PRE FEASIBILITY REPORT

FOR

INTEGRATED STEEL PLANT (1.5 MTPA to 3.0 MTPA) AT BHAGABAND-SIYALJORI, JHARKHAND

Submitted to

Ministry of Environment and Forest & Climate Change

New Delhi

Submitted by:

Electrosteel Steels Limited

June, 2018

1.0 Executive Summary

Electrosteel Steels Limited (ESL) (formally known as Electrosteel Integrated Limited) has earlier obtained Environmental Clearance for installation of 3.0 MTPA steel plant vide letter no F.No.J-11011/137/2006-IA II(I) dated 21st February 2008. ESL has constructed 1.5 MTPA capacity steel plant as on date and operating successfully. ESL now proposes to implement balance 1.5 MTPA integrated steel plant.

The steel plant site is located in Chas and Chandankiyari blocks of Bokaro District of Jharkhand State. This steel plant will cater to the demand of steel for the region as well as for other parts of the country and abroad.

The plant is based on blast furnace (BF) and Basic Oxygen Furnace (BOF) - casters and hot rolling routes to produce long & flat steel products and ductile iron pipe. Initially, coal is processed in Heat Recovery Coke Oven Plant to produce coke, which is used as raw material for blast furnace. The other raw materials for the blast furnace is sinter. Raw materials for sinter plant are Iron ore, dolomite and calcined lime. Fine iron ore will be pelletized in pellet plant. The sinter from sinter plant and pellet from pellet plant, sized ore, fluxes, quartzite etc. from the raw material storage yard and coke from coke.

2.0 IDENTIFICATION OF THE PROJECT/BACKGROUND INFORMATION

2.1 Identification of the Project & Project Proponent

M/s. **Electrosteel Steels Limited (ESL)** has installed an Integrated Steel Plant of production capacity of 3mtpa out of which 1.5 MTPA production has already been achieved, which was promoted by M/s. Electrosteel Castings Limited, (ECL) Kolkata a company established in the year 1951 with a track record of outstanding performance since inception. M/s. ECL has pioneered the manufacturing of Cast Iron (CI) and Ductile Iron (DI) pipes in India at their Khardah unit near Kolkata in West Bengal. ESL has installed one mini blast furnace at Khardah in the year 1996 and later improved upon the same and achieved higher productivity from this furnace. ECL has installed a coke oven complex along with power generating station based on waste heat recovery (CDM initiative) in the port city of Haldia, near Kolkata. The complete design, manufacturing and installation of the coke oven with all its machinery was done in-house. This complex also includes a sponge iron making facility.

2.2 Brief Description and Nature of the Project

The project falls under Category-A, under Section-3(a) as per the prevailing EIA Notification, dated 14th September 2006.

2.3 Need of the Project and its Importance to the Country and Region

Steel is crucial to the development of any modern economy and is considered to be the backbone of the human civilization. The level of per capita consumption of steel is treated as one of the important indicators of economic development and living standard of the people in any country. All major industrial economies are characterized by the existence of a strong steel industry and the growth of many of these economies has been largely shaped by the strength of their steel industries in their various stages of development.

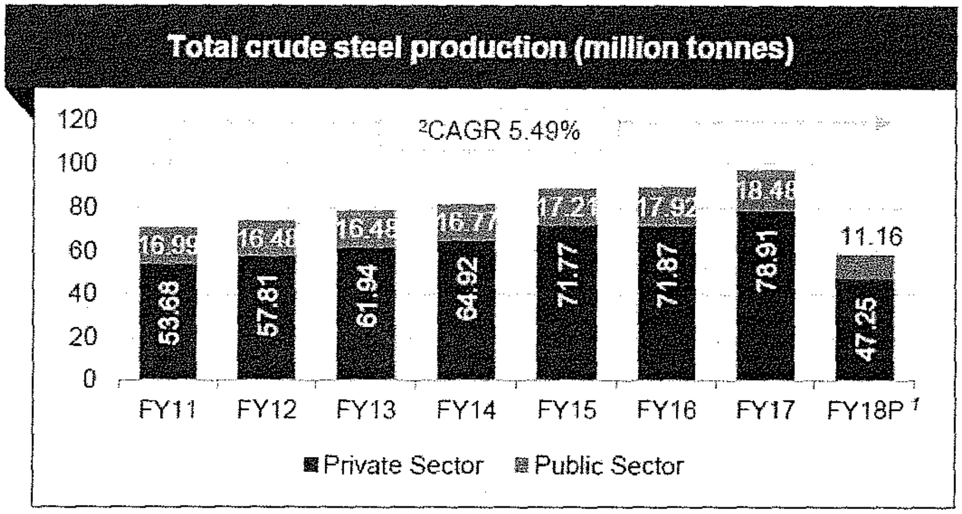
In view of growing demand for steel in the country, Vedanta Ltd envisages balance 1.5 million tonnes per annum (MTPA) steel plant out of remaining 3.0 MTPA in the state of Jharkhand.

Importance to the Country

India was the world's third-largest steel producer in 2016. The growth in the Indian steel sector has been driven by domestic availability of raw materials such as iron ore and cost-effective labour. Consequently, the steel sector has been a major contributor to India's manufacturing output. The Indian steel industry is very modern with state-of-the-art steel mills. It has always strived for continuous modernization and up-gradation of older plants and higher energy efficiency levels. India's comparatively low per capita steel consumption and expected growth in consumption due to growing infrastructure construction, automobile and railways sectors has offered scope for growth.

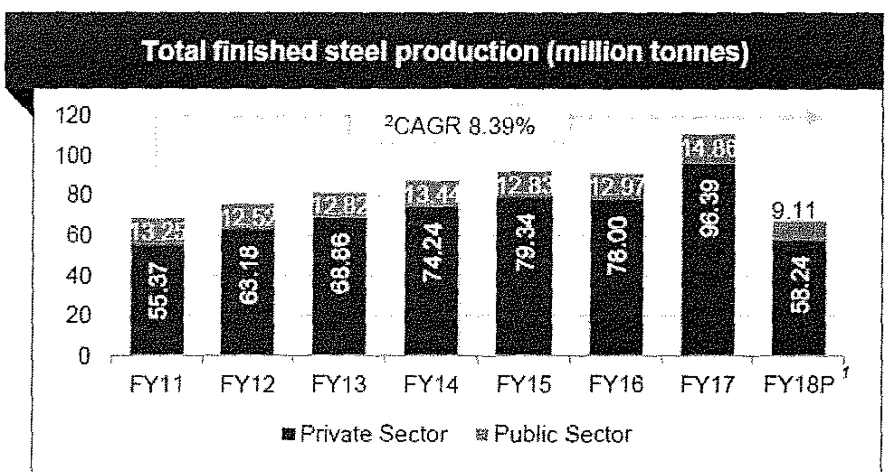
In FY17, crude steel production in India was 97.39 MT, with the total crude steel production growing at a CAGR of 5.49 percent over the last 6 years. The steel sector contributes over 2 percent to the GDP of the nation and provides 20 lakh jobs in the country. During April-October 2017, crude steel and finished steel production in India stood at 58.42 MT and 67.34 MT respectively.

As of march 2017, the capacity utilization of steel producers is set to increase with strong export demand and signs of revival in domestic sales. Steel manufacturing output of India is expected to increase to 128.6 MT by 2021, accelerating the country's share of global steel production from 5.4 percent in 2017 to 7.7 percent by 2021. The graph showing crude steel and finished steel production is given in **Figure-1 & Figure-2.**



Source: Ministry of Steel Annual Report

FIGURE-1
TOTAL CRUDE STEEL PRODUCTION (MILLION TONNES)



Source: Ministry of Steel Annual Report

FIGURE-2
TOTAL FINISHED STEEL PRODUCTION (MILLION TONNES)

Demand Supply Gap

Domestic Scenario

The forecast of likely demand, estimates of availability and shortage/excess for finished steel, long and flat groups of products has been carried out. The future scenarios for finished steel, long and flat products are presented in the following **Table-1** to **Table-3** and shown in **Figure-3** to **Figure-5**.

