td>
<td>Limit Switch</td>
<td>1 No.</td>
</tr>
<tr>
<td>12.</td>
<td>Rotating Diodes</td>
<td>12 Nos.</td>
</tr>
<tr>
<td>13.</td>
<td>Discharge Resistor</td>
<td>1 No.</td>
</tr>
<tr>
<td>14.</td>
<td>Contactor coil &amp; kit (each type)</td>
<td>1 each type</td>
</tr>
<tr>
<td>15.</td>
<td>Thermal over load relay (each type)</td>
<td>1 each type</td>
</tr>
<tr>
<td>16.</td>
<td>RTD in Turbine</td>
<td>5 Nos.</td>
</tr>
<tr>
<td>17.</td>
<td>Speed Sensor</td>
<td>1 No.</td>
</tr>
<tr>
<td>18.</td>
<td>DP switch / gauge</td>
<td>1 No.</td>
</tr>
</tbody>
</table>
LIST OF SPECIAL TOOLS & TACKLES

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Devices and Tools for Control Valve Assembly</td>
<td>1 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Mounting device for ESV</td>
<td>1 No.</td>
</tr>
<tr>
<td>3.</td>
<td>Box Spanner</td>
<td>1 Set</td>
</tr>
<tr>
<td>4.</td>
<td>Bearing dismounting device</td>
<td>1 No.</td>
</tr>
<tr>
<td>5.</td>
<td>Lifting rod for valve</td>
<td>1 No.</td>
</tr>
<tr>
<td>6.</td>
<td><strong>For Alternator</strong></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Alternator rotor removal tool</td>
<td>1 set</td>
</tr>
</tbody>
</table>

The Heat & Mass balance Diagram (HMBD) of the TG set is shown in Figure – 6 & 7 below:
3.5.2 IRON ORE BENEFICIATION PLANT

0.75 MTPA (throughput) capacity of Iron ore beneficiation plant is proposed to be installed in the present proposal.

**Scrubber:**
- Drum scrubbers are used in Iron ore Beneficiation Plant to remove ore scrub, the adhering impurities such as Alumina, Silica from the ore surface.
- The shell is lined and contains number of lifter to produce the necessary washing action and to discharge the washed material through a trammel section.

**Banana / Bow Screen:**
- Banana screens have become widely used in high-tonnage sizing applications where both efficiency and capacity are important. Banana screens typically have a variable slope of around 40-300 at the feed end of the screen, reducing to around 0-150 in increments of 3.5-50. Banana screens are usually designed with a linear-stroke vibrator.
- The steep sections of the screen cause the feed material to flow rapidly at the feed end of the screen. The resulting thin bed of particles stratifies more quickly and therefore has a faster screening rate for the very fine material than would be possible on a slower moving thick bed.

**Ball Mill:**
- In Ball mill the particles are reduced in size by a combination of impact and abrasion, either dry or in suspension in water.
- It is performed in rotating cylindrical steel vessels which contain a charge of loose crushing bodies - the grinding medium- which is free to move inside the mill, thus comminuting the ore particles. According to the ways by which motion is imparted to the charge.
- Ball mills normally use for produce fine product in the range of 35–10 microns. Generally the rule is that the feed should not be coarser than 80% passing ½” size.

**Hydro Cyclone:**
- Hydro-cyclones use the principle of centrifugal separation to remove or classify solid particles from a fluid, based on particle size, shape and density. It utilizes centrifugal forces to increases the settling rates of the particles, the coarser of which reaches the
cone’s wall is discharged through the Underflow and the fine particles with major portions of feed water reports to the overflow of the cyclone.

**Hydro Cyclone: Main futures**

- **Inlet orifice:** Function is to Provide Smooth Flow Pattern at the point of entrance and to avoid turbulence and restrict coarse particles reporting to overflow.
- **Vertex finder:** The Size of Vertex Finder Controls the Pressure drop for a given volume. Larger the Vertex Finder Coarser the Cut. Conversely Smaller the Vertex, Finer the Separation.
- **Apex orifice:** Discharges Coarse Material at Maximum Density.
- **Feed dilution:** More Dilution results in Finer and Sharper Separation.

**High Gradient Magnetic Separation (HGMS)/Slone make:**

- SLON vertical ring and pulsating high gradient magnetic separator utilizes the combined force field of magnetism, pulsating fluid and gravity to continuously beneficiate fine weakly magnetic minerals. It is equipped with unique pulsating mechanism and possesses the advantages of large beneficiation ratio, high recovery, and a matrix that does not easily clog.

**Spirals:**

- A spiral concentrator is a flowing film separation device.
- General operating principle of spiral is continuous gravitational laminar flow.

**Operation Principle:**

- For both wash water and wash waterless spirals the mechanism of separation is the same and involves primary and secondary flow patterns.
- The primary flow is essentially the slurry flowing down the spiral trough under the force of gravity.
- The secondary flow pattern is radial across the trough. Here, the upper, more fluid layers, comprised of lighter density particles, move away from the center while the lower, more concentrated layers of higher density particles move towards the center.
- The conceptual cross section of the slurry shows the trough divided into three zones.
- The innermost zone is generally comprised of higher density particles transported downward, (i.e. primary flow). The rising component of the flow has a certain capacity to lift lower density particles and transport them outward to the intermediate zone (i.e. secondary flow).
• The intermediate or transition zone is a region of free motion above the bed. This zone is relatively less concentrated and more fluid than the inner zone. Particles in this region move with the secondary flow and are transported according to their relative position within the bed.

Thickeners:
• Thickening can be considered as a process of concentrating a relatively dilute slurry pulp into a thick pulp. This is usually carried in circular tank of large diameter known as Thickener.
• The major principle involved in thickening is the gravity sedimentation.
• Industrial sedimentation is conducted as a continuous process in thickener.
• It receives the slurry at the centre, permits the overflow of the supernatant liquid through over weirs in periphery and discharge a thick slurry from the bottom.
• The tank bottom is made conical to facilitate the discharge of the underflow slurry.
• The tank is fitted with rakes, which are rotating railings with fixed vertical plates and positioned slightly above the tank bottom.
• These rakes scrap the concentrate slurry towards the central discharge.
• When the particles are more in fine nature or charge particles, settling rate is extremely slow.
• By adding flocculent, the rate of settling of particles can enhance
Figure – 8 : Process Flow Diagram for Iron Ore Beneficiation Plant

0.75 MILLION/TPA IRON ORE BENEFICIATION PLANT AT CHAMPA

MAIN EQUIPMENTS –
1. PRIMARY BALL MILL – PBM

TO PROCESS WATER

TO PROCESS WATER POND

MAKE UP WATER

PROCESS WATER

6.18 Million TPA

TO TAILINGSpond

PBM

PB

IC

SBM

SH

SH

SBM

IT

TT

PB

PROCESS WATER

2.57 Million TPA to Pellet

0.18 Million TPA

0.18 Million TPA

0.29 Million TPA

Tailings
3.5.3 PELLETISATION PLANT

CAPACITY ASSESSMENT

Presently 5 Sponge Iron Kilns of 2 LTPA capacity each are in operation, 2 Kilns are under installation and 3 Kilns are yet to be installed. For 10 Kilns (Total 2 Million Ton / Annum capacity) we will require approx. 3.2 Million Ton / Annum Pallet @ 1.6 T/T of Sponge Iron. However considering use of some Iron, we have planned installation of 3 Million Ton (2x1.5 Million ton) Palletization plant in two phases of 1.5 Million Ton each.

