PRE-FEASIBILITY REPORT

FOR

Expansion of Steel Plant facilities from 5.0 MTPA Pellet and 3.1 MTPA Rolling Mill to 19.2 MTPA Integrated Steel Plant and 12.5 MTPA Cement Plant

At
Angul, Odisha

APPLICANT

JINDAL STEEL ODISHA

M/s. Jindal Steel Odisha Limited

Regd. Address : GA PL No. 3, REV PL No. 1163N1164,
Forest Park, Bhubaneswar, Odisha- 751009

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PRE - FEASIBILITY REPORT

1.0 EXECUTIVE SUMMARY

(i) Introduction

M/s Jindal Steel Odisha Limited (JSOL) is proposing expansion of Pellet Plant from 5.0 MTPA to 26.0 MTPA and Hot Rolling mill from 3.1 MTPA to 21.1 MTPA along with setting up 19.2 MTPA Integrated Steel Plant (DRI plant- 5.4 MTPA, Sinter Plant- 11.5 MTPA, Coke Oven-5.17 MTPA, Blast Furnace- 14.0 MTPA, EAF- 6.0 MTPA, BoF- 13.2 MTPA, Wire Rod Mill-1.2 MTPA, CRM- 7.5 MTPA, Calcination plant-7200 TPD, Oxygen plant-11000 TPD, Captive Power Plant (Gas based)- 550 MW, Ferro Alloy plant- 0.376 MTPA) and 12.5 MTPA Cement plant at Villages Basudevpur, Panpur, Kaliakata Jungle, Ramadiha, Kaliakata, Sankerjang, Sankerjang Jungle, Badakerjang, Badakerjang Jungle, Jamunda, Jamunda Jungle, Paripara and Jarada, Tehsil-Chhendipada & Banarpal, District-Angul, Odisha. MoEF&CC vide File no. J-11011/365/2006-IA.II(I) (Proposal No. IA/OR/IND/243532/2021) dated 14.03.2022 granted Environmental Clearance (EC) to M/s Jindal Steel Odisha Ltd. (JSOL), a wholly owned subsidiary of M/s Jindal Steel & Power Ltd. (JSPL), for setting up 5.0 MTPA Pellet plant and 3.1 MTPA Hot Strip mill by partially transferring the EC of these units from the 6.0 MTPA integrated steel plant of M/s Jindal Steel & Power Limited (JSPL).

The existing plant area is 86.68 acres, whereas additional area required for expansion is 3522.05 acres. Hence after expansion, the total plant area will be 3608.73acres.

As per EIA Notification dated 14th Sep. 2006 and its subsequent amendments; the project falls under S. No. 3 (Material Production), Project Activity '3 (a)' Metallurgical Industries (ferrous & non-ferrous), 3(b) Cement plants, 4(b) Coke oven plants & '1 (d)' Thermal Power plant.

The project proposal is shown below.

Table 1

Project Proposal

S No.	Unit	Capacity and Configuration as per existing EC	Capacity and Configuration of the proposed expansion project	Capacity & Configuration after proposed expansion project
1.	DRI Plant	-	5.4 MTPA (2x2.7 MTPA)	5.4 MTPA (2x2.7 MTPA)
2.	Coke Oven	-	5.17 MTPA (2x70 ovens & 4x56 ovens)	5.17 MTPA (2x70 ovens & 4x56 ovens)
3.	Sinter Plant	-	11.5 MTPA (2x490.5 m^2)	11.5 MTPA (2x490.5 m^2)
4.	Blast Furnace	-	14 MTPA (2x5400 m^3& 1x6000 m^3)	14 MTPA (2x5400 m^3& 1x6000 m^3)
5.	EAF	-	6 MTPA (1x250 T & 1x360 T)	6 MTPA (1x250 T & 1x360 T)
6.	BoF	-	13.2 MTPA (2x300 T & 2x360 T)	13.2 MTPA (2x300 T & 2x360 T)

7.	Wire Rod Mill	-	1.2 MTPA	1.2 MTPA
8.	Hot Rolling Mill	1x3.1 MTPA	18 MTPA (3x6 MTPA)	21.1 MTPA (1x3.1 MTPA & 3x6 MTPA)
9.	CRM Complex	-	7.5 MTPA (3x2.5 MTPA)	7.5 MTPA (3x2.5 MTPA)
10.	Calcination plant	-	7200 TPD (12x600 TPD)	7200 TPD (12x600 TPD)
11.	Oxygen Plant	-	11000 TPD (2x2700 TPD & 2x2800 TPD)	11000 TPD (2x2700 TPD & 2x2800 TPD)
12.	Power Plant	-	Gas fired- 550 MW (2x275 MW)	Gas fired- 550 MW (2x275 MW)
13.	Ferro Alloy Plant	-	0.376 MTPA	0.376 MTPA
14.	Pellet Plant	1x5 MTPA	21 MTPA (3x7 MTPA)	26 MTPA (1x5 MTPA & 3x7 MTPA)
15.	Cement Plant	-	12.5 MTPA (3x3.5 MTPA & 1x2 MTPA)	12.5 MTPA (3x3.5 MTPA & 1x2 MTPA)

(ii) Brief Summary of the project (Background)

1. M/s Jindal Steel & Power Ltd. (JSPL) is operating 6.0 MTPA Integrated Steel Plant and 810 MW Captive Power Plant at Angul, Odisha. Environmental Clearance for the same was granted by MoEF vide letter dated 22.02.2007 and was amended vide even letters dated 14.11.2008, 08.02.2017, 26.06.2018, 22.01.2019, 19.01.2021. The unit configuration as per EC read with subsequent amendments till 19.01.2021 was for the following product capacities:

S No.	Facilities	Units	Capacity
1	Pellet Plant	MTPA	5.0
2	Coal Gasifier	Nm3/year	$4000x10^6$
3	DRI plant	MTPA	4.0
4	Blast Furnace	MTPA	4.25
5	Coke Oven	MTPA	2.0
6	Sinter Plant	MTPA	5.0
7	SMS	MTPA	6.0
8	Rolling mills	MTPA	6.0
9	Ferro-alloy plant	MTPA	0.08
10	Lime Dolime plant	TPD	3000
11	Process gas/ pressure recovery turbine	MW	62
12	Coal based Power Plant	MW	810

Note- Oxygen Plant was not included in the table mentioned in EC granted for 6 MTPA ISP of JSPL. However, the EIA report submitted for seeking major amendment in EC dated 14.11.2008 included the Oxygen plant of 7200 TPD as one of the proposed facilities in the integrated steel plant. The reason for excluding the same in the table of configuration of EC may be due to the fact that Oxygen plant does not require EC.

2. JSPL submitted an application to MOEF&CC, New Delhi on 31.12.2020 for grant of TOR for expansion of the integrated steel plant from 6.0 MTPA to 25.2 MTPA and Cement plant of 12.5 MTPA at Angul. The TORs for the proposed expansion project was granted to JSPL vide letter dated 08.02.2021. However, as per the recommendations of the EAC the proposed expansion project was titled as an expansion from 4.5 MTPA to 25.2 MTPA integrated steel plant. Subsequently, M/s. JSPL submitted a representation to the Ministry on 29/01/2021 stating that in their EC amendment letter accorded on 08/02/2017, MoEF&CC clarified that validity of EC refers to start of production by the project/activity. In view of the representation, the environment clearance gets completed if the project starts the production within the validity period. In view of this, JSPL submitted that the company started the production within the validity period and the query regarding validity period of EC does not arise. In view of the above, JSPL requested MOEF&CC to amend the existing capacity mentioned as 4.5 MTPA and title the expansion from 6.0 MTPA to 25.2 MTPA ISP capacity. In view of this, Ministry vide letter dated 12.04.2021 informed JSPL to apply for ToR amendment. Accordingly, JSPL submitted the ToR amendment application vide proposal no. IA/OR/IND/212826/2021 dated 21/05/2021 and ToR amendment was accorded on 16/06/2021 with a title "Expansion of Integrated Steel Plant from 6 MTPA liquid steel to 25.2 MTPA liquid steel (24.79 MTPA Crude Steel) and 12.5 MTPA Cement plant by M/s. Jindal Steel & Power Limited.
3. JSPL vide online proposal no. IA/OR/IND/228087/2021 dated 17.09.2021 sought for amendments in the TOR accorded on 08.02.2021, and amended on 16.06.2021 due to change in land use for exclusion of forest land and change in configuration of some facilities of the proposed expansion project.
4. The proposal for TOR amendment seeking change in configuration and change in land use due to the exclusion of the revenue forest land from the expansion project was considered by EAC in its meeting held during 28th-29th September, 2021. The Committee recommended the following regarding exclusion of Revenue Forest land from the proposed project:

   "Ministry shall refer the proposal of proponent regarding exclusion of 27 ha of forest land seeking comments/views of the State Government of Odisha on the same along with consequential likely impact due to the proposed expansion. On receipt of the same, the proposal shall be placed before the EAC for consideration."
5. The proposal with regard to the change in configuration of the project was re-considered and recommended by the EAC in its meeting held on 28th October, 2021 and accordingly MoEF&CC vide letter dated 29.11.2021 granted amendment in TOR. The configuration of the proposed expansion project as per the TOR amendment letter is given below:

S No	Plant Equipment / Facility	As per EC dated 22/02/2007 and its subsequent amendments (A = A1+A2)*							As per approved TOR dated 08/02/2021 and amendment dated 16/06/2021		Proposed changes in ToR (B)		Final after amendment of TOR (A+B)		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO							
		Configu-ration	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	
1.	Coal Gasification Plant	4000 Million Nm^3/year	4000 Million Nm^3/year	2100 Million Nm^3/year	2100 Million Nm^3/year	1900 Million Nm^3/year	1900 Million Nm^3/year	1900 Million Nm^3/year	7x37500 Nm^3/hr	2100×10^6 Nm^3/year	Capacity proposed in the ToR to be deleted.		4000 Million Nm^3/year	4000 Million Nm^3/ year	-
2.	DRI Plant	2x2 MTPA	4 MTPA	1x2 MTPA	2 MTPA	1x2 MTPA	2 MTPA	1.8	2x2 MTPA 2x2.7 MTPA	9.4 MTPA	2x2.7 MTPA + Addition of 0.7 MTPA in 2 MTPA under EC dated 22/02/2007	5.4 MTPA + 0.7 MTPA	1x2 MTPA 3x2.7 MTPA	10.1 MTPA	0.7 MTPA increase within 2 MTPA DRI under EC dated 22/02/07
3.	Coke Oven	4x72 ovens	2 MTPA	4x72 ovens	2 MTPA	-	-	2.0	4x72 ovens 2x63 ovens 6x54 ovens	7.6 MTPA	2x70 ovens, 4x56 ovens	5.17 MTPA	4x72 ovens, 2x70 ovens, 4x56 ovens	7.17 MTPA	Capacity decrease of 0.43 MTPA
4.	Sinter Plant	1x490 m^2	5 MTPA	1x490 m^2	5 MTPA	-	-	4.0	2x490.5 m^2	10.75 MTPA	2x490 m^2	11.5 MTPA	3x490 m^2	16.5 MTPA	Capacity increase of 5.75 MTPA
5.	Blast Furnace	1x4554 m^3	4.25 MTPA	1x4554 m^3	4.25 MTPA	-	-	3.2	1x4554 m^3 1x5400 m^3	18.75 MTPA	2x5400 m^3, 1x6000 m^3	14 MTPA	1x4554 m^3, 2x5400 m^3, 1x6000 m^3	18.25 MTPA	Capacity decrease of 0.5 MTPA