TABLE-1
DEMAND, AVAILABILITY & GAP ESTIMATES –FINISHED STEEL

India: Demand, Availability & GAP Estimates –Finished steel (Million Tonnes)				
Years	Demand	Capacity	Availability	
	Finished Steel	Crude Steel	Finished Steel	Availabilty Shortage (-) Excess (+)
2020	118.4	157.9	135.7	17.3
2025	161.0	176.7	151.9	(-) 9.1
2030	219.0	190.7	163.9	(-) 55.1
2035	297.8	200.7	172.5	(-) 125.3

TABLE-2
DEMAND, AVAILABILITY & GAP ESTIMATES –LONG INCLUDING RAILS

India: Demand, Availability & GAP Estimates – Long including Rails (Million Tonnes)						
Years	Demand	Demand of Long Products		Capacity Availability		Availabilty Shortage (-) Excess (+)
	Finished Steel	% Share	Quantity	Long-Crude	Long-Finished	
2020	118.4	56.0 %	66.3	75.9	65.6	(-) 0.7
2025	161.0	54.0 %	86.9	85.5	73.9	(-) 13.0
2030	219.0	52.0 %	113.9	95.1	82.2	(-) 31.7
2035	297.8	50.0 %	148.9	100.7	87.0	(-) 61.9

TABLE-3
DEMAND, AVAILABILITY & GAP ESTIMATES –FLAT PRODUCTS INCLUDING PIPES AND TUBES

India: Demand, Availability & GAP Estimates – Flat Products including Pipes & Tubes (Million Tonnes)						
Years	Demand	Demand of Long Products		Capacity Availability		Availability Shortage (-) Excess (+)
	Finished Steel	% Share	Quantity	Flat Crude	Flat Finished	
2020	118.4	44.0%	52.1	82.0	70.1	18.0
2025	161.0	46.0 %	74.1	91.2	78.0	3.9
2030	219.0	48.0%	105.1	95.6	81.7	(-) 23.4
2035	297.8	50.0 %	148.9	100.0	85.5	(-) 63.4

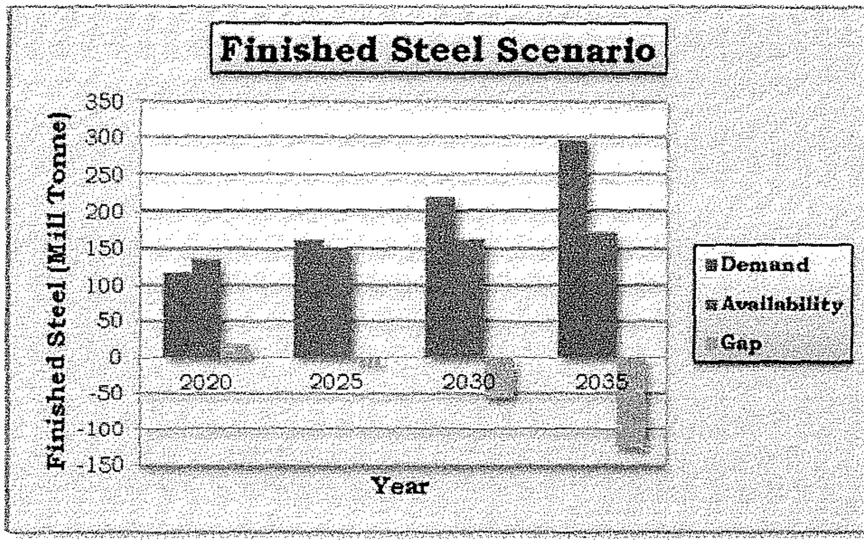


FIGURE-3
FINISHED STEEL SCENARIO

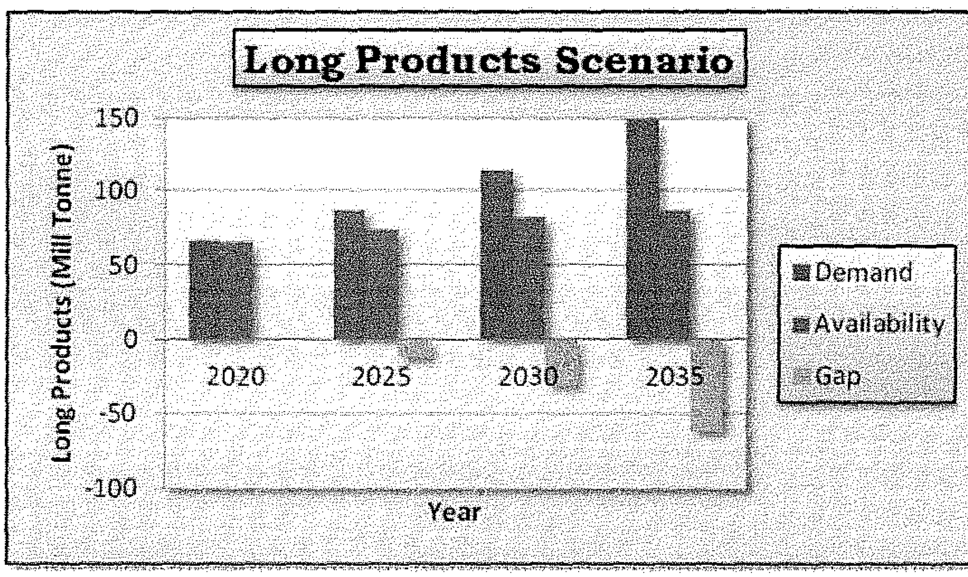


FIGURE-4
LONG PRODUCTS SCENARIO

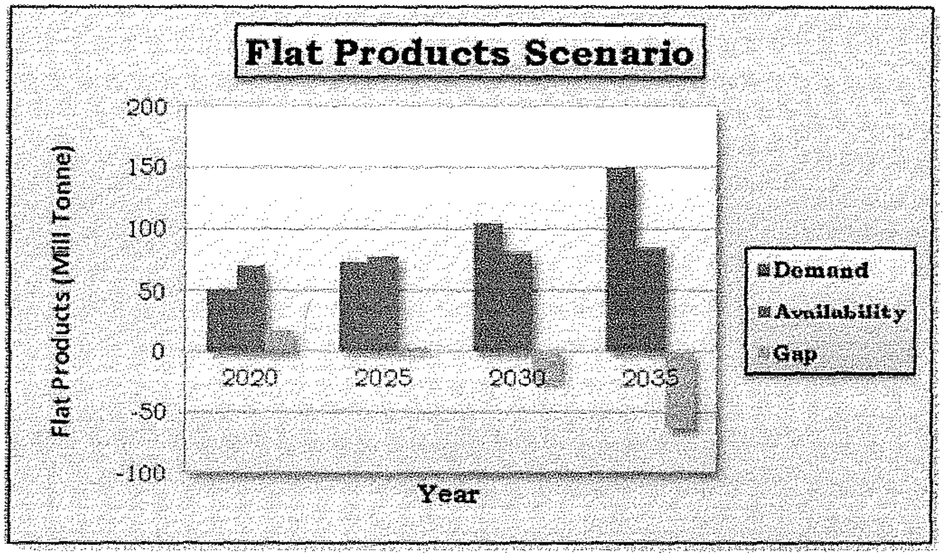


FIGURE-5
FLAT PRODUCTS SCENARIO

2.5 Employment Generation (Direct & Indirect) due to the Project

The manpower in operating 1.5 MTPA plant is about 8895 no.s. However the proposed balance 1.5 MTPA integrated steel plant will additionally generate direct approximately 5500 indirect secondary & tertiary employment.