RAW MATERIAL AVAILABILITY FOR PALLETIZATION PLANT

The requirement of Iron ore fines for the Palletization plant (Approx 3.2 Million Ton) will be fulfilled from the Iron ore fines generation (About 10%) from screening of the sized Iron ore being purchased. Further with the expected start of operations of captive Sirkagutu Iron Ore Mine and Kawardha mines, availability of Iron Ore Fines for the Palletization plant will be more reliable. Apart from this we can also source Iron Ore fines from NMDC mines in case of any Gap. Iron ore fines of +63 Fe content will be planned to use in the Palletization plant however in case Fe content of Iron ore fines is very less, the Iron ore fines will require to be beneficiated. As we have planned installation of 3 Million Ton Palletization plant in two phases of 1.5 Million Ton each, for the first phase of 1.5 Million Ton Iron ore fines will be made available from the 10% and from the fines generation of Sirkagutu mines. Till the time 2nd phase of palletization plant is commissioned, Iron ore fines will be available from the Kawardha mines also. Gap if any will be fulfilled from NMDC Iron ore mines where plenty of Iron ore fines is available.

QUALITATIVE DETAILS OF PELLETS

Pellets are balls produced from natural iron ores fines of different mineralogical and chemical composition with remarkable properties such as:-

- Uniform size distribution within a range of 6 mm to 15 mm diameter
- High and even porosity of 25-30%
- High iron (Fe) content of more than 63%
- Practically no loss on ignition or volatiles
• Uniform mineralogical composition in the form of an easily reducible hematite or hematite-bearing compounds
• High and uniform mechanical strength
• Low tendency to abrasion and good behavior during transportation.
• Sufficient mechanical strength even at thermal stress under reducing atmosphere

LOGISTICS
Prakash Industries Limited proposes to set up the proposed 3 Million Ton (2x1.5 Million Ton) Palletization plant in existing premises of integrate steel plant complex at Champa, District – Janjigir -Champa., Chhattisgarh. Site is suitable for installation of Palletization plant from following favorable points for convenient logistics –
• National Highway 200 gives road connectivity to the site.
• Plant is located on Howrah Mumbai main Rail track
• Railway siding is also under installation which would help in inward transportation of the raw materials.

ELECTRIC POWER REQUIREMENT
Power requirement for both the units of 1.5 Million Ton capacity will be 20 MVA which will be met out from the existing captive power plant of the company.

ENVIRONMENT
Iron ore pelletisation project involves wet grinding of iron ore fines, thickening and filtration of the iron ore slurry, mixing of additives, green balling, sizing and induration. Proposed wet process for grinding the iron ore will ensure a healthy and dust free operation. 100% water will be re-circulated and as such will not require any measure for waste water disposal. There will be no solid waste for disposal as all the dust collected from the ESP, bag filters will be pneumatically and hydraulically handled and used along with fresh feed as it is very rich in iron (Fe) content.
ESP will be used to collect dust from the induration furnace flue gases which will be designed for stack emissions as per the prescribed norms of CPCB / CECB. Dust collected in ESP will be also be reused as feed in the mixer.

**PROCESS TECHNOLOGY**

For economic reason, use of iron ores in the Direct Reduction plants ( Sponge Iron Kilns) is nowadays no longer possible without intensive ore (iron ore) preparation.

Even if individual process stages involve high prime costs, these are accepted, provided that the total production costs of pig iron or sponge iron can, in this way, be kept at lowest level. The purpose of iron ore preparation is the qualitative improvement of different features of raw materials:

- **Involves:** Mechanical crushing, grinding, screening, classification - physical separation of various mineral constituents for the elimination of gangue from the lean ores and preparation of concentrates with high ore content. Thermal or chemical treatment for the elimination of volatile energy-consuming constituents such as H₂O, CO₂, SO₄, S or conversion of hematite to magnetite.

- Metallurgical changes by basic additives which decrease the energy consumption of the succeeding process.

In all four steps pelletizing plays a significant role, such as: Agglomeration of the finest ore particles or concentrates, volatilization of components, such as H₂O, CO₂, SO₄, S, changing chemicals composition by basic additive. The process stages for production of pellets from iron ore are as under with alternative technology / process choices available for each stage.

1. Feed preparation (Iron ore concentrate - wet grinding)
2. Filtration of iron ore slurry and producing filter cake.
3. Formation of green balls
4. Induration of green balls

To obtain pellets of the required strength fineness of materials corresponding to a balance index of 1850 - 2000 is a pre-requisite. This can be achieved through wet grinding process.
PROCESS FLOW CHART OF PALLATIZATION PLANT
TECHNOLOGICAL CONSIDERATIONS

- Capacity of the Plant.
- Conservation of scarce and costly energy input.
- Amenability of available raw materials.
- Cost consideration.

FORMATION OF GREEN BALLS

The concentrate received after filtration of the slurry along with ground iron ore fines and additives will be converted into green pellets after thorough mixing in vertical high intensive mixer. For production of green pellets Prakash Industries Limited will adopt Disc Pelletizer which has been the most proven and efficient process/equipment. It may be mentioned here that majority of the pellet plants in India use disc pelletizers.

INDURATION OF GREEN BALLS

The green pellets of desired size are subjected to thermal treatment during which the pellets attain adequate strength to withstand handling, transportation and charging into furnace besides increased porosity, reducibility, reduction strength, etc. The major indurating processes developed for thermal treatment of green pellets are as follows:

1. Shaft furnace process
2. Grate-rotary hearth-shaft furnace process
3. Annular furnace process
4. Circular indurating furnace process
5. Travelling grate process
6. Grate-kiln process

Straight Travelling Grate and Grate-Kiln process are the two options available for the Palletization plant. Details of the same are given below:
Figure – 10: STRAIGHT GRATE INDURATION FURNACE

Figure – 11: GRATE KILN COOLER INDURATION FURNACE
**DETAILS OF A STRAIGHT TRAVELLING GRATE**
- Complete induration of Green Pellet in a Single Grate.
- When iron ore will be from different source it may be hematite with high L.O.I also. Straight Grate Furnace will be more suitable for induration.
- Suitable to produce acidic or basic pellet for DRI for subsequent use in Steel melting shop.