S No	Plant Equipment / Facility	As per EC dated 22/02/2007 and its subsequent amendments (A = A1+A2)*							As per approved TOR dated 08/02/2021 and amendment dated 16/06/2021		Proposed changes in ToR (B)		Final after amendment of TOR (A+B)		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO							
		Configu-ration	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	
									2x6000 m^3						
6.	EAF	1x250 T	3 MTPA	1x250 T	3 MTPA	-	-	4.5	3x250 T	7.5 MTPA	1x250 T, 1x360 T	6 MTPA	2x250 T, 1x360 T	9.0 MTPA	Capacity increase of 1.5 MTPA
7.	BoF	1x250 T	3 MTPA	1x250 T	3 MTPA	-	-		2x250 T 3x380 T	17.7 MTPA	2x300 T, 2x360 T	13.2 MTPA	1x250 T, 2x300 T, 2x360 T	16.2 MTPA	Capacity decrease of 1.5 MTPA
8.	Plate Mill	1x1.5 MTPA	1.5 MTPA	1x1.5 MTPA	1.5 MTPA	-	-	2.6	1x2.0 MTPA	2.0 MTPA	-	0.5 MTPA	1x2.0 MTPA	2.0 MTPA	-
9.	Bar Mill	1x1.4 MTPA	1.4 MTPA	1x1.4 MTPA	1.4 MTPA	-	-		1x1.4 MTPA	1.4 MTPA	-	-	1x1.4 MTPA	1.4 MTPA	-
10.	Wire Rod Mill	-	-	-	-	-	-		1x1.2 MTPA	1.2 MTPA	1x1.2 MTPA	1.2 MTPA	1x1.2 MTPA	1.2 MTPA	-
11.	Hot Rolling Mill	1x3.1 MTPA	3.1 MTPA	-	-	1x3.1 MTPA	3.1 MTPA	-	1x3.1 MTPA 3x6 MTPA	21.6 MTPA	3x6 MTPA	18 MTPA	1x3.1 MTPA 3x6 MTPA	21.1 MTPA	-
12.	CRM Complex	-	-	-	-	-	-	-	3x2.5 MTPA	7.5 MTPA	3x2.5 MTPA	7.5 MTPA	3x2.5 MTPA	7.5 MTPA	-
13.	Calcination Plant	2x600 TPD, 2x500 TPD, 2x400 TPD	3000 TPD	2x600 TPD, 2x500 TPD	2200 TPD	2x400 TPD	800 TPD	1000 TPD	15x600 TPD 2x500 TPD	10,000 TPD	12x600 TPD	7200 TPD	14x600 TPD, 2x500 TPD, 2x400 TPD	10,200 TPD	Capacity decrease of 600 TPD

S No	Plant Equipment / Facility	As per EC dated 22/02/2007 and its subsequent amendments (A = A1+A2)*							As per approved TOR dated 08/02/2021 and amendment dated 16/06/2021		Proposed changes in ToR (B)		Final after amendment of TOR (A+B)		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO							
		Configu-ration	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	
14.	Oxygen Plant	2x1200 TPD, 3x200 TPD, 1x1710 TPD, 3x200 TPD	5310	2x1200 TPD, 3x200 TPD, 1x1710 TPD, 3x200 TPD	5310	-	-	5310	2x1200 TPD 6x200 TPD 1x2000 TPD 1x1710 TPD 3x3600 TPD	18,110 TPD	2x2700 TPD, 2x2800 TPD	11,000 TPD	2x1200 TPD, 6x200 TPD, 1x1710 TPD, 2x2700 TPD, 2x2800 TPD	16310 TPD	Capacity decrease of 1800 TPD
15.	Power Plant	6x135 MW	810 MW (coal based)	6x135 MW	810 MW (coal based)	-	-	810	6x135 MW (Coal based) 1x350 MW, 1x250 MW (Gas based)	1410 MW	2x275 MW	550 MW	6x135 MW, 2x275 MW	1360 MW	Capacity decrease of 50 MW
16.	Ferro Alloy Plant	3x24 MVA	0.08 MTPA	-	-	3x24 MVA	0.08 MTPA	-	1x18 MVA 1x15 MVA 4x45 MVA 1x15 MVA	0.376 MTPA	0.376 MTPA	0.376 MTPA	3x24 MVA, 1x18 MVA, 2x15 MVA, 4x45 MVA,	0.456 MTPA	-

S No	Plant Equipment / Facility	As per EC dated 22/02/2007 and its subsequent amendments (A = A1+A2)*							As per approved TOR dated 08/02/2021 and amendment dated 16/06/2021		Proposed changes in ToR (B)		Final after amendment of TOR (A+B)		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO	Configu-ration	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	
		Configu-ration	Capacity	Configu-ration	Capacity	Configu-ration	Capacity	Capacity							
									1x6 MVA				1x6 MVA		
17.	Pellet Plant	1x5 MTPA	5 MTPA	-	-	1x5 MTPA	5 MTPA	-	3x7 MTPA 1x5 MTPA	26 MTPA	3x7 MTPA	21 MTPA	1x5 MTPA 3x7 MTPA	26 MTPA	-
18.	Cement Plant	-	-	-	-	-	-	-	3x3.5 MTPA 1x2 MTPA	12.5 MTPA	3x3.5 MTPA 1x2 MTPA	12.5 MTPA	3x3.5 MTPA 1x2 MTPA	12.5 MTPA	-
19.	Iron ore slurry	-	-	-	-	-	-	-	2x18 MTPA	36 MTPA	2x18 MTPA	36 MTPA	2x18 MTPA	36 MTPA	-

**Note* - *MoEF&CC vide letter dated 08/02/2017 clarified that validity of EC dated 22/02/2007 refers to start of production by the project/activity, it does not say start of full production as per the sanctioned environment clearance capacity. In view of this, the environment clearance gets completed if the project starts the production within the validity period.*

6. Subsequently, in line with the EAC's recommendations, MoEF&CC vide its letter dated 07.02.2022 to The Additional Chief Secretary, Forest, Environment and Climate Change Department, Govt. of Odisha sought comments/ view regarding exclusion of Forest land.
7. MoEF&CC vide letter dated 14.03.2022 granted Environmental Clearance (EC) to M/s Jindal Steel Odisha Ltd. (JSOL), a wholly owned subsidiary of JSPL, for setting up 5.0 MTPA Pellet plant and 3.1 MTPA Hot Strip mill by partially transferring the EC of these units from the 6.0 MTPA integrated steel plant of M/s JSPL.
8. Simultaneously, MoEF&CC vide letter dated 14.03.2022 also granted EC amendment to JSPL by deletion of the 5.0 MTPA Pellet plant and 3.1 MTPA Hot Strip mill from its EC for the 6.0 MTPA integrated steel plant.
9. The Forest, Environment & Climate Change Department, Govt. of Odisha vide its letter no. 8819 dated 11.05.2022 furnished its views to MoEF&CC on the exclusion of the Forest land from the proposed expansion project. The PCCF suggested the following actions for execution by the project proponent if the Revenue Forest land will be excluded from expansion of the JSPL Plant.

a) That as proposed, the project proponent will ensure not to enclose or in any other way restrict the movement of wildlife. Green Zone should be maintained without any sort of fencing/ boundary wall but by ensuring full proof watch and ward. The User Agency will not change the proposed land use without prior permission of the competent authority.
b) Accessibility to each Revenue Forest patches is to be ensured through non-private plots with at least 5 mtr wide all weather roads all around the boundary of proposed expansion. The proposed road should be handed over to either Revenue or Forest Department for future management.
c) A scheme for conservation, protection and regeneration of Revenue Forest patches and Durgapur Reserve Forest should be implemented by the Forest Department at the project cost. Further, Soil & Water Conservation Plan should be implemented to compensate change in land use and drainage patterns.
d) Integrated Site Specific Wildlife Management Plan will be implemented by the project Proponent including outcome of periodic revision of existing Wildlife Management Plan as per guidelines issued by CWLW related to Site Specific Wildlife Management Plan if required.
e) The User Agency should prepare a plan for existing drainage line to avoid water logging issues in anticipation.
f) The User Agency should resolve rehabilitation and re-settlement issues of displaced peoples from proposed acquisition area.

10. The proposal was re-considered and recommended by the EAC during its meeting held on 30th-31st May, 2022 and accordingly the TOR amendment was granted by MoEF&CC vide letter dated 15.06.2022.
11. Due to the commercial benefits as also the fact that the new entity name (M/s Jindal Steel Odisha Ltd.) reflects the state of incorporation, it is planned to implement the 19.2 MTPA integrated steel plant and 12.5 MTPA cement plant by JSOL in place of JSPL, as envisaged earlier.

In view of the above, the instant proposal is being submitted for grant of TORs for the proposed expansion of the Jindal Steel Odisha Ltd's steel plant facilities viz. Pellet Plant (5.0 MTPA) and Hot Strip Mill (3.1 MTPA) to 19.2 MTPA Integrated Steel Plant and 12.5 MTPA Cement plant at Angul, Odisha.

