Pre Feasibility Report

Of

Expansion of Iron Ore Beneficiation (63,000 TPA to 2,00,000 TPA), Sponge Iron (62,700 TPA (2x95 TPD) to 4,58,700 TPA by installation of additional 2X100 TPD and 2X500 TPD), Captive Power Plant (4 MW to 22 MW WHRB and New15 MW AFBC) and Installation of New Unit of Iron Ore Crushing and Screening Plant (2,00,000 TPA), Iron Pellets Plant (1.0 MTPA) and Coal Gasifier (40,000 Nm^3/hr)

LLOYDS METALS

M/s. Lloyds Metals and Energy Limited

at

MIDC Konsari, Village: Konsari, Tahsil: Chamorshi, Dist: Gadchiroli, Maharashtra

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Chapter 1
Executive Summary

Lloyds Metals and Energy Limited (LMEL), one of the biggest Sponge Iron manufacturers in Vidarbha region is a unit of Lloyds group. Presently LMEL has proposed expansion of Iron Ore Beneficiation Plant, Sponge Iron Plant, Power Plant and Installation of New Unit of Iron Ore Crushing and Screening Plant, Iron Ore Pellet Plant with Coal Gasifier at MIDC Konsari, Village Konsari, Tahsil Chamorshi, District Gadchiroli, Maharashtra.

The salient features of the project are given in **Table 1.**

Table 1: Salient features of the project

Name of the Company	**:**	Lloyds Metal and Energy Limited
Plant Location	**:**	At MIDC-Konsari, Village: Konsari, Tahsil: Chamorshi, Dist: Gadchiroli, Maharashtra
Contact person	**:**	Mr. Prashant Puri
Land Area	**:**	125 Acres
Coordinates		A 19°46'5.59"N 79°48'50.60"E B 19°46'7.76"N 79°48'45.57"E C 19°46'5.09"N 79°48'43.87"E D 19°46'12.26"N 79°48'29.62"E E 19°46'10.51"N 79°48'24.18"E F 19°46'14.04"N 79°48'19.21"E G 19°46'30.49"N 79°48'24.16"E H 19°46'18.75"N 79°48'57.13"E
Existing Production Capacity(Under Construction/development Stage	:	Iron Ore Beneficiation :63,000TPA Sponge Iron : 190 TPD (62,700 TPA) Captive Power Plant (WHRB) :4MW
Total Production after expansion		Iron Ore Beneficiation :2,00,000TPA Sponge Iron :2x100TPD and 2x500TPD Captive power Plant: 22 MW(WHRB) + 15MW(AFBC) Iron Ore Crushing and Screening plant : 2,00,000 TPA Pellet Plant :1.0MTPA Coal Gasifier : 40,000 Nm^3/hr

Raw Materials for proposed expansion/ modernization & new units	:	1) Iron Ore fines, Bentonite, Binders, Flux for Pellet Plant and Coal for Fuel system in gasifiers. 2) Pellets and coal for sponge iron plant. 3) Coal and Char for power plant
Total Water Requirement and its Source		6360 KLD supplied by MIDC water supply department
Project Cost	:	Rs. 700 Cr.

Sr. No.	Particulars	Details
1	Nearest Highway	Aashti Road at 50 m in East direction.
2	Nearest Airport	Nagpur, 166 Km: NW
3	Nearest Railway Station	Kelzar ,34 Km : NW
4	Nearest Village	Konsari 0.5 Km : SSW
5	Nearest Town	Chamorshi, 20Km.: NNE
6	Nearest water body	Konsari Lake, 0.7 km : SW Varti Wagu stream 3.0 Km: SW Uksa Wagu Stream: 4.5 Km: SE Vainganga River, 6.0 Km (NW-SW) Andhari River 7.5 Km SW Deotri Nala 4.0 Km S
7	Forest	Markhanda Reserved forest Patched at 0.3Km East direction 0.7km North direction 2.0Km West direction 1.5 km South direction
8	School	ZP Primary School (1.0 KM, SW), ZP High School Konsari (1.0Km SE), Little Hearts English Medium School (9.0 Km S) Shishu Mandir Public School (9.5 km S) One School is in the downwind direction.
9	Hospital	Primary Health Center, Konsari (0.5 km SSE), Government Hospital, Yenapur (6.0 Km, N) One health center is in the downwind direction.

1.1 Project details:

Lloyds Metals and Energy Limited (LMEL) has proposed the expansion of Iron ore beneficiation plant, Sponge Iron, Power plant and installation of New Unit of Iron ore crushing and screening plant, Iron Ore pellet plant and Coal Gasifier at

MIDC Konsari, Village Konsari, Tahsil Chamorshi, District Gadchiroli, Maharashtra.

1.2 Water requirement:

The total requirement of water for the operation of plant and the Power plant is 6360 KLD and is supplied by MIDC water supply department.

1.3 Man power:

LMEL will provide Direct and indirect employment to about 1000-1200 people. The local persons will be given preference in employment as per their qualification.

1.4 Power Requirement and Source

Total Power required for proposed expansion project is 45MW. Electric power will be supplied from own captive power plant and MSEB.

1.5 Project Cost

The total investment in the proposed project will be Rs. 700 crores.

Chapter 2.0
Introduction of the Project/Background information

2.1 Identification of Project and Project Proponent.

Lloyds groups started with the modest beginning with fabrication unit in the year 1974 and thereafter expanded rapidly. The rapid growth has been resulted with backward and forward integration within the group companies and using modern technology so to bring in high levels of efficiency.

Lloyds Metals and Energy Limited (LMEL), one of the biggest Sponge Iron manufacturers in Vidarbha region is a unit of Lloyds group. LEML had initially set up its first 500 TPD kiln with the rated capacity of 1,50,000 TPA by opting OSIL-Technology in the year 1994-95 at the Ghugus MIDC, District- Chandrapur (Maharashtra). Experiencing various technical constraints with deterioration in their inputs quality, LMEL has opted for conversion of its 500 TPD kiln from OSIL technology to well proven Lurgi technology. Later the unit has expanded by installing 4 X 100 TPD kilns(with Lurgi technology) in the year 2006 and achieved its production capacity of 2,70,000 TPA.

Identification Project Proponent

Company's name	:	Lloyds Metals and Energy Limited (LMEL),
Registered Address	:	Lloyds Metals and Energy Limited, Plot No. A-1, A-2, MIDC Industrial Area, Ghugus, Dist: Chandrapur-442505.
Telephone No.	:	(+91)(07172)285103/285099/285398
Fax	:	(+91)(07172)285003
E-mail Address	:	lloyds.gadchiroli@gmail.com

2.2 Brief Description of Nature of Project.

Presently LMEL has proposed the expansion of Iron Ore Beneficiation Plant, Sponge Iron Plant, Power Plant and Installation of New Unit of Iron Ore Crushing and Screening Plant, Iron Ore Pellet Plant with Coal Gasifier in the premises of existing plant located at MIDC Konsari, Village Konsari, Tahsil Chamorshi, District Gadchiroli, Maharashtra.

Table 1: Production Details

Sr.no.	Facilities	Existing (TOR has been issued by SEAC-I, Maharashtra. Public Hearing Conducted)	Proposed expansion	Total after expansion
1.	Iron ore Beneficiation	63,000 TPA	2,00,000 TPA	2,63,000 TPA
2.	Sponge Iron Plant	2x95TPD(62,700 TPA)	2x100 TPD & 2x500 TPD (3,96,000 TPA)	4,58,700 TPA.
3.	Captive Power Plant	4MW (WHRB)	22 MW (WHRB) 15 MW (AFBC)	26 MW (WHRB) 15 MW (AFBC)
4.	Iron Ore Crushing & Screening Unit	-	2,00,000 TPA	2,00,000 TPA
5.	Iron Ore Pellet	-	10,00,000 TPA	10,00,000 TPA
6.	Coal Gasifier	-	40,000 Nm^3/Hr	40,000 Nm^3/Hr

2.3 Need of the Project

2.3.1 Iron Ore Crushing and Screening

Crushed Iron Ore will be available for the Beneficiation Plant which will be further used in Pellet Plant.

2.3.2 Need of Iron Ore Beneficiation Plant:

Iron-making technology was established for conversion of iron ore lumps to hot metal/Direct Reduced Iron (DRI). However, with mechanized mining, production of iron ore lumps suitable for efficient iron making operation leads to generation of significant amount of fines (more than 60%) at the mines, which cannot be used directly in the Blast Furnaces / Corex units/DR Units. Thus the agglomeration technologies have been developed for processing iron input to the iron making processes- which are mainly sintering and pelletizing. Blast furnace operators worldwide are using either sinter or pellets in varying proportions depending on the availability and cost consideration. It may be noted that while sinter is extensively used for iron making in blast furnaces, pellets are used not only for blast furnaces and Corex units iron making but also for production of DRI / HBI in direct reduction processes.

Utilization of low grade ore and fines has to play an important role in India. Partly due to the sponge iron sector; the overall percentage of lumps usage in steel making (47%) is higher than most other countries. As hard ore reserves is depleting day by day, lump generation suitable for blast furnace operation is coming down resulting in production of large amount of surplus fines. Alternative iron making processes for production of steel may lead to changing pattern of use material inputs and feed stock causing significant shift in respective share of lumps and agglomerated iron ore (pellets) and will also enable the use of ores which could not be utilized earlier. As fines form considerable part of iron ore resources, value addition to the iron ore fines, through various activities such as Beneficiation, Palletization is the need of the hour.

Presently, most of the coal based sponge iron plants in India, use iron ore lumps. The requirement is generally 1.6 to 1.8 t/ t of sponge iron. These high requirements are mainly due to the fines generated in handling the purchased ore from the sources to the plant. This reduces the kiln campaign length and increases the loss of ore fines.

Use of pellets with better physical and metallurgical properties for sponge iron production reduces the accretion formation in the kiln and the pellets consumption is about 1.6 t/t. Further, the production from the kiln is expected to increase by 35% to 40%. It is noteworthy that the operations of the iron ore mines of LMEL at Viom (high grade) and Lyll (Low grade) are in process. Thus, the iron ore fines so generated are utilized through pelletizing route for making mainly coal based sponge iron and sometimes at blast furnaces also.

The use of pellets is however, restricted in the Indian Blast Furnaces mainly due to high cost of pellets compared to lump ore and captive sinter. But In the face of shrinking reserves of high-grade ores, low grade ores must now be concentrated before further processing and used. Pellets form one of the best options, due to their excellent physical and metallurgical properties. Concentrating iron values in ore needs grinding to liberate the gangue. Pelletizing is the only agglomeration process of these beneficiated concentrates. Moreover, due to their high strength and suitability for storage, pellets can be easily transported over long distances, with repeated transhipments if necessary.

Considering the above facts Lloyd Metals and Energy Limited proposed to install Iron Ore Beneficiation plant to upgrade and utilized the low grade of Iron is blend with high grade Iron ore.

