Pre-feasibility Report

for

Proposed expansion of existing sponge iron plant through installation of 2 X 600 TPD DRI kilns along with installation of Steel Melting Shop (3 X 10 T & 4 X 15 T Induction Furnaces with matching LRF & CCM and Metal Recovery Plant), Rolling Mill (2,30,000 TPA) and 49 MW (37 MW WHRB based + 12 MW AFBC based) capacity Captive Power Plant.

at

Ratanpur-Kandra Village, Gamharia Block,
District Saraikela-Kharsawan, Jharkhand

M/s Nilachal Iron & Power Ltd.

5, Bentinck Street, Kolkata – 700001, West Bengal

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PRE-FEASIBILITY REPORT

1.0 INTRODUCTION

Nilachal Iron & Power Limited (NIPL) is a company incorporated under the Companies Act 1956 and has its registered office at 5, Bentick Street, Kolkata - 700001, West Bengal (hereinafter referred as NIPL). M/s NIPL has rich experience in manufacturing of sponge iron and its group companies have rich experience in making iron and steel, rolling of metals (ferrous and non-ferrous), power generation, mining, ore transportation, metallurgical processes, refining, cement making. M/s NIPL has the financial capacity, organizational strength and the operational experience to set up an Integrated Steel Plant in the State of Jharkhand.

M/s NIPL is a continuously performing company with more than a decade of experience in the field of iron making and marketing. NIPL desires to expand and diversify into manufacturing and processing of metallurgical products like iron and steel making, rolling, pellet making, ferroalloy making and captive power generation with a focus on Eastern India. The company intends to further invest for its backward and forward integration so as to consolidate its core business activity and insulate it from market volatility.

On the basis of Consent to Establish (ref. F.No.: 307, dated 18.12.2003) obtained from Jharkhand State Pollution Control Board, M/s. Nilachal Iron & Power Limited had set up 1 X 350 TPD DRI Kilns to produce 1,05,000 TPA Sponge Iron at Ratanpur-Kandra Village, Gamharia Block, District Saraikela-Kharsawan in the state of Jharkhand. Further, the company obtained environmental clearance for Expansion of Sponge Iron Plant (350 TPD) into integrated steel plant (0.7 MTPA) alongwith Captive Power Plant (75 MW) from the MoEFCC on 24.12.2009 (F. No. J-11011/662-2008-IA II (I))

The expansion proposal (for which EC was granted) comprised of various facilities like Sponge Iron Plant, Blast Furnace, Pelletisation Plant, Coal washery, Steel Melting Shop, Oxygen Plant, Ferro-Alloys Plant, Rolling Mill and Captive Power Plant.

On account of global slow down, out of the above mentioned facilities the company could implement only 2 X 100 TPD DRI Kilns. after obtaining Consent to Establish from Jharkhand State Pollution Control Board (ref. A.No.:10094, dated 01.04.2009). At

present the above mentioned EC (F. No. J-11011/662-2008-IA II (I)), dated 24.12.2009 is not valid.

In the last CTO (ref. No. JSPCB/HO/RNC/CTO-6643985/2020/715 dated 26.03.2020) of the existing Sponge Iron Plant (1X350 TPD & 2 X100 TPD), setting up of WHRB was one of the specific conditions.

To comply the condition stipulated in the above CTO dated 26.03.2020, the company had set up 12 MW WHRB based Captive Power Plant. Consent to Establish for setting up 12 MW CPP was obtained from Jharkhand State Pollution Control Board on 26.03.2020 (ref. F.No.: JSPCB/HO/RNC/CTE-61 19599/2020/168)

CTO application for 12 MW WHRB based CPP and the Renewal application for CTO of 1X350 TPD & 2 X 100 TPD DRI Plant (which was valid till 30.06.2021) was made on 21.11.2022. The application is still under process at State Pollution Control Board.

It is pertinent to mention here that total operation of the company was suspended almost four years (i.e. from 2013 to 2015) under Jai Balaji Group (erstwhile promoter). In the 2016, NIPL was handed over to S. M. Niryat Private Limited to operate the plant on trial and run basis.

After two-year of trail run, M/s S. M. Niryat Private Limited had legally acquired the NIPL from Jai Balaji Group on 26.03.2018.

Under the new management/promoters, the company planned to expand the existing steel plant to Integrated Steel Plant through installation of 1800 TPD (3x600 TPD) DRI kilns along with Beneficiation Plant for Iron ore (1X0.6 MTPA), Pellet Plant (1x0.6 MTPA), Steel Melting Shop (2x25 T + 4x15 T Induction Furnaces) with matching LRF & CCM, Rolling Mill (0.35 MTPA), Ferro alloy Plant (4x16.5 MVA), Briquette plant for Chrome Ore (1x30 TPH), Oxygen plant (100 TPD) and 82 MW (57 MW WHRB based + 25 MW AFBC based) Captive Power Plant.

In accordance with EIA Notification, 2006 and its subsequent amendments, the company had applied for grant of EC to MoEFCC by submitting PFR, Form-1 and other relevant documents.

Terms of Reference (ToR) was granted on 06.09.2020 which was further amended on 12.02.2021.

As per the terms stipulated in the granted ToR (amended), public hearing was arranged on 27.09.2021, which was completed with grand success.

It is very well known fact that on account of COVID PANDEMIC, many local people surrounding the plant lost their jobs who were working in different state and returned back to home. A huge socio-economic pressure was developed in the project besiding area because of sudden increase of unemployment. To cope with the unprecedented socio-economic situation arisen that time M/s. Nilachal Iron & Power Limited was compelled to commence part of the project implementation of its expansion proposal for which the company obtained ToR and conducted successful public hearing, i.e. the plant activities were started without having any prior EC.

Although the project implementation was started on the basis of huge social interest, but it was a **violation case** under EIA notification, 2006 and its subsequent amendments.

Details of the project activities implemented by the company is given in next page.

Table 1.0 - Project Implementation status

S. N.	Facility	EC details	CTE details	CTO details	Implementation Status			Remarks
					Construction		Commissioning	
					Start	End		
1	1 X 350 TPD DRI Kiln (1,05,000 TPA DRI)	-	17.12.2003 (JSPCB ref. F.No.: 307)	JSPCB/HO/RNC/CTO-6643985/2020/715 dated 26.03.2020 valid till 30.06.2021 (Renewal application - dated 22.11.2022 under process at JSPCB)	December. 2003	March 2005	April 2005	CLOSURE NOTICE (11.04.2023) DUE TO NOT HAVING VALID CTO
2	2 X 100 TPD DRI Kiln (60,000 TPA DRI)	24.12.2009 J-11011/662/2008-IA-II(I)	01.04.2009 (JSPCB ref. A.No.:10094)		April 2009	March 2012	March 2012	
3	1 X 12 MW CPP (WHRB)	24.12.2009 J-11011/662/2008-IA-II(I)	26.03.2020 (JSPCB ref. F.No.: JSPCB/HO/RNC/CTE-61 19599/2020/168)		March 2020	June 2022	June 2022	
4	1 X 600 TPD DRI Kiln(1,98,000 TPA DRI)	-	-	-	September 2020	June 2022	July 2022	VIOLATION CASE
5	1 X 600 TPD DRI Kiln (1,98,000 TPA DRI)	-	-	-	June 2022	January 2023	Not Yet	VIOLATION CASE
6	37 MW CPP (WHRB)	-	-	-	August 2021	April 2023	Not Yet	VIOLATION CASE
7	Induction Furnace (3 X 10 T) 99,000 TPA Billets	-	-	-	June 2020	March 2022	March 2022	VIOLATION CASE
8	Induction Furnace (4 X 15 T)	-	-	-	May 2022	April-2023	Not Yet	VIOLATION CASE

	1,98,000 TPA Billets							
9	Rolling Mill (2,30,000 TPA)	-	-	-	June 2020	March 2022	March 2022	VIOLATION CASE

In the meantime, MoEF&CC published an O.M. F. No. 22-21/2020-IA.III, Dated: 7th July, 2021 bearing subject 'Standard Operating Procedure (SoP) for identification and handling of violation cases under EIA notification 2006 in compliance to order of Hon'ble Nation Green Tribunal in Q.A. 34/2020 WZ'.

Therefore, the proposed project of NIPL will be appraised as per the above mentioned MoEF&CC O.M. dated 7th July 2021.

Under the provision of the above said the project proponent has already deposited the required amount based on the calculation (1% of the total project cost under violation plus 0.25% of the total turnover for the period of operation after implementation) as mentioned therein.

As per the calculation, the Project Proponent has already deposited a Bank Demand Draft (D.D. No. No. 507592) amounting Rs. 5,36,32,000.00 (i.e Rupees Five Crores Thirty-Six Lakh Thirty-Two Thousand only) in favour of "Member Secretary, Jharkhand State Pollution Control Board, Ranchi".

Earlier proposal of the company (for which ToR was granted on 12.02.2021) has been revised and downsized, based on the feasibility of the existing market scenario. The new revised expansion proposal is being tabulated below:

Unit	*Existing Unit under Operation*	*Unit under Implementation*	*Proposed Units Capacity*	*Total Capacity and Products*
Sponge Iron Plant	*550 TPD (2x100 TPD, 1x350 TPD) (1,65,000 TPA DRI)*		*1200 TPD (2x600 TPD)* *(3,96,000 TPA DRI)*	*1750 TPD Sponge Iron (2x100 TPD, 1x350 TPD, 2x600 TPD) (5,61,000 TPA DRI)*
Steel Melting Shop (SMS) with matching LRF & CCM and Metal Recovery Plant	-	-	*Induction Furnaces (3x10 T + 4x15 T)*	*Induction Furnaces (3x10 T + 4x15 T) 2,97,000 TPA Liquid Steel (2,97,000 TPA Billets)*
Rolling Mill (Liquid Steel)	-	-	*2,30,000 TPA*	*2,30,000 TPA Rods, Bars, Light Structural*
Captive Power Plant	*12 MW WHRB based*	-	*49 MW (37 MW WHRB based + 12 MW AFBC based)*	*61 MW (49 MW WHRB based + 12 MW AFBC based)*

2.0 THE PROJECT

With respect to increasing demand for its products, M/s Nilachal Iron & Power Limited (NIPL) is now planning to expand the existing 550 TPD (2x100 TPD + 1x350 TPD) sponge iron plant through installation of 1200 TPD (2x600 TPD) DRI kilns, Steel Melting Shop (IFs: 3x10 T + 4x15 T Induction Furnaces) with matching LRF & CCM and Metal Recovery plant, Rolling Mill (0.23 MTPA) and 49 MW capacity Captive Power Plant based on WHRB and AFBC Boiler to utilize the waste heat generated from the proposed sponge iron plant and dolochar (generated/ to be generated from the existing and the proposed sponge iron plants) within its existing plant premises at Ratanpur-Kandra Village, Gamharia Block, District Saraikela-Kharsawan in the state of Jharkhand.