In summary, the main points of the instant proposal for TOR of the proposed expansion project area are as follows:

a. The instant proposal will be expansion of the steel facilities of JSOL to achieve integrated steel plant of 19.2 MTPA and cement plant of 12.5 MTPA. The capacity and configuration of the proposed units of JSO expansion project will be exactly same as the capacity and configuration of the expansion project of JSPL for which the TOR has already been granted vide letter dated 08.02.2021 and subsequent amendments.

b. The proposed expansion project of JSOL will be located in the same co-ordinates andwith same layout as proposed and approved by MOEF&CC for expansion plant of JSPL. The total area also remains the same. The total land required for the proposed expansion project includes land already acquired by JSPL and additional land to be acquired.

c. Revenue and Disaster Management Department, Govt. of Odisha vide its letter dated 21.06.2022 has already allowed JSPL to sub-lease the land measuring 2120.325 acres to JSOL for setting up of 19.2 MTPA Steel plant and 12.5 MTPA Cement plant.

d. The actions suggested by the PCCF & HoFF vide letter no. FE-DIV-FLD-0156-2021-8819/FE&CC dated 11.05.2022 of the Govt. of Odisha for exclusion of the forest land will be implemented by JSOL on grant of TOR and EC for its proposed expansion project.

e. JSPL will continue to operate its integrated steel plant of 6.0 MTPA as per the existing EC dated 22.02.2007 read with subsequent amendments.

f. JSPL will continue to implement the unimplemented facilities as per the MoEF&CC's EC dated 02.2007 and was amended vide even letters dated 14.11.2008, 08.02.2017, 26.06.2018, 22.01.2019, 19.01.2021 &14.03.2022.

(iii) Brief description of the project

Brief description about the project is given in table below: -

Salient Features of the Project

S. No.	PARTICULARS	DETAILS
A.	**Nature of the Project**	Expansion of Steel Plant facilities
B.	**Size of the Project**	Expansion of Pellet Plant from 5.0 MTPA to 26.0 MTPA and Hot Rolling mill from 3.1 MTPA to 21.1 MTPA along with setting up 19.2 MTPA Integrated Steel Plant (DRI plant- 5.4 MTPA, Sinter Plant- 11.5 MTPA, Coke Oven-5.17 MTPA, Blast Furnace- 14.0 MTPA, EAF- 6.0 MTPA, BoF-13.2 MTPA, Wire Rod Mill-1.2 MTPA, CRM- 7.5 MTPA, Calcination plant-7200 TPD, Oxygen plant- 11000 TPD, Captive Power Plant (Gas based)-550 MW, Ferro Alloy plant- 0.376 MTPA) and 12.5 MTPA Cement plant
C.	**Location Details**	
1.	Village	Basudevpur, Panpur, Kaliakata Jungle, Ramadiha, Kaliakata, Sanakerjang,Sanakerjang Jungle, Badakerjang, Badakerjang Jungle, Jamunda Jungle, Paripara and Jarada.
2.	Gram panchayat	Paranga, Sankerjang, Jarada, Tukuda
3.	Tehsil	Chhendipada & Banarpal
4.	Police Station	Nisha & Jarpada

S. No.	PARTICULARS	DETAILS
5.	District	Angul
6.	State	Odisha
D.	**Geographical extent of the plant site**	
1.	Latitude	20°51'20.09"N to 20°54'33.28"N
2.	Longitude	84°55'22.20"E to 84°59'57.46"E
3.	Toposheet No.	73D13, 73C16, 73H1 & 73G4
E.	**Area Details**	
1.	Total Plant area	3608.73 acres (1460.4 hectares)
2.	Greenbelt & Plantation area	35% i.e. 1263 acres (511.18 ha) of total plant area will be developed as greenbelt and plantation.
F.	**Environmental Setting Details (with approximate aerial distance and direction from the plant site)**	
1.	Nearest City	Angul (15.0 km in ESE direction)
2.	Nearest National / State Highway	❖ SH-63 (1.2 km in East direction) ❖ NH - 42 (2.0 km in South West direction) ❖ SH-23 (6.5 km in SSE direction)
3.	Nearest Railway station	Kerjang Railway Station (~1.5 km in South direction)
4.	Nearest Airport	Biju Patnaik International Airport, Bhubaneshwar (~150 km in SE direction)
5.	National Parks, Reserved Forests (RF) / Protected Forests (PF), Wildlife Sanctuaries, Biosphere Reserves, etc. within 10 km radius	No National Parks, Wildlife Sanctuaries, Biosphere Reserves lies within 10 km radius. **7 Protected Forests lies in 10 km radius: -** ❖ Derjanga Golabandha PF (~1.0 km in SE direction) ❖ Paranga PF (~1.5 km in ENE direction) ❖ Nisha PF (~3.0 km in North East direction) ❖ Arishila Sulia PF (~3.3 km in WNW direction) ❖ Mandargiri PF (~7.0 km in South East direction) ❖ Nanda PF (~9.0 km in SSE direction) **21 Reserved Forests lies in 10 km radius: -** ❖ Kerjang RF (Adjacent to the plant site in South direction) ❖ Durgapur RF (Adjacent to the plant site in North West direction) ❖ Kaliakata RF (Adjacent to the plant site in North direction) ❖ Hinsar Sorishpal RF (~3.6 km in SSW direction) ❖ Pathargarh RF (~4.5 km in South West direction) ❖ Malibandha RF (~5.0 km in North East direction) ❖ Katara RF (~5.3 km in West direction) ❖ Kalapat RF (~5.5 km in SSW direction)

S. No.	PARTICULARS	DETAILS
		❖ Sorishpal RF (~ 5.8 km in SSE direction) ❖ Jaipur RF (~7.0 km in NNE direction) ❖ Kuio RF (~7.0 km in East direction) ❖ Simuliapathar RF (~7.2 km in WNW direction) ❖ Barhadandasahi RF (~8.5 km in SSE direction) ❖ Gopalprasad RF (~ 9.0 km in North East direction) ❖ Kauchiakhol RF (~9.0 km in ENE direction) ❖ Sakasingha RF (~9.0 km in ENE direction) ❖ Kulasinga RF (~9.0 km in South direction) ❖ Burti RF (~9.0 km in SSW direction) ❖ Parha RF (~9.0 km in WSW direction) ❖ Barha Kathia RF (~9.5 km in NNE direction)
6.	Water Bodies within 10 km radius	❖ Kurdabhali Nala (In plant site of JSPL) ❖ Nandira Jor (~Adjacent in East direction) ❖ Parang Minor Irrigation project (~Adjacent in East direction) ❖ Nigra Nala (~0.4 km in WSW direction) ❖ Derjanga Reservoir (~2.0 km in SE direction) ❖ Angul Main Canal (~3.2 km in ESE direction) ❖ Lingra Nala (~3.5 km in ESE direction) ❖ Ligra Nala (~4.0 km in SW direction) ❖ Balaldhara Nala (~4.5 km in ENE direction) ❖ Matelia Jor (~5.5 km in SSE direction) ❖ Singhada Jor (~7.0 km in North direction) ❖ Gundijerl Nala (~7.5 km in NNW direction) ❖ Mutkuria Nala (~8.0 km in South direction) ❖ Kandhanal Nala (~8.0 km in North direction) ❖ Purunapani Nala (~9.5 km in NNE direction) ❖ Marahha Jor (~9.5 km in NNE direction) ❖ Nuabanda Nala (~10.0 km in NW direction)
7.	Seismic Zone	Zone - III [based on the Vulnerability Atlas of India – 3rd Edition, BMTPC]
G.	**Cost Details**	
1.	Total Cost of the Project	Rs. 119,952 Crores
2.	Cost for Environmental Protection Measures	❧ Capital Cost - Rs. 4280 Crores ❧ Recurring Cost – Rs 290 Crores/annum
F.	Fresh water requirement	12,115 cu m/hr - Existing 1095 cu m/hr, Additional – 11020 cu m/hr

S. No.	PARTICULARS	DETAILS
H.	Power Requirement	1945 MW - Existing 185 MW Additional – 1760 cu m/hr
I.	Employment Generation	Construction phase - Direct 170, Indirect 42,800 Operation phase - Direct 6,500 Indirect 2,900

1.1 ENVIRONMENT MANAGEMENT PLAN

Particulars	Details
Air quality management	COKE OVEN: ▪ Charging emissions will be controlled by High Pressure Liquor Aspiration (HPLA) injection in goose neck during charging. ▪ Coking emissions will be controlled by efficient sealing arrangement of AP cap. ▪ Land based fume extraction system would be adopted for charging and pushing emission control. ▪ Hot coke would be quenched by CDQ with recovery of sensible heat for steam generation. ▪ Raw coke oven gas (COG) would be cleaned in by-product recovery plant with recovery of tar, ammonia and sulphur to make it suitable for use as plant fuel and as reductant in the DRI plant. PELLET PLANT: Installation of ESP with adequate height of chimneys. GAS BASED DRI: Flue gas generated due to combustion of syn gas will be vented to the atmosphere through a stack of adequate height. SINTER PLANT: ▪ Conventional air pollution systems like DE systems of sinter stock house based on ESP and waste flue gas cleaning by ESP would be considered. ▪ Particulate dust emission from product sinter screening units would be controlled by DE systems complete with duct, fabric filters and stack of adequate height. ▪ Partial recirculation of waste gas would be adopted for heat recovery and energy conservation measures. LADLE FURNACE: Fume extraction devices routed to overall secondary fume extraction system of shop through ducts to clean dust laden fumes. BLAST FURNACE: ▪ BF stock house would be provided with DE systems complete with dust extraction hoods, ESP/ Bag Filter, ID fan and stack of adequate height. ▪ Cast house would have separate fume collection system during taping of hot metal and slag, equipped with bag filter/ESP for separation of particulates before venting through a stack of appropriate height. ▪ Dust extraction hoods, ESP/Bag Filter, ID fan and stack of adequate height LIME DOLO CALCINATION PLANT:

	▪ Emissions would be collected and taken through a bag filter to separate out the lime/dolo fines. ▪ Lime/dolo fines thus collected would be recycled to sinter plant. ▪ Kilns in calcining plant and other dust generation areas would be provided with separate DE systems, complete with bag filters and stack of adequate height to clean particulates. BOF & EAF: APC comprising of doghouse with collection hood, ID fan, bag filter and stack of appropriate height. EAF will be provided with fourth hole fume extraction system . FERRO ALLOY PLANT: Fourth hole fume extraction system with Bag filter and stack of adequate height CEMENT GRINDING UNIT: Proper raw material and product handing facilities with dust extraction systems comprising of bag filters. CAPTIVE POWER PLANT: ▪ Surplus by-product fuels gases would be burnt in boilers for generation of power. Power would also be generated from CDQ & TRT. ▪ Flue gas thus generated from boiler would be vented through stack of appropriate height. ROLLING MILLS: ▪ Use of clean by-product gas in RF as fuel. ▪ Optimisation of the excess air supply and proper burner design and fume extraction system to control NOx emissions. ▪ Fume extraction (FE) system would be installed. ▪ Flue gas, which is fairly clean, would be vented through a stack of adequate height. ▪ Acid pickling line of CRM would be provided with a scrubber system for FE along with acid regeneration plant (ARP). ▪ For annealing/galvanizing/colour coating of Cold rolled (CR) coils, it would be heated in inline annealing furnaces prior to its respective treatments. Waste produced due to burning of fuel would be vent to atmosphere through a stack of adequate height. ▪ Non-annealed cold rolled coils would undergo hot dip galvanisation in molten zinc baths followed by passivation which would generate vapours and fumes which would be controlled by fume extraction systems. FUGITIVE EMISSION CONTROL: ▪ De-dusting will be provided for product handling area. ▪ Fugitive emissions will be suppressed by using dust suppression system. ▪ Every possible effort will be made to conserve the raw materials, energy and water consumption to match with the international standards. ▪ Good housekeeping practices will be maintained. ▪ All vibrating screens will be covered to preventing the leakages of Dust. ▪ Raw material handling/dispatch will be conveyed to all particular units in acoustic

	conveyor belt.
Water quality management	▪ The plant will be completely based on Zero Liquid Discharge. ▪ Contaminated water will be cleaned and recycled to process. Treated water will be used in greenbelt & dust suppression. ▪ Continuous attempt will be made to optimize/reduce the use of water and to avoid wastage and leakage of water. ▪ Non-contaminated and potentially contaminated run-off will be channelized separately and treated in 3 ETPs (Bio-ETP for Coke Oven, ETP for CRM complex and ETP for blowdown water from all other units) separately. Sediment trap will be provided to prevent the discharge of excessive suspended solids. ▪ Waste effluent and blow down from the recirculating water systems will be sent in the waste water pit where the suspended solids, oil etc. will be removed. ▪ The supernatant water will be utilized in low end application such as sprinkling, gardening etc. ▪ Domestic waste water will be treated in STP and used in dust suppression & greenbelt development. ▪ Raw materials stock pile, open dump yard will be made inside the plant premises, which have the potential to contaminate the groundwater level through seepage. Mitigation measures like Stockpiles of all raw materials and coal will be made on pucca platform (preferably concrete / clay compacted) and provided with garland drains and sedimentation pit, Stockpiles preferably will be covered under covered shed and temporarily using tarpaulin, etc., Wind breakers in the form of tin sheds will be installed around open stock yard to avoid any groundwater contamination. ▪ Regular monitoring of influent and effluent surface, sub-surface and ground water will be ensured and treated waste water meets the norms prescribed by SPCB or EPA.
Noise Management	▪ The equipment with high noise such as crusher, air compressor and air blow down will be enclosed in soundproof rooms, vibration-reducing material shall be installed on the foundation, and mufflers shall be installed at entrances and exits. ▪ Time to time oiling and servicing of machines will be done. ▪ Acoustic enclosures for DG sets will be provided. ▪ Earmuffs provided to workers while running the equipment of the plant. ▪ Periodic monitoring will be carried out. ▪ Greenbelt of appropriate width inside the plant premises and at the plant boundary will be developed and same will be maintained in the future. ▪ Sound absorbing material will be provided in rooms where both the noise source and plant personal is present so that the reflecting sound is absorbed. ▪ Alternation of duties and regular check ups will be conducted to find any anomaly related to auditory capacity of employees.

	▪ Proper training will be provided to workers related to impacts of long term high noise level exposures.
Solid & Hazardous Waste Management	▪ BF Slag - Granulation in Slag granulation plant and used in the captive cement manufacturing plant to produce Portland slag cement. ▪ BOF Slag - BOF Slag would be processed in Metal recovery plant. Use in construction purposes mainly for road sub grade preparation and for paver block making. Proposed use in railway ballast, etc. after accelerated weathering. 10% of unweathered slag would be used in Cement plant after metal recovery. ▪ EAF Slag - Used as construction aggregate, as road sub grade and for paver block making. ▪ BF and SMS Flue Dusts - Reuse in Agglomeration in Sinter plant and balance to be sold to external agencies. ▪ Mill Scales - Reuse in agglomeration in Sinter Plant. ▪ BOD Sludge - Recycled to Coke Oven Battey. ▪ Coal Tar Sludge – Recycled to Coke Oven Battery. ▪ CETP Sludge - RO rejects will be treated in MEE and the crystallised solids which have no commercial value will be transferred to authorized agency for disposal. Carbon bearing sludge would be recycled back to Coke Oven. ▪ Waste Oil to be given to authorized recyclers.
Greenbelt development & plantation	▪ 35% i.e. 1263.15 acres (511.18 ha) of total plant area will be developed as greenbelt and plantation. ▪ The greenbelt & plantation development in and all around the plant site help to attenuate the pollution level. ▪ Greenbelt will be developed as per Central Pollution Control Board (CPCB) guidelines. ▪ Plantation of selected tree species, which are suitable to area condition, will be done for attenuation of air & noise pollution. ▪ Native species will be planted in consultation with the local DFO.
Occupational Health & safety	▪ PPE like earplugs and muffs will be provided and administrative pressure applied for using them. ▪ Engineering measures will be implemented to reduce the dust generation at the originating point by installing appropriate control devices and / or regular water sprinkling. ▪ Regular monitoring of work environment for humidity, heat, illumination, metal fumes, gases, dust, etc. will be carried out and shall be done in near future also. ▪ 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, including heat stress. ▪ Proper illuminations will be maintained at each and every nook and corner of the work

	places. ▪ Regular advice will be given to the workers through special campaigns and illustrations related to safe work practices so that they do not develop any muscular strain or fatigue during their work schedules. ▪ Medical check-up of all the employees will be done during pre-employment. The health of workers will be regularly monitored under an occupational surveillance programme.

2.0 INTRODUCTION OF THE PROJECT/ BACKGROUND INFORMATION

i. Identification of Project and Project Proponent

M/s Jindal Steel Odisha Limited (JSOL) is proposing expansion of Pellet Plant from 5.0 MTPA to 26.0 MTPA and Hot Rolling mill from 3.1 MTPA to 21.1 MTPA along with setting up 19.2 MTPA Integrated Steel Plant (DRI plant- 5.4 MTPA, Sinter Plant- 11.5 MTPA, Coke Oven-5.17 MTPA, Blast Furnace- 14.0 MTPA, EAF- 6.0 MTPA, BoF- 13.2 MTPA, Wire Rod Mill-1.2 MTPA, CRM- 7.5 MTPA, Calcination plant-7200 TPD, Oxygen plant-11000 TPD, Captive Power Plant (Gas based)- 550 MW, Ferro Alloy plant- 0.376 MTPA) and 12.5 MTPA Cement plant at Villages Basudevpur, Panpur, Kaliakata Jungle, Ramadiha, Kaliakata, Sankerjang, Sankerjang Jungle, Badakerjang, Badakerjang Jungle, Jamunda, Jamunda Jungle, Paripara and Jarada, Tehsil-Chhendipada & Banarpal, District-Angul, Odisha.

Project Proponent

M/s Jindal Steel Odisha Ltd. (JSO) is a 100% subsidiary of M/s JSP. M/s JSO has been incorporated on 17th April, 2021 under the Companies Act, 2013 (18 of 2013). Jindal Steel & Power Limited (JSP) is one of India's leading industrial houses with a dominant presence in steel, power, mining and infrastructure sectors. With an investment of 12 billion USD across the globe, the company is continuously scaling its capacity utilisation and efficiencies to capture opportunities for building a self-reliant India. JSP has manufacturing units at Angul, Raigarh, Raipur, Patratu and Barbil to produce diverse products like plates, slabs, billets, blooms, beam blanks, rounds, plates, beams, flange columns, channels, rails, angles, bricks, etc. Brief particulars of the plants in India are as follows:

a) 6 MTPA Steel Plant at Angul with 6 X 135 MW Captive Power Plants (CPP)
b) 3.6 MTPA Steel Plant at Raigarh with 299 MW CPP
c) 540 MW Captive Power Plant at Dongamahua (DCPP)
d) 1.6 MTPA Rolling Mills at Patratu
e) 9 MTPA Pellet Plants at Barbil
f) Machinery Works at Raipur

ii. Brief description of nature of the project

M/s Jindal Steel Odisha Limited (JSOL) is proposing expansion of Pellet Plant from 5.0 MTPA to 26.0 MTPA and Hot Rolling mill from 3.1 MTPA to 21.1 MTPA along with setting up 19.2 MTPA Integrated Steel Plant (DRI plant- 5.4 MTPA, Sinter Plant- 11.5 MTPA, Coke Oven-5.17 MTPA, Blast Furnace- 14.0 MTPA, EAF- 6.0 MTPA, BoF- 13.2 MTPA, Wire Rod Mill-1.2 MTPA, CRM- 7.5 MTPA, Calcination plant-7200 TPD, Oxygen plant-

11000 TPD, Captive Power Plant (Gas based)- 550 MW, Ferro Alloy plant- 0.376 MTPA) and 12.5 MTPA Cement plant at Villages Basudevpur, Panpur, Kaliakata Jungle, Ramadiha, Kaliakata, Sankerjang, Sankerjang Jungle, Badakerjang, Badakerjang Jungle, Jamunda, Jamunda Jungle, Paripara and Jarada, Tehsil-Chhendipada & Banarpal, District-Angul, Odisha.

The proposed production of crude steel and subsequent rolling would be accomplished via blast furnace (BF)-basic oxygen furnace (BOF)-caster route as well as direct reduced iron (DRI)-Electric Arc Furnace (EAF)-caster route, followed by hot rolling and further value addition by galvanising, colour coating, annealing and galvanising in cold rolling mill.

The integrated steel plant would falls under Category ‘A’ ofitem 3(a) “Metallurgical Industries (ferrous & non -ferrous)” of theSchedule to the EIA Notification 2006 and amendments there under videNotification No. S.O 3067 (E) dated 1st December 2009 under theEnvironment (Protection) Rules 1986.

iii. Need for the project and its importance to the country and/ or region

In 2018, India has replaced Japan as world's second largeststeel producer with a production of 106.5 MT, up by 4.9 per cent from101.5 MT in 2017. India’s per capita steel consumption is about 66 kg,much lower than the global average of 214 kg. The Government of Indiahas set pragmatic target of achieving per capita steel consumption of158 kg by 2030-31 requiring a crude steel production of 255 MT andcapacity of 300 MT.

Indian economy is rapidly growing with key focus on

infrastructure and construction sector. Several initiatives mainly,affordable housing, expansion of railway networks, development ofdomestic shipbuilding industry, opening up of defence sector for privateparticipation, and the anticipated growth in the automobile sector, areexpected to create significant demand for steel in the country.