3.0 PROJECT DESCRIPTION

3.1 Type of the Project Including Interlinked & Interdependent Projects, if any

ESL proposes to install balance capacity 1.5 MTPA out of total 3 MTPA of the integrated steel plant for which EC has already obtained.

3.2 Location

The plant site is located in Chas and Chandankiyari blocks of Bokaro District of Jharkhand state. The nearest town to the proposed site is Bokaro, which is at about 22 km away on the west. The approximate geographic location of the site is 23°37'55.1" N latitude and 86°17'40.8" E longitude respectively.

Index map and study area map of the project site shown in **Figure-6** & **Figure-7**. The environmental setting of the project is given below in the **Table-4.**

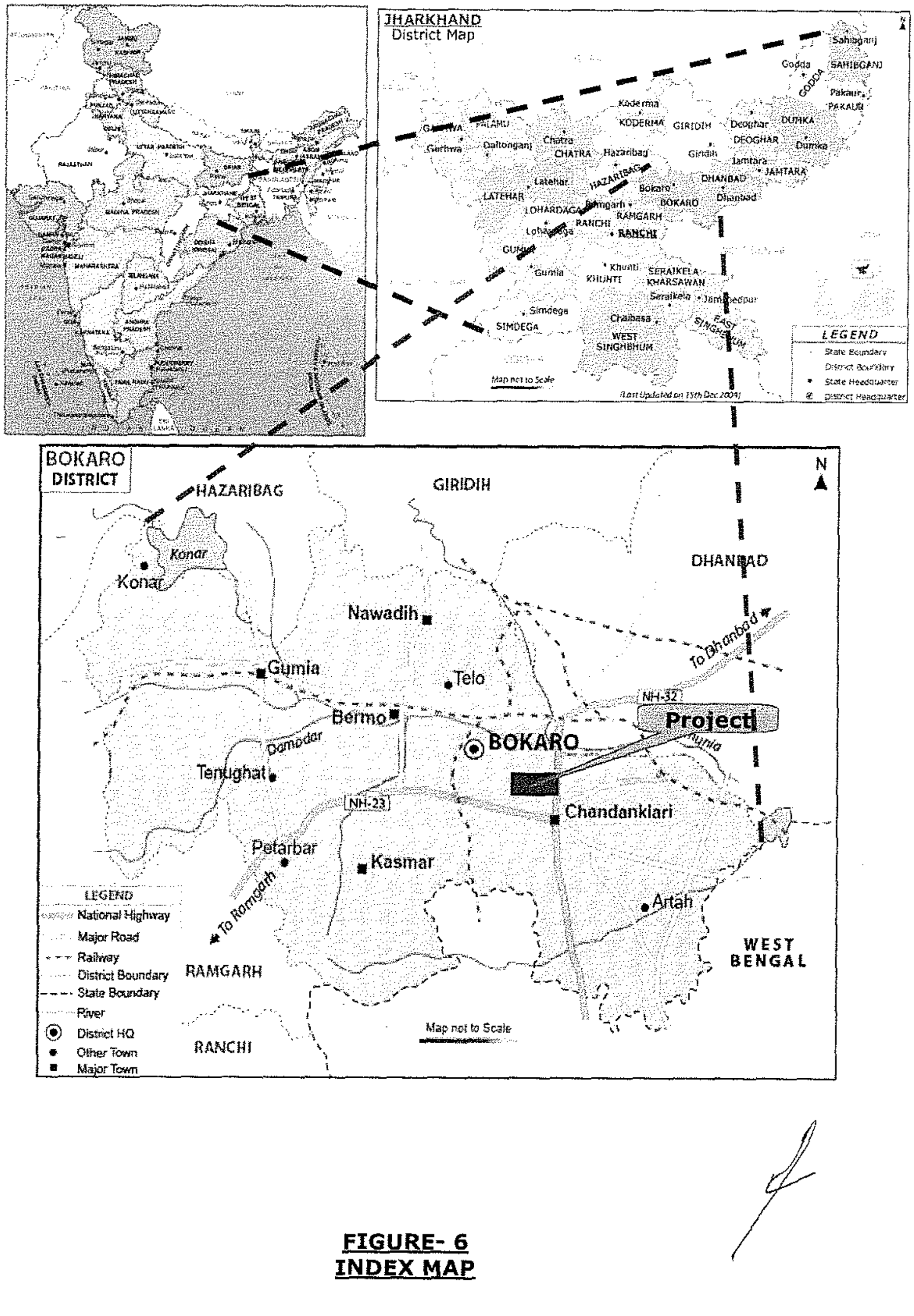


FIGURE- 6
INDEX MAP

FIGURE- 2
STUDY AREA MAP

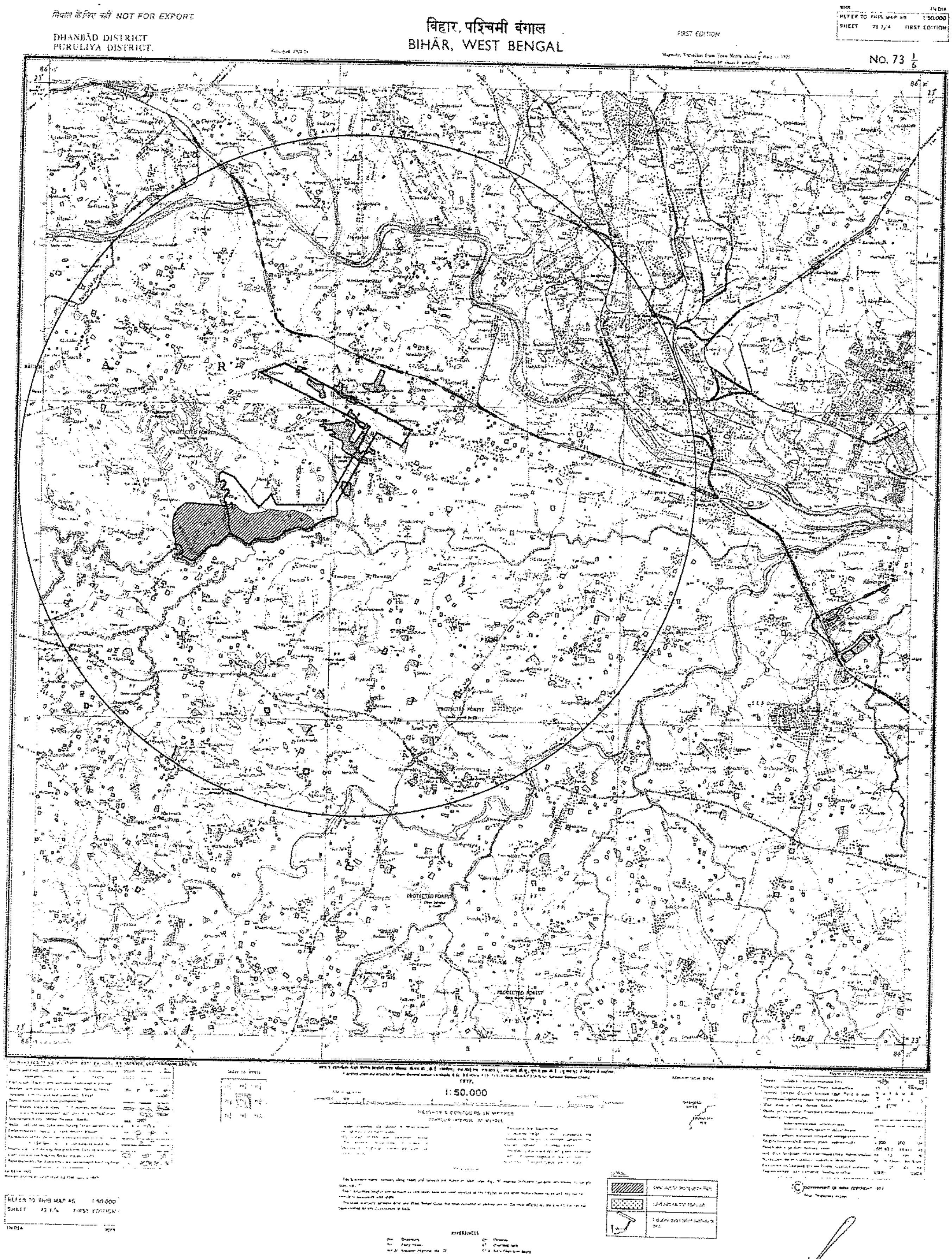


TABLE-4
ENVIRONMENTAL SETTING OF THE PROJECT SITE

Sr. No	Particulars	Details
1	Location	Chandankiyari-Chas block of Bokaro District of Jharkhand State
2	Coordinates	23°37'58.5" N 86°18'22.1" E
3	Toposheet nos	73 I/5, I/6
4	Elevation	180
5	Nearest village	Bhagabandh- Siyaljori (0.4 km ,W) Batbinor (0.1 km , N)
6	Nearest town & district	Chas (11.0 km, W) & Bokaro (14.0 km , NW)
7	Nearest highway	NH-32 (9.0 km , W) SH-12 (3.8 km, S)
8	Nearest railway line	Talgaria (1.1 km , NNE)
9	Nearest airport	Ranchi (103 km,WSW)
10	Nearest seaport	Haldia (255.0 km , SE)
11	Interstate boundary	West Bengal-Jharkand (9.0 km ,SE)
12	Reserve forest	No Reserve forest. P.F near Bhagabandh (0.4 km , NW) P.F near Asanbani (5.1 km, SW) P.F near Chakparabaid(4.5 km , SSW) P.F near Gopinathdih (6.8 km , South) P.F near Sabaldih (1.8 km, North) P.F near Galgaltnar (4.9 km , SE)
13	Water bodies	Damodar river (3.2 km ,E) Ijri Nadi(Adjacent to South side) Katri Nadi (3.5 km, North) Jarian Nala(6.0 km, North) Gobai Nadi (7.5 km, S)
14	Seismicity	Zone-III

3.3 Details of alternative sites, considered & the basis of selecting the proposed site, particularly the environmental considerations gone into should, be highlighted.

No proposal for alternative site is considered as the remaining 1.5 MTPA will be within the existing plant premises located at Chas - Chandankiyari Block of Bokaro District of Jharkhand. Hence alternate sites are not applicable in the proposed project.

3.4 Size or Magnitude of Operation

ESL proposes expansion of steel plant from 1.5 MTPA to 3 MTPA. The estimated cost of the project is about Rs.5000 crores. The anticipated capital expenditure for the pollution control measures is about Rs. 200 crores.

Total project area is 1,350 acres which is already in industrial use.

3.5 Project Description with Process Details (a schematic diagram/flow chart showing the project layout, components of the project etc., should be given)

Brief Process Description

Electrosteel Steels Limited (ESL) proposes to set up 3 Million Ton Per Annum (MTPA) integrated steel plant, of which 1.5mtpa production capacity has already been achieved. The plant will be based on Blast Furnace
(BF), Basic Oxygen Furnace (BOF), Caster and Hot Rolling route to produce long and steel products and ductile iron pipe. Initially, coal is processed in Heat Recovery Coke Oven Plant to produce coke, which is used as raw material for blast furnace. The other raw materials for the blast furnace are sinter. Raw materials for sinter plant are Iron ore, limestone, dolomite, calcined lime. Iron ore will also be palletized in pellet plant. The sinter from sinter plant and pellet from pellet plant, sized ore, fluxes, quartzite etc. from the raw material storage yard and coke from coke ovens will be charged in the Blast furnaces. The hot metal from Blast Furnaces will be used in DIP plant, Pig casting machine and Hot metal De-sulphurisation (HMDP). After processing of the metal, Ductile Iron Pipe, long and flat steel products will be produced in the integrated steel plant. The process flow diagram for integrated steel plant is shown in **Figure-10.**

Coke Oven

After evaluation of different coke making options heat recovery, stamp charged coke-making technology has been considered for the project to produce 1,60,000 tons per year of gross coke. The description of the process is given below.