**LIMITATION OF A GRATE KILN COOLER FURNACE**
- Complete induration of green pellet in three different equipments, Drying and pre-heating in chain grate, firing in rotary kiln and cooling in annular cooler.
- Suitable more for magnetite ore with single quality of pellet production.
- Higher fuel consumption & more maintenance.
- Higher maintenance.

**BENEFITS OF STRAIGHT GRATE FURNACE**
- Capable of producing varieties of pellet.
- Capable of using different iron ore particularly ore with higher loss on ignition.
- Capital investment at par with Grate Kiln plant.
- Lower fuel consumption.
- Less and easy maintenance.
- Easy operation.
- Less Bentonite dose.
- High turndown ratio.
- Energy efficient.
- Better quality control.
- Higher productivity
- Higher profitability

For induration of hematite iron ore Travelling Grate process has been adopted by the majority of the pellet plants worldwide (84%) and the Grate-kiln process has been adopted mainly for magnetite iron ore. As Prakash Industries Limited will be pelletizing hematite iron ore, satisfactory operating experience of Travelling Grate technology in India and for the overall economics, the company has decided to adopt Travelling Grate process.
The Travelling Grate line will be equipped with latest state-of-the-art automation and control system for uniform heating and firing of green pellets, speed control of the grate, etc. for production of superior uniform quality of products.

For mixing and green pellets manufacturing and induration, discussions will be made with Outokumpu / Aker Kvaerner and others. For grinding of the iron ore fines in wet and filtering of slurry, discussion will be made with Metso, Mcnally Bharat and FFE Minerals which are the renowned suppliers in this field.

All are leading supplier of equipment, service and process solutions to industries including quarrying and aggregates production, mining and minerals processing, construction and civil engineering, and recycling and waste management.

**INPUTS FOR PRODUCTION - Raw materials**

Production of every ton of pellet for the proposed pellet plant will require about 1.063 tons of various raw materials such as iron ore concentrate, coal or coke breeze, limestone, bentonite and Dry composite sludge.

RCC roads will be provided as necessary in the plant area for convenient transportation of raw material for controlling the fugitive emission. A Storm water Drainage network is provided throughout the plant collecting water from the buildings in the different areas and Draining it to the collection ditch (Drainage trench) running along the boundary walls. The Drains are made of RCC.

In the finished product storage area, iron ore pellets will be stacked over an area of two-(2) stockpile 35m X 200 m. The material will be stocked to a height of 8m. The Stacker reclaimer and connected facilities (conveyor galleries, junction houses, Drive stations and electrical sub-stations) will be installed as required.

**RAW MATERIAL PREPARATION - GRINDING AND CLASSIFICATION**

Iron ore of a single quality lot is fed to the ground hopper directly by tippers or by a loader. In future, material feeding will be done by the conveyor belt coming from the stacker reclaimer. From here the iron ore will be fed to a wet screen. (-) 1 mm material will directly go to the discharge sump of the Primary Ball Mill discharge and (+) 1 mm material will be fed to the rubber lined Ball Mill to grind the ore to (-) 1 mm. The discharge of the Ball Mill along with the (-) 1 mm material coming from the wet screen will be fed to the Hydro-cyclone to separate –
325 mesh 70 -80 % grinded ore. Over flow of the cyclone separator containing micro fine iron ore will be fed to concentrate thickener. Under flow from the cyclone will be fed to the ball mill for further grinding.

**FILTRATION AND MIXING**

Under flow of the concentrate thickener will go to slurry tank to give consistent density slurry feed to the Pressure Filter. Filter cake will be stocked in the concentrate storage silo from where, it will be fed to the high intensity vertical inclined mixer. Arrangement will also be made to stock filter cake.

The carbon carrier (coke, anthracite), bentonite and flux (limestone, dolomite) are stored in the bins (optional arrangement) equipped with a de-dusting unit. Via loss-in-weight-feeders the additives are transported to the mixer.

All the additives will be added by weigh feeder to a common conveyor belt going to feed the chute of the mixer.

In the mixer, filter cake is mixed with the controlled addition of additives, filter dust from the de-dusting systems and process water. The moisture content of the material is controlled to approximately 9 – 10 %.

These types of mixers are successfully installed in many pelletizing plants. The mixing performance is excellent and lifetime of mixing tools has been proven in other pelletizing plants to be longer than any other type of mixer.

After the intensive mixing, the mixed material is transferred by belt conveyors to the mixed material bins provided above the pelletisation disc.

**Green Pelletizing**

The production of green pellets is performed in four closed pelletizing disc circuits. Pelletizing discs were selected over pelletizing Drums because of their lessor space requirements, and their self-classifying effect.

The mixed material is received into the mixed material bins with a storage capacity of approximately 40 m3 each, installed directly above the three discs.

The material discharge from each mixed material bin is done by a vibrating mouth and controlled by weigh feeders equipped with variable speed Drivers, thus feeding the required
amount of mixed material onto the corresponding palletizing disc. The charging is done automatically in accordance with a pre-set time schedule. A control loop, governed by the filling degree of the bins, is superimposed on this schedule for determining the destination of feed. The bins filling degree is measured by load cells.

The weigh feeder discharges into the disc feeding chutes are equipped with fluffier for a disintegration of any compacted material as well as for distribution of the mixed material on the palletizing disc.

The green pellets are formed in the discs with a diameter of 7.5m each, with simultaneous and variable addition of water. The inclination of each disc is variable and optimum setting will be determined during start-up, according to mixed material properties, desired green pellet diameter and feed-rate. The rotary speed of the disc can also be varied during operation by means of frequency-controlled motors, depending on the palletizing characteristic of the concentrate mixtures.

The green pellets produced are discharged onto a reversible belt conveyor.

In case of emergency and also during start-up of a disc when the green pellets do not have the required properties, the disc discharge can thus be recycled or discharged to an emergency stockpile by means of another reversible belt conveyor.

During normal operation, the green pellets are discharged to the green pellet collecting belt conveyor, which ensures the smooth handling of the green pellets. A belt weigh feeder is installed in this belt conveyor for weighing the total amount of green pellets discharged from the palletizing discs. This belt weigh feeder is used for mass balancing and services as a standby signal for the speed control of the induration machine.

Green pellets are distributed onto the wide belt conveyor by the reciprocating head of belt conveyor. Head pulley of this conveyor is supported in a reciprocating carriage, which moves the head pulley over the width of the downstream perpendicular, arranged wide belt conveyor. The forward velocity of the carriage with the head pulley is identical to the belt speed and during the backward stroke the green pellets are discharged onto the wide belt conveyor.