Major factors which carry the potential of raising the percapita steel consumption in the country are listed below:

a) Infrastructure improvement initiatives, such as ’SmartCities project’, 'Housing for All by 2022', ’Atal Missionfor Rejuvenation and Urban Transformation (AMRUT)’.
b) Manufacturing growth driven by Make-in-Indiainitiative.
c) Encouraging use of Made in India steel for variousprojects and levying of anti-dumping duties on certainsteel products from Brazil, Russia, China, Korea,Japan and Indonesia.
d) National Mineral Development Corporation expected toincrease the iron ore production favoring steelproduction.
e) Emergence of the rural market for steel buoyed byprojects like MGNREGS, development of ‘RurbanClusters’ under the Shyama Prasad Mukherjee RurbanMission, Pradhan Mantri Gram Sadak Yojana, amongothers.

As per the National steel policy (NSP) 2017, in order toachieve expected capacity of 300 MT, finished steel production of 230 MTand per capita consumption of 158 kg of finished steel by 2030-31, steeldemand would need to grow at a CAGR of around 7.16 per cent duringthe period against a CAGR of 3.5 to 4 per cent over the last 5 years. Thiswould mean that capacity additions planned by most of the major steelplayers need to come on stream in next few years. In respect, theproposed project would contribute substantial ly towards the target steelproduction of NSP 2017.

The concept of the proposed project is in alignment with thecurrent progress plan of the country.

iv. Demand- Supply Gap, Import vs. Indigenous Production, Export Possibility&Domestic / Export Markets

Consumption

Finished steel consumption in India during FY 2019-20 was100.1 MTPA, consisting of 94.1 MTPA of carbon steel and 6 MTPA of alloyand stainless steel. Within carbon steel, demand for flats has grownfaster than longs in the recent past, and presently both flats and longshave almost equal shares of demand.

Steel demand in India is dominated by the constructionsector, followed by the capital goods and auto sectors. Most of the endues sectors of steel consumption in India have moderate to strong growthprospects, based on which a 5 to 6 per cent per annum growth infinished steel consumption in India is likely to be achievable in theimmediate future, i.e. at least till 2025-26. However, the demand growthrate thereafter is expected to taper from 2025-26 to 2030-31.

Forecast

The National Steel Policy 2017 (NSP 2017) has laid down aframework of development of steel sector in India till 2030-31. Amongother issues, the NSP 2017 has projected the domestic steel demand toreach 230 million tons by 2030-31 from 81.5 million tons achieved in2015-16, implying a grow rate of 7.16 per cent CAGR.

Four years have elapsed since the NSP was released in 2017based on the 2015-16 performance of the steel industry. The progress indomestic steel consumption over the last four years since 2015-16,which reached a level of 100.1 million tons in 2019-20 against the targetof 107.5 million tons, registered a growth rate of 5.27 per centcompounded annually. This is lower than the NSP'17's projection of 7.16per cent CAGR per annum. The comparatively lower growth has made itimperative to revise the projection of steel demand based on the marketreality as it is obtaining now. Keeping a tab on the nature of developmentof the industries likely to drive the demand of steel in future, a morerealistic growth rate of 5.5 per cent CAGR on a higher base level ofconsumption of 2019-20 is considered to be in order by the industryexperts for the domestic market to expand in future. At this rate theprojected demand of finished steel works out 106, 138 and 180 million tons by 2020-21, 2025-26 and 2030-31 respectively.

Long Products

Bars & Rods are the leading product category in the long'smarket, with 81 per cent share, followed by structural (15percent) and rails (4 per cent). In comparison to the demand for flats,demand for longs has grown at a slower pace in the last few years, due tolow demand growth for both bars and rods and structural, whichconstitute 96 per cent of the long products' market. Both of theseproduct categories are primarily consumed in the construction sector.

The systemic and structural changes in the Indian economy, such asdemonetisation, GST, and RERA, have affected the growth of theconstruction and real estate industry in the last few years.

Given the state of the current and the future state of theeconomy, especially those of the construction sector, the bars and rodsand structural, whose growth in consumption was subdued in the recentpast, are expected to expand at a modest rate of 4 per cent CAGR till3035-26 and taper off to 3.5 per cent CAGR primarily to take care of thehigher base values. The demand of Rails is, however, expected toaccelerate at a much higher rate as indicated in Table.

DEMAND FORECAST FOR LONG PRODUCTS IN INDIA(MTPA)

Productcategory	Demand2019-20	Growthrate2025-26	Demand2025-26	Growthrate2030-31	Demand2030-31
Bars&rods	39.7	4.0%	50.3	3.5%	59.7
Structural	7.2	4.0%	9.1	3.5%	10.8
Rails	1.8	10.0%	3.3	8.0%	4.2
Totallongs	**48.7**	**4.3%**	**62.6**	**3.1%**	**75.3**

The demand-supply scenario in longs has been forecast for2025-26, based on the current capacity of long products of ISPs andsecondary players, as well as information available on the expansionplans of the ISPs for these products.

DEMAND - SUPPLY SCENARIO - LONG PRODUCTS ININDIA (MTPA)

Productcategory	Demand 2025-26	ISP capacity2019-20	ISP capacityadditions	ISP capacity2025-26	Secondaryproducers'capacity	Demand-supplyshortfall
Bars&rods	50.3	17.5	3.8	21.3	35.5	6.6(1)
Structural	9.1	5.3	-	5.3	9.4	0.3(2)
Rails	3.3	2.3	0.5	2.8	-	1.3(3)
Totallongs	**62.6**	**25.1**	**4.3**	**29.4**	**44.9**	**8.2**

Notes:

(1) For calculating demand-supply gap for bars & rods, capacity utilisation ofISPs has been taken at 80 per cent and secondary producers at 75per cent.

(2) For calculating demand-supply gap for structural, capacity utilisation ofISPs and secondary producers has been taken at 60 per cent.

(3) For calculating demand-supply gaps for rails, capacity utilisation has beentaken at 70 per cent.

(4) ISP capacity additions considered: SAIL Bhilai 0.9 mtpa; ESL Bokaro:1.1 mtpa; TSL KPO: 1.8 mtpa

There is a 6.6 MTPA demand-supply gap expected in bars androds, which offers an attractive market segment for future investment options as JSPL already has a branded presence in this market through 'Panther'.

Flat Steel Market

Flat steel products consist of nearly 50 per cent of the total carbon steel consumption in India; the major flat product categories (PM Plates. HRC, CRC, Galvanised & Coated steel) account for 90 percent of flat steel consumption in India. The flat steel market is showing a much stronger growth compared to long products; demand for flats has grown at nearly 9 per cent per annum in the recent past, with few segments showing even higher growth rates.

At the gross level, flats essentially comprise of two products -PM Plates and HRC; other product categories are value-added downstream products made from HRC. HRC accounts for nearly 90per cent of the flats market, and PM Plates the remaining 10 per cent.

The gross market for HRC includes both HRC sold in the market for final use and HRC consumed for making downstream value-added products for further use by the manufacturing industry.

Hot Rolled Coils (HRC) account for 90 per cent of the flat steel market in India and is the source material for several down stream value-added products like Cold Rolled Coils (CRC), Galvanised & Coated Coils & Sheets, Steel Pipes, etc. About 55 per cent of HRC demand is from downstream products, while the remaining 45 per cent is directly consumed by the various end-using industries. The end-use of HRC is primarily in the manufacturing sector, in making wagons, coaches, pipes, tubes, machinery, cylinders, furniture, fabrication of drums and barrels etc.

Excepting PM Plates, which did not exhibit any significant growth in the recent past, all other products like Hot and cold rolled coils, galvanised and coated steel grew at significantly higher rates of ten exceeding 10 per cent or more CAGR per annum. However considering the long term nature of the forecast a more reasonable set of growth rates have been assumed for forecasting which are likely to both achievable and sustainable in the long run. The projected demand scenario of flat steel products is furnished in Table.

DEMAND FORECAST FOR FLAT PRODUCTS IN INDIA(MTPA)

Product category	Demand 2019-20	Growth rate 2025-26	Demand 2025-26	Growth rate 2030-31	Demand 2030-31
PM Plates	4.70	3.0%	5.6	2.5%	6.5
HRC & Sheets	40.6	9.7%	70.9	6%	100.5
CRC & Sheets	16.1	10%	28.5	8%	45.1
Coated Steel	7.9	6.0%	11.2	5%	14.9
Note: The above analysis excludes other relatively smaller down-stream value added products like Tin Plates, Electrical steel sheets and large diameter pipes.					

The demand-supply scenario in flat steel has been forecast for 2025-26, based on the current capacity of flat products of ISPs and secondary players, as well as information available on the expansion plans of the ISPs for these products.

The definitive HRC expansion plans of Indian ISPs are asunder, based on which the demand-supply forecast scenario in FY 2025-26 is shown in Table.

i) Tata Steel Ltd.'s Kalinganagar Phase-2 expansion -3.2 MTPA.

ii) JSW Steel Ltd.'s Dolvi expansion - 5 MTPA expansion

iii) JSW Steel Ltd.'s Vijaynagar expansion - 5 MTPA expansion

iv) NMDC Ltd.'s Nagarnar green-field steel plant -2.9 MTPA HSM capacity

Among the ISPs, only TSL has announced a definite capacity expansion with a 2.2 MTPA CRM, as part of the TSL KalinganagarPhase-2 project.

Among ISPs, only TSL has announced a definite capacity expansion plan, with a 0.45 MTPA continuous galvanizing line (for non-auto demand) and 0.55 MTPA continuous galvanizing line (for auto demand) expansion at TSL Kalinganagar.

DEMAND - SUPPLY SCENARIO - FLAT FORECASE ININDIA (MTPA)

Product category	Demand 2025-26	ISP Capacity 2019-20	ISP Capacity Additions	ISP Capacity 2025-26	Secondary Producers' Capacity	Demand-supply Shortfall
PM Plates	5.6	6.1	1.2 (Monnet)	7.3	-	-
HRC& Sheets	70.9	38.1	16.1	54.2	13.0	14.4(1)
CR Coils &Sheets	28.5	12.6	2.2	14.8	12.2	9.8(2)
Coated Steel	11.2	5.6	1.0	6.1	6.6	0.3(3)

Note: The above analysis excludes other relatively smaller down-stream value added products like tin plates, electrical steel sheets and large diameter pipes.

(1) For calculating demand - supply short fall, capacity utilization considered as 85 per cent for ISPs and 80 percent for secondary producers.