The proposed expansion project will be installed on the available land 34.80 Hectares (86 acres). The required land is already acquired by the company. The land is generally flat and does not come under flood zone. There is no human settlement at the project site. The existing units, the unit under implementation and proposed units are presented in **Table-2.0**.

Table-2.0: OVERALL PROJECT SCENARIO

Unit	*Existing Unit under Operation*	*Unit under Implementation*	*Proposed Units Capacity*	*Total Capacity and Products*
Sponge Iron Plant	*550 TPD (2x100 TPD, 1x350 TPD) (1,65,000 TPA DRI)*		*1200 TPD (2x600 TPD) (3,96,000 TPA DRI)*	*1750 TPD Sponge Iron (2x100 TPD, 1x350 TPD, 2x600 TPD) (5,61,000 TPA DRI)*
Steel Melting Shop (SMS) with matching LRF & CCM	-		*Induction Furnaces (3x10 T + 4x15 T)*	*Induction Furnaces (3x10 T + 4x15 T) 2,97,000 TPA Liquid Steel (2,97,000 TPA Billets)*
Rolling Mill (Liquid Steel)	-		*2,30,000 TPA*	*2,30,000 TPA Rods, Bars, Light Structural*
Captive Power Plant	*12 MW WHRB based*		*49 MW (37 MW WHRB based + 12 MW AFBC based)*	*61 MW (49 MW WHRB based + 12 MW AFBC based)*

3.0 INDUSTRY SCENARIO

Indian steel industry plays a significant role in the country's economic growth. It now occupies the position of 4th largest steel producer at the global front and struggling to become the 2nd largest producer of crude steel in the world by 2015-16. India has

taken over a central position on the global steel map with its giant steel mills, acquisition of global scale capacities by players, continuous modernization and up gradation of old plants, improving energy efficiency, and backward integration into global raw material sources. Global steel giants from across the world have shown interest in the industry due to its phenomenal performance in the recent years.

Demand-Supply Gap

On a conservative estimate, the steel demand in India is expected to touch around 90 MTPA by 2015 and around 150 MTPA by 2020. Steel supply is, however, expected to reach only around 88 MTPA by 2015 and around 145 MTPA by 2020. While the demand for steel will continue to grow in traditional sectors, specialized steel is also increasingly being employed in various hi-tech engineering industries. Globally, a relation can be observed between steel consumption and the GDP growth rate. Overall, India, being in a high growth phase with huge planned infrastructure development, is bound to witness sustained growth in steel requirement in the years to come.

M/s Nilachal Iron & Power Ltd. has drawn up a growth plan with the objective of increasing its market share in Indian steel industry. Keeping all these in mind, the Company has planned to set up the proposed expansion project in a more environment friendly way.

4.0 SITE LOCATION

The geographical co-ordinates of the project site are located at latitude 22°52'39.94"N and longitude 86°03'55.24"E. The altitude of the project site is 170 m above mean sea level.

Site for the proposed expansion project is located near Ratanpur-Kandra, Gamharia Block, District Saraikela-Kharsawan in Jharkhand State. The site is located adjacent to Chandil-Kandra road and Chowka-Kandra road. NH-33 and NH-32 are located at distances of 4.5 km and 5.5 km respectively, from the project site. The site is surrounded by Ragunathpur, Ratanpur, Raipur, Giddibera and Madhupur villages. Kunki railway station of South Eastern Railway is located almost adjacent to the project site. Nearest town is Kandra located at about 2.0 km from the site in southern direction.

District Headquarter Saraikela is located more than 25 km away from the project site in southwestern direction. Ganharia is located at a distance of about 7-8 km in southeast direction. Adityaur and Jamshedpur are located more than 15 km away in eastern and south eastern direction respectively, from the site.

The nearest river is Subarnarekha River, located at a distance of about 3.5 km from the project site in northern direction. Kharkai River is located towards south of the project site, about 9 km away. Kandra nala flows near the site.

No ecologically sensitive area like national park and wildlife sanctuary, archaeological monuments, health resorts and defence installations are present within 10 km radius of the site.

The forests located within 5 km radius of the project site are Pendrabera PF, Kanki PF, Basnapahar PF, Palubera PF, Giddibera PF. The forests located within 5-10 km radius of the project site are Muskikudar PF, Tetuldanga PF, Poradih PF, Dalma PF, Baijnathpur PF, Baslikoacha PF. The western fringe of Dalma forest range is located towards the northeast side of the site, about 8 km away.
Within 25 km radius of the project site there are many operating industries. The name of major industries is given below:

- Adhunik Alloys & Power Limited
- Kohinoor Steel & Power Limited
- AML Steel & Power Limited
- Bihar Sponge Iron Limited
- Chandil Sponge Iron Limited
- Ma Mangla Sponge Iron Limited
- Zoom Ballabh Steel & Power Limited
- Usha Martin Steel & Power Limited
- Power Grid Corporation of India Limited
- Spectra Alloys Private Limited
- Tata Steel Limited
- Telco Limited

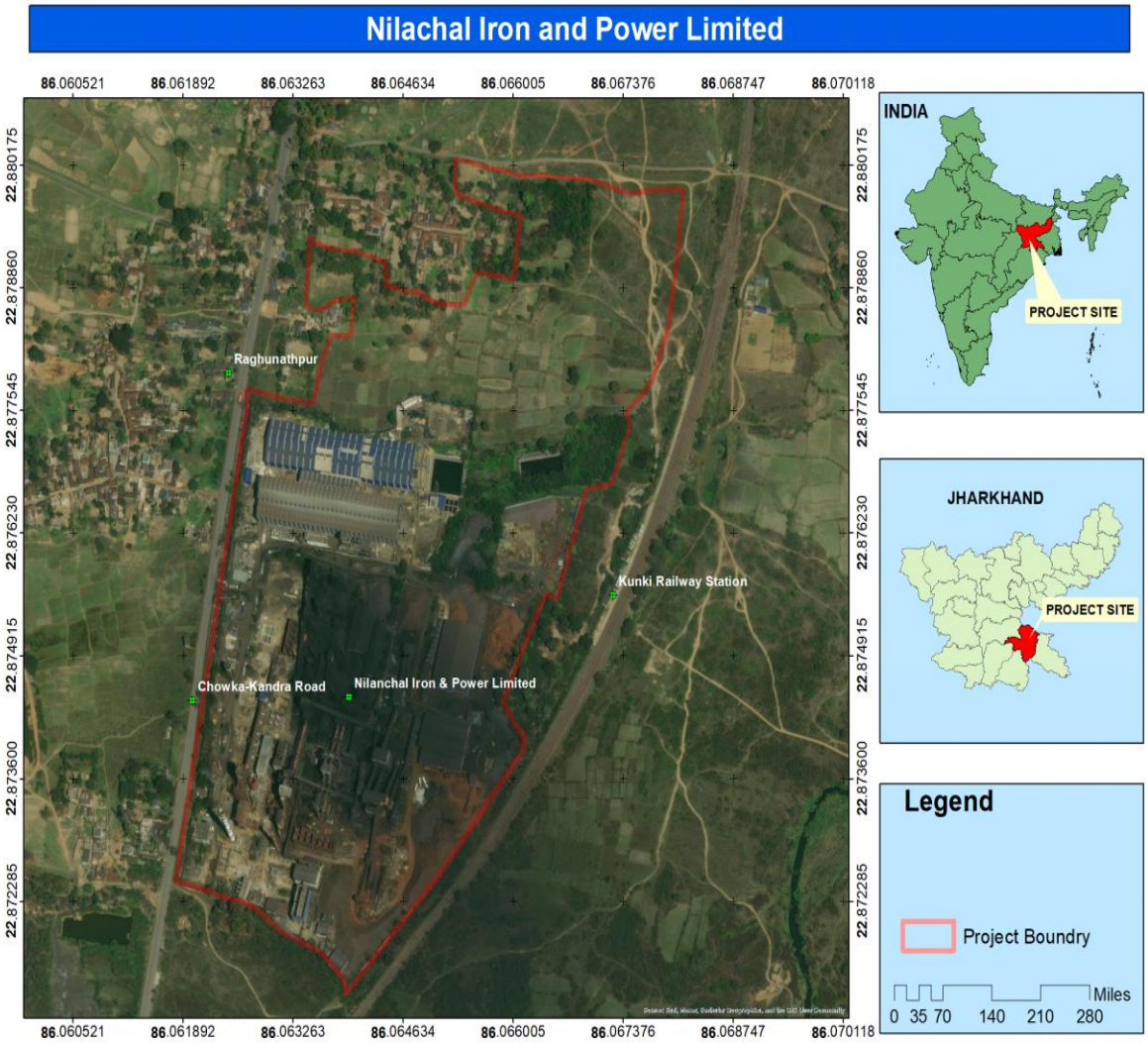


Figure – 1.0.

5.0 PROCESS OF MANUFACTURING

5.1 SPONGE IRON PLANT

M/s NIPL is planning to install 2x600 TPD DRI kilns for production of 1200 TPD (3,96,000 TPA) sponge iron in addition to the existing 2x100 TPD and 1x350 TPD DRI Kilns (1,65,000 TPA). The total capacity after expansion shall be 1750 TPD (5,61,000 TPA).