The wide belt conveyor discharges the green pellets onto the double deck roller screen which consists of an upper and a lower roller deck.

The upper deck, screens oversize green pellets (> 16 mm) and the lower deck has the function to screen out undersize green pellets of < 6.3 mm. On-space green pellets 6.3 – 16
mm is re-rolled on the lower deck and evenly distributed over the width of the pallets of the induration machine.

Undersize and oversize green pellets are recycled by belt conveyors back to the green palletizing area. Belt weigh feeder will measure the amount of green pellet under and over size.

**Pellet Induration**

The pellets are completely heat hardened and cooled on one strand, thus not requiring any intermediate pellet transfer. Dust and spillage creation in the hot phase of traveling grate process is practically negligible.

Travelling grate system pellets are uniformly cooled since the total pellet layer remains undisturbed while being transported through the total induration and cooling stages. This avoids the creation of larger clusters, which would diminish the effect of cooling. Properly heated and cooled pellets are of superior quality.

The Travelling Grate Process assures that during the preheating and firing stage always sufficient oxygen is available in the hot gasses for proper oxidation. The Travelling Grate machine on which the green pellets will be indurated and cooled in a reaction area of 189 m², (3m wide and 63 m long) consists of an endless chain of approximately 108 pallet cars, which will continuously revolve. One of the process pre-requisites for obtaining a uniform product quality is a uniform bed height.

This is ensured by automatic control of the Travelling Grate speed as a function of the ultrasonic level measuring devices installed after green pellets are charged to travelling grate. Grate speed control by ultrasonic replaces the old concept of speed control by green pellet, hearth and side layer quantity, because of significantly reduced response times and thus improved pellet bed level on the indurating machine.

A stand-by input data for the grate speed control system is the actual feed rate (t/h) of green pellets (difference of mass flows of belt weigh feeders and to the travelling grate).

Thermal attack on the pellets and grate bars, which would lead to excessive wear, is avoided by using a hearth and side layer of indurated pellets. Side layer is used for protecting the side walls of pellets and avoiding the so called “side wall effects”.


A storage bin for hearth and side layer is arranged at the feed-end of the travelling grate. A motor Driven discharge gate can adjust the height of the hearth layer on the pallets. The standard height for this application is 10 cm.

The three components are fed onto the pallets in the following order:

- Hearth layer.
- Side layer.
- Green pellets.

The hearth and side layer bin is equipped with an emergency chute which permits additional filling of the pallets with hearth layer in case of failure in the green pellet feeding system and thus protecting the pallets and grate bars from overheating.

The complete pellet induration process takes place in the following zones, through which the pellets are conveyed:

<table>
<thead>
<tr>
<th>Process Zone</th>
<th>Wind boxes</th>
<th>Process Gas Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Updraft Drying</td>
<td>1 to 3</td>
<td>250 – 350 °C</td>
</tr>
<tr>
<td>Downdraft Drying</td>
<td>4 to 5</td>
<td>350 – 380 °C</td>
</tr>
<tr>
<td>Preheating</td>
<td>6 to 8</td>
<td>380 – 1200 °C</td>
</tr>
<tr>
<td>Firing</td>
<td>9 to 14</td>
<td>1200 – 1350 °C</td>
</tr>
<tr>
<td>After firing</td>
<td>15 to 16</td>
<td>1075 °C</td>
</tr>
<tr>
<td>Cooling 1</td>
<td>17 to 19</td>
<td>150 °C</td>
</tr>
<tr>
<td>Cooling 2</td>
<td>20 to 21</td>
<td>100 °C</td>
</tr>
</tbody>
</table>

Hot combustion gases enter the firing zone by the direct recuperation principle, which means that hot gases from the cooling zone 1 are recuperated. Burners are arranged opposite to each other on the longitudinal sides of the preheating and firing zone. The arrangement and sizing of the burners ensures a uniform hot gas temperature over the width of the pellet bed.

Since the burners are divided in several control zones, an optimum temperature profile can be adjusted thus permitting an optimum heat treatment of the pellets. The burners are of the self-inspiratory type and operate with mixed gas. The temperatures in the individual control zones of the preheating and firing zone are measured with thermocouples and
indicated by the central control system; they serve as control variables for the automatic supply of fuel to the burners.

Intake and circulation of the air and gas required for the process is ensured by the application of various fans. The induration process is characterized by the recovery of maximum heat from cooling of the hot pellets by applying the direct recuperation principle, which means transportation of recovered hot air from the first cooling zone to the preheating and firing zone without a fan. The cooling air fan sucks in ambient air through a silencer and forces this air through an air duct into the wind boxes of cooling zones.

The cooling air, which becomes heated after passing through the hot pallets and the hot pellet bed, is collected in the first and second cooling hood. These hoods are installed directly above and sealed against the travelling grate. The heated air streams are recycled to the process as a “heat carrier”.

Hot air collected in the second cooling hood and hot process gas from the wind box recuperation system (supplied via bypass) is extracted by the Updraft-Drying fan and forced through duct into the wind boxes of the Updraft-Drying zone and through a duct and damper into the hood above the preheating zone.

Wind box pressure in the Updraft-Drying zone is automatically controlled by a damper, which leads excessive air to the hood exhaust gas system. The hot gases of the Downdraft-Drying, preheating and firing zone are sucked in “down-Draft” through the pellet charge by fans.

The wind boxes 4 and 5 of the Downdraft Drying zone and the preheating zone are connected to the wind box exhaust fan will be recycled to the process after re-slurring. All clean gases will be released via one common stack to the atmosphere. The hot combustion gases from the last section of the firing and the after firing zone serve as Drying gases in the Downdraft Drying zone. They are sucked through the pellet bed by the wind box recuperation fan and then forced via gas ducts into the hood above the Downdraft-Drying zone.

An appropriate temperature profile in the preheating zone is essential for the production of high quality oxide pellets. This temperature profile can be adjusted easily by mixing controlled quantities of second cooling air / wind box recuperation air, supplied by up-brought Drying fan by-pass between the wind box recuperation and the up-Draft Drying system allows the passing of heat from the one to the other system.

The hood exhaust fan sucks off the humid exhaust air from the Updraft-Drying hood. Hot excess gas from the recuperation fan is added in order to raise the temperature of this air and to control the pressure in the Downdraft hood. The exhaust gas is cleaned in the electrostatic
precipitator and direct to atmosphere together with the waste gases via the common waste gas stack.

A grate bar cleaning device is located near the lowering station on the return track of the traveling grate.