(2) For calculating demand - supply short fall, capacity utilization considered as 85 per cent for ISPs and 50 percent for secondary producers.

(3) For calculating demand-supply short fall, capacity utilization considered as 85 per cent for ISPs and 80 percent for secondary producers.

Finished Steel Market

The consolidated future demand of finished steel as it worked out above is furnished in Table.

FINISHED STEEL - CONSOLIDATED DEMAND FORECAST(MTPA)

Product category	Product		Estimated demand		
		FY2019-20	2020-21	2025-26	2030-31
Longs	Bars & Rods	39.7	41.2	50.3	59.7
	Structural	7.2	7.5	9.1	10.8
	Rails	1.8	2.0	3.3	4.2
Total Longs Demand		**48.7**	**50.7**	**62.6**	**75.3**

Product category	Product		Estimated demand		
		FY2019-20	2020-21	2025-26	2030-31
Flats	PM plates	4.7	4.8	5.6	6.5
	HRC (gross level)	40.6	44.5	70.9	100.5
Total Flat Demand		**45.3**	**49.3**	**76.4**	**107.0**
Total Finished Steel		**94.1**	**100.0**	**139.1**	**182.3**

Conclusion

The market analysis reveals following opportunities for capacity expansion in the domestic market in India in the next five years by 2025-26.

Long steel: There is expected to be a demand-supply gap of the order of 6 mtpa for Bars & rods and more than a million tons for rails by 2025-26.

Flat steel: The window of opportunity in HRC is expected to be 14-15 mtpa and CRC to the tune of 10 mtpa in the next 5 years.

v. Employment Generation (Direct and Indirect) due to the project

Manpower requirement will be 9400 persons including 6550 regular and 2900 contractual persons which will include all categories of unskilled, semi-skilled from local area & skilled personnel from local &outside areas. The details of manpower requirement are shown below:

Temporary employment during construction	42800
Permanent employment during construction	170
Temporary employment during operation	2900
Permanent employment during operation	6550

3.0 PROJECT DESCRIPTION

(i) Type of Project including interlinked and independent projects, if any.

Yes, the existing 6 MTPA Integrated steel plant of JSPL is related to this expansion project.

(ii) Location (map showing general location, specific location, and project boundary & project site layout) with coordinates

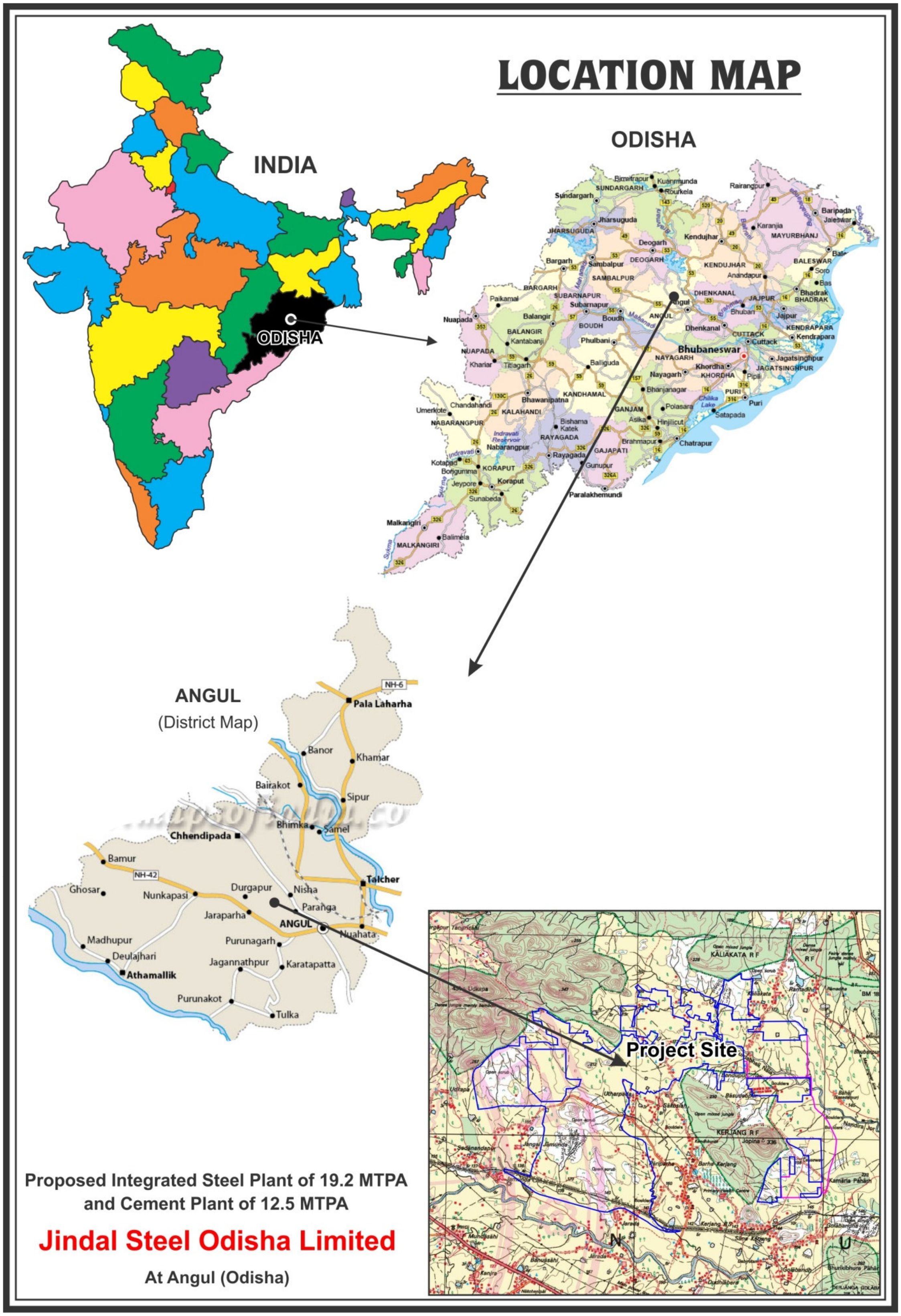
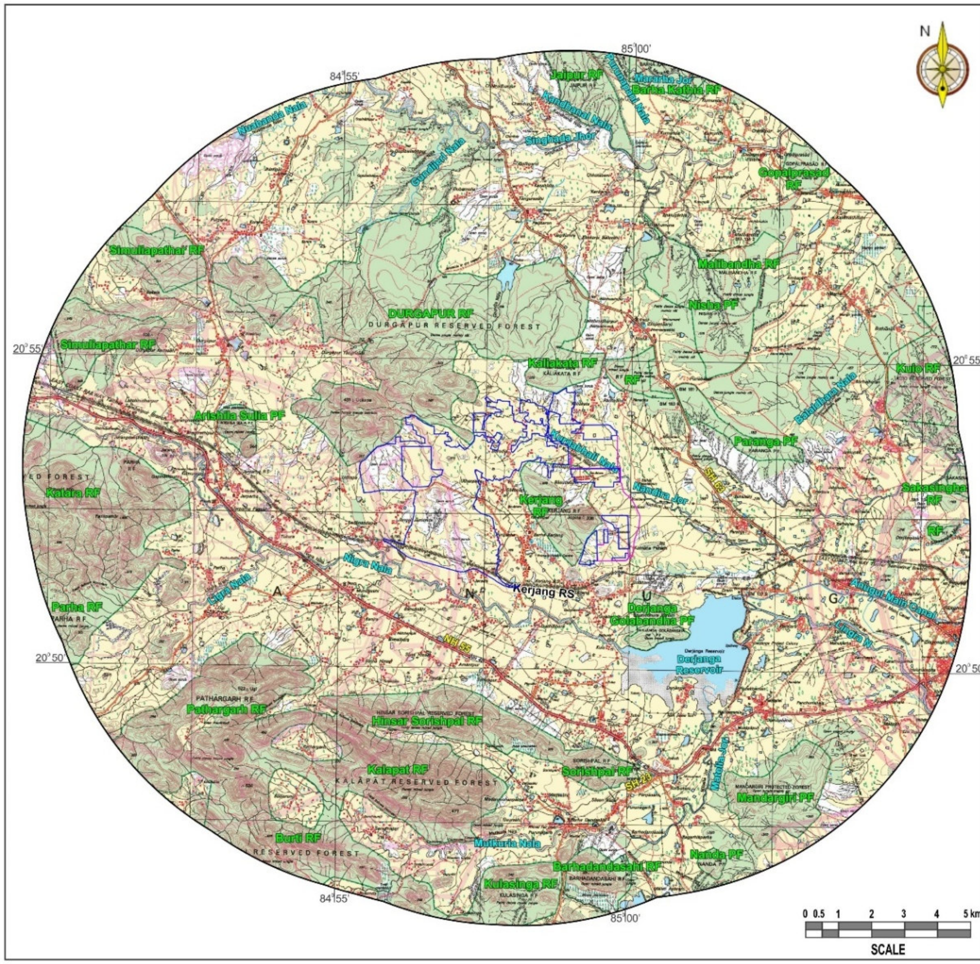


Figure - 1: Location Map



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S. No.	Environmental Setting	Distance	Direction
1.	Barha Kathia RF	~ 9.5 km	NNE
2.	Jaipur RF	~ 7.0 km	NNE
3.	Gopalprasad RF	~ 9.0 km	NE
4.	Malibandha RF	~ 5.5 km	NE
5.	Nisha PF	~ 3.0 km	NE
6.	Simuliapathar RF	~ 7.0 km	WNW
7.	Durgapur RF	Adjacent	NW
8.	Kaliakata RF	Adjacent	North
9.	Kuio RF	~ 8.0 km	ENE
10.	Arishila Sulia PF	~ 3.0 km	WNW
11.	Paranga PF	~ 2.0 km	East
12.	Sakasingha RF	~ 9.0 km	East
13.	Katara RF	~ 5.0 km	West
14.	Kerjang RF	Adjacent	South
15.	Derjanga Golabandha PF	~ 1.5 KM	SE
16.	Pathargarh RF	~ 4.0 km	SW
17.	Hinsar Sorishpal RF	~ 3.5 km	SSW
18.	Kalapat RF	~ 5.0 km	SSW
19.	Sorishpal RF	~ 5.5 km	SSE
20.	Mandargiri PF	~ 7.0 km	SE
21.	Burti RF	~ 9.0 km	SSW
22.	Nanda PF	~ 9.0 km	SSE
23.	Barhadandasahi RF	~ 8.0 km	SSE
24.	Kulasinga RF	~ 8.0 km	South
25.	Parha RF	~ 9.0 km	WSW
26.	Nuabanda Nala	~ 9.5 km	NW
27.	Singhada Jhor	~ 7.0 km	North
28.	Purunapani Nala	~ 9.5 km	NNE
29.	Mararha Jor	~ 9.5 km	NNE
30.	Gundijerl Nala	~ 7.0 km	NNW
31.	Kandhanal Nala	~ 8.0 km	North
32.	Balaldhara Nala	~ 6.0 km	ENE
33.	Kurdabhali Nala	In project site	-
34.	Nandira Jor	Adjacent	East
35.	Lingra N	~ 5.5 km	ESE
36.	Ligra Nala	~ 4.0 km	SW
37.	Nigra Nala	~ 400 m	WSW
38.	Anugul Main Canal	~ 4.0 km	ESE
39.	Derjanga Reservoir	~ 2.5 km	SE
40.	Matelia Jor	~ 5.5 km	SSE
41.	Mutkuria Nala	~ 7.5 km	South
42.	SH 63	~ 2.0 km	East
43.	NH 55	~ 2.0 km	West
44.	SH 23	~ 6.5 km	SSE