Manufacturing Process

The proposed plant shall use the coal based process in which iron oxide in pellet / iron ore will be reduced with non coking coal in a rotary kiln to make sponge iron. The raw materials (Pellet / iron ore, coal and dolomite), in desired quantities and sizes, are fed

into the rotary kiln from the feed end, after the rotary kiln has been fired and reaches the desired temperature. The rotary kiln is a refractory lined cylindrical vessel on which blowers and air pipes are mounted to provide combustion air to the kiln. The rotary kiln has a downward slope and is mounted on rollers to enable rotation. The angle of inclination, rotational speed, and length of time the charge is exposed to the atmosphere and temperature has important bearings on the quality of the end product. The rotary kiln has three functions as: It is a heat exchanger, Vessel for chemical reaction, Conveyor for solids.

With the rotation of the kiln, the charge moves down the slope and the surface of the material is exposed to heat. The heat exchange takes place via the non-refractory lining of the kiln. The reduction from oxide to metal occurs by gradual removal of oxygen at various temperatures giving rise to various intermediate oxides. Hot sponge iron is discharged from the kiln discharge end and taken into the rotary cooler. The effluent gas that contains coal volatile matter, fine carbon particles, iron fines and sponge iron dust is treated separately in the waste gas handling system. The system consists of:

a) Dust settling chamber
b) After burner chamber
c) Waste heat recovery boiler
d) Electrostatic precipitator
e) ID fan
f) Chimney

Direct Reduced Iron / Sponge Iron Process (DRI)

The process of reduction takes place inside the rotary kiln, which is mounted on tyres and supported by support rollers. The transverse motion of the kiln is controlled with the help of hydro thruster and thrust rollers. The kiln is rotated at the rate of 0.35 rpm with the help of a girth gear mounted on the kiln and connected with pinion drives, which in turn are coupled with gear boxes and motors.

The direct reduction of iron oxides inside the kiln is held due to CO gas, which is generated out of coal at nearly 950°C. Shell air fans are mounted on the kiln, which inject air in controlled manner into the kiln for creating reducing atmosphere. The CO reacts with Fe_2O_3 and reduces it to Fe. The kiln is lined with refractory for sustaining the high temperature.

The hot sponge iron is then cooled by indirect cooling inside a cooler. The rotary cooler is supported on tyres and support rollers. The cooler is rotated at the rate of 0.6 rpm with the help of a girth gear mounted on the cooler and connected with single

pinion drive, which is coupled with a gearbox and motor. The water is sprayed on the cooler shell while the sponge iron travels inside the cooler and hence, the material gets cooled at outlet to 150°C while discharged on the product conveyor.

In the kiln, the iron oxide will be heated to the reduction temperature of 1000-1050°C. The iron oxide of the ore will be reduced to metallic iron by carbon dioxide generated in the kiln from coal. The heat required for the reduction process will also be supplied by the combustion of coal.

Thermocouple will be installed along the length of the kiln shell for measurement of thermal profile of the kiln. The temperature will be controlled by regulating the amount of combustion air admitted into the kiln through no. of ports with help of fans mounted on the kiln will have variable speed drive. Auxiliary drive is provided for slow rotation.

The cooler will be lined with refractory castable for about 4.0 m from the feed end. Bypass arrangement will be provided at discharge end of the cooler for emergency discharge of materials. The cooled product will be conveyed to the product processing building by a system of belt conveyors.

The cooling water will be collected in the trough below the cooler and sent to the cooling tower for cooling. The cooled water will be re-circulated. Closed circuit cooling system will be followed in the plant.

Product Separation

The sponge iron along with unburnt coal in the form of dolochar comes out of the cooler. The sponge iron being magnetic is separated out of the dolochar by passing it through a magnetic separator. The sponge iron and char, recovered separately, are stored in the storage bunkers and discharged through trucks.

Off gas cleaning system

The off gases moving in counter current of material flow inside the kiln are at a temperature of 1000°C and carry coal dust, which is passed through dust settling chamber and after burning chamber (ABC). Air is added into the ABC for converting CO to CO_2. The hot flue gas stream is taken to the waste heat recovery boiler (WHRB) for utilization of the sensible heat for making steam. The off gases are then allowed to pass through ESP for removal of dust so that the concentration of dust is limited to below 30 mg/Nm^3 before being discharged from the chimney.

In-plant de-dusting system

Reverse air bag filter shall be installed for catching the dust from various conveyors, material handling equipment and-product handling equipment. The dust collected from the bag filter shall be conveyed pneumatically to a distant location and discharged on trucks in wet condition.

Raw Materials required for Sponge Iron manufacture

The main raw materials for sponge iron production are pellet / iron ore, coal, and dolomite.

Preferred Raw Material Characteristics

The principal burden material will be used for production of steel making grade DRI in the sponge making process is pellet / iron ore, non-coking coal and dolomite.

The pellet/iron ore should be preferably high in Fe content (>62% Fe). Coal with a high reactivity and high fusion temperature is preferred. The coal should also be non-coking.

A low ash fusion temperature is undesirable as it promotes formation of accretions in the kiln. The coal ash composition is also important as a siliceous ash might react with ferrous oxide to form low melting ferrous silicate and interfere with the reduction to metallic iron.

Product characteristics of Sponge Iron are as follows:

Sponge Iron (coal based) characteristics

Fe (total)		92% min
Fe (met)		83 % max
Metallization		90 % max
Carbon		0.25 % max
S		0.025% max
P		0.06% max
Re-oxidation		Non-pyrophoric characteristics

Major plant facilities

The major plant facilities for the sponge iron plant envisaged are as follows:

1. Day bins
2. Rotary kiln and cooler
3. Off gas system including waste heat power generation
4. Product processing and storage.

Day bins

There shall be a day bin building to cater to raw material requirement of the kiln. These bins will generally have storage of about one day's requirement of pellet, feed coal (4-8, 8-18 mm) & dolomite (1-4 mm). Weigh feeders will be provided to draw the required quantity of various materials in proportion from the bins and the same will be conveyed to the kiln feed and discharge end.

Rotary kiln and cooler

The rotary kilns with 5 m of diameter, 125 m length will be provided for reduction of iron oxides into sponge iron using non-coking coal as reductant. The kiln will be lined with abrasion resistant refractory castables throughout its length with damps at feed end and discharge end.

The rotary kiln will be supported on four piers. A slope of about 2.5% shall be maintained. Then main drive of the kiln will be by A.C motors with VVF drive control. The speed of the kiln will be in the range of 0.3-0.9 & 1.05-3.15 rpm. The auxiliary drive of the kiln will be by A.C motors.

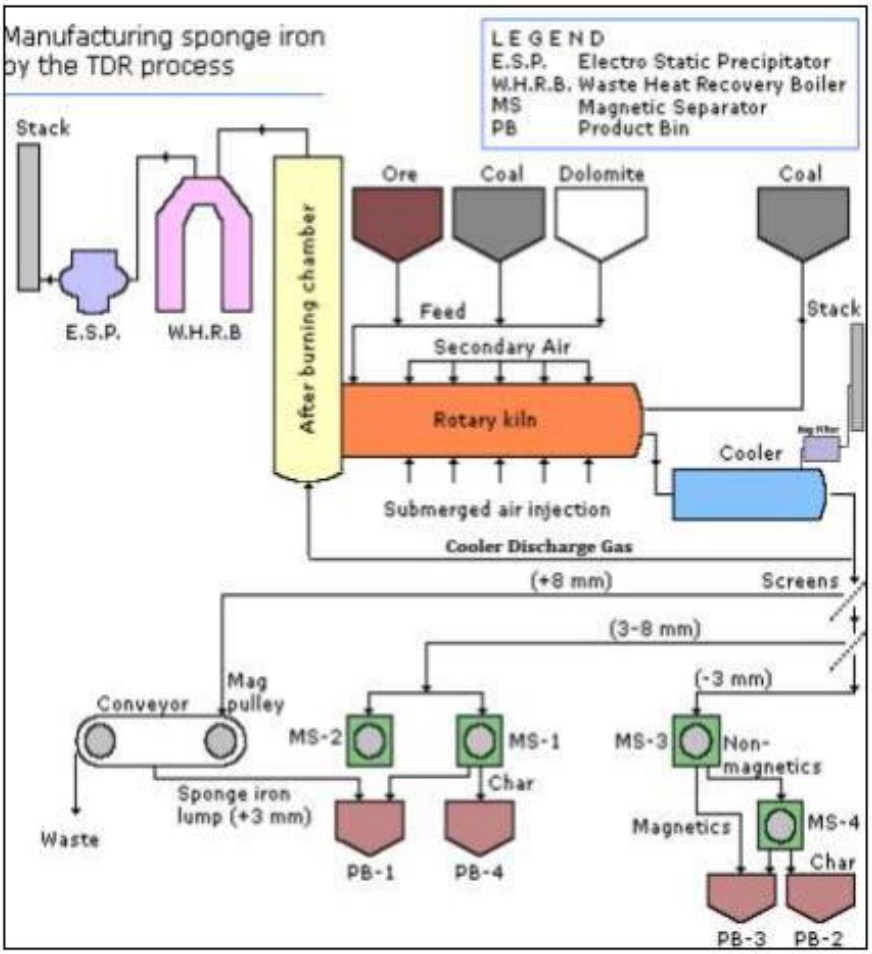
The other main components of the kiln will be as given below:

a. Feed end and discharge end transition housing of welded steel construction with refractory lining including feed chute.
b. Pneumatic cylinder actuated labyrinth air seal complete with auto lubricating at feed end and discharge end.
c. On board equipment like fans, manifolds, ports, slip ring, instrumentation etc.
d. Cooling fans at feed end and discharge end.
e. Feed end double pendulum valve & dust valves.