**Screening and Product Handling**

The indurated and cooled pellets are discharged from the Indurating machine into the discharge bin, mounted on load cells. The Product belt conveyors is equipped with a water spray system, which is used to cool down hot pellets > 120 °C in case of emergency only. The cooling zone of the Indurating machine is designed to cool down fired pellets in normal operation to temperatures of 100–120 °C.

The vibrating product screen finally screens out undersize material from the product pellets and to separate a certain quantity of fired pellets which will be recycled as hearth layer to the Indurating machine.

A product screen mainly consists of vibrating screen decks and four chutes to further convey 4 size fractions of fired pellets:

- Undersize pellets - 6 mm
- Product pellets - 8.5 – 12.5 mm
- Hearth layer pellets - 12.5 – 16 mm
- Oversize pellets - 16 mm

The fines < 6 mm will be transported via a conveyor to a stockpile.

Sized pellets are used as hearth layer to avoid clogging of side layer chutes and improve the permeability of the hearth layer, and thus reduce pressure Drop and energy consumption of this system.

Screened hearth and side layer is transported by belt conveyors and to the hearth layer bin at the feed end of the indurating machine. Conveyor is equipped with a variable speed Drive. The belt speed is controlled by the level of the hearth and side layer bin.

Belt weigh feeder registers the production rate of the plant. A sampler is installed in the discharge chute of product conveyor, which takes samples for pellet quality control.
**Process & Cooling Water Systems**

The process water system mainly consists of:
- Process water tank.
- Various pumps to supply process water to different consumers.

The main consumers of process water are:
- Mixers
- Pelletizing discs (make up water)
- Gland water system (make up water)
- Floor cleaning

For pelletizing discs and gland water, fresh make up water instead of recycled process water, is used in order to avoid clogging and excessive wear at the spraying systems of the palletizing discs and the slurry pumps.

All process water (except process water used for wetting ground ore at the mixers) for Pelletizing and gland water is recycled via the thickener. Thickener overflow is recycled for use as process water. Thickener underflow is pumped to the mixer for wetting the Dry ground ore. Make up water is received at the battery limit and added at the makeup water basin.

The cooling water system consists of a closed circuit consisting of
- Two cooling water tanks
- Heat exchanger
- Cold water basin

For cooling of:
- Lintels of the Indurating machine
- Fan motors and fan lubrication systems
- Reciprocating belt conveyor

A second, open cooling water circuit consists of:
- Cold water basin
- Warm water basin
- Evaporation cooling tower
**Ventilation, air conditioning & dust control facilities**

These facilities are provided for various plant units, to remove excessive heat liberation in the working zone and maintain pressurization if required, keep the environment clean and maintain the required temperature & humidity conditions.

**Ventilation systems**

Natural ventilation will be provided for the indurating building by providing adequate inlet area for fresh air at lower levels of the building and letting out hot air through roof monitors located above the indurating bay of the building.

Fresh filtered air supply systems with centrifugal fans & filters are provided for MCC rooms of balling & filtering building, grinding shop and complete MRSS (Main Receiving Sub-Station), to prevent dust ingress by maintaining pressurization inside the premises. The ventilation equipment for these premises is located in the ventilation chambers of the respective buildings.

Cable floors are provided with wall mounted tube axial flow fans with filters & fire dampers to supply filtered air for the basement to supplement natural ventilation of the building available through doors & windows. Stores, compressor rooms are provided with exhaust fans. Battery rooms are provided with exhaust fans of acid proof painting and explosion proof motor.

**Air conditioning Systems**

Air cooled packaged type air conditioning plant will be provided for the main control room of the induration building, to maintain the temperature and relative humidity of the control room within the limits prescribed for the technological equipment/control panels. The AC plant is roof mounted and air ducting for the conditioned air is located above false ceiling of the control room.

**BAG FILTERS**

Bag Filters will be provided to suck the dust generated during process operations like conveyor transfer points, loading of the bins, indurating machine feed and discharge ends, mills etc. Conveyor transfer points, bin loading points of additive grinding building, mills etc
are provided with bag filter units. The discharge of the dust collected in the bag filter shall be on to the process stream itself.

Conveyor transfer points of junction houses handling iron ore fines are provided with dust suppression system by spraying water with chemical flocculants at the discharge & take up ends of the conveyors.

The feed & discharge ends of the indurating machine are provided with scrubber units. The slurry from the scrubber is led to thickener.

The iron ore bins and the weigh feeders are served with unit type bag filters mounted over the bins.

The clean air from the bag filters & scrubbers is let into atmosphere through stacks of suitable height. The limiting dust concentration in the outgoing gases through stack will be within the statutory limits.

3.6 RAW MATERIAL REQUIREMENT (FOR PROPOSED EXPANSION)

The following will be the raw material requirement for the proposed expansion project:

Table - 17

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Raw Material</th>
<th>Per Ton</th>
<th>MTPA</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For Iron ore Beneficiation Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Iron ore fines</td>
<td>---</td>
<td>7,50,000</td>
<td>Kawardha Iron ore Mines / Sirkagutu mines</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(throughput)</td>
<td>Iron ore Mines</td>
</tr>
<tr>
<td></td>
<td>For Pelletisation Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Iron Ore Fines</td>
<td>1.03 (96.9%)</td>
<td>3,09,000</td>
<td>In-house generation through screening at Champa, Company’s own mines and from NMDC iron ore mines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Bentonite</td>
<td>0.008 Min (0.75%)</td>
<td>24,000</td>
<td>Kutch &amp; Bhuj (Gujrat)</td>
</tr>
<tr>
<td>3</td>
<td>Anthracite Coal or Coke breeze</td>
<td>0.015 (1.43%)</td>
<td>45,000</td>
<td>Open market and coke producers</td>
</tr>
<tr>
<td>4</td>
<td>Dolomite/ Limestone</td>
<td>0.01(1%)</td>
<td>30,000</td>
<td>Open market</td>
</tr>
</tbody>
</table>
3.7 WATER REQUIREMENT AND ITS SOURCE

- Water required in the existing plant is 18.25 MCM and same being sourced from Hasdeo river
- Water required for the proposed expansion project will be 2220 KLD and same will be sourced from Hasdeo river through Intake wells already installed for which permission from Water Resource Department of Govt of Chhattisgarh has already been obtained.