2.3.3 Need of Iron Ore Pellet Plant

In India partly due to the sponge iron sector; the overall percentage of lumps usage in steel making is higher than most other countries. As hard ore reserves is depleting day by day, lump generation suitable for blast furnace operation is coming down resulting in production of large amount of surplus fines. Alternative iron making processes for production of steel may lead to changing pattern of use material inputs and feed stock causing significant shift in respective share of lumps and agglomerated iron ore (pellets) and will also enable the use of ores which could not be utilized earlier. As fines forms considerable part of iron ore resources, value addition to the iron ore fines through various activities such as Pelletization is the need of the hour.

The present condition and scenario o steel industry also encourages for establishment of Iron Ore Beneficiation and Pelletization plant to utilize the huge stock pile of iron ore fines.

2.3.4 Need of Sponge Iron Plant

The iron and steel industry is one of the most important industries in India. During 2014 through 2015, India was the third largest producer of raw steel and the largest producer of sponge iron in the world. The industry produced 91.46 million tons of total finished steel and 9.7 million tons of pig iron. Most iron and steel in India is produced from iron ore. The Indian Ministry of Steel is concerned with: the coordination and planning of the growth and development of the iron and steel industry in the country, both in the public and private sectors; formulation of policies with respect to production, pricing, distribution, import and export of iron and steel, ferroalloys and refractories; and the development of input industries relating to iron ore, manganese ore, chrome ore and refractories etc., required mainly by the steel industry.

Since 2002, India has been the largest producer of sponge iron, also called direct reduced iron (DRI), in the world. Today about 20 per cent of the sponge iron produced worldwide is made in India. Analysts estimate that about 20 per cent of steel is manufactured in India by using sponge iron as raw material. The bulk of the sponge iron produced is used in the production of secondary steel.

2.3.5 Need of Captive power plant (22WHRB and 15 AFBC)

WHRB (Waste Heat Recovery Boiler) is a type of boiler which utilize waste heat for generating steam Discharge gas temperature from stack of Sponge Iron Kiln is approx. 700 °C.

Earlier most of the sponge iron units were releasing this high temperature gas in huge quantity into atmosphere. These types of gas which are not utilized by any means are known as waste heat. Now most of the sponge iron units are utilizing this waste heat for generating steam thought WHRB.

With rapid growth in infrastructure and other aspects, power has become the most sought out commodity. Globally conventional flues are about to exhausts worldwide all the organizations are focusing on non-conventional energy and effective utilization of conventional energy. In Sponge Iron plant, rotary kiln is used to manufacture iron billets from combustion of coal and iron ore. Waste flue gas emitted from the rotary kiln has a temperature of about 7000 C and above. Gas coolers are required to cool down the gas. Proposed project is based on the Waste Heat Recovery Boiler instead of gas cooler for both gas cooling and heat recovery and steam generation. Thus the whole plant efficiency will be improved by effective utilization of waste heat energy and eliminating the power which will be consumed by the gas coolers. As well as the power generated could be used in the production.

2.4 Project Benefit and Employment Generation

The proposed project therefore would bring the following benefits to the company as well as to the country as a whole.

- Poorer grade local iron ore fine (with Fe 54-56%) which have a very restricted use in the Indian/local steel industry will find an outlet leading to the conservation of iron ore resources in line with our national mineral policy.
- This would lead to clearing of accumulated low grade fine ore dumps in nearby mines.
- The company would be able to increase the output of the mine with poor grade ore and would be able to lengthen the life of the better ore grade mine by reducing output. This would improve the viability of the pellet production. The present margin in pellet production from better grade ores is very thin.
- Even when the company is to buy fine ore from the market, going for poorer grade fines would give price advantages.
- Employment generation in the backward area of Maharashtra.
- Revenue generation for State Government and Central Government by addition collection of GST, IT and other due to industrial development.
- Direct and indirect employment to about 1000-1200 people.

Chapter 3.0
Project Description

3.1 Type of project

SEAC-I, Maharashtra has issued TOR to LMEL for the installation of Iron ore Beneficiation Plant of 63,000 TPA, Sponge Iron Plant of 190 TPD (2X95 TPD) and Captive power plant (WHRB) of 4 MW and Public Hearing has been carried out for the same. Now Company wishes to propose expansion of Iron Ore Beneficiation plant (63000 TPA to 2,00000 TPA), Sponge Iron [62,700 TPA(2x95 TPD) to 4,58,700 TPA by installing additional 2X100 TPD and 2X500 TPD], Captive Power Plant (WHRB) (4 MW to 22 MW and New 15 MW AFBC) and Installation of New Iron Ore Crushing and Screening Plant (2,00,000 TPA), Iron Pellet Plant (1.0 MTPA) with Coal Gasifier (40,000 Nm^3/hr) in existing premises of plant located at MIDC Konsari, Village Konsari, Tahsil Chamorshi, District Gadchiroli, Maharashtra

3.2 Location of the project

The expansion activity is proposed in the premises of existing plant located at MIDC Konsari, Village Konsari, Tahsil Chamorshi, of Gadchiroli District of state Maharashtra.

<table>
<tr><th>Sr. No.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>1</td><td>Project Site</td><td>MIDC Konsari, Village: Konsari, Tahsil: Chamorshi & District: Gadchiroli, Maharashtra.</td></tr>
<tr><td>2</td><td>Site Co-ordinates</td><td><table>
<tr><td>A</td><td>19°46'5.59"N 79°48'50.60"E</td></tr>
<tr><td>B</td><td>19°46'7.76"N 79°48'45.57"E</td></tr>
<tr><td>C</td><td>19°46'5.09"N 79°48'43.87"E</td></tr>
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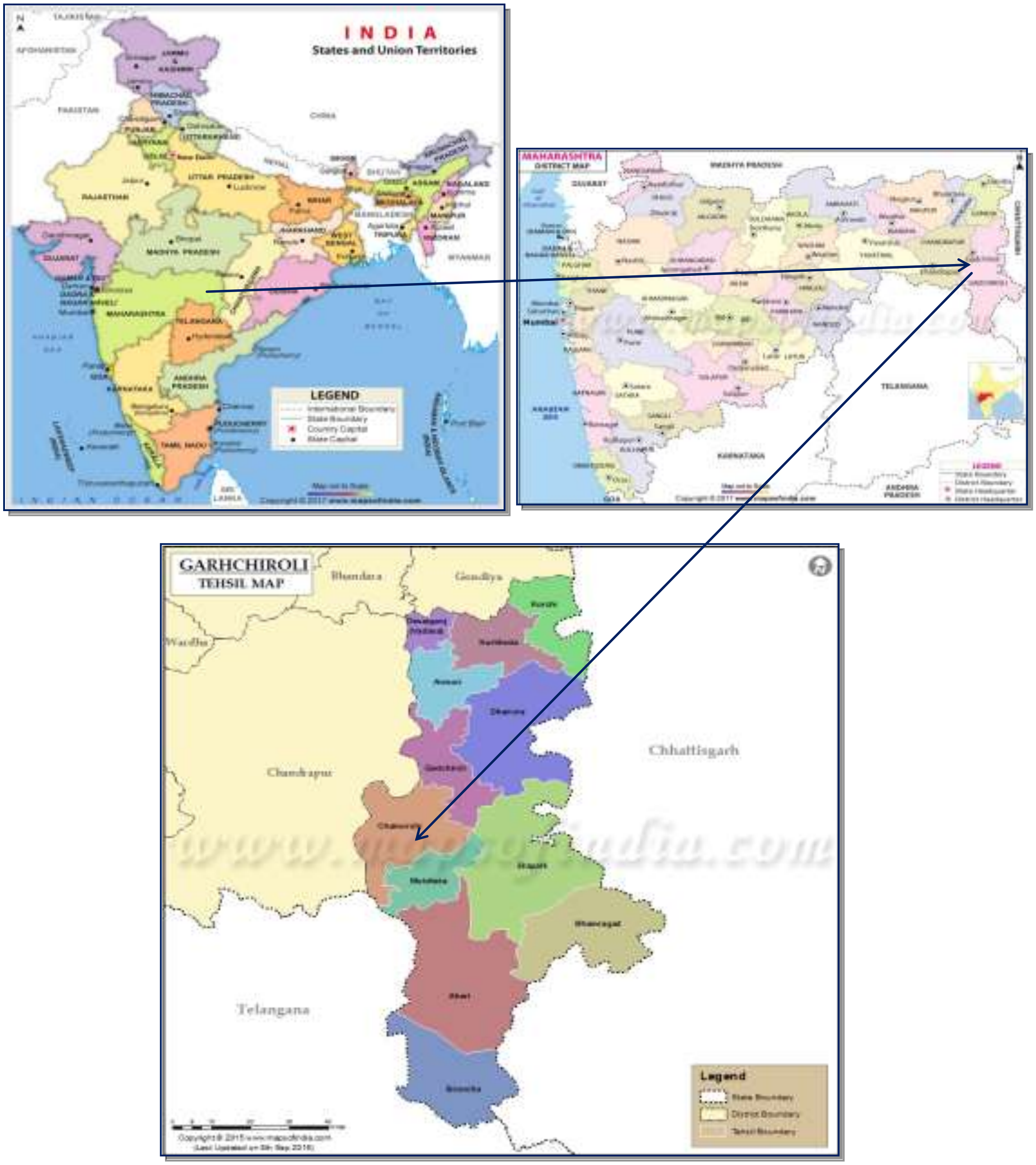
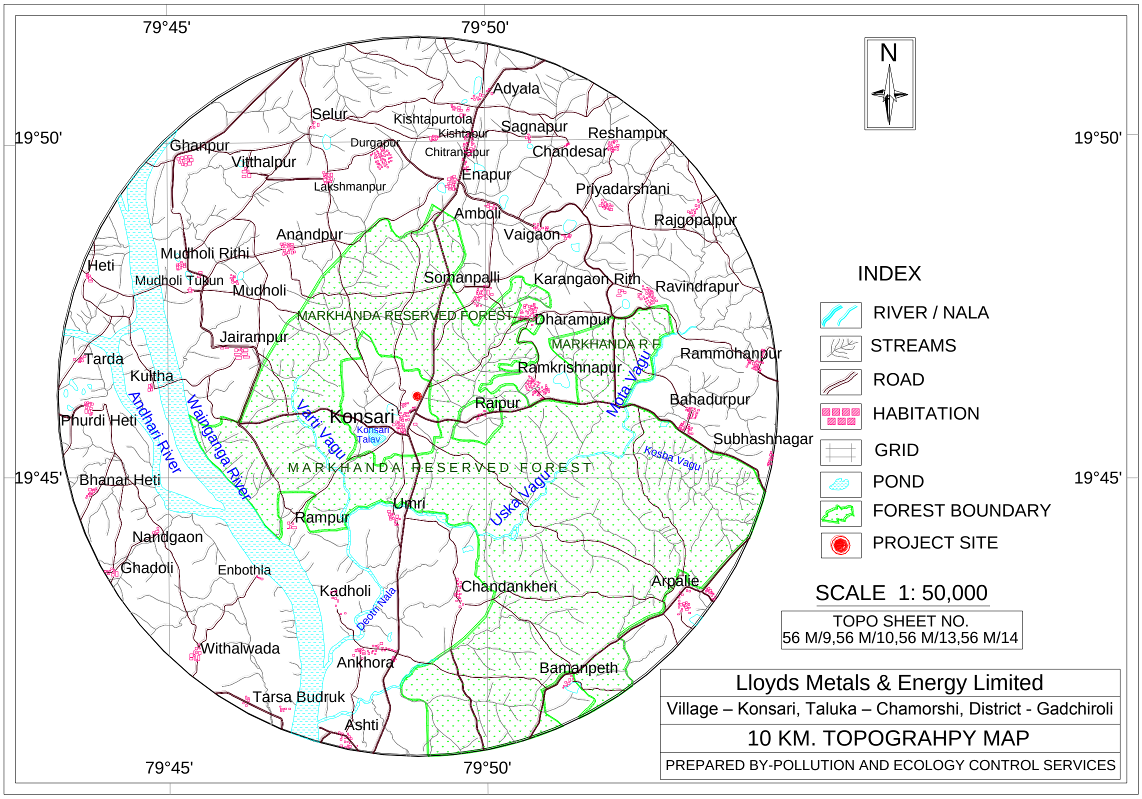
<tr><td>E</td><td>19°46'10.51"N 79°48'24.18"E</td></tr>
<tr><td>F</td><td>19°46'14.04"N 79°48'19.21"E</td></tr>
<tr><td>G</td><td>19°46'30.49"N 79°48'24.16"E</td></tr>
<tr><td>H</td><td>19°46'18.75"N 79°48'57.13"E</td></tr>
</table></td></tr>
<tr><td>3</td><td>Topo sheet No.</td><td>56M/9, 56M/10, 56M/13,56M/14</td></tr>
<tr><td>4</td><td>Elevation above MSL</td><td>179 m</td></tr>
<tr><td>5</td><td>Present Land use</td><td>Industrial</td></tr>
</table>