Product processing and storage

There shall be one product processing unit for handling the cooler discharge. The product containing sponge iron, char and spent lime from the cooler discharge end will be discharged to a set of conveyors and sent to the product processing building. The kiln cooler system shall have a separate surge bin. Product from surge bin can be withdrawn through vibrating feeder and to the product will first be screened in a double deck screen having 3 mm and 20 mm screens. +20 materials shall be dumped as rejects. The screened product i.e. +3 – 20 mm and -3 mm fraction shall separately be sent to the product storage separation. Sponge iron lump (3 – 20) shall be sent to the product storage building for storing in two no. of bunkers where three days storage has been proposed. The sponge ion fines (-3 mm) will be stored in the fines bunker in the product processing building itself where one day storage will be provided. The sponge iron lump and fines will be further conveyed from the respective bunkers by truck to the steel making unit as per the requirement. The char/non-magnetic shall be stored in a separate bin from where it will be sent to the power plant through conveyors for its utilization for power generation in FBC boiler.

Indicative process flow diagram of DRI Plant is presented below.

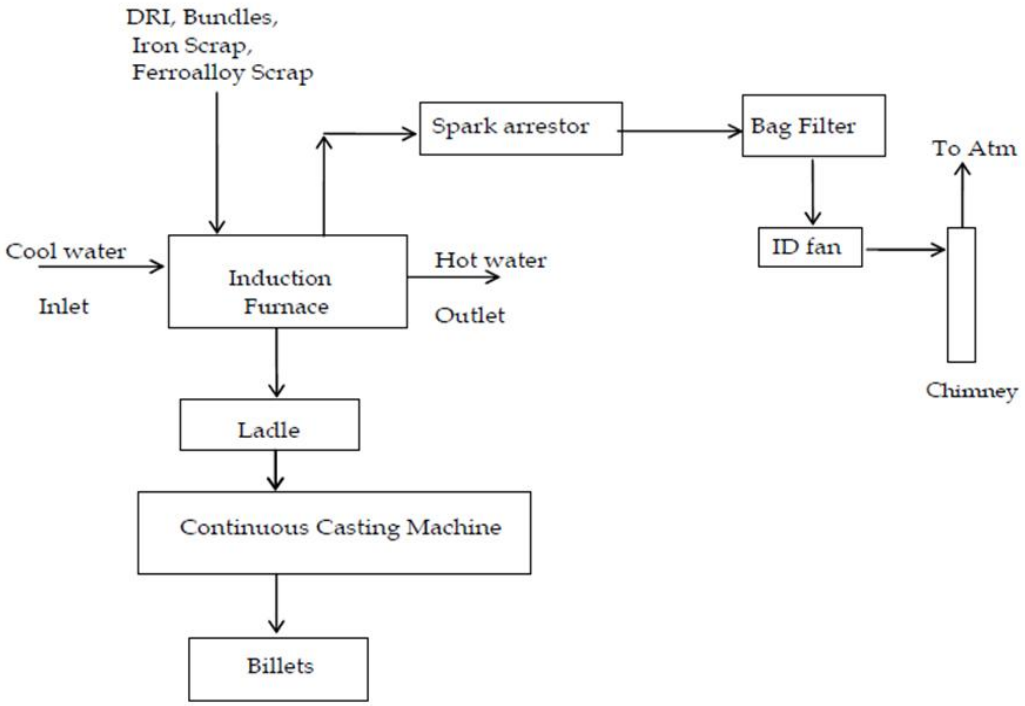


5.2 STEEL MELTING SHOP

5.2.1 INDUCTION FURNACE

It has been proposed to install 3 (three) numbers of 10 tonnes (each) and 4 (four) numbers of 15 tonnes (each) Induction furnaces having production capacity of 2,97,000 TPA Liquid steel (2,97,000 TPA Billets).

The plant will produce steel in the form of billets, TMT Bars and Strips & Structural products through IF-CCM-RM route. Steel making will be done using induction furnaces. A brief description of the processes is dealt in subsequent paragraphs and the process flow sheet is given below.



Steel Making by Induction Furnace

The greatest advantage of the Induction Furnace is its low capital cost compared with other types of Melting Units. Its installation is relatively easier and its operation simpler. Among other advantages, there is very little heat loss from the furnace as the bath is constantly covered and there is practically no loss during its operation. The molten metal in an Induction Furnace is circulated automatically by electromagnetic action so that when alloy additions are made, a homogeneous product is ensured in minimum time. The time between tap and charge, the charging time, power delays etc. are items of utmost importance is meeting the objective of maximum output in tones/hours at a low operational cost. The disadvantage of the induction furnace is that the melting process requires usually selected scrap because major refining is not possible.

The process for manufacturing steel may be broadly divided into the following stages:

i. Melting the charge mixed of steel & Iron scrap
ii. Ladle teeming practice for Casting (OR)
iii. Direct teeming practice for billet Casting unladdable teeming machine

The furnace is switched on, current starts flowing at a high rate and a comparatively low voltage through the induction coils of the furnace, producing an induced magnetic field inside the central space of the coils where the crucible is located. The induced magnetic fluxes thus generated out through the packed charge in the crucible, which is placed centrally inside the induction coil.

As the magnetic fluxes generated out through the scraps and complete the circuit, they generate and induce eddy current in the scrap. This induced eddy current, as it flows through the highly resistive bath of scrap, generates tremendous heat and melting starts. It is thus apparent that the melting rate depends primarily on two things (1) the density of magnetic fluxes and (2) compactness of the charge. The charge mixed arrangement has already been described. The magnetic fluxes can be controlled by varying input of power to the furnace, especially the current and frequency.

In a medium frequency furnace, the frequency range normally varies between 150-10K cycles / second. This heat is developed mainly in the outer rim of the metal in the charge but is carried quickly to the center by conduction. Soon a pool of molten metal forms in the bottom causing the charging to sink. At this point any remaining charge mixed is added gradually. The eddy current, which is generated in the charge, has other uses. It imparts a molten effect on the liquid steel, which is thereby stirred and mixed and heated more homogeneously. This stirring effect is inversely proportional to the frequency of the furnace and so that furnace frequency is selected in accordance with the purpose for which the furnace will be utilized.

The melting continues till all the charge is melted and the bath develops a convex surface. However, as the convex surface is not favorable to slag treatment, the power input is then naturally decreased to flatten the convexity and to reduce the circulation rate when refining under a reducing slag. The reduced flow of the liquid metal accelerates the purification reactions by constantly bringing new metal into close contact with the slag. Before the actual reduction of steel is done, the liquid steel which might contain some trapped oxygen is first treated with some suitable deoxidizer. When no purification is attempted, the chief metallurgical advantages of the process attributable to the stirring action are uniformity of the product, control over the super heat temperature and the opportunity afforded by the conditions of the melt to control de-oxidation through proper addition.

As soon as the charge has melted clear and de-oxidising ions have ceased, any objectionable slag is skimmed off, and the necessary alloying elements are added. When these additives have melted and diffused through the bath of the power input may be increased to bring the temperature of metal up to the point most desirable for pouring. The current is then turned off and the furnace is tilted for pouring into a ladle. As soon as pouring has ceased, any slag adhering to the wall of the crucible is crapped out and the furnace is readied for charging again.

As the furnace is equipped with a higher cover over the crucible very little oxidation occurs during melting. Such a cover also serves to prevent cooling by radiation from the surface heat loss and protecting the metal is unnecessary, though slags are used in special cases. Another advantage of the induction furnace is that there is hardly any melting loss compared with the arc furnace.

A metal Recovery Plant is proposed to recover the metals from the stag, to be generated.

5.2.2 CONTINUOUS CASTING MACHINE

The molten steel from the IF is cast in a continuous casting machine to produce billets. In some processes, the cast shape is torch cut to length and transported hot to the hot rolling mill for further processing. Other steel mills have reheat furnaces. Steel billets are allowed to cool, and then be reheated in a furnace prior to rolling the billets into bars or other shapes.

The process is continuous because liquid steel is continuously poured into a 'bottomless' mould at the same rate as a continuous steel casting is extracted.

1. Before casting begins a dummy bar is used to close the bottom of the mould.
2. A ladle of molten steel is lifted above the casting machine and a hole in the bottom of the ladle is opened, allowing the liquid steel to pour into the mould to form the required shape.
3. As the steel's outer surface solidifies in the mould, the dummy bar is slowly withdrawn through the machine, pulling the steel with it.
4. Water sprays along the machine to cool/ solidify the steel.
5. At the end of the machine, the steel is cut to the required length by on line PLC based hot shearing machine.
6. After cut, hot billets will directly go to rolling mill through conveyer.

5.2.3 Metal Recovery Unit

Suitable metal recovery unit will be part of the proposed Steel melting shop for metal recovery from IF slag.

5.3 ROLLING MILL

The company is planned to set up a rolling mill of capacity 2,30,000 TPA for production of TMT Bars, Strips & Structural as a finished product.

Hot rolling process

Hot billet directly transferred through conveyor in the rolling mill. Rolling Mill is already in running condition with all water circuits on, to check the sizes on every pass. If some minute adjustment is required it is made & again samples are fed to confirm size of pass in Rolls, then 1st piece of billet is passed through & leader & tail end is cut in on line Rotary Shears & final size, which is put on cool Bed manual & again size is reconfirmed.

If rolling is going on without hindrance which is observed upto 10 approx. pieces the process become continuous. On an average when 8 MM size is being rolled & 6 Meter billet is use approximately 65-70 pieces come in one hour. Production increases for high sized sections 10 MM & above on Cooling Bed when quantity is collected, one piece of 48 M length is pushed manually/ automatically on pieces conveyor. Which

when pass through cold shear is cut in to 12 M length & workers make bundles of these & stack these size wise for checking & dispatching.

5.4 CAPTIVE POWER PLANT

The company intends to set up a Captive Power Plant of 49 MW capacity (out of which 37 MW will be based on WHR Boiler, utilizing waste heat, generated from the proposed DRI plant and 12 MW, based on AFBC Boiler, utilizing dolo-char, generated from the existing as well as the proposed DRI plants & domestic coal).