Following is the break up of water requirement for the proposed expansion:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Unit</th>
<th>Quantity (m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>WHRB based Power Plant</td>
<td>Nil</td>
</tr>
<tr>
<td>2.</td>
<td>Iron ore Beneficiation plant</td>
<td>2.5</td>
</tr>
<tr>
<td>3.</td>
<td>Pellet Plant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Process</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Evaporation &amp; Cooling</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Floor Washing</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>92.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2220 m³/day</td>
</tr>
</tbody>
</table>

3.8 WASTEWATER GENERATION & ITS MANAGEMENT

Existing

- There is no wastewater generation from the existing plant as Closed circuit cooling system is being adopted.
- Boiler blowdown & DM plant regeneration wastewater is being treated in Neutralization tanks and is being mixed in a Central Monitoring Basin (CMB). The treated effluent from CMB is being utilized for dust suppression, ash conditioning and for greenbelt development.
- Only wastewater is sanitary wastewater, which is being treated in Sewage Treatment Plant (STP).
- Zero liquid effluent discharge is being maintained in the existing plant.
There will be no effluent generation in the WHRB Power Plant (DRI based), Iron Ore beneficiation plant & Pellet Plant as closed circuit cooling system will be adopted.

Sanitary waste water will be treated in Sewage Treatment Plant (STP).

3.9 SOLID WASTE GENERATION & ITS MANAGEMENT
Solid waste generation from the proposed expansion project will be:

From WHRB Power Plant
Presently the generation of Dust from Bagfilters which needs to be injected in ABC/DSC of Kilns for additional generation of steam contains 80% ash so by using the dust in Dust Injection system, there will be a reduction of 20% in overall solid waste generation. This dust shall come out as solid waste through hoppers of the Boilers / ESP.

From Iron Ore beneficiation Plant
0.18 MTPA of Tailings will be generated from the proposed Iron ore beneficiation plant, which will be used partially for embankments, road making, brick making & will also be given to nearby cement plant.

From Pellet plant
The collected dust from bag filters and ESP will be pneumatically transported to feed proportioning system for continuously feeding to the production of pellets, thus, there will be “NO SOLID WASTE” generated from the plant.

3.10 POWER REQUIREMENT

For WHRB Power Plant
200 kW for two kiln i.e. 1 MW for 10 Kilns which will be met through captive power plant of the company.

For Iron Ore beneficiation Plant
Power requirement will be 0.42 MW and same will be met from the existing captive power plant.

For Pellet Plant
Power requirement for both the units of 1.5 Million Ton capacity will be 20 MVA which will be met out from the existing captive power plant of the company.
Chapter – 4 : SITE ANALYSIS

4.1 CONNECTIVITY

The proposed site is well connected with Road network. The following table gives brief regarding connectivity of the proposed site:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>Site is connected to National Highway # 200 (0.5 Kms.)</td>
</tr>
<tr>
<td>Rail</td>
<td>Nearest station – Champa Railway Station (4.0 Kms.)</td>
</tr>
<tr>
<td>Air</td>
<td>Raipur Airport – 131.0 Kms.</td>
</tr>
</tbody>
</table>

Below mentioned table gives brief regarding environmental setting of the project site

<table>
<thead>
<tr>
<th>S.No</th>
<th>Particulars</th>
<th>Distance from the site (within 10 kms.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Habitation</td>
<td>Kotadabri (adjacent to plant)</td>
</tr>
<tr>
<td>2.</td>
<td>National Park</td>
<td>Nil</td>
</tr>
<tr>
<td>3.</td>
<td>Wild life sanctuaries</td>
<td>Nil</td>
</tr>
<tr>
<td>4.</td>
<td>Eco Sensitive Areas</td>
<td>Nil</td>
</tr>
<tr>
<td>5.</td>
<td>Forests</td>
<td>Nil</td>
</tr>
<tr>
<td>6.</td>
<td>Surface water bodies</td>
<td>Hasdeo River (0.14 Kms.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Son Nadi (8.0 Kms.)</td>
</tr>
<tr>
<td>7.</td>
<td>Costal Regulation Zone [CRZ]</td>
<td>Nil</td>
</tr>
</tbody>
</table>

4.2 LAND USE & LAND OWNERSHIP

- Existing plant is located at Village: Hathneora, Champa, District: Janjgir – Champa Chhattisgarh.
- Existing land use is Industrial use
- Existing plant is located in 601.47 acres / 243.4 Ha. of land and same is under possession of management.
- Proposed will be taken up in the Existing plant only.
- Khasra nos. of total land area are enclosed as Annexure - 1
- Coordinates of the project site:
### Table - 21

<table>
<thead>
<tr>
<th>Point No.</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>22° 0'58.14''N 82°39'52.32''E</td>
</tr>
<tr>
<td>14.</td>
<td>22° 0'53.30''N 82°40'6.92''E</td>
</tr>
<tr>
<td>15.</td>
<td>22° 0'50.75''N 82°40'23.52''E</td>
</tr>
<tr>
<td>16.</td>
<td>22° 0'28.93''N 82°40'23.53''E</td>
</tr>
<tr>
<td>17.</td>
<td>22° 0'15.75''N 82°40'37.04''E</td>
</tr>
<tr>
<td>18.</td>
<td>22° 0'3.89''N 82°40'35.67''E</td>
</tr>
<tr>
<td>19.</td>
<td>22° 0'4.36''N 82°40'47.84''E</td>
</tr>
<tr>
<td>20.</td>
<td>21°59'51.89''N 82°40'49.53''E</td>
</tr>
<tr>
<td>21.</td>
<td>21°59'47.99''N 82°40'29.26''E</td>
</tr>
<tr>
<td>22.</td>
<td>21°59'40.61''N 82°40'5.87''E</td>
</tr>
<tr>
<td>23.</td>
<td>21°59'54.41''N 82°40'1.92''E</td>
</tr>
<tr>
<td>24.</td>
<td>22° 0'28.18''N 82°39'44.04''E</td>
</tr>
</tbody>
</table>

### 4.3 EXISTING INFRASTRUCTURE

For establishment and successful operation of plant, it is imperative to ensure availability of the following infrastructure:

- Availability of iron ore and its proximity to the plant to reduce cost of transportation.
- Road / Rail head connection so that the raw materials can be easily and economically transported.
- Availability of water.
- Permanent and reliable source of power.
- Adequate land for the plant, storage of raw material & disposal of waste material.
Chapter – 5 : PLANNING BRIEF

5.1 PLANNING CONCEPT

Prakash Industries Limited (PIL) is existing Integrated Steel Plant located at Hathneora & Champa Villages, Janjgir-Champa District, Chhattisgarh.