(Source: mapsofindia.com)

Figure 1: Location Map of the Project Site



Source: SOI Toposheet

Figure 2: Specific Location of the Project Site

Figure 3: Google Image of the Project Site (Source: Google Earth)

Figure 4 Layout Plan

3.3 Details of Alternate sites considered and the basis of selecting the proposed site

The proposed expansion will be carried out in the existing premises of Lloyds Metal and Energy Limited at MIDC Konsari, Village: Konsari, Tahsil: Chamorshi & District: Gadchiroli, Maharashtra. Hence no alternative site is considered.

3.4 Size or Magnitude of operation

SEAC-I, Maharashtra has issued TOR to LMEL for the installation of Iron ore beneficiation with a capacity of 63,000 TPA, Sponge iron with a capacity of 2X95 TPD and Captive power plant (WHRB) of 4 MW and Public Hearing has been carried out for the same. Now Company wishes to propose expansion of Iron Ore Beneficiation plant (63000 TPA to 2,00000 TPA), Sponge Iron 62,700 TPA (2x95 TPD) to 4,58,700 TPA by installing additional 2X100 TPD and 2X500 TPD), Captive Power Plant (WHRB) (4 MW to 22 MW and New 15 MW AFBC) and Installation of New Iron Ore Crushing and Screening Plant (2,00,000 TPA), Iron Pellet Plant (1.0 MTPA) with Coal Gasifier (40,000 Nm^3/hr) in existing premises of plant located at MIDC Konsari, Village Konsari, Tahsil Chamorshi, District Gadchiroli, Maharashtra

3.5 Project Description with Process

3.5.1 Iron Ore Beneficiation Plant

The beneficiation plant is being set up for proper beneficiation of the iron ore from our captive mines. The iron ore from Gadchiroli captive mines will be crushed to size in the crushing plant. This is a physical process to reduce the non-ferrous impurities.

Iron Ore Beneficiation Process &Equipment

The low grade iron ore fines needs to be concentrated for upgradation of Fe content through the process of beneficiation. Such an upgradation is done by elimination of unwanted gangue materials mainly Silica (SiO_2) and Alumina (Al_2O_3) and few other trace elements found in the iron ore.

Primarily, the method of beneficiating iron ore fines includes washing out and eliminating the gangue constituents at every stage of the beneficiation process.

The typical steps in the process are as under:

1. Scrubbing, Slurry making, wet screening and physical separation by spiral classifiers:

Iron ore fines are first passed through spiral classifiers which have triple functions – function of making slurry (mixing & agitating with water), function of wet scrubbing and also classifying. Wet Scrubbing is the process to wipe out the undesirable elements like silica, alumina and other trace elements adhering to the surface of the iron ore fines so that these do not enter the beneficiation & classification circuit. This improves the quality of concentrate. Classification is conducted to reduce the load on the grinding ball mills so that only the coarser particles enter the primary ball mill for grinding and finer particles are taken to secondary ball mill for further grinding.

The coarser particles of the iron ore from the spiral classifier is sent to a battery of high end wet screens having a cutoff point of 80 # and coarser. After wet screening the material coarser than 80 # is sent to the primary ball mill and the finer than 80 # is sent to the battery of low end wet screens having a cut off point of 230 mesh.

During the spiral classification process of the fines the free alumina, silica and clay is almost completely washed away thereby substantially upgrading the ferrous content of the iron ore fines. On the wet screens the particles are thoroughly washed with strong currents of pressurized water jets, thereby loosening and separating gangue particles.

The underflow of the low end wet screen i.e. finer than 230 # along with underflow of the spiral classifier is fed into the triple chuted spiral concentrator.

The overflow of the high end wet screens i.e. coarser material is further ground in a primary ball mill to the specified mesh range of about 230# to get the interlocked gangue materials further liberated from the iron ore.

2. **Separation through Spiral Concentrators:**

The feed to the spiral concentrator is the underflow of the spiral classifier and the underflow of the low end wet screens.

Due to gravitational forces, the heavier particles containing iron ore particles follow the path of the main column which is diverted to the secondary ball. The lighter particles follow the path of the outer circumference of the spiral concentrator, which is sent to a thickener for settling.

As the material is passed through the sets of spiral chutes, due to difference in specific gravity of gangue materials and the iron ore fines, the iron ore fines tends to move speedily adhering all along the centre column spiral chute, while the lighter gangue particles especially the SiO_2 and the Al_2O_3 tend to move slowly during the downward fall by taking the path of the outer circumference of the spiral chute. At the bottom of the spiral chutes diverters are positioned to separate the heavier particles and the lighter particles.

3. Primary grinding through Ball Mill and Hydro Cyclone in closed circuit:

The feed to the primary ball mill is the overflow of the high end & low end wet screens. A primary ball mill is for primary grinding i.e. breaking down to the mesh size to about # 230.

After primary grinding, the fines of about 230# needs to be classified for size in a hydro cyclone enabling remaining coarser sizes (coarser than # 230) to be re-ground to finer than # 230 to be sent for further processing in a secondary ball mill.

4. Secondary grinding through Ball Mill and hydro cyclone in a closed circuit:

The feed to the secondary ball mill is the overflow of the spiral concentrator and the underflow of the primary ball mill. Here the material is ground close 325 mesh which is the liberation point for Indian hematite grade iron ore fines.

5. **High Gradient Magnetic Separation (primary):**

The slurry from the secondary ball mill is fed into the Pulsating Type High Gradient Magnetic Separator where the remaining foreign material is separated from the iron slurry by electro magnetic process.

6. **Wet screening (super fine):**

The beneficiated fines now obtained from the high gradient magnetic separator is passed through a high end wet screen with a cut off point of 325 mesh and is sent to the thickener, while the particles finer than 325 mesh is once again routed through another High gradient magnetic separator (secondary).

7. **High Gradient Magnetic Separation (Secondary):**

The underflow of the wet screen (super fine) is re-circulated in this magnetic separator. The overflow of this magnetic separator is sent to the thickener and the underflow is sent to the tailing pond for settling.

8. **Thickening:**

The beneficiated slurry containing high ferrous contents of iron is made to settle in a thickener from where over the period of few hours the thick beneficiated & concentrated iron ore slurry can be pumped out as underflow from thickener. The overflow of the thickener is nearly clear water which is recycled as process water.

9. **Dewatering through Ceramic Vacuum Disc Filter:**

The process of balling (making green balls) in a pelletizing plant requires the moisture content of a maximum of 8.5 percent which is considered the ideal moisture content for the balling process.

The underflow or the output from the thickener contains water of more than 50 percent. To substantially reduce the moisture content ceramic vacuum disc filters are used where not only the slurry with moisture content of about 8.5 percent is obtained but clear water is also recovered for reuse in the process.

Production Process

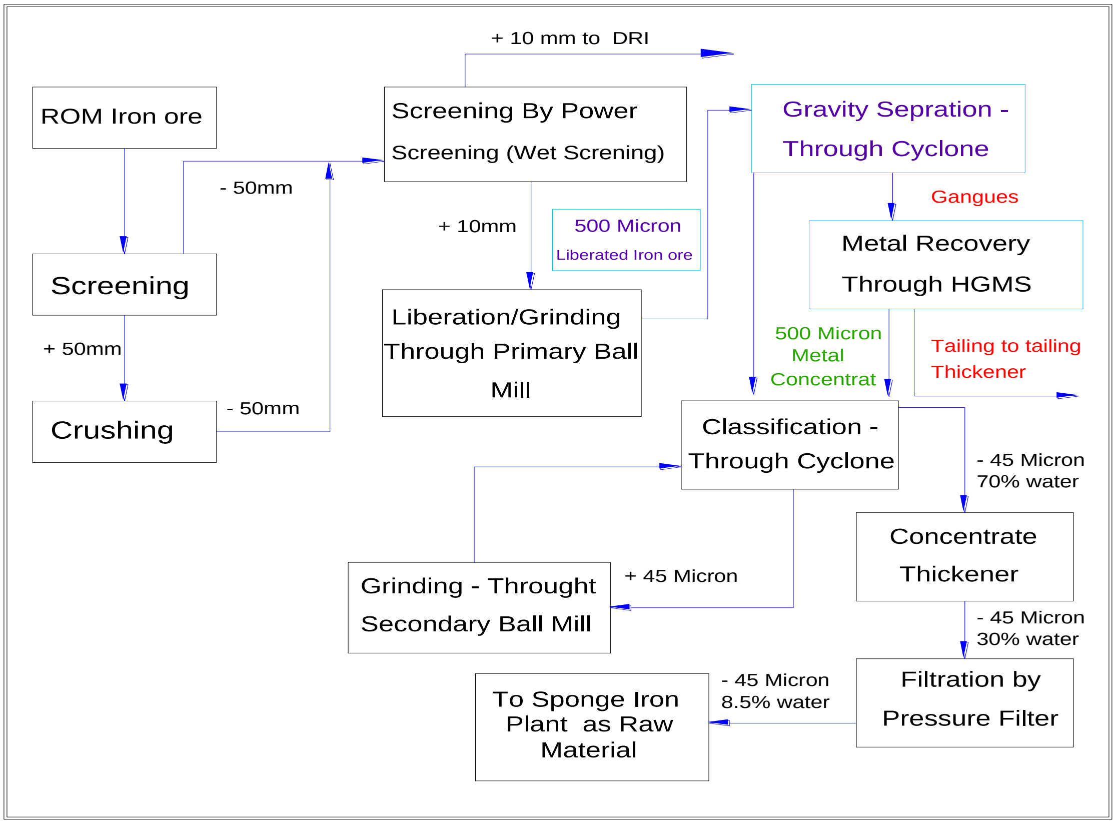
- The iron ore of size 0 - 30 mm will be supplied to the feed hopper with the help of dumpers. The sized ore shall be fed accurately through vibrating feeder, Weigh feeder and belt conveyor to the scrubber. By the combined action of attrition & scrubbing the adherent clay & silicate contents are washed away from the surface of ore particles.
- After scrubbing the iron ore shall be discharged to a double deck dewatering screen where the iron ore shall be dewatered and screened.
- The iron ore (+8mm) dewatered from the 1st deck of the screen and shall be discharged on to the belt conveyor to be conveyed to the Alljig through vibrating feeder.
- The iron ore 1mm - 8 mm dewatered from the 2nd deck of the screen and shall be discharged on to the belt conveyor to be conveyed to the Alljig through vibrating feeder.
- The Alljig will process the ore and shall produce two products i.e. clean iron ore and rejects. The overflow from the Alljig shall be discharged to a static screen for dewatering. Further dewatering shall be done in a dewatering screen. The overflow from the screen shall be discharged to a conveyor for conveying the rejects to the rejects yard. The underflow from the screen shall be taken to the sump through the