Waste Heat Recovery Boilers will be installed behind the ABC of proposed DRI kilns in bypass configuration. The flue gases after ABC will be taken to unifired furnace chamber and then flow over banks of super heater, convective evaporator and economizer before being discharged to atmosphere through ESP, ID fan and stack. In the proposed Fluidized Bed Combustion (FBC) boiler envisaged, combustion of fuel particles is achieved in suspension with an inert aggregate i.e. sand. Combustion air will be fed through air nozzles from underneath into the sand fuel bed. Oil burner will be provided for start up and low load flame stabilization. The fuel proposed in FBC Boiler is dolochar. The flue gases will pass over various heat transfer surfaces to ESP and then finally discharged into chimney by ID fan. Condensate extraction pumps will pump the condensate after condenser of STG to a common deaerator. Feed water from the deaerator will be pumped to the waste heat recovery boiler as well as AFBC boiler by boiler feed pumps. The steam generated from both the Waste Heat Recovery boilers and AFBC boilers will drive the steam turbine through a common steam header.

5.4.1 Brief description of major plant and equipment

The proposed plant will comprise the following major systems:

- Fluidized bed combustion boiler with auxiliaries
- Steam turbine generator and auxiliaries
- De-aerator and feed water system
- Electrical systems
- Instrumentation and controls
- Compressed air system (service air and instrument air)
- Handling & hoisting facilities
- Plant communication system
- Ventilation and air conditioning
- Fire fighting detection & alarm system

5.4.2 Waste Heat Recovery Boiler

After burning chamber (ABC) and Dust settling chamber (DSC) will be located at the exit of DRI Kilns. Part of the dust carried by the waste gases will settle down at DSC. The DSC and ABC assembly will be connected to the DRI Plant Kiln through refractory lined duct.

The combustibles in the waste gases are burnt in the After Burning Chamber which will raise the waste gas temperature thus making the waste gases free from carbon mono-oxide. Provision for spraying water will be made to control the temperature if required.

From ABC outlet the WHRB will be connected through a refractory lined duct. An emergency stack cap on the top of ABC will be provided for diverting the waste gases to atmosphere when WHRB is under shutdown or break down. The energy balance of WHRB boiler based on DRI waste gas is as follows:

Facility	Hot Waste Gas Generation	Ultimate Hot Waste Gas Generation	Remarks
Proposed DRI Plant (2x600 TPD)	3,00,000 NM^3/ hr. with gas temperature 900^o - 1000^{o}C	Total 3,00,000 NM^3/hr with gas temperature 900^o-1000^{o}C will be generated from DRI Plant. Such volume of waste gas will generate around 130 (2 X 65 T) tonnes of steam per hour from WHRB boiler.	130 tonnes of steam per hour generated from WHRB boilers will be used for generation of 37 MW Power.

The boiler will be complete with evaporator steam drum, mud drum, bank of super heaters, economizer, atemperator, air fans, ESP, internal piping etc. Soot blowing and super heater atemperation system will be also provided. Boiler will be provided with blow down tanks (IBD, CBD etc), sample cooler.

Flue gas cleaning system

The exhaust gases will be discharged from boiler to ESP and then into the atmosphere through induced Draft fan and chimney. The pressure drop in the boiler ducts and ESP will be kept to match with the requirement of ID fan. The boiler will be of semi out door type with a weather canopy and side covering of trapeze corrugated steel sheets or other suitable materials as available.

The gases passing out of WHRB will be passed through one multi-field Electrostatic Precipitator before escaping the gas, having huge quantity of dust particles, into the atmosphere. The ESP will be installed between the WHRB and the stack. The dust content in gas down stream of ESP shall be limited to 30 mg/Nm^3. The ESP Unit will be provided with transformers, rectifier and controls. The dust particles will be collected below ESP in hoppers and conveyed by means of conveyors or pneumatically and stored in silos. This will be subsequently disposed by trucks.

5.4.3 AFBC Boiler

It is planned to install 12 MW capacity captive power plant based on AFBC Boiler, utilizing dolo-char, generated from the existing and the proposed DRI Plants. The AFBC boiler plant shall comprise of boiler and its auxiliaries.

The boiler

Boiler will be completed with evaporated steam drum, mud drum, bank of super heater. Attemperation system will be also provided. Boiler will be provided with blow down tanks (IBD, CBD etc), sample cooler. The exhaust gases will be discharged from boiler to ESP and then into the atmosphere through 1x100% induced Draft fan and chimney.

The ESP will be installed to dust content within 30 mg/Nm^3.

SO_2 emission shall be limited to 100 mg/Nm^3 by neutralizing the sulphur in coal with Dolomite. NOx emission shall be content within 100 mg/Nm^3 by the installation of low pressure and high volume NOx burner.

Steam Turbine generator:
There will be one TG of 12 MW capacity. The broad description of the steam turbine generator envisaged is indicated below:

The Steam turbine will be single, Horizontal, Singled bleed condensing type. The set shall be complete with gear box, Barring gear box, condenser, air evacuation system condensate extract pumps, generator cooling systems, gland sealing with gland vent condenser and lube oil system. Condensing steam turbine generator with inlet steam parameter of 66 ata and 465+/-5°C at emergency steam valve inlet is provided.

Conversion of Heat Energy in Steam to Mechanical work will be done by expanding the same in Steam Turbine which shall provide mechanical energy in the form of rotational torque. Steam while passing through various stages of Turbine will release both pressure and temperature and ultimately dumped to Condenser at near vacuum condition. Low pressure steam will be condensed by Air in Air Cooled Condenser. Condensed Water from the Air Cooled Condenser will be fed back to Boiler through Air Ejector, Gland Steam Condenser and Deaerator for re-generative heating and air removal. Boiler Feed Pump shall take suction from Deaerator and feed deaerated water to Boiler Economiser.

Deaerator and feed water system:
There will be a deaerator with feed tank. 2 numbers boiler feed water pumps with motors (1 working + 1 stand by) shall be provided along with common suction header, auto recirculation valve, suction/discharge valve, non return valve, pressure gauge, temperature gauge etc.

Electrics:
The electrics include generators, transformers, switchgear – main and auxiliary, battery room etc.

Instrumentation & Control:
Effective control and measurement of process parameters along with data acquisition system in the control room has been envisaged.

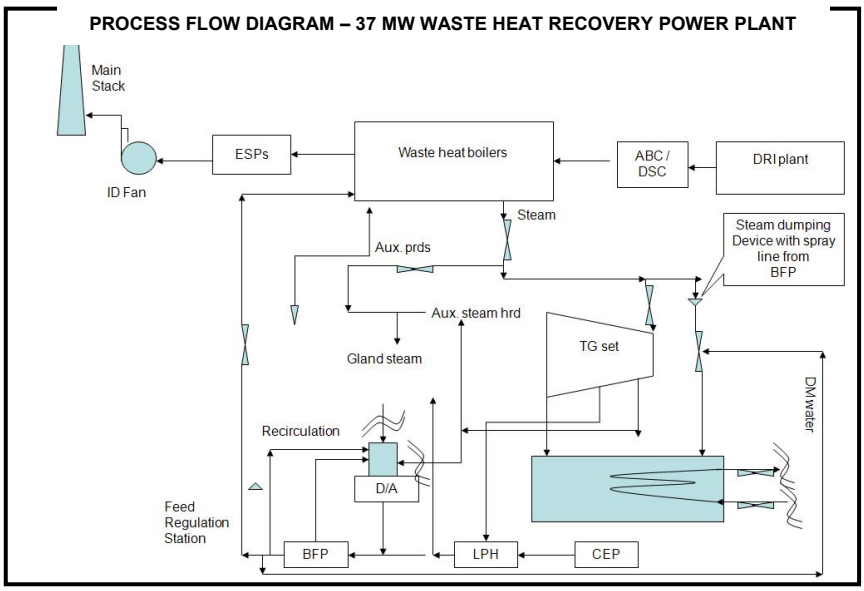
Auxiliary Services:
Auxiliary service systems such as ash handling, EOT crane, telecommunication, air conditioning and ventilation shall be adequately envisaged.

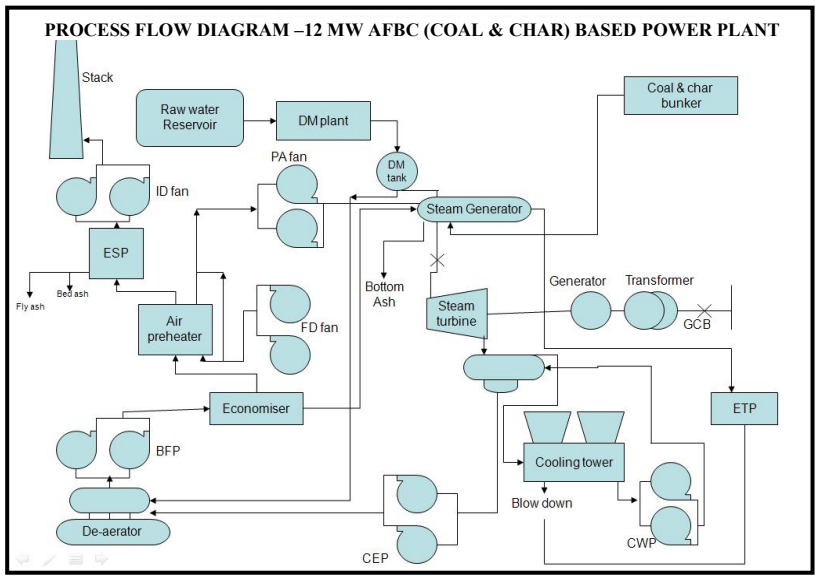
Ash Handling:
Ash handling plant system design would be based on above estimated figures and bottom and fly ash equipment parameters would be guided by the following:

The fly ash from the proposed boilers will be collected in economizer hoppers, air heater hoppers, ESP hoppers and will be conveyed through dense phase pneumatic conveying system to silo. The fly ash to be disposed from the silo will be moistened to reduce the dust while collecting the ash. The system will be provided with telescopic chute and rotary feeder for loading the ash into covered trucks.