Coal receiving pits are provided in the coal yard. Coal is fed onto the belt conveyor and then conveyed to the top-level belt conveyor of coal blending bunkers. Another belt conveyor to the reversible hammer crusher then transports blended Coal. The crushed coal blend is then conveyed through the clean coal belt conveyor to the coke oven coal tower. The stamping station is arranged under coal tower. Coal cake is stamped in layers. The coal box with the ready coal cake are together loaded onto the coal-charging car and transported to the oven, which is ready. Coal pushing car pushes the coke out of the carbonization chamber and immediately closes the coke-side door. The coal cake together
with the coal box is pushed into the carbonization chamber and the baffle at the coal cake end is locked on the oven door. The pushing car draws the coal box out and immediately closes the charging-side door. Owning to the heat cumulated in the fire channels of the main wall and bottom of the oven, the coking coal is heated and raw gas is separated out.

Adjustable suction valves on the oven roof and oven doors allow the introduction of primary air to combust with raw gas. The temperature of the space under oven roof is thus increased and coal cake is heated up through heat exchange and radiation. Due to the inadequacy of air coming through suction valves, the reductive atmosphere in the roof space forms a protecting layer for the coal cake. Incompletely combusted gas goes into the coke-side descendent channels via the down-coming channels on the two sides of the oven walls, and then into the combustion chamber channel under the oven bottom. Each oven bottom channel is divided into four sections. Secondary air is introduced into such sections to burn with the incompletely combusted gas and heat the base of coal cake through heat exchange with oven bottom bricks.

Gas from oven bottom flue flows into the ascendant channels in the oven wall on the other side and then into the uptake at the center of the oven roof. To maintain the suction of the carbonization chamber, every two batteries share one waste gas header. The waste gas is finally discharged into the waste gas heat recovery boiler. After cooled and dried, the coke is put by coke placing machine onto the belt conveyor and conveyed to screening tower to be screened. The quality of coke produced is shown as follows in **Table-5**

TABLE-5
PRODUCED COKE QUALITY

Sr.No	Parameters	Contents (%)
1	Moisture	4
2	Ash (dry basis)	12.5
3	Volatile matter (dry basis)	1.2 (max)
4	Sulphur	0.6 (max)

Sinter Plant

For various types of input materials, adequate number of proportioning bins mounted on load cells to ascertain material level in each bin and electronic weigh feeders under each bin shall be provided to draw materials of required proportions. Two stages of mixing and nodulising drums with water proportioning system and calcined lime addition facilities will be provided for the sinter machine. The drums will facilitate stage-wise intimate mixing and rolling of sinter mix where approximate amount of water and required calcined lime will be added. Each sinter machine will consist of hearth layer feeding system, raw mix feeding system comprising of anti segregation filling method at the top of raw mix feed bin and drum feeder, ignition furnace, sinter breaker, segregation chute, etc. Sintering will be performed during the movement of the bed from ignition furnace to the discharge end. One elevator will be provided in each sinter machine building. A suitable forced draft type cooler comprising adequate number of fans, drives, cooler troughs, sealing etc will be installed so that temperature of the sinter at discharge point is 100°C (maximum) in each sinter machine.

The cooler discharge hopper shall be load cell mounted. Waste heat recovery systems from cooler for ignition furnace combustion systems are envisaged for each sinter machine, and would be developed under the Clean Development Mechanism. Sinter of minus 50 mm size will be screened for separation of hearth layer material and plant return fines. Electrostatic precipitator (ESP) dry type, of suitable capacity will be provided for cleaning each sinter strand. Waste gases and the dust content will be maintained within the required norms of pollution control agency in sinter plant. Collected dust will be recycled. Storage provision will be available for one day's sinter production for each sinter plant. Facilities will also be provided to discharge sinter at the bottom on conveyor for transporting to blast furnace stock house.