catch pan of the dewatering screen. From the sump it shall be pumped to hydrocyclone.

- The over flow of the Hydrocyclone shall be taken to the thickener for clarification. The underflow of the Hydrocyclone shall be discharged to the dewatering screen. The over flow of the dewatering screen shall be conveyed through the fines refuse conveyor to the reject yard.
- The underflow from the Alljig shall be discharged to a double deck dewatering screen through a VFD controlled vibrofeeder. The oversize (+18mm) from the screen shall be discharged to a conveyor for conveying the iron ore lumps to the storage yard. The intermediate product (8 -18mm) shall be discharged to the product yard through the conveyor. The underflow from the screen shall be taken to sump.
- The underflow from the Alljig shall be discharged to a double deck dewatering screen. The oversize (3 -18 mm) from the screen shall be discharged to a conveyor for conveying the iron ore to the storage yard. The intermediate product (1 -3mm) shall be discharged to the fines iron ore stock yard through the conveyor. The underflow from the screen shall be taken to sump.
- The slurry from the sump shall be pumped to the catch pan of dewatering screen. The overflow from the screen shall be discharged to the conveyor for conveying the iron ore fines to the storage yard. The underflow from the screen shall be discharged to the sump and pumped to hydrocyclone. The overflow from the cyclone shall be taken to the thickener. The underflow from the hydrocyclone shall be fed to the dewatering screen.
- The underflow from the double deck dewatering screen shall be discharged to a sump and pumped to the all flux. The overflow from the All flux shall be discharged to a sump which shall be pumped to hydrocyclone. The underflow of the hydrocyclone shall be discharged to a sump .The thickened slurry shall be pumped to the WHIMS for further recovery of fines. The recovered fines product shall be fed to the fines dewatering screen. The tailings slurry from the WHIMS along with the overflow of hydrocyclone shall be fed to the thickener for clarification.
- The overflow clarified water from the thickener shall be fed to the All flux push water sump. The underflow from the thickener shall be pumped to the sump. From the sump

the slurry shall be pumped to the plate filter press to recover the maximum amount of water. The tailings cake from the filter press shall be discharged to the reject conveyor In case of emergency the underflow from the thickener shall be discharged to the emergency slime pond.

- The underflow coarse concentrate from the All flux shall be discharged to the dewatering screen. The intermediate product from the All flux shall be taken to the sump. From sump slurry shall be pumped to spiral for further concentration.
- The concentrate from the spiral shall be fed to the fines product dewatering screen. Similarly the tailings from the spiral shall be fed to the fines refuse dewatering screen.
- Emergency slime pond has been provided with a sump and pump for recovery of clarified water.
- The All flux upstream push water shall be pumped from the sump. The spray water for WHIMS shall be pumped from the sump.
- The over flow from the sump shall be taken to the sump. The upstream push water for the all jig shall be pumped from the sump. Similarly the water for scrubber, spray water for desliming screen shall be pumped from the sump. The circuit proposed is a totally closed circuit with zero



Flow chart for Iron Ore Beneficiation

3.5.2 Sponge Iron

Lloyds Metals and Energy Limited (LMEL) has existing Sponge Iron plant of capacity 190 TPD. The present proposal is for the increase the sponge iron production capacity installing rotary kiln of 2x100TPD and 2x500TPD.

Raw Material

The raw materials required for sponge iron making in coal based plants are presented below. The details of raw material used and physical and chemical properties of raw material is presented below.

Iron ore or Iron oxide is the source of iron in Sponge Iron making. High grade iron ore contain hematite (Fe_2O3) mineral. These are associated with undesirable minerals containing Silica (SiO2), Alumina (Al2O3) etc. Pure hematite has the chemical formula Fe2O3 and contains 69.94 % of iron balance 30.06% being oxygen. But in majority of Indian iron ore mines, iron ore contains 64% of iron. The available iron ore from the mines are screened and up to 8- 18mm size of iron ore is used for rotary kiln process. The chemical composition of available Iron ore in Indian Iron Ore mines is presented below.

3.5.2.1 Equipment and Machinery in sponge Iron manufacturing

The following major equipments/systems required for coal based sponge Iron plant for manufacturing of sponge iron from iron Ore.

3.5.2.2 Raw material preparation and handling system

The major raw materials required for the sponge iron production are iron ore, coal and dolomite/lime stone. The iron ore and coal are obtained mostly through the road transport from mines with different sizes. These materials are unloaded in stock yards and then are fed into the respective circuit for further processing. Each raw material has individual crushing circuit. But for the Lime stone which is only small quantity, is procured in the required size and fed to the stock bins through the iron ore circuit. The raw material Handling Equipments required are feeders, vibrating screen, impactors and crusher.

Ore Crushing Circuit

The size of iron ore procured for the suppliers are higher than the required size to feed into the kiln. So, the iron ore is required to crush in to required size, it is essential to install the ore crushing unit. The capacity of crushing unit is depends on the plant capacity. The required size of iron ore in the rotary kiln is in the range of 5-16mm. The Ore crushing unit has ground hopper, feeder, two iron ore crushers and one screen with the interconnected conveyors for handling the material. Dust suppression system is provided for pollution control system.

Coal Crushing Circuit

The size of coal procured for the suppliers are higher than the required size to feed into the kiln. So, the coal is required to crush in to required size, it is essential to install the coal crushing unit. The capacity of crushing unit is depends on the plant capacity. The required size of coal in the rotary kiln is in the range of 5-20mm and 0 5mm. The coal crushing unit has ground hopper, vibrating feeder, one coal crushers and one screen with the interconnected conveyors for handling the material to various bins. Bag filters for separation of dust particles is provided for pollution control.

Raw material Storage System and feeding

The raw material storage system is essential to stock the required raw material for uninterrupted production of the plant. The capacity of storage system is usually designed for one day ore more depending up on the plant requirements and operations. The raw material storage system is designed for iron ore, coal and dolomite with feeding systems for better process control. Weigh Feeders are provided under each bin to supply of the required quantity of raw material in each raw material to the kiln.

3.5.2.3 Reduction Unit.

In coal based sponge iron manufacturing reduction unit is heart of the plant where the actual reduction of iron ore is takes place. The reduction unit consists of rotary kiln and rotary cooler and details are presented below.

3.5.2.4 Rotary Kiln

The rotary kiln is longer in size and smaller in diameter (higher L/D ratio). This is due to heat transfer from flame to the solid charge in inside the kiln which is the main requirement during the process.

The oxide of Iron is reduced to its metallic form below the melting points of the metal and the oxide in the rotary kiln by supplying the adequate quality and quantity of coal. The entire process of reduction is takes place in the rotary kiln at higher temperature. In this process coal will be used for producing reducer gas and the process will be carried out in a Horizontal Rotary Kiln.

The Rotary Kiln is operated and rotated with help of AC motor and gears. The speed of the rotation is used by gear box and the speed is controlled by Variable Drive System. The temperature and pressure measuring systems are required to install to measure the different temperatures zones and air flow velocity during the process of kiln.

The sealing system is provided to prevent atmospheric air is enter in to the kiln. Raw material iron ore and coal, dolomite is enter in to the kiln in one side and powdered coal is enter in to the another side of the kiln. The gas generated in the kiln i.e. CO is passes opposite to the raw material pass during the operation. The finished product from the rotary kiln is discharges and enters in to the cooler main drive after completion of the reactions.

3.5.2.5 Rotary Cooler

The Rotary Cooler is another rotary kiln in reduction units which is used to cool the high temperature metallic iron i.e. sponge iron cooled to around 250 C. The cooler main drive also similar to the rotary kiln but the operation is mainly to cool the finished product. The cooler main drive is driven by the motor with gear system. The cool water is circulated on the top of the kiln for heat exchange between product and water. Sufficient water is sprayed along the cooler main drive at top. The cooler shell will be of 2.2 m diameter and 22 meters long and the shell plate will be 16 mm thick. The shell is supported by 4 numbers of roller assemblies. The other items include gear rim, spring plate system, pinion shaft system, thrust roller base frame for rollers, drive frame for cooler, thrust roller for frame, Transfer chutes, cooler hood, needle gate head for cooler outlet, spring ring carriage.

3.5.2.6 Product separation and Storage System

The finished product from the cooler drive is sent to the magnetic separators where metallic and non metallic is separated. The separated non metallic material is send to the dumping yard. The segregated metallic material i.e. sponge Iron is sent to vibrating screens for segregating the different sizes. Conveyor belts are used to transport the metallic and non metallic material.

The segregated material is stored in intermediate storage system provided in the plant. A Bag filter is provided for collecting the fine dust during the material transportation. The Product Separation system has one screen and two magnetic separators positioned at various elevations. The product house bins have three to four bins with the higher volume of storage capacity. The four bins have the material discharge system with three bins for sponge iron and one for char + dolo char.