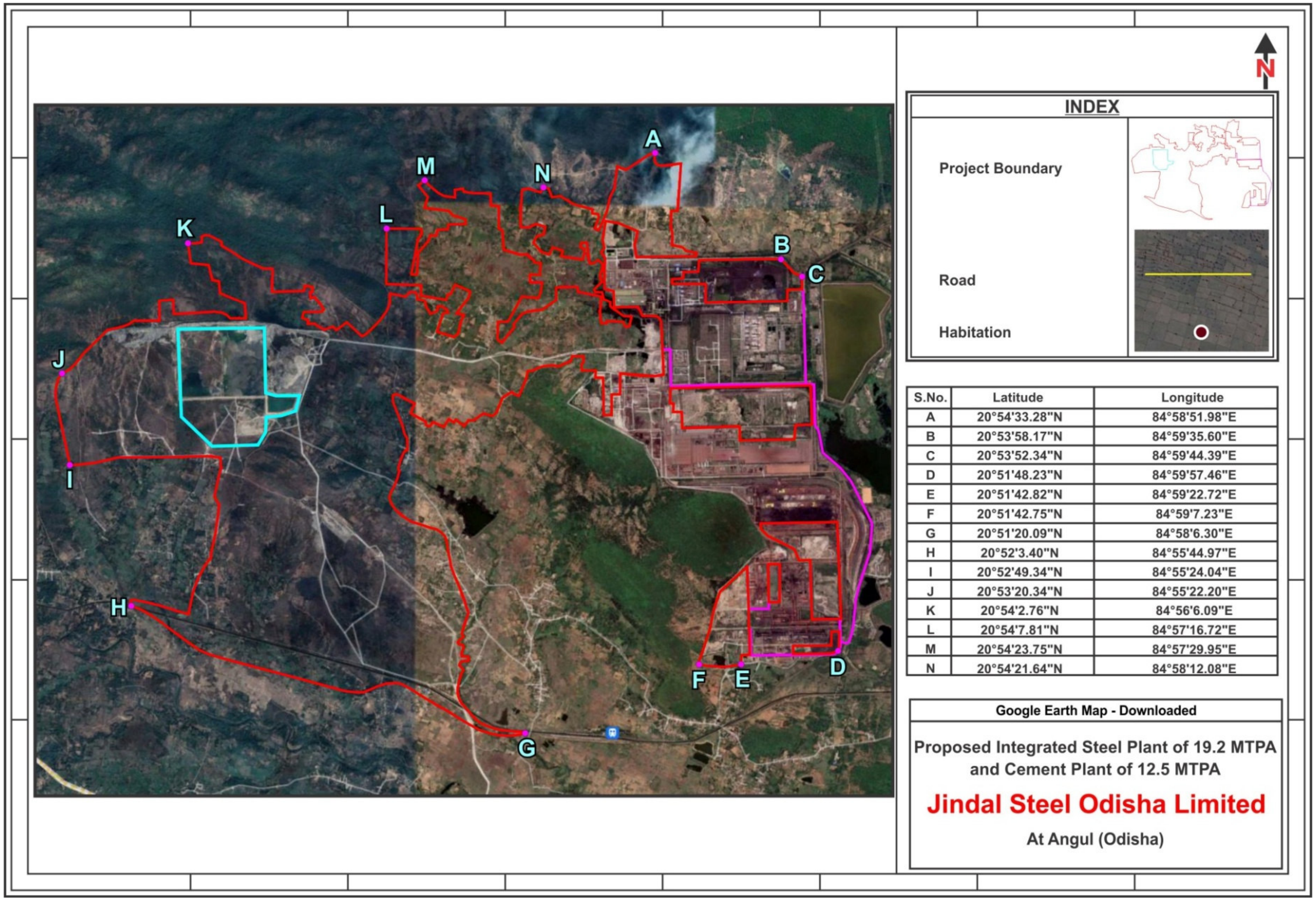
ENVIRONMENTAL SETTING MAP

Proposed Integrated Steel Plant of 19.2 MTPA and Cement Plant of 12.5 MTPA

Jindal Steel Odisha Limited

At Angul (Odisha)

Figure - 2: Environmental Setting Map of the study area



S.No.	Latitude	Longitude
A	20°54'33.28"N	84°58'51.98"E
B	20°53'58.17"N	84°59'35.60"E
C	20°53'52.34"N	84°59'44.39"E
D	20°51'48.23"N	84°59'57.46"E
E	20°51'42.82"N	84°59'22.72"E
F	20°51'42.75"N	84°59'7.23"E
G	20°51'20.09"N	84°58'6.30"E
H	20°52'3.40"N	84°55'44.97"E
I	20°52'49.34"N	84°55'24.04"E
J	20°53'20.34"N	84°55'22.20"E
K	20°54'2.76"N	84°56'6.09"E
L	20°54'7.81"N	84°57'16.72"E
M	20°54'23.75"N	84°57'29.95"E
N	20°54'21.64"N	84°58'12.08"E

Figure - 3: Google Earth Downloaded map showing plant site

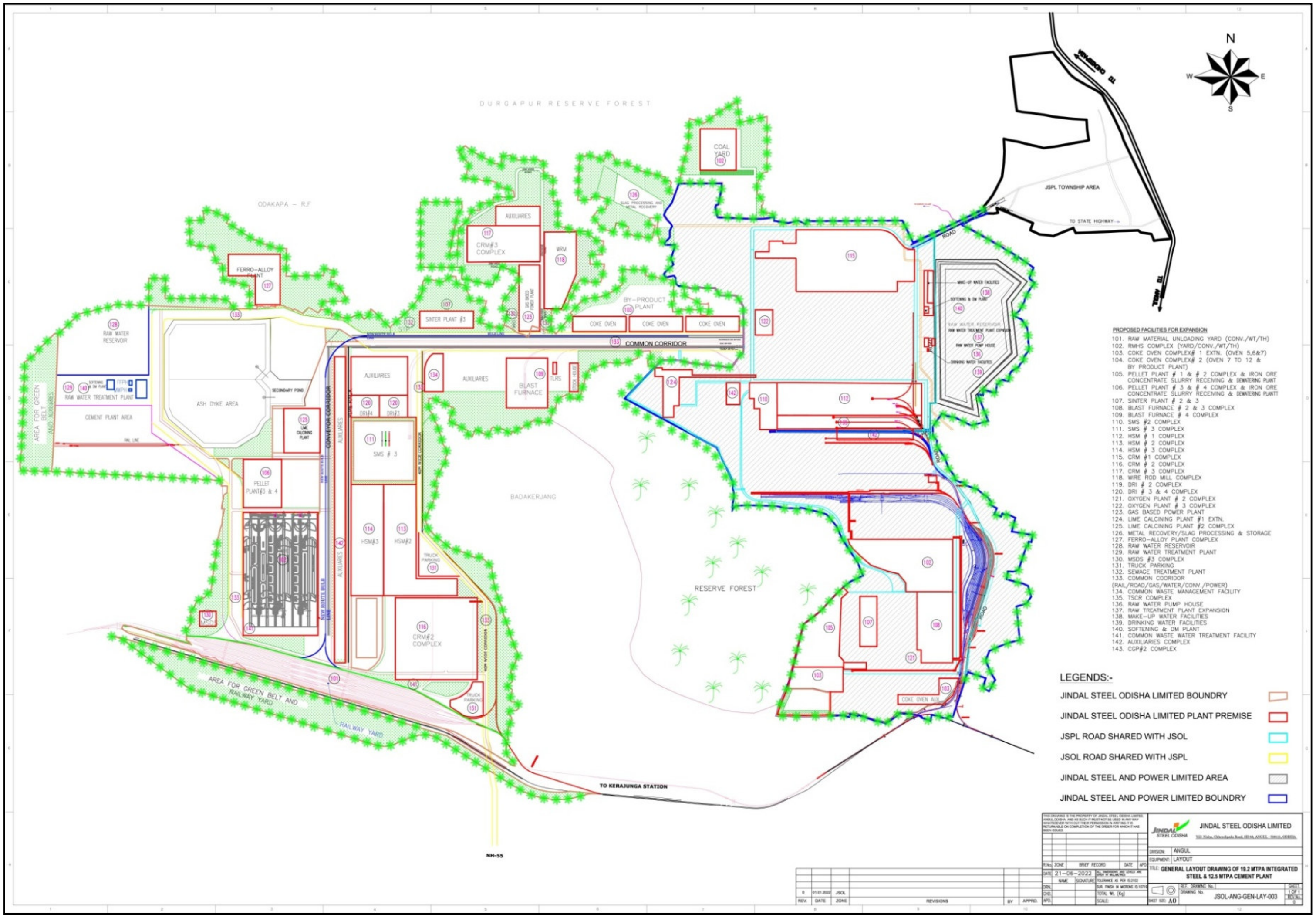


Figure - 4: Engineering Drawing Layout

(iv) Details of alternative sites consideration and basis of selecting the proposed site, particularly the environmental considerations gone into should be highlighted.