Lime dosing entails reduction in the specific consumption of coke in the sinter plant, resulting in reduction in CO_2 emissions associated to coke combustion. The Sinter will have provisions for Lime dozing. This activity would be envisaged under the Clean Development Mechanism. The consumption and characteristics of Raw Materials for Sinter Plant is shown as follows:

TABLE-6
CONSUMPTION OF RAW MATERIALS

Sr. No	Materials	Consumptions (Tons/year)
1	Iron ore fines	30,92,000
2	LD slag	52,600
3	Limestone	1,99,100
4	Dolomite	2,40,000
5	Flue dust	26,300
6	Mill scale	30,100
7	Calcined lime	37,600
8	Coke breeze	2,40,423

TABLE-7
CHARACTERSTICS OF RAW MATERIALS

	Fe %	SiO_2 %	Al_2O_3%	CaO %	MgO %	LOI %
Iron ore fines	64.49	1.87	1.73	-	-	3.85
Limestone	0.45	5.06	1.00	50.30	1.93	40.67
Coke breeze	0.50	7.02	3.51	-	-	86.50
Flue dust	42.39	7.28	2.79	1.45	0.75	26.00
Mill scale	69.50	1.23	1.22	0.68	0.25	5.00
Lime	0.14	0.75	0.50	95.00	1.55	2.00
L.D. slag	21.50	12.00	1.40	50.05	1.50	3.00
Dolomite	0.30	0.97	0.64	30.27	21.52	44.27

Pellet Plant

System design of a pellet plant is carried out on the basis of desired capacity, quality of raw materials, desired product quality as well as the process parameters established through appropriate test work.

The thoroughly mixed pre- wetted material will be conveyed and distributed to mixed material bins from where it will be drawn out by feeders to be fed to balling discs on which water will be sprinkled at a controlled rate. Green pellets produced from the balling discs in predominantly 6 to 16 mm size will be treated on roller screen for precise size control. The consumption and characteristics of Raw Materials from Pellet Plant is shown as follows:

Consumption Raw Materials

Raw materials	Consumptions (tons/year)
Iron ore fines	12,20,000
Bentonite	24,000
Dolomite	12,000
Coal (Anthracite)	42,000

Characteristics of Raw Materials

Parameters	Contents (%)
Fe	65.7
SiO_2	2.81
Al_2O_3	2.08

Blast Furnace

Blast furnaces will be installed to produce 31,14,000 tons of hot metal in a year, major part of which will be processed in BOF for steel making. About 3,98,000 tons of basic grade hot metal will be utilized to produce 4,00,000 DI pipes.

Blast furnaces will be designed for 1.35 kg/cm2 top pressure and 1100°C hot blast temperature. Each BF will have one tap hole and one slag notch. The furnaces will be self supporting free standing type. The top equipment and platform at various levels around the furnace will be supported by an independent tower structure. Each blast furnace will be provided with bell less top charging system. They will be provided with modern facilities, like above burden probe, heat flux and pressure profile measurement etc. The cooling system will be of cast iron stave. Furnace under hearth will be cooled by water pipes. Cast iron staves will be provided for cooling refractory from hearth to the stack. Cooling system will be complete with all piping, valves, pumps etc.

The hearth bottom and crucible including taphole will be lined with high conductive carbon in Blast furnaces. Bosh to lower shaft is lined with silicon carbide/high alumina. Rest of the shaft will be lined with high Al2O3 brick and cone portion will be gunnited with CO resistant refractory materials.

Automation and control system, which will include control of hot blast temperature,charging etc., will be provided to take care of smooth operation of blast furnace. Instruments for measuring flow, pressure, temperature etc will also be provided.

Each blast furnace will be served by three top fired type stoves to supply hot blast at a temperature of 1100°C (design 1200°C). The stoves will be fired with blast furnace gas.

Combustion air fans will be provided for supply of combustion air to stove burner. One chimney will be provided for each stove system. The upper high temperature zone of stoves will be lined with high alumina refractory and other portions will be lined with fire clay refractories. Hot blast main and bustle main will be lined with high alumina refractories. The stoves will be provided with necessary platforms for providing approach to various valves, fittings etc. Necessary lifting beams with hoist will be provided above the stove valves to facilitate maintenance. The stove valves will be hydraulically actuated and the stove changing will be PLC controlled. There will be provisions in the Blast Furnace for injection of Pulverized coal/waste coal dust. This activity would be envisaged under the Clean Development Mechanism.

Each blast furnace will be provided with cast house, having tap hole and slag notch. Mud gun & drilling machine will be provided in each cast house. One slag granulation system and dry slag pit will be provided for each furnace along with granulated handling system. The slag runner arrangement will be made such that it can flow either to the slag pit or to the granulator of the slag granulation plant. A granulated slag pit will be provided for collecting the granulated slag. The water will be drained off from the bottom of the pit through filter bed and will be collected to a hot well connected with a pump house.

The gas cleaning plant for each blast furnace will consist of a dust catcher and a dry type bag filter system. The top gas of furnace will be drawn through off-takes which extends upward to form vertical bleeder pipes provided with bleeder valves at the top. The off-take and up-take pipes are connected to form down-comer, which terminates at the dust catcher. The gas leaving dust catcher will flow into a dry type bag filter system for final gas cleaning. The cleanliness of blast furnace gas will be 10 mg/nm^3 of clean gas. Flare stack of adequate capacity will be provided.

Pig casting machines of adequate capacity will be installed to handle hot metal in emergency for Blast furnaces. Necessary facilities for preparation of lime wash required for coating the moulds will be provided. Recirculating water system for cooling pigs including a settling tank will be installed. Cold pig will be stored in pig storage yard. Blowers of adequate capacity will be provided for each Blast furnace.

The ladle repair shop will be located adjacent to the pouring bay of pig casting machine. Cranes of adequate capacity will be utilized for the ladle repair shop. The shop will have facilities for servicing, cooling, repairing and relining of hot metal ladles. The shop will have facilities for drying and heating of relined ladles. Adequate number of ladle cars will be provided for transporting the hot metal from cast house of Blast furnaces to all the hot metal consuming areas.

Input Material Quantities

Material	Consumption (tons/year)(Approx.) Blast Furnaces
Charge Sinter	33,80,000
Pellet	9,44,400
Sized Iron Ore	4,85,300
Quartzite	53,550
Charge Coke	14,48,100
Anthracite	2,83,300

Average Annual Yields from Blast Furnaces

Items	Yields (tons/year)(Approx.)
Hot metal	31,14,000
Granulated slag	7,24,000
Iron scrap	13,750
Flue dust & sludge	55,000

DRI Plant

The process consists of reduction of iron ore with solid carbonaceous material such as coal or coke or lignite in a rotary kiln which is heated to a temperature of 950-1000° C and then cooled to room temperature in the rotary cooler with indirect water cooling system. The products are then screened and magnetically separated. Sponge iron being magnetic gets attracted and separated from the non-magnetic char. The raw materials namely iron ore and feed coal in coarse form in predetermined ratio are fed to the rotary kiln and rotated by an AC variable speed motor. Due to inclination and rotary motion of kiln the materials move from the feed end of the kiln to the discharge end. The fine coal is blown from the discharge end of kiln to maintain required temperature and carbon concentration in the bed. The kiln has seven shell air fans mounted on the top, which blow air in the respective zones to maintain required temperature profile. The material and hot gasses move in counter current direction as a result of which the iron ore gets preheated and gradually reduced by the time it reaches the discharge end.

The kiln is divided process-wise into two zones namely preheated zone and reduction zone. The preheated zone is normally 30% of the total length of the kiln and the rest is taken as reduction zone. The material gets heated to the reduction temperature in the preheating zone up to 200° C, the iron ore, coal and limestone gets dried and all the moisture is vaporized. Up to 800°C, the iron gets roasted and any carbonates in it get calcinated. In the coal, the volatile matter starts getting released. The limestone also gets calcinated and becomes active. The iron ore, which is in the form of hematite, gets reduced to magnetite. After this the materials enter to the reduction zone where the magnetite is reduced to wustite and then to the metallic iron.