3.5.2.7 Waste Gas Cleaning System

The flue gasses are generated in the kiln during the sponge iron manufacturing. These gases are mainly contains CO, dust particles with higher temperature. The dust settling chamber (DSC) is provided where the higher particles are settle down and gases with fine particles are passes to After Burner Chamber (ABC).The water is sprayed in the ABC where the dust particles coagulate and further settle in the DSC tank. The hot gases from kiln have higher temperature and contain CO which cannot escape to environment. The ABC system is provided to convert the CO in to CO2 by supply the atmospheric air. The higher temperature CO is converted in to CO2, and the temperature of the gas increased up to 1000 C. The gases from the ABC are required to cool which cannot be sent directly to atmosphere.

The hot gasses from after burner chamber (ABC) are passed through the Forced Draft cooler (FDC)/Gas Cooled Terminal (GCT) to cool the hot gases from 1000 C to 250C.These gases are passes further through Electro-Static Precipitator (ESP) where fine dust particles in gasses were removed. Induced draft (ID) fan is used to suck the gases from ESP and sent to atmosphere through chimney.

3.5.2.8 Auxiliary Facilities

The other equipments/machinery required for sponge iron plant is discussed which are directly/indirectly required for the operation of the plant. Water supply system Make up water and water circulating system is required for cooler main drive to cool the product. Pumps are used to supply the water in cooler main drive and makeup water in the ponds. The quantity of makeup water is required is depends up on the how much water is evaporated during the process. In some industries where Gas cooled Terminal is used for cool the waste gases are required water for cooling the gas.

Compressed air system

Compressors are used to for supply the compressed air required in the both rotary kiln and cooler main drive.

Shell Air Fans

Shell air fans are required to supply the air to the rotary kiln for combustion of coal. These fans are mounted in the across the rotary kiln. The quantity of air is depends upon the coal consumption and temperature in side the kiln. At least 5 to 7 shell air fans are provided in the rotary kiln across the kilns.

Instrumentation

The instrumentation has been designed to meet the continuous operation of the plant to meet the desired parameters in the kiln. Instrumentation is required for electrical and process operations in sponge iron plants due to continuous operations. During the process in the sponge iron many parameters i.e. temperatures, excess air, raw material feed are required to observe and maintain required values. To control the all the parameters it is require proper instrumentation system in the plant for smooth operation of plant.

3.5.2.9 Manufacturing Process

The process of sponge iron manufacturing involves removal of oxygen from iron ore. Sponge Iron also called as Direct-Reduced Iron (DRI) is produced from direct reduction of iron ore (in the form of lumps, pellets or fines) by a reducing gas using fuel i.e. natural gas or coal. The reducing gas is a mixture majority of Hydrogen (H2) and Carbon Monoxide (CO) which acts as reducing agent. This process of directly reducing the iron ore in solid form by reducing gases is called direct reduction. In this process coal will be used for producing reducer gas and the process will be carried out in a Horizontal Rotary Kiln. The finished product i.e. sponge Iron observed under a microscope, resembles a honeycomb structure,which looks spongy in texture. Hence the name is called sponge iron. The reduction of Iron Ore can be achieved by using either carbon bearing material, such as non-coking coal or a suitable reducing gas in the form of reformed natural gas. The processes employing coal are known as solid-reluctant of coal-based processes while those employing reducing gases are known as gas-based processes. The basic reactions in this process are as follows:

$C + O_2 = CO_2$

$CO_2 + C = 2CO$

$Fe_2O_3 + CO = Fe_2O_3 + CO_2$

$Fe_3O_4 + CO = FeO + CO_2$

$FeO + CO = Fe + CO_2$

Non-coking coal and iron ore along with limestone in the required size range and quantityare continuously fed into the feed end of the inclined rotary kiln through a feed pipe. The materials move along the length of the kiln due to its inclination and rotation. Air is blown in through required number of air tubes suitably located along the length of the kiln. At the feed-end of the kiln air is blown in through nozzles for drying and pre heating of the charge. Initial heating of the kiln is carried through a central oil burner located at the discharge feed end. As the charge moves through the kiln, it is heated by the hot gases, which flow in the opposite direction to the charge (i.e. counter current flow). The initial part of the kiln (about 30%) is called the pre Heating zone, where moister in the charge and volatiles in the coal are removed / burnt off as waste gases.

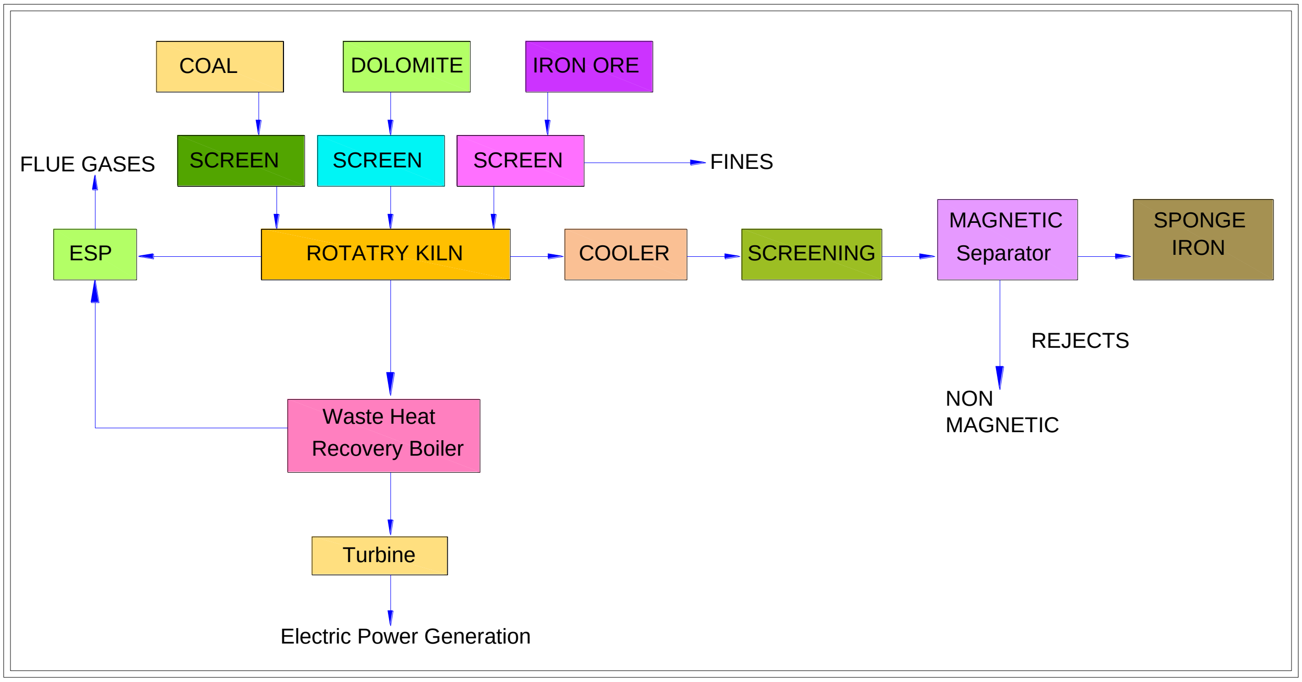
The required heat in this zone is provided by the combustion of the feed coal. The remaining portion of the kiln is called as the reduction zone. In iron ore is removed leaving metallic iron as per the following chemical reaction.

$3FeO_3 + CO$ --------------------2 $Fe_20_4 + CO_2$

$FeO + CO$ --------------------$Fe + CO_2$

The CO is generated for the above reaction according to CO_2 + C above 900 deg. C, carbon monoxide will combine with the oxygen in the iron ore forming carbon dioxide and thus reduce the ore to metallic state. faster would be the oxygen removal.

After the removal of oxygen and grater is the metallization of sponge iron. Metallization levels can roughly be checked by density of the sponge iron. It can also be judged by the metallic luster if a sample is rubbed against a rough surface.



Block Diagram of Sponge Iron Manufacturing Process

After the iron ore has been metallic to the desired level, sponge iron and residual char are discharged from the kiln into a rotary drum type cooler. In the cooler sponge iron is cooled to below 250 deg. C before the material is discharged on to a belt conveyor.

If the sponge iron were exposed to air at high temperatures (i.e. above 250 deg C) it would tend to re oxidize. It is therefore, necessary that the temperature of the product at the point of discharge from the cooler is as close as possible to the ambient temperature. The reduction process occurs in solid state. The crucial factor in this reduction process is the controlled combustion of coal and its conversion to carbon monoxide to remove oxygen from the iron ore.

The overall process extends to a period of 10 to 12 hours inside the kiln. During this time, iron ore is optimally reduced and the hot reduced sponge iron along with semi-burnt coal is discharged to a rotary cooler for indirect cooling to a temperature of around 12 °C. Sponge iron being magnetic in nature, the discharge from cooler main drive consisting of sponge iron, chars & other contaminations are routed through electromagnetic separators, to separate other impurities from sponge iron. The product is then screened in size fractions of lump (+3mm) and fines (0-3 mm). Separate bins are installed to preserve its quality, reduce re oxidation and facilitate faster loading on to the trucks.

3.5.3 Power Generation

Existing Capacity: 4MW (WHRB)

Expansion: 22 MW (22MW WHRB & 15 AFBC)

Waste heat recovery system to generate Power

In Sponge Iron manufacturing, flue gases are generated with a temperature of 900-1000 C during the process. This heat is cooled without utilizing heat by supplying the air by using FD fans. The heat content in the flue gas is enough to generate the power by installing the waste heat recovery system i.e. boiler. The high temperature flue gases are pass through the boiler for generate the steam and that can be used in turbine to generate the power.

Background

All sponge Iron Manufacturing Industries in India are coal based industries and flue gases are generated during the process which have higher temperature i.e.900-1000 Deg C. These industries are operated throughout the year. At present all industries are not utilizing the heat from the flue gases and cooled by FD/GCT system before sending to ESP. Thus power generation using generated flue gases are one of energy conservation opportunities in sponge iron plants by installing waste heat recovery system.

Energy Conservation Potential

In 500 TPD coal based sponge iron plants, during the process at least 120000 m^3/hr flue gases are generated and having the temperature of 900-1000C. The heat from the flue gas is recovered using Waste Heat recovery Boiler and generates at least 11 MW power. The total power generated in sponge iron plants are depends on installed capacity of sponge iron plants.