Now, as part of expansion, company has proposed following:

i. Augmentation to enhance power generation capacity of the Co-generation captive power plant through WHRB attached with the Sponge Iron Kilns from 100 MW power (10 MW/Kiln) to 150 MW (15 MW/Kiln) from the flue gases emanating from the Sponge Iron Kilns as per the details given in the Table below:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Modifications / Changes proposed for Augmentation</th>
<th>Additional Power Generation/ Kiln</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>More steam generation in WHRB by injecting Bag Filter dust in ABC / DSC of Kiln</td>
<td>2 MW</td>
</tr>
<tr>
<td>2</td>
<td>Installation of efficient TG set for consuming lesser specific Steam</td>
<td>3 MW</td>
</tr>
<tr>
<td>Total / Kiln</td>
<td></td>
<td>5 MW</td>
</tr>
<tr>
<td>Total for 10 Kilns</td>
<td></td>
<td>50 MW</td>
</tr>
</tbody>
</table>

Hence, we will be able to enhance power generation to the extent of 150 MW from 10 Kilns instead of 100 MW.

ii. Installation of Iron Ore Beneficiation Plant of Capacity 0.75 MTPA (throughput)

iii. Installation of Captive Palletisation plant of 3 Million Ton capacity in 2 phases of 1.5 Million ton each as a step towards backward integration to fulfill Pellet requirement for DRI Kilns, as a substitute of Iron Ore.

5.2 POPULATION PROJECTION

According to the 2011 census Janjgir–Champa has a population of 1,620,632. This gives it a ranking of 308th in India (out of a total of 640). The district has a population density of 421 inhabitants per square kilometre (1,090/sq mi). Its population growth rate over the decade
2001-2011 was 23.01%. Janjgir–Champa has a sex ratio of 991 females for every 1,000 males, and a literacy rate of 73.7%.

5.3 LAND USE PLANNING

- Existing plant is located at Village: Hathneora, Champa, District: Janjgir – Champa Chhattisgarh.
- Existing land use is Industrial use
- Existing plant is located in 601.47 acres / 243.4 Ha. of land.
- Proposed expansion will be taken up in the Existing plant only.

5.4 AMENITIES / FACILITIES

Facilities like canteen, rest room has already been provided in the existing plant as basic facilities to workers. No other additional facilities are proposed.
Chapter – 6 : PROPOSED INFRASTRUCTURE

6.1 INDUSTRIAL AREA (PROCESSING AREA)

Company has envisaged a 0.75 MTPA of Iron Ore beneficiation plant & 3 (2 x 1.5) MTPA Pellet Plant to be completed in two phases. The company proposes to install identical modules with the following facilities:

- Raw materials grinding facilities
- Mixing and balling facilities
- Straight Grate Induration Furnace

There will be common facilities for both the units like:

- Raw material storage & handling
- Finished product storage yard.
- Utilities

6.2 RESIDENTIAL AREA (NON PROCESSING AREA)

No colonization is proposed; as colony already exists in the existing plant.

6.3 GREEN BELT

We have already developed adequate green belt all along the boundary and in the plant premises. Till date we have planted 266640 Nos. of trees in the plant premises which were verified by the approved agency (Forest Deptt of Govt. of CG). Apart from the above we have also developed Green belt along 161 Km roads near plant under Chief Minister HariHar Chhattisgarh Yojna. Every year we plant more than 10000 trees. Main local species which has been planted are Neem, Gilmohar, Ashoka, Mango, Bair and Peepal.

Greenbelt development plan

- Local DFO will be consulted in developing the green belt.
- Greenbelt of 33% of the area will be developed in the plant premises as per CPCB guidelines.
- 10 m wide greenbelt is being maintained all around the plant.
• The tree species to be selected for the plantation are pollutant tolerant, fast growing, wind firm, deep rooted. A three tier plantation is proposed comprising of an outer most belt of taller trees which will act as barrier, middle core acting as air cleaner and the innermost core which may be termed as absorptive layer consisting of trees which are known to be particularly tolerant to pollutants.

6.4 SOCIAL INFRASTRUCTURE
Social infrastructure will be developed as per need based in the Villages of the close vicinity of the project.

6.5 CONNECTIVITY
The proposed site is well connected with Road network. The following table gives brief regarding connectivity of the proposed site:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>Site is connected to National Highway # 200 (0.5 Kms.)</td>
</tr>
<tr>
<td>Rail</td>
<td>Nearest station – Champa Railway Station (4.0 Kms.)</td>
</tr>
<tr>
<td>Air</td>
<td>Raipur Airport – 131.0 Kms.</td>
</tr>
</tbody>
</table>

6.6 DRINKING WATER MANAGEMENT
It is estimated that 30 KLD of water will be required for domestic purpose during operation of proposed expansion project.

The desired amount of water will be Sourced from Ground water sources.

6.7 WASTEWATER GENERATION & ITS MANAGEMENT

Existing
• There is no wastewater generation from the existing plant as Closed circuit cooling system is being adopted.
• Boiler blowdown & DM plant regeneration wastewater is being treated in Neutralization tanks and is being mixed in a Central Monitoring Basin (CMB). The treated effluent from
CMB is being utilized for dust suppression, ash conditioning and for greenbelt development.

- Only wastewater is sanitary wastewater, which is being treated in Sewage treatment plant.
- Zero liquid effluent discharge is being maintained in the existing plant.

**Proposed**

- There will be no effluent generation in the Co – Generation Captive Power Plant (DRI based), Iron ore beneficiation plant & Pellet Plant as closed circuit cooling system will be adopted.
- Sanitary waste water will be treated in sewage treatment plant followed by sub-surface dispersion trench.

### 6.8 SOLID WASTE GENERATION & ITS MANAGEMENT

Solid waste generation from the proposed expansion project will be:

**From Co – Generation Captive Power Plant**

Presently the generation of Dust from Bagfilters which needs to be injected in ABC/DSC of Kilns for additional generation of steam contains 80% ash so by using the dust in Dust Injection system, there will be a reduction of 20% in overall solid waste generation. This dust shall come out as solid waste through hoppers of the Boilers / ESP.

**From Iron Ore beneficiation Plant**

0.18 MTPA of Tailings will be generated from the proposed Iron ore beneficiaiton plant, which will be used partially for embankments, road making, brick making & will also be given to nearby cement plant.