Bottom Ash: Bottom ash from proposed boilers will be carried through a submerged belt conveyor to silo. From Silo it will be conveyed to safe destination through covered trucks in moistened condition.

Indicative process flow diagram of WHRB based and AFBC based captive power plant are presented in below.





6.0 UTILITIES & COMMON FACILITIES

6.1 RAW MATERIAL

The annual requirement of major raw materials, which will be required additionally for the proposed project, is presented in **Table-3**.

Table-3: List of Raw Materials

SL. NO.	RAW MATERIALS	ANNUAL REQUIREMENT (IN TPA)
DRI PLANT (2x600 TPD)		
1.	IRON ORE	6,73,200
2.	COAL	3,96,200
3.	DOLOMITE	23,760
INDUCTION FURNACES (3x10 T + 4x15 T)		
1.	SPONGE IRON	2,97,000
2.	SCRAPS / RETURN SCRAP	29,700
3.	PIG IRON	29,700
4.	FERRO ALLOYS	3,564
ROLLING MILL (2,30,000 TPA)		
1.	BILLETS	2,39,200
CAPTIVE POWER PLANT (12 MW) BASED ON AFBC BOILER)		
1.	DOLO-CHAR	1,12,750
2.	COAL	54,750

Raw materials will be received at plant site by rail/road. All the trucks for raw material and finished product transportation shall comply with the applicable environmental norms.

6.1.1 Raw Material Storage and Handling

Raw materials will be brought to the plant site by means of rail. Railway siding will be taken from the nearest Kunki railway station and brought inside the plant site upto the raw material handling yard. The materials will be unloaded by means of wagon tipplers. The unloaded materials will be stacked in the stock yard by means of stackers. Reclaimers will pick up the raw materials and place them on conveyor belts for further transportation to the consumption points.

6.2 WATER SYSTEM

Water requirement for the project is about 2,780 cu.m/day, which will be taken from Subarnarekha river.

Water will be brought to the site by underground pipelines and stored in the water reservoir. Water will be clarified for making it fit for industrial use in raw water treatment plant. Part of the industrial water will be treated in softening plant and distributed through closed circuit pipelines as soft water make-up. Part of the water will be used to produce DM water, necessary for boiler feed requirement. The recirculating

cooling water system will be applied for all units of the integrated steel plant. The entire waste water will be reused and none will be discharged outside the plant premises. Water for drinking will be taken from the water reservoir and treated in a chlorination unit by adding bleaching power. Drinking water to the plant will be distributed through overhead tank by gravity.

The estimated unit wise make up water requirement for the proposed project from each unit are given below in **Table-4**.

Table-4: Water Requirement

Sl. No.	Name of Unit	Water Requirement, cu.m/day
EXISTING		
1	Sponge Iron Plant (2 X 100 TPD & 1 X 350 TPD)	350
2	CPP (12 MW) - AIR COOLED	300
	SUB TOTAL (A)	**650**
1	Sponge Iron Plant (2 X 600 TPD)	800
2	Induction Furnaces (3x10 T + 4x15)	280
3	Rolling Mill (2,30,000 TPA)	50
4	Captive Power Plant 37 MW (WHRB) - Air Cooled	700
5	Captive Power Plant 12 MW (AFBC) - Air Cooled	250
6	Domestic Use (for plant)	50
	SUB TOTAL (B)	**2,130**
	Total	**2,780**

6.3 DEMINERALISATION PLANT

Two Demineraliser chains are proposed for meeting the boiler feed water requirement. Each of the DM chains would comprise activated carbon filter, strongly basic cation exchanger, degasser tower, strongly basic anion exchanger and mixed bed unit. The system will be complete with necessary pumps, control valves, instrumentation and controls etc. for complete sequential, semi-automatic push button operation from the common control panel. The DM water from the mixed bed unit outlet will be stored in a mild steel rubber lined water storage tank. The ion-exchangers in the DM chains will be regenerated by HCl (cation resins) and caustic soda (anion resins). Appropriate handling, storage, mixing and injecting facilities of the chemicals will be provided for convenient operation of the plant.

6.4 POWER

As per initial estimation, total power requirement of the proposed project will be about 62.2 MW which will be sourced from 61 MW capacity Captive Power Plant and rest from State Grid. Unit wise power breakup for the proposed project is presented in **Table-5**.

Table-5: Power Requirement

Sl. No.	Name of Unit	Power Requirement (MW)
EXISTING		
1	Sponge Iron Plant (2 X 100 TPD & 1 X 350 TPD)	1.5
2	CPP (12 MW) - AIR COOLED	1.2
3	Utility & Misc. Uses	0.5
	SUB TOTAL (A)	**3.2**
PROPOSED		
1	Sponge Iron Plant (2 X 600 TPD)	3.0
2	Induction Furnaces (3x10 T + 4x15)	45
3	Rolling Mill (2,30,000 TPA)	3.5
4	Captive Power Plant 37 MW (WHRB) - Air Cooled	3.7
5	Captive Power Plant 12 MW (AFBC) - Air Cooled	1.2
6	Utility & Misc. Uses	2.5
	SUB TOTAL (B)	**59.0**
	GRAND TOTAL (A+B)	**62.2**
	SOURCE	
	CAPTIVE POWER PLANT	**61.0**
	FROM OUT SOURCE(JBVNL)	**1.2**

6.5 COMPRESSED AIR SYSTEM

Dry compressed air will be used at various points like DR plant, SMS, Rolling Mill, TPP, etc. The exact capacity of the air compressors is not available at present. The compressors, dryers and associated pipework will be located in one place, within a building. Compressed air to various consumers will be distributed through a compressed air piping system.

6.6 FUEL STORAGE FACILITIES

LDO is proposed to be used for startup in boilers of power plant. 100 KL LDO storage tank will be installed. LDO will be brought by road tankers and unloaded into the storage tanks by means of pumps. Delivery pumps of adequate capacity will be provided for circulating oils in the ring main. From the ring main oil will be supplied to the consuming points. Necessary unloading header, hoses, piping, valves and fittings will be provided for the system.

6.7 LABORATORY

Quality assurance will be possible in the form of chemical analysis, which can be provided by well-equipped laboratories with day to day quality control at all stages of processing and quality evaluation of outgoing products. Following separate laboratories will be installed within the integrated steel plant complex:

- Iron making lab catering to the quality control requirement of DRI plant
- Steel making lab catering to SMS, CCM and Rolling Mill
- Power plant lab catering to fuel, water and ash analysis
- Environmental laboratory catering to pollution monitoring and testing needs of the plant

6.8 AIR CONDITIONING AND VENTILATION SYSTEMS

Ventilation and air conditioning system comprises fans, air filters, air conditioning units, duct work, pumps, cooling tower, air supply grills, dampers, insulation, electrical and instrumentation and controls required for protection of equipment from excessive thermal loading and working comfort for plant personnel. All control rooms, offices, laboratories will be air conditioned and the type depends on specific requirement and application (room air conditioners or centralized air conditioners). Highly energy efficient HVAC system comprising water cooled chillers and cooling systems will be installed. CFC and HCFC free refrigerants will be used in the air conditioning system. Cooling towers will be provided for dissipation of water vapours.

All work areas will be provided natural ventilation and where required, mechanical ventilation will be provided. Cast house, SMS and Rolling Mill shops will be provided with mechanical ventilation and exhaust / pressurized system for adequate dispersal of fugitive dust and fumes. Air-coolers will be provided in work areas that are subjected to high heat radiation stress. The details and type of systems proposed are shown below in **Table-6**.

Table-6: Details of Type of System Proposed

	Location / Shop	Ventilation Facility
1	Electrical premises	Pressurized ventilation with washed air
2	Compressed air station	Exhaust ventilation
3	Battery rooms	Exhaust ventilation
4	Pump houses	Exhaust ventilation
5	Toilet	Exhaust ventilation
6	Stores	Exhaust ventilation
7	Repair shops	Exhaust ventilation & man-coolers
8	Transformers room in SMS	Pressurized ventilation with fan and filter
9	SMS	Exhaust ventilation
10	Casting Shop	Exhaust ventilation
11	Rolling Mills	Exhaust ventilation
12	Laboratory	Exhaust ventilation
13	TG Building	Pressurized ventilation with washed air

6.9 REPAIR AND MAINTENANCE FACILITY

In order to ensure continuous operation of plant and equipment, adequate repair and maintenance facilities comprising Mould and Roller Repair Shop, Maintenance Garage and Loco and Wagon Repair Shop will be established. The shops will be equipped with horizontal boring and milling machine, plano milling machine, deep hole drilling, radial drilling machine, copy milling machine, roll turning lathe, press, submerged arc welding machine and other welding equipment, stands for assembly, disassembly and

checking of rollers and copper moulds, test stands and other equipment like pedestal grinder, bench grinder, bench drill, fitters bench, etc. The repair shop will be housed in a building and serviced by several EOT cranes. The garage will have one main bay and one lean bay for routine repairs of automobile fleet of the plant. The lean bay comprises parts store, electrical repair section and battery room. The main bay consists facilities like inspection pits, hydraulic elevated platform, washing ramp and testing facilities. The diesel loco and wagon repair shop comprises two bays, one for loco repair and one for wagon repair.

6.10 PRODUCT DISPATCH

The steel products will be dispatched using rail. Some road dispatch may be necessary keeping in view the requirement of customers located in adjoining districts. The steel products from Rolling Mill will be stacked in covered store yard from where it will be directly loaded into rail wagons by means of EOT cranes. EOT cranes will be also used to load the products on truck trailers.

6.11 OCCUPATIONAL HEALTH AND SAFETY

Exposure problems to noise, dust, heat and gases are the major occupational hazards. Silicosis, Bronchitis, CO poisoning and Noise induced hearing loss are the occupational health hazards identified from steel and power plants.