All these reactions being exothermic supply the heat required for the reactions in the bed phase to occur. The oxygen required for burning of these combustibles is supplied from the air tubes placed along the length of the kiln. By controlled combustion, the temperature in the various zones is maintained so that the reduction is proper and to sufficient degree.

The product quality is defined by the degree of metallization. The degree of metallization is defined as the ratio of the metallic iron to the total iron present. The hot reduced metal is then transferred to the rotary cooler via the transfer chute and driven by an AC variable speed motor. The water is sprayed on the top of the shell, which cools the material inside the cooler indirectly. The material gets cooled to 80°C and is discharged on the belt conveyor by the double pendulum valve. The double pendulum valve acts as seal for preventing entry of atmospheric air into the kiln cooler system.

The cooler discharge is then sent to the product separation system. In this the material is screened to various size fractions and then led to the magnetic separators, which separate the magnetic sponge iron from the non- magnetic char.

The gases, which are at high temperature and have lot of heat energy, can be utilized for the power generation through the waste heat recovery boiler. The hot gases after the heat recovery boiler get cooled to 200°C or below and then passed through an ESP and let off to atmosphere through a chimney.

Ductile Iron Pipe Plant (DIPP), DI Fittings & Rubber Gaskets

DI Pipe

Liquid metal received from BF is fed to a hot metal mixer. Ladles transfer the liquid metal from mixers poured into Induction Furnaces. The temperature of the liquid metal is raised (superheated) to required level in the Induction Furnace and the composition is further homogenized. Ladles then transfer the metal to a magnesium treatment chamber, where solid lumps of pure magnesium or an alloy of Ferrosilicon Magnesium are added to the liquid metal. The magnesium reacts with the liquid and goes into solution forming what is known as nodular iron or ductile iron. Ductile iron has all the characteristics of cast iron with excellent strength and bending characteristics as of steel. It is thus superior to any other material for producing pipes.

Treated metal after removing small amount of magnesium sulfide slag is poured into casting machines for formation of pipes using state-of-the-art "de Lavaud" machines.

The casting machines house steel moulds, cylindrical in shape and rotate them at required speeds. The high centrifugal force thus generated helps to form the pipes and imparts soundness, which is not achieved by any other process. The steel moulds are encased in water jackets that keep them cool and assist solidification of liquid metal after casting thus accelerating the production process. The pipes after solidification are removed from the moulds in hot condition with the help of automatic tongs/pincers and fed mechanically into the heat treatment furnace.

The heat treatment furnace is a chamber, through which pipes are rolled from the entry end to the exit at a predetermined speed and controlled temperature. The flue gases pass through an adequately designed Recuperator, which heats up the inlet air for reducing fuel consumption by facilitating more efficient combustion. Low NOx burners ensure the control of emissions.

After the pipes cool down, they are coated from outside with metallic zinc. The purpose is to give additional protection against corrosion under poor soil conditions. Two strands of zinc wire of high purity are fed through a small "pistol" under strong electric current. This starts an arc of molten zinc, which is blown at a high velocity on the surface of the pipe by a high-pressure air jet. The pipe is held at an optimum distance so that extremely expensive zinc does adhere to the pipe. A small amount rebounds from the surface of the pipe and is lost. The coating process takes place in a closed chamber to avoid fugitive emissions of zinc dust. An Induced Draft Fan sucks the waste zinc dust from the coating chamber and passes it through a cyclone and battery of bag filters, and clean air is let out through the stack. Zinc dust is collected into drums, sealed, and sold for reprocessing in the form of high purity zinc sulphate.

The inside wall of the pipe barrel is cleaned by grinding/scouring, and deburring operation is carried out to remove sharp edges. The pipes are then subjected to high pressure water test to determine soundness of casting and leakage. Pipes failing the pressure test are rejected, broken into pieces, and remelted in the Blast Furnace (BF).

Good quality pipes are weighed, marked and are passed on for lining inside the barrel with Cement-Sand slurry.

Exact quantities of sand and cement are measured in automatic weighing machines and fed into a high-speed inclined plane mixer. Measured quantity of water is added and slurry is prepared. This slurry is poured into the barrel of pipes, which is held in a horizontal plane. The pipes are then transported mechanically onto a rotating station where they are rotated at extremely high speed. The high centrifugal force makes the slurry adhere to the inner wall of the pipes, and the excess water is squeezed out. A very smooth lining is thus achieved which will reduce the friction of water, power consumption of pumping station and will help in increasing the longevity of the pipe line. This lining also prevents deposition and reduction of the bore over a period of time as experienced with unlined pipes.

The freshly lined pipes are passed through a tunnel where low-pressure steam is fed. This accelerates the curing process, and helps in developing the strength of the lining. The warm pipes from the curing chamber are fed into a bitumen painting, where the inner surface (cement lined) is given a seal coat of the required specification. The exterior of the pipes is subsequently given a coat of bitumen of desired thickness.

The coated pipes with wet paint are tapped out at periodic intervals and passed through post heating chamber to the hardening of the freshly painted pipes and then cooled by a spray of water. The pipes with the protective coating are either bundled for ease of handling or stacked loose, depending on the size and the final destinations are kept ready for dispatch.

DI Fittings

The fittings plant shall adopt the standard lost foam process and sand casting process.

Lost Foam Process

In this process the Styrofoam / Polystyrene granules are sieved and sized. The desired mould box is put on to the pattern manufacturing press. The granules are fed into the mould box and steam is injected into the same to heat the granules and form the pattern. The pattern is then removed, inspected, the fins are removed before going for assembly.

The pattern is assembled with other components with refractory glue as demanded by the component geometry. The cores as required by the geometry of the fitting also are assembled. The pattern then is removed, dried and dipped into a refractory paint which is generally applied to the outer surface of the object. The coating then is dried at a temperature of 200°C with hot air generated in an air to air heat exchanger of the heat treatment furnace of the pipe plant.

Dry sand is screened and is filled in a mould box post which the pattern is placed in it. Jolting is done for compaction. Polythene sheet is applied on top of the mould box.

Vacuum suction is switched on to remove all the gases etc from inside the mould box.

Magnesium treated liquid iron is poured through a runner into the mould boxes The polystyrene gets burned off giving way to the hot metal, any fumes generated is sucked off by the vacuum system. The fitting castings are then fettled, shot blasted, water pressure tested, cement lined, cured and finished with brush painting of bitumen or Fusion bonded epoxy coated as per requirement. The fittings are heated in a low temperature oven to a temperature of 220°C before the application of the fusion bonded epoxy coating. The finished fittings are then inspected packed and dispatched.

Sand Casting Process

In case of sand moulding, standard processes will be followed. In all the above cases wooden or metallic pattern used is reusable.
1) Green sand
2) No – bake process
3) CO_2 process.

Flanged Pipes

Ductile Iron Flanged Pipe is used in pressure pipelines for drinking water and sewage distribution. The flange pipes will be produced in various configurations such as single flange & socket end, double flange, single flange and spigot end, etc. Flange pipes with puddle flange will also be manufactured.

Pipes are produced in the DI pipe plant and are coated with zinc. The cast flanges are procured from the market. The pipes to be converted to flange pipes have their ends machined and machined flanges are shrunk fit on the pipes onto the machined portion. On completion of the assembly the flange pipe thus assembled undergo submerged arc welding process and the faces of the flange will be machined square to the pipe axis. The flange pipes then undergo high – pressure water test to determine soundness of the castings and leakage. The good quality pipes are passed for either internal epoxy coating or cement mortar lining and then left for curing of the cement. The pipes are then externally protected with bitumen or epoxy depending on the requirement of customers.