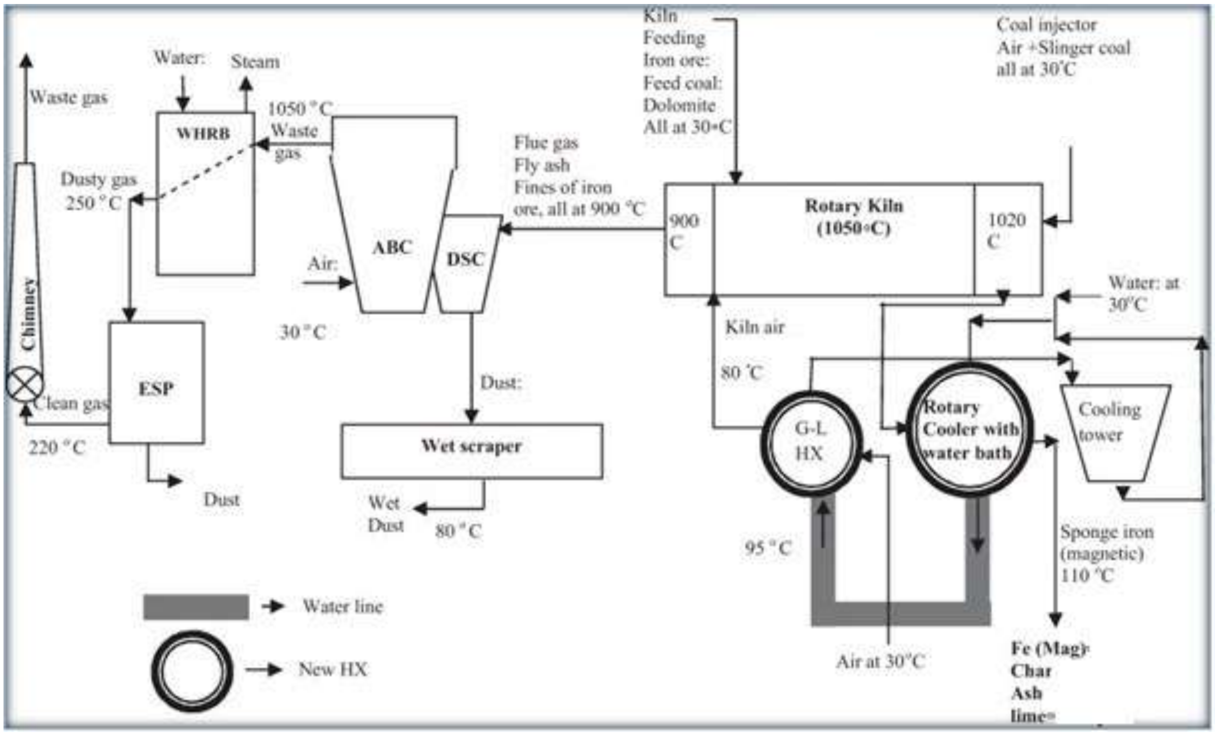
Technical Specifications

Sr.No.	Parameter	Unit Value	Design Parameter
1.	Type of Boiler	-	Horizontal Water Tube
2.	Steam Pressure	Kg/Cm2	66
3.	Steam Temperature	Deg C	485
4.	Steam Flow	TPD	100
5.	Flue Gas Temp.	Deg C	950
6.	Installed capacity of Sponge iron Plant	TPD	500 and 200
7.	Total No. of Sponge Iron Plant		4
8.	Flue Gas flow per Hour per unit	Nm3/Hr	1,20,000
9.	Flue Gas Outlet Temp.	Deg.C	180
10.	Total Power Generation Possible	MW	27
11.	WHRB Power Plant Capacity	MW	22
12.	AFBS Power Plant Capacity		15

Process Details

The waste gases generated from the Rotary kiln is passed through the boiler to generate the steam. The generated steam is used for generation of power. The temperature available in flue gasses is enough to generate the required steam for power generation through boilers. The boiler is a bi-drum, water tube boiler.

The super heater in boiler is designed for an outlet temperature of 490 deg C. The gases leaving the kiln would enter a super heater. The gases leaving the super heater would enter a set of boiler bank tubes are expanded into the steam and water drums. The gases after passing across the boiler bank would enter a bare tube economizer. This is an inline counter flow economizer and heats up the feed water going to the drum.



Power Generation

The gases are reduced to around 180 Deg C for the economizer. After the economizer, the gases are let into a Bag Filter which is provided to reduce the dust emission level. An ID fan has been provided to take care of the gas draft losses in the system. The steam turbine is of multistage horizontal spindle condensing type turbine. The turbine is provided with gear unit capable of continuously transmitting the necessary power and designed for speed reduction ratios for the turbine

Details	Unit	500TPDx2 Kiln	100TPDx2
Waste Heat Recovery Potential	Kcal/Hr	69504240	139008
Power Generation By Flue Gas	Mw / Hr	**11**	**5**
Quantity Of Flue Gas Generated Per Kiln	Nm^3/Hr	**120000**	**24000**
Total Flue Gas Generated By installed capacity	M^3/Hr	**240000**	**48000**
Gas Density	Kg/M^3	**1.3**	**1.3**
Flue Gas temperature at outlet of Kiln	Deg C	**950**	**950**
Enthalpy of Flue Gas at Kiln Outlet	Kcal / Kg	**261.2**	**261.2**
Enthalpy of Flue Gas at Boiler Outlet @ 170 Deg C	Kcal / Kg	**39.15**	**39.15**
Flue Gas Temperature at inlet of	Deg C	**170**	**170**

ESP			
Heat Value available in Flue Gas	Kcal/ Hr	**69504240**	**139008**
Radiation Heat Loss at 1 %	Kcal/Hr	**695042.4**	**13900.8**
Blow Down loss at 2 %		**1390084.8**	**27800**
Steam Enthalpy or Total heat at 66 Kg/Cm2 490 Deg C	Kcal / Kg	**800**	**800**
Feed Water Temperature	Deg C	**126**	**126**
Enthalpy Of Feed Water	Kcal Kg	**127**	**127**
Generated Steam @ 66Kg/Cm2	Kg / Hr	**100175**	**40070**
Power Generation By Generated Steam	MW/Day	**22**	**5**
Total Power Generation By Waste Heat Per Day	MU	**0.528**	**0.12**
Total Power Generation Per Year 320 Days	MU	**168.69**	**38.4**

Availability of Technology /Equipment

Power generation from waste heat gases Technology is proven in sponge Iron plants and operating successfully in many sponge Iron plants in India. The technology is available and manufacturing in India by few major companies.

Benefits

The following benefits are expected by Installing waste heat recovery Power plant using flue gases during the process in sponge iron plants.

- Heat from flue gases is used for power generation. No other raw material is required for power generation
- Reduction in environment Pollution
- Generated power can be used in SMS which is high power requirement industry. This will save the energy cost.
- Reduce the GHG emissions.

Plant, Machinery & Equipment of Power Plant

Major Plant & Machinery proposed to be installed for new Captive power plant

- Turbine, Boiler Feed System
- Deaerator System

- Steam Piping
- Auxiliary Cooling Water system, Cooling Water Pump with piping
- GRP, GCP & Synch. Panel
- HT Breaker
- GT Transformer for TG
- HT, LT & Control Cables
- AC for Control & MCC Room

3.5.4 IRON ORE CRUSHER & SCREENING FACILITIES

Iron Ore Crusher and Screening is proposed to be setup. The ROM from Gadchiroli captive mines will be received in dumping yard. The received ROM would be in the size range upto 1000 mm. The ROM will be fed into the Ground Hopper by dumpers/trucks.

Crushing Unit

- The material will be fed to Ground Hopper and then to Grizzly Feeder
- From Grizzly Feeder material will flow in two ways;
- One flow will pass from Grizzly Feeder of 400 TPH subjected to another Grizzly Feeder and goes to Jaw Crusher
- After crushing in Jaw Crusher the material goes to Vibrating Screen where it will separate to sizes 0-10 mm, 10-40 mm and 40-80 mm.
- 0-10 mm is the Product-1 which in turn goes to Loading Hopper.
- 10-40 mm is the Product-2 subject to smooth Roll Crusher to make the size to 0-10 mm as Product-3 and goes to Loading Hopper.
- 40-80 mm the oversize material goes to Cone Crusher for further crushing which after crushing takes back to Vibrating Screen.
- Another flow of material passes from Grizzly Feeder subject to Primary Jaw Crusher and after crushing the material flows to Vibrating Screen where it will separate to sizes 0-10 mm, 10-40 mm and 40-250 mm.
- 0-10 mm material is the Product-1 and 10-40 mm is the Product-2.
- 40-250 mm takes back to Primary Jaw Crusher for further crushing through Grizzly Feeder.

Screening Unit

- The material will be fed to Ground Hopper and then to Vibrating Screen.
- After screening, the material will separate to 0-10 mm Product-1, 10-25 mm Product- 2 and 25-250 mm Product-3.
- Product-3 of size 25-250 mm will pass to the Ground Hopper of Crushing Unit for reducing the size of the material

3.5.5 Iron Ore Pellet Plant with Gasification System

The company is proposed to establish iron ores pellet plant in existing plant premises for production of 1.0 MTPA pellet using iron ores fines source from captive mines of Gadchiroli.

Process routes and facilities

Main technological facilities

Sl. No.	Processing step	Technological facility
1	Grinding	Closed Circuit Wet Ball Bill, Filter
2	Green Ball	Mixer, Disk Pelletizer
3	Induration	Grate-Kiln-Cooler

Reportedly, with incorporation of wet grinding of iron ore, energy consumption would be reduced by 25% to 35% as compared to dry grinding

Process Details

Iron Ore Pellet Plant

In order to make entire technological level, environment protection level, advanced stage and suitable for operation and maintenance, it is designed to have some new material, new technology, new process, new equipment and new structure, with aim at improving reliability, reducing investment, extending life campaign, lowering operation cost, facilitating maintenance and replacement.

Travel grate machine - Rotary kiln process features as :

- Drying, Preheating, Baking, Cooling and etc are carried on different equipments including travel grate machine, rotary kiln and annular machine, leading to uniform quality of product and reliable and simplified equipment.
- Each set of equipment can be controlled individually and adjusted conveniently, which is strongly adapted for raw material, particularly hematite.
- Good adaptability for fuel. Low fuel consumption, power consumption and low operation cost.
- Rotary kiln is step-less adjusted by speed reducer and AC frequency converter to enable operation smooth and stabilized.
- To adopt advanced air flow system, fully recovering sensible heat of high temperature flue gas generated from annular cooler, making utilization of thermal energy to the maximum extent, and lowering thermal consumption of pellet.
- Main operation process are centralized controlled and adjusted by computer, main technological process are monitored and administrated by industrious TV with high automatic control level.
- High attention is put on the protection of environment, which purify the dust contained waste gas by use of high effective dust catcher to discharge into the air after reaching standard discharge norm.
- Dust is collected in centralized manner, which can be fully recovered and utilized.

The Iron Ore Pelletization Plant has the following major units:

Iron Ore grinding system& Filtration

The design capacity of fine grinding machine is 350T/Hr. feeding fines of incoming raw iron ore is around 63.5%. Granular sizes of output of iron ore after grinding is around 70 to 90 passing through 325 mesh, subject to filtration to produce iron ore concentrate with water content of around 9% to 10%. Preliminary iron ore grinding is carried out in closed circuit ball mill and Wet screen.

Mixing room

Iron ore fines, Bentonite, flux, coke and ESP dust are all mixed uniformly in a mixer. As per water content of material, some certain quantities of water is added so as to maintain water content before balling process ranged from 9 to 10%.