**From Pellet plant**

The collected dust from bag filters and ESP will be pneumatically transported to feed proportioning system for continuously feeding to the production of pellets, thus, there will be “NO SOLID WASTE” generated from the plant.
Chapter – 7: REHABILITATION & RESETTLEMENT (R & R) PLAN

No rehabilitation and resettlement is required as existing Steel Plant is already in operation at Village: Hathneora, Champa, District: Janjgir - Champa (Chhattisgarh).
Existing plant is located in 601.47 acres / 243.4 Ha. of land and same under possession of management.
Proposed expansion will be taken up in the Existing plant premises only.
Chapter – 8 : PROJECT SCHEDULE & COST ESTIMATES

8.1 PROJECT SCHEDULE

We have planned following implementing schedule for the augmentation project as well as Diversification project –

I) Augmentation Project –

A) Dust Injection System

Dust injection System for Kiln-1 to 6 - By June 2019
Dust injection System for Kiln-7&8
( To be installed in ongoing project) - By Sep 2019
Dust injection System for Kiln-9&10
( To be installed along with the Project) - By Sep 2020

B) Installation of Efficient TG Sets

1x30.5 MW TG sets with Kiln-1 & 2 - By Dec 2018**
1x30.5 MW TG sets with Kiln-3 & 4 - By March 2019
1x30.5 MW TG sets with Kiln-5 &6 - By June 2019
30.5 MW TG sets with Kiln-7&8 - By Sep 2019
30.5 MW TG sets with Kiln-9&10 - By Sep 2020

( ** Order already placed on M/s Siemens)

II) Backward Integration Project –

0.75 Million Ton Iron ore beneficiation plant - By March 2020
1x1.5 Million Ton Palletization Project - By March 2020
1x1.5 Million Ton Palletization Project - By Sept 2021
8.2 PROJECT COST

I) Augmentation Project

A) Dust Injection System

As there are 5 Kilns in operation at present and 2 Kilns are under installation stage, we will require to install 03 Dust injection system which will fulfill requirement for six Kilns. For balance four Kilns 02 more Dust injection system will be installed along with the Kiln project without any additional investment.

For One Dust Injection System (2 Kilns), project cost will be Rs. 80 lac as per following breakup:

- Design & engineering - Rs. 8 Lac
- Supply of equipments - Rs. 21 Lac
- Quench cum dilution fan - Rs. 18 Lac
- Civil Work - Rs. 20 Lac
- Equipment erection - Rs. 10 Lac
- Miscellaneous - Rs. 3 Lac
- TOTAL cost - Rs. 80 Lac

Project cost for Three Dust Injection System for 6 Kilns – Rs. 240 Lacs (Rs. 2.4 Cr)

Balance two Dust injection System will be installed along with Kiln Project without any additional investment.

B) Installation of Efficient TG Sets

The project cost for installation of each set of 30.5 MW TG sets will be attached with 2 Kilns will be rs. 15.85 Cr as per the details mentioned in below

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>DESCRIPTION</th>
<th>COST (RS IN CR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1 No. 30.5 MW TG set with accessories</td>
<td>11.75</td>
</tr>
<tr>
<td>2.</td>
<td>Civil work for TG foundation modification</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Other Miscellaneous Expenses</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL PROJECT COST</strong></td>
<td><strong>13.00</strong></td>
</tr>
</tbody>
</table>

Project cost for 5 TG sets (For 10 Kilns) – Rs.65 Cr
II) Backward Integration Project –

Project cost for 0.75 MTPA Iron ore beneficiation plant will be as follows:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Amount (Rs. In Cr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Civil &amp; Structural Work</td>
<td>2.5</td>
</tr>
<tr>
<td>2.</td>
<td>Plant &amp; Machinery</td>
<td>12.0</td>
</tr>
<tr>
<td>3.</td>
<td>Miscellaneous</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td><strong>15.00</strong></td>
</tr>
</tbody>
</table>

The total project cost of 3 Million Ton (2 x 1.5 Million ton) Palletization Plant will be Rs.425 Cr as per following phase wise breakup –

Phase-1 (1.5 Million Ton) - Rs. 240 Cr
Phase-2 (1.5 Million Ton) - Rs. 185 Cr

**TOTAL project Cost** - Rs. 425 Cr

We will plan installation of the common facilities for both phases like material handling system, bag Filters etc in 1st phase itself. Accordingly the project cost for Phase-2 is less. **Details of the Total Project cost of Rs. 425 Cr is as mentioned below:**

**Table - 25**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Amount (Rs. In Cr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Land &amp; Site Development</td>
<td>2.00</td>
</tr>
<tr>
<td>5.</td>
<td>Building</td>
<td>22.00</td>
</tr>
<tr>
<td>6.</td>
<td>Plant &amp; Machinery</td>
<td>305.00</td>
</tr>
<tr>
<td>7.</td>
<td>Misc. Fixed assets, Electrical installations etc</td>
<td>45.00</td>
</tr>
<tr>
<td>8.</td>
<td>Prel. &amp; pre-operative expenses</td>
<td>20.00</td>
</tr>
<tr>
<td>9.</td>
<td>Engineering &amp; Consultancy Charges</td>
<td>10.00</td>
</tr>
<tr>
<td>10.</td>
<td>Contingencies</td>
<td>21.00</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>425.00</strong></td>
</tr>
</tbody>
</table>
TOTAL PROJECT COST FOR PROPOSED PROJECTS

Total project cost for the proposed augmentation project and Diversification project will be as mentioned below

Table - 26

<table>
<thead>
<tr>
<th>S.No.</th>
<th>DETAILS OF THE PROJECT</th>
<th>PROJECT COST (RS IN CR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I)</td>
<td>AUGMENTATION PROJECT</td>
<td></td>
</tr>
<tr>
<td>A)</td>
<td>Dust Injection system</td>
<td>2.4</td>
</tr>
<tr>
<td>B)</td>
<td>Installation of efficient TG sets</td>
<td>65.00</td>
</tr>
<tr>
<td></td>
<td>Total (A+B)</td>
<td>67.40</td>
</tr>
<tr>
<td>II)</td>
<td>BACKWARD INTEGRATION PROJECT</td>
<td></td>
</tr>
<tr>
<td>A)</td>
<td>0.75 MTPA Iron Ore beneficiation plant</td>
<td>15.0</td>
</tr>
<tr>
<td>B)</td>
<td>3 Million Ton (2x1.5 Million ton) Palletisation Plant</td>
<td>425.00</td>
</tr>
<tr>
<td></td>
<td>TOTAL PROJECT COST</td>
<td>507.4</td>
</tr>
</tbody>
</table>

MEANS OF FINANCE

The proposed projects shall be funded from the internal accruals from existing operations. We are one of the lowest leverage company in the steel sector having strong financials with Topline of approx. 3000 Cr and operating margins about 22%.
Chapter – 9 : ANALYSIS OF PROPOSAL

9.1 FINANCIAL AND SOCIAL BENEFITS
With the implementation of the proposed expansion project, the socio-economic status of the local people will improve substantially. The land rates in the area will improve in the nearby areas due to the proposed expansion activity. This will help in upliftment of the social status of the people in the area. Educational institutions will also come-up and will lead to improvement of educational status of the people in the area. Primary health centre will also be developed by us and the medical facilities will certainly improve due to the proposed expansion project.

9.2 SOCIO-ECONOMIC DEVELOPMENTAL ACTIVITIES
The management is committed to uplift the standards of living of the villagers by undertaking following activities / responsibilities as the part of Corporate Social Responsibility.

- Health & hygiene
- Drinking water
- Education for poor
- Village roads
- Lighting