Rubber Gaskets

Rubber Gaskets are used as sealing medium in Tyton push -on type joints for Ductile Iron pressure pipes and fittings. It is proposed to manufacture gaskets suitable for pipe size ranging from DN 80 to DN 1600 mm.

The raw materials necessary for moulding process are synthetic rubber compounds such as EPDM / SBR which is mixed with carbon black and other compounds.

The compounds are tested for quality, consistency and conformance to specifications. After testing the acceptable materials will be weighed in proportion in a batch weighing system.

The compounds are then batch mixed in a dispersion kneader and subsequently in open roll mills. After mixing they are again subjected to tests for quality. The acceptable lot is then warmed in the open roll mills and extruded. The extruded product will be inspected and tested again. The product is then compression moulded in moulding presses, where steam shall be used as the medium for heating. The steam as required for the process in the desired specification will be drawn from the steel plant. The finished products undergo inspection and any projections or fins are trimmed and removed before sending the final product for packing.

Calcining Plant

The calcining plant will produce calcined lime and dolomite which are to be used in steel melt shop as a flux.

Long Product Mills

Long product mills are proposed to be installed to produce various sizes of plain rounds in coil. The input material will be continuously cast (CC) billets. The BFG based reheating furnaces of the rolling mills will be designed to utilize BFG gas and will be undertaken under the Clean Development Mechanism.

Flat Product Finishing Mill

A flat product finishing mill is proposed to be installed to produce various sizes of plates/sheets. The input material will be continuously cast (CC) billets. The BFG based reheating furnaces of the rolling mills will be designed to utilize BFG gas and will be undertaken under the Clean Development Mechanism.

Captive Power Plant

The DR gas, Blast Furnace gas, Coke Oven waste gas, Basic Oxygen Furnace gas and LD gas have substantial heat energy which may be utilized to generate steam and/or power or act as heat energy source. Suitable combination of heat, steam and/or power generation facilities are envisaged under the Clean Development Mechanism by recuperating chemical and sensible heat of the exhaust gas from coke oven batteries and by burning of excess gas from blast furnace and LD Converters. In addition, imported coal /middlings / char based power plant will be installed.

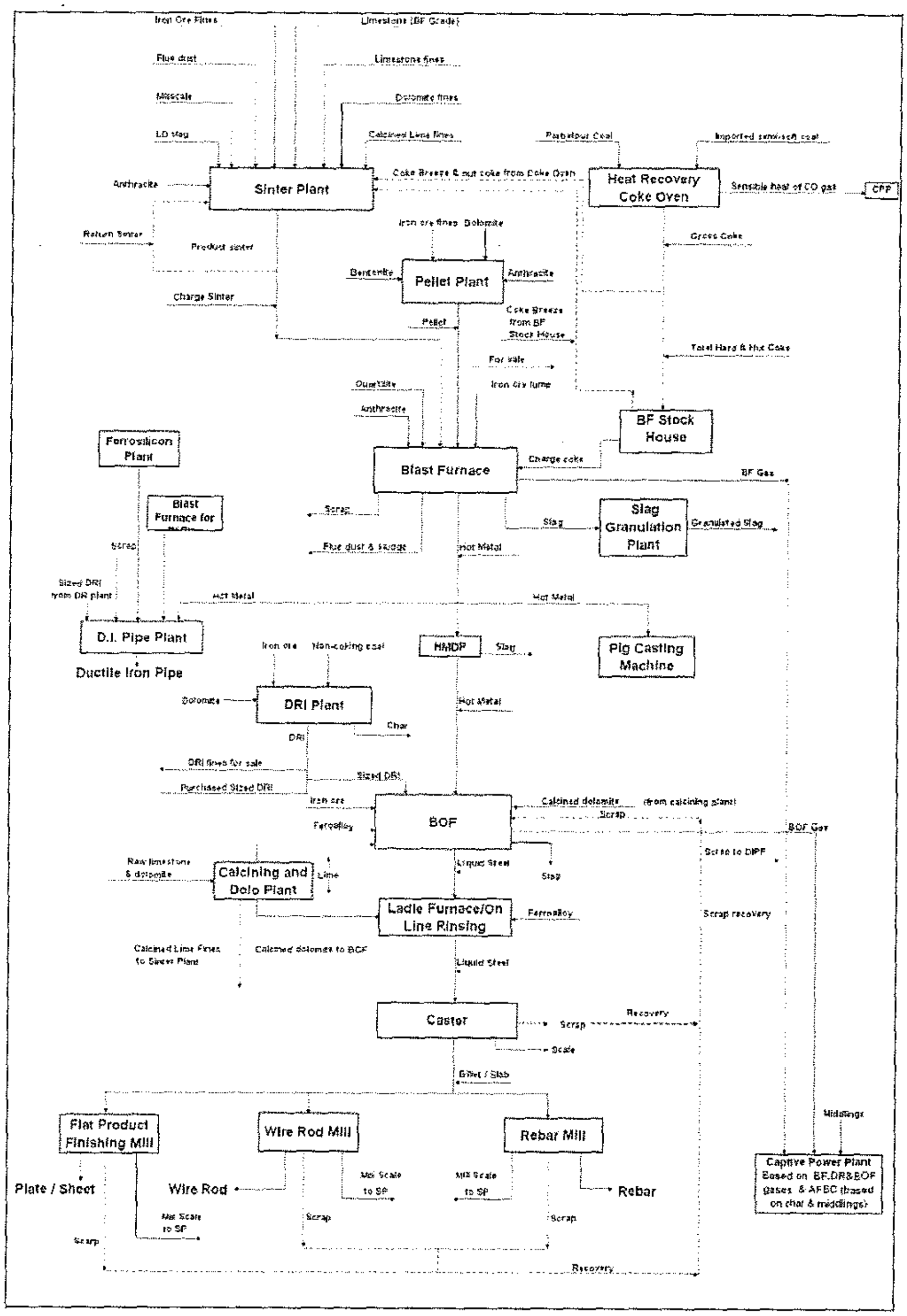


FIGURE-10

PROCESS FLOW DIAGRAM OF THE INTEGRATED STEEL PLANT

3.6 Raw Material Required along with Estimated Quantity, Likely Source, Marketing area of Final Product/s, Mode of Transport of Raw Material & Finished Product.

Major Raw Materials for the Proposed Project

Processing Units	Raw materials	Net & dry (tons/yr)
Coke oven	Captive coking coal	6,50,000
	Imported semisoft coal	15,18,000
Sinter Plant	Iron ore fines	30,92,000
	Lime stone fines	71,400
	Lime stone (BF grade)	1,27,700
	Dolomite fines	2,40,400
	Calcined lime fines	37,600
	Millscale and BOF slag	82,700
Pellet Plant	Iron ore fines	12,20,000
	Dolomite	12,000
	Coal (Anthracite)	42,000
	Bentonite	24,000
Blast Furnaces	Iron ore lump	4,85,300
	Anthracite	2,83,300
	Quartzite	53,250
DR Plant	Sized Iron ore	3,99,000
	Non coking coal	3,45,000
	Dolomite	4,200
Calcining Plant	Limestone (SMS grade)	4,09,400
	Dolomite (SMS grade)	92,400
Steel Melt Shop (BOF)	Iron ore lump	1,06,300
	Ferro alloys	28,600
Power Plant	Coal / Middlings	87,600

3.7 Resource optimization/recycling & reuse envisaged in the project, if any, should be briefly outlined.

A separate waste heat recovery boiler is in operation to supplement the captive power generation system from by-product gases. Under normal condition when all the in-plant power generating units are available, the entire sent-out power from the captive power generation system will be utlised for catering the plant loads with balance power requirement met from the grid power supply system.

3.8 Availability of Water & its source, Energy/Power Requirement & Source should be given

Water Requirement & its Source

Total water requirement from Damodar river will be 86016 m^3/day. The Central water Commission DVRR unit, Government of Jharkhand granted permission to drain 22.0 MGD of water from the river Damodar vide their letter no. MD/DVRR/W-6-116/20007/623-629 dated 10th July 2007.