Balling Room

Mixed material is transferred through belt conveyor into the high level of balling room, where the material mix is discharged through plough-type dumper above belt conveyor separately into 9 mixed material bunker, under which, 9 sets of Φ6.0m balling disc are installed. Green ball produced from balling disc is transferred from collective belt conveyor into the green ball distribution system in the travel grate machine for material distribution.

Green ball distribution system

Green ball from balling room is fed into the distribution system through belt conveyor. In reciprocating process, head swinging belt conveyor feed the green ball into large ball roll screen for screening. Unqualified green ball of more than 16mm are separated out and then fed back into the balling room through return material system. Green ball of less than 16mm is fed onto wide belt conveyor, which transfers the green ball onto roll distributor through AC frequency converter. Roll distributor fed qualified green ball of 5-16 mm onto travel grate machine. Undersized balls less than 5 mm are recycled to the balling system.

Baking System

Travel grate machine, rotary kiln and annular circular machine are designed to formulate baking system. Green ball are dried and preheated in the travel grate machine, and then baked, solidified in the rotary kiln, cooled in the annular cooler.

Travel Grate Machine

The travel grate machine is divided into 4 zones each unit, which are separately for suction drying zone, preheating zone I and preheating zone II.

Suction drying zone I & II

In suction drying zone, recoverable hot west gas suctioned by heat resistant fans from wind boxes in preheating zone II penetrates material layer downward from up, to keep green ball free of water and dried.

A set of main suction blower is provided to exhaust waste gas from wind box into the air through ESP.

Preheating zone I

Hot waste gas flow in the preheating zone I is utilized to keep drying green ball through material layer, in order to assure pellet to sustain high temperature in Preheating Zone II.

Hot waste gas in preheating zone I is merged through main pipes at a side of wind box with hot waste gas from suction drying zone to be discharged into air all together through ESP, Main suction blowers and chimney.

Preheating zone II

In preheating zone II, pellet is further heated. Pellet is partially solidified and hardened to achieve certain strength to sustain impact caused by pellet falling from travel grate machine into the rotary kiln to avoid being crushed in process of rotation of the kiln.

Rotary Kiln

Pellet, after preheated by the traveling grate machine, is discharged into the end of the kiln through scrapper and chute. The kiln is provided with HFO & producer gas spraying gun in its head.

The well baked pellet, is discharged, after large sizes of pellet is sieved out by fixed screen at the head of the rotary kiln, into the material receiving hopper of annular cooler.

Annular Cooler

The annular cooler consists of Rotary mechanism, Wind Box, Driving Device, Frame, Upper Cover and etc. The pellet, after cooled down to below 100 centigrade in the annular cooler, is discharged outside through discharging hopper.

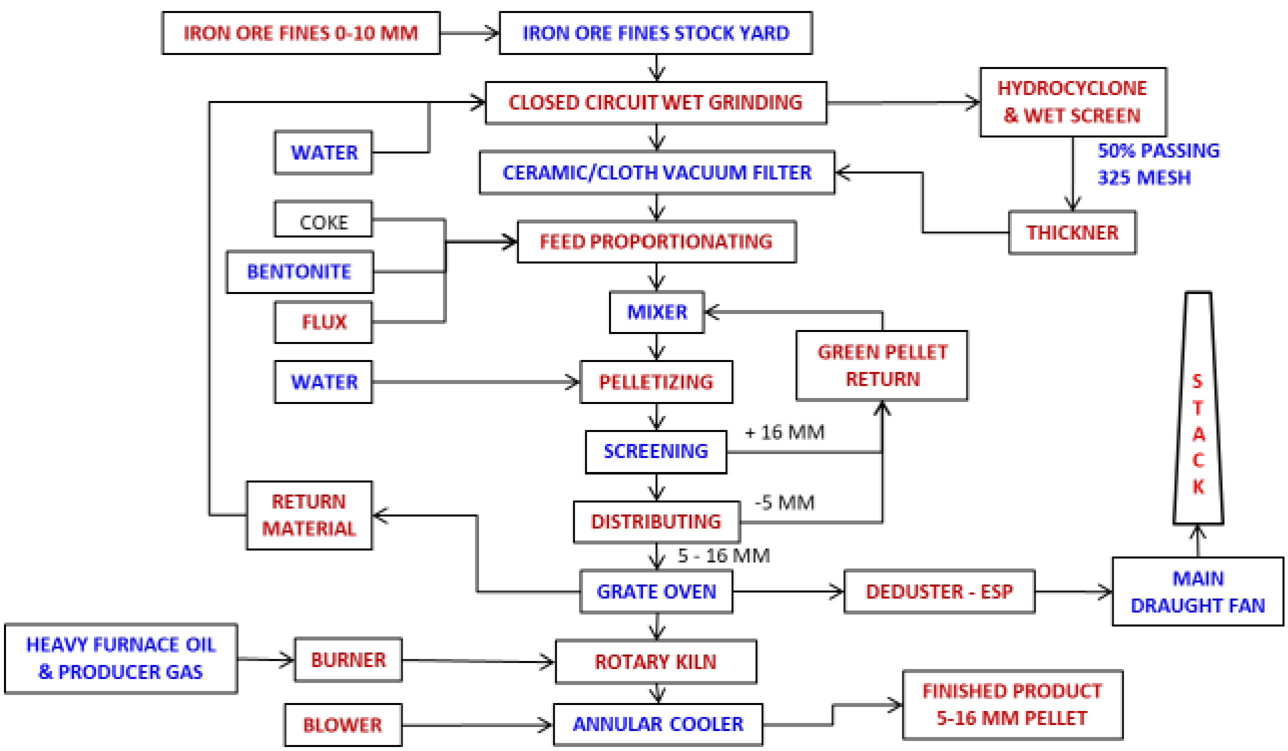
Main air suction blowers

Waste gas from preheating zone I merge with those from Wind Box of Suction drying zone is discharged through ESP and main chimney into the air. Dust content of waste gas to be discharged into the air is not more than 50 mg/Nm^3.

Finished Product Transportation System

Cooled pellet, after discharged from material discharging hopper of annular cooler, is transferred through belt conveyor into the Junction Box, where the cooled pellet 100 to 150 deg C is transferred through metal belt conveyor into the finished product transportation system.

Flow Sheet of Pellet Plant



Fuel Firing System

In view of better efficiency of heat in kilns and clean coal technology, the company is adopting a pulverized Coal firing system along with furnace oil in both the Pelletizing Plants in addition of coal gas.

Coal Gasification

Coal Gasifiers of 40,000 Nm^3/hr (10 Nos. x 4,000 Nm^3/hr) is estimated for pellet plant. Coal gasification process is one of the cleanest technologies currently available. In the process of coal gasification, water gas is produced with zero fugitive emission. The coal gasification process stands better in comparison to other fuels and there is about 50% reduction in the air emissions.

The Coal Gasification Facility consists of:

- Coal sizing.
- Coal conveying from ground hopper to top of battery of coal Gasifiers.
- Coal Gasifiers.
- Gas cleaning system consisting of gravity settlers, cyclones and electrostatic tar precipitator.
- Insulated gas piping.
- Process water system.
- Ash handling consisting of ash conveyor and storage hopper
- Instrumentation, automation & control for the entire facility

From environmental point view, the usage of producer gas through Coal Gasifier has proven lowest NOx, SOx, particulate matter and lower hazardous air pollutants. Ash is in the form of small clinkers / granules and also be slightly wet when disposed. Therefore, it does not fly and being used for brick making. Water used in the process is either converted into steam or re-circulated and therefore there is no waste water stream.

3.6 Raw Material requirement along with quantity and Its Source

3.6.1 Iron Ore Beneficiation Plant

INPUT		OUTPUT		USE
Material	Qty. (TPA)	Material	Qty(TPA)	
Iron Ore	2,00,000	Beneficiated Ore	1,40,000	For pellet manufacturing

		Tailings	60,000	Will be used for road construction and Cement Industries

3.6.2 Raw Material requirement proposed Sponge Iron Ore plant:

Input Raw Materials	Quantity (Ton)	Total Quantity (TPA)	Output from Kiln	Quantity (Ton)	Total Quantity (TPA)
Pellet	1.42	5,62,320	Sponge Iron	1.00	3,96,000
Coal	0.99	3,92,040	Char & Dolochar	0.12	47,520
Dolomite	0.03	11,880	Moisture	0.06	23,760
			ESP Dust	0.12	47,520
			Energy/Flue Gas	1.14	4,51,440
	2.44	**9,66,240**		**2.44**	**9,66,240**

3.6.3 Captive Power Plant

Raw Materials / Fuel	Average Consumption (TPA)
Coal	69300
Char	21600

3.6.4 Proposed Raw Material Balance of Pellet production of 1.0 MTPA

	INPUT				OUTPUT	
Item	**Quantity (Kg/ton)**	**Quantity (TPA)**		**Item**	**Quantity (Kg/ton)**	**Quantity (TPA)**
Iron Ore Fines DRY including Return Fines	1,040	10,40,000		Pellet production	1,000	10,00,000
Bentonite / Binder	10	10000		Process Loss	1	1000
Lime Stone / Dolomite	16	16000		LOI	23	23000
				Return Fines	42	42000
Green Ball Moisture (10%)	110	1,10,000		Steam	110	110000
TOTAL	**1,176**	**11,76,000**			**1,176**	**11,76,000**

Fuel Consumption in Gasification system

	Fuel	Gasification System (Tons /per Annum)
1	Coal	143183

Source of Raw Material

Sr. No.	Raw Material	Source	Mode of Transportation
1.	Iron Ores	Captive mines in Surajgarh, Gadchiroli & open market	By Road in Tarpaulin Covered Trucks
2.	Pellet	In-house Production	
3.	Coal	WCL Mines and open market	
4.	Char	Own Sponge Iron Plant	
5.	Dolomite/Bentonite	Open market	

3.7 Water Requirement, availability and its source

Sr.No.	Purpose	Quantity m^3/day			Source
		Existing	Proposed	Total	
1	Sponge Iron Plant	280	1765	2045	MIDC water Supply
2	Iron Ore Beneficiation Plant	190	410	600	
3	Pellets Plant	-	700	700	
4	Gasifier System	-	300	300	
3	Power Plant	280	2370	2650	
4	Domestic	10	55	65	
Total		**760**	**5600**	**6360**	

Wastewater Generation

Sr.No.	Purpose	Total Wastewater generation
1	Sponge Iron Plant	39
4	Gasifier System	15
3	Power Plant	570
4	Domestic	52
Total		676

Effluent generation:

Thickeners and filter press will be installed for the treatment of wastewater from the Beneficiation Unit. The wastewater from the other units will be treated in Effluent Treatment Plant and reused in the process. The domestic wastewater will be treated in Packaged Type STP.