Workers involved in raw material handling activity, ash handling and those working close to the furnaces are exposed to high dust levels. Over a long period of time such exposure is likely to result in respiratory problems like silicosis, asthma and bronchitis. Measures will be implemented to reduce the dust generation at the originating point by installing appropriate control devices and / or regular water sprinkling. Plant personnel working in dust prone areas will be encouraged to wear personnel protective equipment like air filters over their nose. Job rotation schemes will be practiced for over-exposed persons.

It will be ensured that workers are not exposed above the threshold noise levels through suitable administrative controls. PPE like earplugs and muffs will be provided and administrative pressure applied for using them. Auditory examination by qualified doctors upon the first employment and thereafter periodic examination will be conducted which include determination of auditory threshold for pure tones.

Medical checkup of all the employees will be done during pre-employment. The health status of workers will be regularly monitored under an occupational surveillance programme. Under this programme, all the employees are subject to detailed medical examination at the time of employment. The medical examination covers the following tests.

- General Physical Examination and Blood Pressure
- X-Ray Chest and ECG
- Sputum Examination
- Routine Blood and Urine Examination

- Lung Function Test

The medical histories of all the employees will be maintained in a standard format. Thereafter the employees will be subjected to medical examinations on annual basis. The tests to be carried out and the results of which will upgrade the data-base of medical history of the employees have been presented in **Table-7**.

Table-7: Details of Tests to be carried out

	Disease	Tests to be conducted
1.	Heart Disease	ECG, blood for lipid profile, stress test, 2D-Echo and other tests are required
2.	Lung Diseases	Total Count (WBC Count), Differential Count, Sputum examination, X-ray Chest, Alveolar macrophage
3.	Asthma	Differential Count, ESR, X-ray chest, Lung Function Tests (Spirometry) and Sputum examination
4.	Diabetes	Random blood sugar, urine sugar, if positive, BSL-Fasting / pp, Diabetic profile
5.	Hypertension	Blood Pressure reading, if required Renal profile, ECG and stress test
6.	Abdomen Pain	Routine Urine for Albumin, Sugar bile salts, Liver function test

Workers exposed to high level noise as well as other mechanical accident-prone areas will be given personal protective equipment (PPE). The non-respiratory PPE includes tight rubber goggles, safety helmets, welders hand shields and welding helmets, plastic face shields, ear plugs, ear muffs, rubber aprons, rubber gloves, shoes with non-skid soles, gum boots, safety shoe with toe protection. Wherever necessary, personal protection equipment that will be provided have been presented in **Table-8**.

Table-8: Details of personal protection equipment

	Item	Equipment
1.	Face Protection	Face Shield, welding screen
2.	Eye Protection	Welding screen for welder, different types of goggles used for different purposes
3.	Body Protection	Leather apron
4.	Ear Protection	Ear plug, ear muff
5.	Leg Protection	Safety shoes, gum – boots
6.	Working at height	Safety belts
7.	Head Protection	Safety helmets
8.	Protection from Dust	Dust Mask
9.	Protection from Heat	Asbestos suit

All safety and health codes prescribed by the Bureau of Indian Standards will be implemented. Safety data sheets of the hazardous chemicals will be displayed at specific locations. Fire hydrants will be located at all convenient and strategic points along the major drains and checked for water availability on regular basis. Fire

extinguishing equipment, sand buckets, water sprinklers and water hoses will be provided at all convenient point. Fire and smoke detection alarms will be installed.

7.0 ENVIRONMENTAL ASPECTS

This section covers the genesis of pollution, principal sources of pollution, nature of pollution and proposed measures required for meeting the prevailing statutory requirements of gaseous emissions, waste water characteristics, noise level, etc. for environmental management purpose in connection with the proposed expansion project.

Pollution prevention and control measures are enumerated as below:

Genesis of Pollution:

The genesis of industrial pollution can be assessed from the project concept described in earlier paragraphs. The specific aspects, which need to be looked into for assessing the pollution potential, are:

- Physical-chemical characteristics of raw materials,
- Manufacturing technology involving a set of physical and chemical conversions of raw materials and lastly,
- The generation of all types of wastes, namely, gaseous, liquid and solid having specific characteristics.

The pollutants in the form of solids, liquids and gases that are expected to be generated from various Units of the proposed integrated steel plant. Release of such pollutants without proper care may affect the environment adversely. Pollution of the environment not only adversely affects the human beings, flora and fauna but also shortens the life of the machinery and equipment. This vital aspect, therefore, has been taken into account while planning the plant and equipment and adequate measures have been proposed to limit the emission of pollutants within the stipulations of statutory norms.

7.1 POLLUTION MITIGATION MEASUES OF SPONGE IRON PLANT

a) Air Pollution Control System

Three separate product handling dedusting systems have been considered to minimize the escape of dust from Product cooler, Product silos and Bottom seal gas (hot discharge system). Two separate iron oxide handling dedusting systems have been considered to minimize the escape of dust from oxide screen and day bins. The dust collection systems consist of exhaust fan, scrubber, stack and associated ducts and hoods. For each dust collection system, dust laden air is collected and conveyed at a sufficient velocity to prevent settling and accumulation within the ducts. The dust laden air enters a bag filter. Cleaned air is pulled from the dust collection system by the exhaust fan and discharged into the atmosphere through stack. The outlet dust concentration from each point will be limited to 30 mg/Nm^3.

Hot flue gases coming out of the chamber of Kiln after burning will be taken to Waste Heat Recovery Boiler for power generation. After completion of required passage of the flue gases through boiler, these gases will be taken to the ESP for trapping the dust in the gases before leaving into atmosphere. The outlet of the ESP will be connected to a stack. The ESP will be designed to achieve particulate matter emission of 30 mg/Nm^3.

b) Noise Pollution Control System

Noise generated from material and product handling, machines and equipment of DRI plant will be located inside a shed that will contain the noise level.

c) Water Pollution Control System

DRI making is a dry process where no water is consumed in the process / reaction. Make-up water is required for equipment / machine cooling to compensate the evaporation loss and for flue gas scrubbing. The cooling water is re-circulated through cooling tower, to reduce the consumption.

d) Solid Waste Generation

Dust from ESP, bag filters and char comprises solid wastes from DRI plant. Accretions are generated only when the kiln stops. The ESP and Bag Filter dust contains substantial iron content, which will be reused in sinter plant. Accretions will be used for landfilling and road making purpose. Char will be used as fuel in the FBC Boiler for steam and power generation.

7.2 POLLUTION MITIGATION MEASURES OF STEEL MELTING SHOP

a) Air Pollution Control System

The dust bearing gases will be collected using fume hood extraction system, taken to after combustion chamber for converting CO to CO_2, cooled in water circulating duct to bring temperature to 130°C and finally taken to bag filter. The clean gas is discharged through stack. The outlet dust concentration is limited to 30 mg/Nm^3 through suitable design of the bag house.

The shed of casting shop is provided with sufficient height. Ventilation system at skylight disperses uncollected emissions outside the shed and maintains clean work environment.

The stack height is calculated as per Central Pollution Control Board formula H = 14 x $Q^{0.3}$, where H is the stack height and Q is the SO_2 load in kg/h.

b) Noise Pollution Control System

The various noise generating sources in the SMS and Rolling Mill are feeding systems, casting transfer, lifting and placement of steel products. The operations are confined within a covered shed with skirt boards, which prevents excessive noise from coming outside the shed.

c) Water Pollution Control System

Only non-contact cooling water is required to maintain the desired temperature of furnace shell, casting shell and moulds. Make-up water is added to cooling tower to compensate for evaporation loss. Direct circulating cooling water used in rolling mill is contaminated with scales and traces of oil. The scales is collected from scale pit and reused in sinter plant. The lubricant is skimmed from the settling tank periodically and sold to authorized recyclers. The water is allowed to return to ambient temperature and reused for cooling purpose. Only make-up water is added.

d) Solid Waste Generation

Mill scales are carried away with the flowing water to the settling tank. It is collected by EOT crane periodically and used in IF. End cuts and trimmings from rolling mill are reused in IF. Flue dust is also used in IF. Slag is used for road making after metal recovery in the Metal Recovery Plant.

7.3 POLLUTION MITIGATION MEASURES OF RAW MATERIAL HANDLING AREA

Wagon tipplers will generate considerable dust, which will be controlled using dry fog type dust suppression system, water sprinkling system and air curtains at the entry and exit point of wagon tipplers. Alignment of the stacking yard will be done with respect to wind direction so that excessive dust is not generated due to surface wind blowing over the stocked materials. Adequate number of water sprinkling system complete with water storage, pumps and pipeline network will be installed all around the stacking yard. The conveyor belts carrying raw materials will be covered. Bunkers will be provided with ventilation system and bag houses for dust extraction. Stock house and day bins of respective manufacturing units will be provided with plant dedusting system using Bag Houses.

7.4 POLLUTION MITIGATION MEASURES OF WATER TREATMENT PLANT

The raw water treatment will be done by chemical coagulation, flocculation and clarification process. Lime and poly-electrolyte will be added for coagulation and flocculation. The sludge generated at the bottom of clarifier will be collected and dewatered in filter press. The sludge will be disposed as landfill material inside the plant premises / mixed with soil and used as manure, as per the local regulations. Softener regeneration water will be reused in the ash handling unit of the power plant. No air pollution or noise will be generated from the plant water system.

7.5 POLLUTION MITIGATION MEASURES OF DEMINERALISATION PLANT

The DM plant will be regenerated once every two days using acid and alkali. The regeneration waste water coming out of the DM plant will be taken to neutralization pit. After neutralization the waste water will be used for dust suppression in raw material yard using water sprinklers. There will be no air pollution, noise generation or solid waste generation from the DM plant.

7.6 POLLUTION MITIGATION MEASURES OF COMPRESSED AIR SYSTEM

There will be no air pollution, water pollution or solid waste generation from the Compressed Air Plant. Noise generated from compressors will be confined within the compressor building, which will be provided with noise absorbent materials.