Power Requirement & its Source

The estimated power requirement of the plant will be about 160 MW. In order to meet the requirement of power for the proposed plant, a captive power plant 120 MW has been envisaged. Balance power will be drawn from DVC.

3.9 Quantity of wastes to be generated (liquid & solid) & scheme for their management/disposal

Wastewater generation

The total fresh water requirement will be 92328 m3/day out of which the wastewater generation will be 30048 m^3/day from the proposed project. A major portion of effluent about 24456 m^3/day (81% of total effluent) for suitable purpose within the plant site. The balance wastewater i.e. 5592 m^3/day (about 19 % of the total effluent) after treatment will meet the prescribed standards for inland disposal and will be suitable for irrigation purpose

Solid Waste / Hazardous Waste Management

The details of solid waste generation is given in **Table-9**

TABLE-9
SOLID WASTE GENERATION

Details of Solid Waste Generation at Integrated Steel Plant

Plant	Material	Quantity mt / day	Method of Collection	Method of Disposal
Sinter Plant	Return sinter	1073	Conveyor	Used in sinter plant
Coke Oven	Coke fines	416	Conveyor	Used in sinter plant
Blast Furnace	Scrap	39	Earth moving equipment	Used in sinter plant
	Flue dust	157	Equipment earth moving	Used in sinter plant
	Slag	2069	Earth moving equipment	Sold off
DI Pipe Plant	Casting rejection & runner	134	Manual	Used for remelting
	Zn dust	1	Bag filter	Sold off
	Burnt core & sand	52	Manual	Sold off
	Waste sand/cement	54	Settling tank	Sold off
DRI Plant	Char	200	Earth moving equipment	Used for power
Steel Melt Shop	BOF slag	1259	Earth moving equipment	Land filling
	Scrap	181	Earth moving equipment	Used in BOF
	Scale	15	Earth moving equipment	Used in sinter plant
Rolling Mills	Scarp	164	Earth moving equipment	Used in BOF
	Mill scale	77	Earth moving equipment	Used in sinter plant
Lime Plant	Quick Lime fines	107	Earth moving equipment	Used in sinter plant
	Limestone fines	204	Earth moving equipment	Used in sinter plant
Dolo Plant	Dolo fines	687	Earth moving equipment	Used in sinter plant
Common	Used refractory	20	Earth moving equipment	Sold off/ used as grog
Power Plant	Ash	190	Earth moving equipment	Sold off

4.0 SITE ANALYSIS

4.1 Connectivity

Road & Rail Connectivity

NH-32 passes at a distance of 9.0 km in direction of west from plant boundary. The nearest railway station is Talgaria at a distance of 1.1km in NNE direction.

Air Connectivity

Ranchi airport is located at a distance of 103 km in the direction of WSW from the project site.

4.2 Land Form, Land Use & Land Ownership

Total land of about 1,350 acres is under possession of ESL and land is in industrial use.

4.3 Existing Land Use pattern

Existing land use is in industrial category. Total project area is about 1,350 acres.

4.4 Infrastructure

The existing infrastructure includes the following.

- Relief, Exhaust and Blow down system;
- Electrical Distribution system;
- Emergency Power system;
- Cooling water system;
- Fire fighting system;
- Utility water system;
- Drinking water system;
- Steam system;
- Fuel system;
- Water and wastewater treatment facility;
- Air pollution control system; and
- Laboratory facility for Blast Furnace, Sinter Plant and Coke Oven.

4.5 Climatic data from Secondary Sources

The climate of the study area is sub humid sub tropical; the average annual rainfall in this region is 1238 mm. The mean annual temperature varies from 2.9°C to 44.7°C however the mean summer temperature ranging between 29.0°C to 32.4°C and mean winter temperature between 17.7°C to 19.0°C. The soil temperature regime is hypothermic and soil moisture regime is 'Ustic'. The study area may be categorized under three natural formation namely central plateau, lower plateau and Damodar Valley. The agro ecological sub region is hot dry and sub humid plateau.

5.0 PLANNING BRIEF

5.1 Planning Concept (types of industries, facilities, transportation etc.)

The project falls under Category-A, under section-3(a) as per the prevailing EIA Notification, dated 14th September 2006.

5.2 Population Projection

The manpower in operating 1.5 MTPA plant is about 8895 no.s. However the proposed balance 1.5 MTPA integrated steel plant will additionally generate direct approximately 5500 indirect secondary & teritiary employment.

5.3 Land use Planning

Existing land use is in industrial category.

5.4 Assessment of Infrastructure Demand

The necessary infrastructure like internal roads, parking provision and administration building is already developed.

5.5 Amenities/ Facilities

The existing infrastructure and utilities like internal roads, water supply, adequate parking provisions, power backup, firefighting measures, landscaping, storm water drains, rain water harvesting, solid waste management are provided.

6.0 PROPOSED INFRASTRUCTURE

6.1 Industrial Area (Processing Area)

The total area under ESL's possession is 1350 acres. Hence, no additional land acquisition is involved.

6.2 Residential Area (Non -Processing Area)

The land is already under industrial use and does not have any settlement.

6.3 Greenbelt

Green belt of 33% of the total project area is already developed.

6.4 Drinking Water Management

Water requirement needs are being met from Damodar river.

6.5 Sewerage System

Proposed project is designed for maintaining zero discharge. The storm water and drains will be separately constructed to minimize storm water contamination with process water.

6.6 Industrial Waste Management/ Solid Waste Management

Major solid waste generated from the proposed plant complex would include BF slag, SMS slag, gas cleaning sludge, ESP/bag filter dust, refractory debris, flyash and bottom ash generated from plant etc. The iron ore, coal and other fines generated in the process would be granulated and sold as raw material to cement manufacturing units. The SMS slag would be recovered in the waste recycling plant (WRP) for separation of magnetic components. The ash would be utilised for cement manufacturing to the possible extent. The rejects would be dumped in a designated area.

Waste oil, used oil and other hazardous wastes will be safely stored in drums/tanks/covered shed and sold to authorized recyclers.

Organic waste will be used as organic manure in the green areas. The municipal waste will be given to authorized agencies for suitable disposal

6.8 Power Requirement and Supply/ Source

Details are provided in **Section-3.8.**

7.0 REHABILITATION AND RESETTLEMENT (R & R PLAN)

7.1 Policy to be adopted (Central/ State) in respect of the project affected persons including home outsees, land outsees and landless labores (a brief outline to be given)

The balance 1.5 MTPA project will be set up within the existing plant premises, thus no additional land is required. Hence, R & R plan is not envisaged for the project.

8.0 PROJECT SCHEDULE AND COST ESTIMATES

8.1 Likely date of start of construction and likely date of completion (Time schedule of the project to be given)

The implementation schedule for the steel plant will be from 12 months after obtaining all necessary clearances.

8.2 Estimated Project Cost along with analysis in terms of economic viability of Project

The estimated cost of the project is about Rs. 5000 crores. The anticipated capital expenditure for the pollution control measures is about Rs. 200 crores.

9.0 ANALYSIS OF PROPOSAL

9.1 Financial and Social Benefits with Special Emphasis on the Benefits to the Local People including the Tribal Population if any

The proposed project will generate revenue to the state government as well as central government in the form of taxes and duties. The people around the region will get direct and indirect employment thus improves the financial status.

The proposed expansion project shall proactively participate in the upliftment of socio economic index of the communities around the project site by way of financial and administrative support. The project will open up employment opportunities, directly and also indirectly. There shall be opportunities for entrepreneurs to engage in many service sectors directly or indirectly associated with the project.

The CSR approach of the company shall be towards sustainable livelihood management of the community around. There shall be focus on education, health, sanitation, drinking water, agriculture, water shed management, culture identity preservation, tribal welfare, welfare of socially weaker sections and marginalized people.