3.8 Quantity of Wastes to be generated (Liquid and Solid) Scheme for their management/Disposal

Solid Waste Generation and Management in Iron ore Beneficiation Plant

The iron ore beneficiation process will generate tailing to the extent of about 30% of the input iron ore. At rated output of the plant, the annual generation of tailings would be 60,000 TPA. The generated tailings will be used partially for road formation, filling of low line areas, back filling of abundant mines nearby and partially as additives in cement plants.

Solid Waste Generation and Management in Sponge iron plant

The solid waste generation from the Sponge Iron process is Char & Dolochar and dust from ESP.

Solid Waste generation	Quantity (TPA)	Method of Disposal
Char &Dolochar	47,520	It will be used in own captive power plant (AFBC) & sold to secondary users viz. nearby power plant.
ESP Dust	47,520	It will be used for brick manufacturing and land filling

Solid Waste Generation and Management in CPP

Solid Waste generation	Quantity (TPA)	Method of Disposal
Fly Ash	27720	Land filling / leveling and supply to brick manufacturing units/ cement plants

Solid Waste Generation & Management in Pellet Plant

Solid Waste	Gasifiers	Utilization
	Ton/ Annum	
Ash Generation	57275	Sold to Brick manufacturer
Tar Generation	4000 KL	Sold to authorized vendor

3.9 Systematic representation of the feasibility drawing which give information of EIA purpose

The purpose of this Pre-Feasibility Report is to help the regulatory authority to review the proposed project and its impact on environment due to proposed expansion project. This Pre-Feasibility Report (PFR) accordingly addresses the change in environmental concerns for the proposed project of Iron Ore Crushing Screening, Beneficiation plant, Pellet Plant along with Coal Gasifier, Sponge Iron Plant, Captive Power Plant.

Chapter 4
Site Analysis

4.1 Connectivity

Project site is located at 50 m from Ashti Road which is further connected to Mul-Chamorshi highway. Nearest Railway Station is Kelzar 34Km at NW direction.

Table 2Details of buffer zone of Project site

Sr. No.	Particulars	Details
1	Nearest Highway	Aashti Road at 50 m in East direction.
2	Nearest Airport	Nagpur, 166 Km: NW
3	Nearest Railway Station	Kelzar ,34 Km : NW
4	Nearest Village	Konsari 0.5 Km : SSW
5	Nearest Town	Chamorshi, 20Km.: NNE
6	Nearest water body	Konsari Lake, 0.7 km : SW Varti Wagu stream 3.0 Km: SW Uksa Wagu Stream: 4.5 Km: SE Vainganga River, 6.0 Km (NW-SW) Andhari River 7.5 Km direction SW Deotri Nala 4.0Km South direction.
7	Forest	Markhanda Reserved forest Patched at 0.3Km East direction 0.7km North direction 2.0Km West direction 1.5 km South direction
8	School	ZP Primary School (1.0 KM, SW), ZP High School Konsari (1.0Km SE), Little Hearts English Medium School (9.0 Km S) Shishu Mandir Public School (9.5 km S) One School is in the downwind direction.
9	Hospital	Primary Health Center, Konsari (0.5 km SSE), Government Hospital, Yenapur (6.0 Km, N) One health center is in the downwind direction.

4.2 Land Form, Land Use and Land ownership

Present land is having flat terrain. The present land is in industrial use located in Konsari MIDC area.

4.3 Topography (along with map)

4.4 Soil Classification

The soils in the area are generally of clayey loam types with sandy loam soil in some areas. Soil sample from project site is collected and analyzed in line with IS: 2720 & Methods of Soil Analysis, Part-1, 2nd edition, 1986 (American Society for Agronomy and Soil Science of America).

4.5 Climate Data from Secondary Source

The regional climatologically data source from the IMD station at Gadchiroli indicates that during summer season humidity is about 25% and temperature varied between 27^{o}C to 48^{o}C.

The climatic condition of this area is semi arid. The maximum temperature goes up to 48ºC during summer in the month of May and the minimum temperature goes down to 4.0ºC during winter in the month of January-February. The winds in the area are light to moderate during summer and winter. The rainfall of the district is 1000 mm to 1400 mm. Generally light to moderate winds prevails throughout the year. Winds were light and moderate particularly during the morning hours. While during the afternoon hours the winds were stronger. A review of the wind rose diagram shows that predominant winds are mostly from E, SE, ESE, SSE and S directions

4.5.1 Existing land use pattern

The total leased land by MIDC is 125 Acres. About 30 acres of land is utilized for existing project and balance land will be used for proposed expansion project.

4.6 Existing infrastructure

All required infrastructure will be prevailed in the site.

Chapter 5.0
Planning Brief

5.1 Planning Concept

LMEL has proposed to increase the existing production capacity of Iron Ore Beneficiation from 63,000TPA to 2,00,000 TPA, Captive Power Plant(WHRB) from 4MW to 22MW(WHRB) + 15MW(AFBC) and Sponge Iron 62,700 TPA (2 x 95 TPD) to 4,58,700 TPA by installing 2x100TPD and 2x500TPD, Iron Ore Crushing and Screening plant:2,00,000TPA, Pellet Plant :1.0MTPA, and Coal Gasifier: 40,000 Nm^3/hr in existing plant located in MIDC Konsari, Village Konsari, Tahsil Chamorshi, District Gadchiroli, Maharashtra.

5.2 Population Projection

Total Population in 10 KM radius of site is estimated as 33144.

5.3 Assessment of Infrastructure Demand (Physical & Social)

Basic infrastructure demand for nearby area would be first to have internal roads, availability of clean and pure drinking water, availability of good schools, availability of Hospitals, community halls, Sulabh Shauchalaya , easy and faster means of transportation and connectivity to nearby town and city, availability of uninterrupted electricity etc.

5.4 Amenities/Facilities

The unit will spend CER amount as per OM 1-05-2018 for developmental activities.

Chapter 6.0
Proposed infrastructure

6.1 Industrial Area (Processing)

Rotary kiln, Boiler House, Iron ore crusher house, Gasifier etc will be installed in the proposed expansion project.

6.2 Green Belt

Out of 125acres 33% (41.25acres) land will be developed as green belt. Adequate green belt will be developed in plant premises. Locally available types of trees as specified by the Pollution Control Board will be planted, which are resistant to pollutants.

6.3 Social Infrastructure

Social infrastructure will be developed as per need in the village of close vicinity of the project.

6.4 Connectivity

The connectivity in terms of traffic, transportation road is already developed and good. There are well connected roads in the area.

6.5 Drinking Water Management

Drinking water facilities will be provided to employees in existing plant provided by MIDC

6.6 Waste water treatment system

Thickeners and filter press will be installed for the treatment of wastewater. The domestic wastewater will be treated in Packaged Type STP. LMEL will maintain a policy of Zero Discharge.

6.7 Power Requirement & Supply/Source

Total Power required for proposed expansion project is 45MW. Electric power will be supplied from own captive power plant and MSEB.

Chapter 7.0

Rehabilitation and Resettlement Scheme

The total land of Lloyds Metals & Energy Limited for the proposed expansion plant is 125 Acre which is industrial land in MIDC area. There will be no displacement of people. Thus R & R issues are not applicable.

Chapter 8.0
Project Schedule & Cost estimates

8.1 Likely date of start of construction

Construction activity pertaining to installation of proposed expansion will be started within 6 month from the date of Environmental Clearance and Consent to establishment from State Pollution Control Board.

8.2 Estimated Project Cost

The estimated project cost is about Rs 700 Cr. approx.

Chapter 9.0
Analysis of the proposal

9.1 Financial and social benefit

With the implementation of the proposed project, the socio-economic status of the local people will improve substantially. The land rates in the area will improve in the nearby area due to the proposed 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 study area, Primary health centre will also be developed by us and the medical facilities will certainly improve due to the proposed project.

9.2 Socio-Economic Development Activity

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 & Sanitation
- Drinking water
- Education for poor
- Village road
- Lighting

<u>Health & Hygiene</u>

- Personal and domestic hygiene
- Maintaining clean neighborhood,
- Weekly health camps offering free-check up and medicines
- Ambulance services
- Education and drug de-addiction, aids.

<u>Drinking Water</u>

- Making drinking water available at centralized location in the village

<u>Supporting Education</u>

- Providing books to all poor children
- Conducting annual sports festival in the village schools,
- Providing amenities like fan, lavatories
- Maintain play ground etc.

9.3 Other Benefits

- CER amount as per OM dated 01-05-2018 will be spend towards development activities of nearby villages as per the requirement of local people.

ENVIRONMENTAL MANAGEMENT PLAN

Air pollution

- There will be fugitive emission from proposed expansion plant which will be controlled by proper dust suppression system.
- The pollutants in the form of gases generated from various points of the Sponge Iron Plant. This has been taken into account and adequate measures are being taken to arrest the emission of pollutants within the stipulations of statutory norms. Adoption of technology like recovery of dust/ash for re-use as raw material is fulfilling the twin objectives of material conservation and pollution control.
- In Captive Power Plant, The gases generated from Sponge Iron project will be re-used to generate electricity.
- Proper Dust Suppression is proposed in the premises, sprinkling on internal roads, regular checkup & maintenance of vehicles, it will be ensured that all trucks/dumper will be covered by Tarpaulin.
- Water spraying on coal hip, coal yard and raw material is being done to control the fugitive emissions
- Internal roads are being Tarred / Concreted with installation of water sprinklers to suppress dust due to transportation.

Water Pollution

Thickeners and filter press will be installed for the treatment of wastewater from the Beneficiation Unit. The wastewater from the other units will be treated in Effluent Treatment Plant and reused in the process. The domestic wastewater will be treated in Packaged Type STP.

Noise Pollution

Noises from fans, centrifugal pumps, electrical motors etc. will be kept in control so that the ambient noise level shall not exceed 75dBA during daytime and 70dBA during night time. Noise pollution control measures will be provided in respective departments by way of providing silencers soundproofs cubicles / covers and proper selection of less noise prone machinery and by development of green belt.

Solid Waste Generation & Management in Plant

Solid Waste Management in Beneficiation Plant

The iron ore beneficiation process will generate tailing to the extent of about 30% of the input iron ore. At rated output of the plant, the annual generation of tailings would be 60,000 TPA. The generated tailings will be used partially for road formation, filling of low line areas, back filling of abundant mines nearby and partially as additives in cement plants.

Solid Waste Management in Pellets plant

- The main solid waste generation from the coal gasifier unit used in Pellets plant Ash and Tar. Ash will be sold to Brick manufacturer and Tar which will be sold to authorized vendors.

Solid Waste Management in Sponge Iron

- The solid waste generation from the Sponge Iron process is Char & Dolochar which will be used in captive power plant & sold to secondary users viz. nearby power plant and dust from ESP will be used for land filling and will sell to brick manufacturing unit

Solid Waste Generation and Management in CPP

- The solid waste generation from the Power plant is Fly ash which will be used in land filling / levelling and supply to brick manufacturing units/ cement plants

Plantation & Green belt

The 33% of the total plant area will be developed as green belt.