7.7 POLLUTION MITIGATION MEASURES OF FUEL STORAGE FACILITIES

The fuel oil storage tanks will be provided with properly sealed fixed roof, to prevent leakage of hydrocarbons. There will be no water and noise generation from the fuel oil storage tanks. Safety measures as per approval of Chief Controller of Explosives will be provided. Solid wastes in the form of tank sludge will be generated every 5 years during the tank cleaning. The sludge will be mixed with coal and fired in the coke ovens.

7.8 POLLUTION MITIGATION MEASURES OF LABORATORY

The laboratory will generate water pollution, which will be taken to Effluent Treatment Plant. The treated wastewater will be reused for ash handling in the power plant. Fumes generated from the laboratory will be scrubbed with water and the scrubbed water will be recycled. The final scrubbed water will be taken to ETP for treatment, and reused in the ash handling system of power plant. Solid wastes in the form of chemical bottles and cans will be given to recyclers / given back to manufacturer for recycling.

7.9 POLLUTION MITIGATION MEASURES OF AIR CONDITIONING AND VENTILATION SYSTEMS

There will be no air pollution or solid waste generation from the Air Conditioning and Ventilation System. Blowdown from cooling towers will be taken to settling tank and reused after cooling. Noise generated from the plant will be confined within the building.

7.10 POLLUTION MITIGATION MEASURES OF REPAIR AND MAINTENANCE FACILITY

The Repair and Maintenance Workshop will generate water pollution, which will be taken to Effluent Treatment Plant. The treated waste water will be reused for ash handling in the power plant. Used oil and used lubricants will be collected in tanks and given to authorized recyclers. Oil contaminated cotton wastes will be mixed with coal and burned in the Coke Ovens.

7.11 POLLUTION MITIGATION MEASURES OF PRODUCT DISPATCH AREAS

Approach roads to the product dispatch unit will be asphalted and cleaned regularly to prevent re-suspended road dust generation during vehicular movement. No solid wastes or water pollution will be generated from this unit. Following precautionary methods of product loading on rail wagons will minimize noise generation.

7.12 POLLUTION MITIGATION SYSTEM FOR OCCUPATIONAL HEALTH

The pathological and anatomical wastes generated from the occupational health center will be buried underground at an earmarked place inside the plant premises. Used needles and syringes will be shredded, disinfected and given to authorized recyclers. The measures are in compliance with Bio-medical Wastes (Handling and Management (Rules).

8.0 SOLID WASTE MANAGEMENT

The solid waste generation and disposal for the different sources are described as follows:

- Dolo-char (79,200 TPA) from the DRI units will be used in AFBC boiler for power generation.
- The hot slag (42,708 TPA) generated from IF will be transferred to slag yard after cooling. After metal recovery IF slag will be used for road construction and land filling purposes after metal recovery in the metal recovery plant.
- Solid waste (dust as collected in the De-dusting systems) from SMS will be used in nearby brick manufacturing unit.
- Solid wastes that will be generated from caster as well as Rolling Mill are the scales, end cuts, miss rolls (1485 TPA) will be used in Induction Furnaces.
- The fly ash (49,152 TPA) generated from Captive Power Plant will be utilized as raw material for the cement plant/Brick Manufacturing. Bottom ash (12,288 TPA) generated from the power plant will used for land filling/Road construction purpose.
- Dust collected from ESP and Bag filters and hearth layer of the main furnace comprises solid wastes from pellet plant. The entire dust will be collected and reused in pellet making process. The hearth layer is also reused. There will be no solid waste disposal from the pellet plant.
- Solid waste of domestic / commercial origin generated in the plant will be disposed of suitably in consultation with the concerned Civic body.

9.0 FIRE PROTECTION SYSTEM

Fire protection system for the integrated steel and power plant comprises an elaborate network of fire brigades, water reservoir, pumps, hydrants, fire engines, sprinkler system, fire alarms, smoke and heat detectors, etc. Portable fire extinguishers of various capacities containing agents such as CO_2, DCP, etc. and will be located at strategic points of the plant. In view of vulnerability to fire, effective preventive and design measures will be taken to minimise fire hazard. The following areas in the plant are mainly susceptible to fire:

- Cable galleries.
- Electrical switchgear/MCC room.
- Coal handling areas; conveyors, transfer points, tunnels and storage yard
- Transformers and turbine oil tank
- Liquid fuel storage tank

For containment of fire and preventing it from spreading in cable galleries, section wise fire barriers with self-closing fire resistant doors will be provided. The ventilation systems, if any, provided in cable galleries will be interlocked with the fire alarm system, so that in the event of a fire, the ventilation system will be automatically switched off. In order to avoid spreading of fire, all cable entries/openings in cable galleries, tunnels, channels, floors, barriers etc. will be sealed with non-inflammable/fire resistant sealing materials. For detection and protection of the plant against fire hazard, any one or a combination of the following systems will protect susceptible areas:

- Hydrant system

- Medium velocity spray system
- Portable fire extinguishers
- Fire alarm system

Fire hydrant points will be provided throughout the premises. Automatic high velocity spray system will be provided for protection of transformers and cable galleries. Manual medium velocity spray system will be provided for protection of fuel oil and turbine oil storage tanks and coal conveyor galleries. Water for hydrant, spray and sprinkler systems will be supplied from the fire water pumps located in fire water pump house adjacent to Raw Water Reservoir. Adequate number of portable and mobile chemical fire extinguishers will be provided at strategic locations throughout the plant. Fire detection and alarm system will be provided to detect smoke in vulnerable areas of the plant through smoke detectors.

There will be a separate firefighting department for the integrated steel plant, which will be full-fledged comprising fire brigade, trained crew, firefighting materials, dress and equipment. The department will conduct mock drills at regular intervals to check the efficacy of firefighting systems.

10.0 LAND

After the proposed project expansion (existing projects + proposed projects) land requirement will be 34.80 hectares (86 acres).

Land Acquisition Status:

Required 34.80 hectares (86 acres) land is acquired by the company

11.0 GREEN BELT DEVELOPMENT OBJECTIVE

To capture the fugitive emission, if any, from the plant and to attenuate the noise generated from the plant machinery and to improve the aesthetics of the plant site, a green belt will be developed within the plant area.

The green belt is a set of rows of trees planted in such a way that they form an effective barrier between the plant and the surrounding areas. Prevalent wind directions shall be taken into consideration to ensure adequate capturing of the air pollutants around the plant.

Open spaces, where tree plantation is not possible shall be covered with shrubs and grass. The plantations shall match with the general landscape of the area and be aesthetically pleasant. Adequate attention will be paid to planting of trees and their maintenance and protection. 40% of the total area shall be covered under Green Belt.

12.0 RAIN WATER HARVESTING

Rainwater harvesting broadly refers to the collection and storage of rainwater and recharge of groundwater. In general, water harvesting is an activity of direct collection and usage of rainwater to reduce the freshwater consumption from the source which is

under constant pressure. Otherwise, the precious rainwater will run off, which can be stored for direct use or can be utilized to recharge the groundwater depending upon the technique used for harvesting.

The company has already developed 8 No. (eight) pits to recharge 1,25,682M^3 ground water annually.

13.0 MANPOWER REQUIREMENT

Operation and maintenance of the proposed expansion project requires human resources in different categories like managers, engineers of different discipline like metallurgical, mechanical, electrical, electronics, computer, civil, structural, chemical, etc., highly skilled, skilled and semi-skilled work force in different disciplines, commercial, accountants and financial managers, unskilled labour force, clerical, security personal, etc.

Factory human resources

In order to operate and maintain the plant facilities, including its technical and general administration needs, the manpower requirement for the proposed project has been estimated to be 1655 persons (including 1000 contractual man power).

The above estimate covers the top management, middle and junior level executives and other supporting staff.

Sl. No.	Category	Number of persons
1	Executives	20
2	Managerial/Engineers	70
3	Skilled staff	450
4	Semi-skilled/unskilled staff	1000
5	Office staff / Others	125
Total		**1655**

14.0 PROJECT PERIOD

The installation of several production units along with utilities and services require co-operation for procurement of equipment, equipment foundations, awarding of all contracts and supervision of all construction jobs at plant site. The factors which are responsible for timely implementation of the project are :

i) Arrangement of proper finance for the project.
ii) Finalization of layout of the proposed plant.
iii) Designing of utilities and services.
iv) Placement of orders for plant and machinery.
v) Arrangements for Govt. sanctions and supply of power.
vi) Recruitment of personnel.

As per an initial estimate around 36 months will be needed for implementation of the project.

15.0 ESTIMATED COST

As per initial estimate, the cost of the project works out to around Rs. 493.03 Crores. Unit wise breakup of cost is presented below,

Sl. No.	Description	Investment (in Rs. Crores)
1	2 X 600 TPD DRI Plant	185.57
2	SMS (3 X 10 T & 4 X 15 T Induction Furnaces)	70.56
3	Rolling Mill (2,30,000 TPA)	43.88
4	Captive Power Plant 37 MW (WHRB)	119.02
5	Captive Power Plant 12 MW (AFBC)	54.00
6	Land & other Misc. Expenses	20.00
	TOTAL	**493.03**

16.0 COMMERCIAL & FINANCIAL FEASIBILITY EVALUATION

The focus of proposed expansion project is cost reduction by producing quality material as per the required specification. There will be complete integration right from the beginning to finished products (viz. TMT bars). The estimated cost of the project is expected to be around Rs. 493.03 Crores. There will be substantial savings due to the said project as company will also be eligible for various incentives. The company has a good track record of implementing and commissioning capital for the proposed project as per schedules. The total project is expected to be commissioned over a period of around 36 months in phased manner. The benefit from the project planned will begin to be acquired from year one only.

17.0 CONCLUSION

Here we have examined the feasibility of the expansion project from 3 angles, which is the backbone of any project to succeed -

- Environmental feasibility
- Commercial and financial feasibility and
- Pre and post project scenario in which company will operate.

The outcome shows that results are positive which indicate a positive feasibility.