The proposal under consideration is an expansion project. Hence, it would be most suitable w.r.t infrastructure logistics if the facilities under expansion are installed adjacent to the existing plant. This would enable appropriate sharing of the existing infrastructure, other ancillary & auxiliary facilities and ensure uninterrupted movement of various raw materials without additional cost or involving minimal augmentation of material movement logistics. The site for expansion of the ISP is congruent to the existing plant on its western side and has the following advantages:

a) Availability of adequate land for installation of additional units.
b) Suitability of sharing existing infrastructure in terms of connectivity, water resource and grid power.
c) Availability of major raw materials due to proximity to the mineral resource belts.
d) Ease of raw materials acquisition and products transportation.
e) Availability of economical labour force.
f) The area does not come under the critically polluted area as identified by CPCB and no polluted stretch of river nearby.
g) Scope for regional development. In view of the above, no alternative site was explored.

(v) Size or magnitude of operation

Size or magnitude of operation for the project is given below:

Table 2

Details of proposal

S No.	Unit	Capacity and Configuration as per existing EC	Capacity and Configuration of the proposed expansion project	Capacity & Configuration after proposed expansion project	Product
1.	DRI Plant	-	5.4 MTPA (2x2.7 MTPA)	5.4 MTPA (2x2.7 MTPA)	DRI/HBI
2.	Coke Oven	-	5.17 MTPA (2x70 ovens & 4x56 ovens)	5.17 MTPA (2x70 ovens & 4x56 ovens)	Metallurgical coke
3.	Sinter Plant	-	11.5 MTPA (2x490.5 m^2)	11.5 MTPA (2x490.5 m^2)	Sinter
4.	Blast Furnace	-	14 MTPA (2x5400 m^3& 1x6000 m^3)	14 MTPA (2x5400 m^3& 1x6000 m^3)	Hot metal (Liquid Iron)
5.	EAF	-	6 MTPA (1x250 T & 1x360 T)	6 MTPA (1x250 T & 1x360 T)	Liquid steel
6.	BoF	-	13.2 MTPA (2x300 T & 2x360 T)	13.2 MTPA (2x300 T & 2x360 T)	Liquid steel

7.	Wire Rod Mill	-	1.2 MTPA	1.2 MTPA	Wire rod
8.	Hot Rolling Mill	1x3.1 MTPA	18 MTPA (3x6 MTPA)	21.1 MTPA (1x3.1 MTPA & 3x6 MTPA)	Hot rolled products
9.	CRM Complex	-	7.5 MTPA (3x2.5 MTPA)	7.5 MTPA (3x2.5 MTPA)	Cold Rolled Coils
10.	Calcination plant	-	7200 TPD (12x600 TPD)	7200 TPD (12x600 TPD)	Calcined Lime & Dolo
11.	Oxygen Plant	-	11000 TPD (2x2700 TPD & 2x2800 TPD)	11000 TPD (2x2700 TPD & 2x2800 TPD)	Oxygen
12.	Power Plant	-	Gas fired- 550 MW (2x275 MW)	Gas fired- 550 MW (2x275 MW)	Power
13.	Ferro Alloy Plant	-	0.376 MTPA	0.376 MTPA	Ferro alloy
14.	Pellet Plant	1x5 MTPA	21 MTPA (3x7 MTPA)	26 MTPA (1x5 MTPA & 3x7 MTPA)	Pellet
15.	Cement Plant	-	12.5 MTPA (3x3.5 MTPA & 1x2 MTPA)	12.5 MTPA (3x3.5 MTPA & 1x2 MTPA)	Cement

Table- 3

Other details of the Project

A.	**Cost Details**	
1	Total Cost for the Project	Rs. 1,19,952 Crores
2	Cost for Environmental Protection Measures	Capital Cost – Rs 4280 Crores
		Recurring Cost- Rs 290 Crores/annum
B	**No. of working days**	330 days/annum
C.	**Products**	Products – HBI, Hot Rolled Coil, Cold Rolled Annealed Coil, Cold Rolled Galvanised Coil, Colour Coated Coil, Plates, Wire Rod, Bar and Rod, Billets, Cement By-products - Crude Tar, Slag, Sulphur, Benzol, Ammonia, Sulphur

(vi) Project Description with Process Details

The Integrated manufacturing process for iron and steel will be using the blast furnace and basic oxygen furnace (denoted BF and BOF hereinafter, respectively), which is presently the most commonly used method (51% of world steel production). After the BF-BOF process, molten steel is controlled to a target composition and temperature and is then cast by continuous casting machine to produce slabs, blooms, and billets. These castings are rolled to the required dimensions by the rolling mill to produce steel products. The smelting and refining process for iron and steel in the BF-BOF process involves the carbon reduction of iron ore ($Fe2O3$) in the BF to make molten iron, and decarburization of molten iron in the BOF to make molten steel. Major reducing agent in the BF is the carbon monoxide gas (CO) generated by the oxidation of the carbon(C) in coke. Consequently, carburization takes place at the same time as reduction, producing hot metal (molten iron) containing about 4% carbon. The hot metal is decarburized to the required carbon content in the BOF. The main reaction in this process is the oxidization of the carbon in the hot metal by both pure oxygen gas ($O2$) and iron oxide ($Fe2O3$). The residual oxygen, after contributing to this decarburization reaction, remains in the molten steel. This oxygen is fixed and removed by deoxidation reagents such as silicon and aluminum as $SiO2$ and $Al2O3$ or is removed as carbon monoxide gas in the subsequent vacuum degassing process. In addition to the BF-BOF process, there is another process which utilizes direct reduced iron and scrap as an iron source. The direct reduced iron is produced by reducing iron ore with reformed natural gas, whose principal components are hydrogen, carbon monoxide, and methane. The scrap, along with direct reduced iron, is then melted in an electric arc furnace (denoted EAF hereinafter) to produce molten steel which is subsequently processed by the continuous casting machine, as mentioned above. The molten steel from the BOF and EAF is then deoxidized and alloying elements are added in the prescribed amounts. The molten steel is then held at the target temperature and continuously cast, and the castings obtained are cut to the prescribed length. After heating to the rolling temperature in a reheating furnace, these castings are hot-worked to the required products. Steel shapes, bars, and wire rods are worked on section and bar mills and wire-rod mills equipped with caliber rolls, plates are worked on reversing mills, and hot-rolled steel sheets are worked on hot strip mills. After pickling to remove scale from the surface, the hot-rolled steel sheets are worked to cold-rolled steel sheets on reversing mills or tandem rolling mills, and the cold-rolled steel sheets are tinned or galvanized as required to produce various surface-treated steel sheet products.

A. DRI PLANT

A direct reduced iron (DRI) production plant is a vertical shaft reduction furnace to produce DRI with large metal iron content by directly reducing iron ore (or iron ore pellets) with reducing gases like Syngas, Coke Oven gas, etc. While the produced DRI is mainly used as the raw material for electric steelmaking, a wide variety of gases including by-product gases generated in Coke Oven and coal gas refined in coal gasifiers, as well as widely-used natural gas, may be used as reducing gases.

The proposed project plans to install two gas based DRI plants of 2.7 MTPA each. Syngas from the Coal Gasification Plant of JSPL will be utilized for the purpose. The balance fuel requirement for the proposed

DRI Plant shall be met through coke oven gas. Pellet from captive pellet plant as well as through purchased pellet will be used in the DRPs.

Design basis

The design basis considered for the new DR plant is given in table below:

Design Basis of Gas based DRI Plant

Item	Design parameter
Plant capacity, MTPA	2 x 2.7
Charge pellet, MTPA	7.506
Gas energy, mill Gcal/yr	4.2 (each)
Operating hrs/year	8000(each)
Expected analyses of product DRI:	
Fe (total), %	~88.8
Degree of metallization, %	~93
Carbon Content, %	~1.3

Major Plant Facilities

The major facilities proposed for the new DR Plant are given below:

i.	Raw materials charging system	xii.	Plant electrics
ii.	Shaft furnace	xiii.	Instrumentation and automation systems
iii.	CO2 removal system	xiv.	Plant communication systems
iv.	Process gas heater	xv.	Utility systems
v.	Gas compressors		
vi.	Gas saturator		
vii.	Gas handling facilities		
viii.	Hot briquetting system		
ix.	External DRI Cooler		
x.	DRI handling facilities		
xi.	Water systems		

Process Description:

The Plant will be designed to use syngas and Coke Oven gas as its reducing gas source. The following is a description of the major component i.e. Shaft furnace of the plant.

The Shaft Furnace feeding system begins with the charge hopper. The charge hopper located at the top of the shaft furnace is equipped with strain gauges which allows to know the quantity of feed in the charge hopper.

From the charge hopper, the iron ore passes through the upper dynamic seal leg and enters the Proportioning Hopper. A dynamic seal is created by a small flow of inert seal gas into the upper seal leg of the furnace. The flow of inert seal gas into the furnace seal leg prevents the escape of furnace gases to the atmosphere while still allowing the free flow of material by gravity into the furnace without the use of lock-hoppers. The iron ore is discharged from the proportioning hopper and uniformly distributed onto the stock line inside the Shaft Furnace by symmetrical furnace feed legs.

The Shaft Furnace is a vertically mounted, cylindrical vessel. The Shaft Furnace is divided into the reduction zone and the lower cone. The reduction zone is located in the upper section of the Shaft Furnace and the lower cone is the lower section of the Shaft Furnace. The entire Shaft Furnace shell is refractory lined.

The iron ore is reduced to metallic iron in the reduction zone by contact with the hot reducing gas (H2 and CO) that flows counter current to the descending iron oxide. Depending on the specific Shaft Furnace operating conditions, the hot reducing gas temperature is typically in the range of 750 – 1000 °C. Uniform reducing gas flow to the furnace burden is assured by special designed inlet ports (tuyeres). The spent reducing gas exits near the top of the Shaft Furnace and enters the process gas system.

In the lower cone, the furnace contains three levels of burden feeders and a flow aid insert. The burden feeders are water cooled shafts that run the width of the shaft furnace with alloy "teeth" on the outside. The burden feeders slowly rotate back and forth to help relieve some of the overpressure in oxide / DRI bed. The flow aid insert is a large conical shaped alloy device located in the center of the lower cone. The flow aid insert prevents the DRI from preferentially flowing down the center of the Shaft Furnace("ratholing"). Using the burden feeders and flow aid insert ensure a uniform material flow through the furnace, which results in a more uniform DRI product quality. The total material retention time in the Shaft Furnace is typically 5 – 6 hours, which has been found to be sufficient for achieving the desired product metallization of 93%.

At the outlet of the lower cone, the hot DRI either flows down the Intermediate Seal Leg to the Product Cooler or down the HDRI seal leg to the Product Discharge Chamber.

Table- 4

Material Balance of proposed DRI

Raw material	Input TPA	Product/wastes	Output TPA
Pellet	7506000	DRI	5400000
Lime	18900	Dust & Sludge	1026000
		Losses	1098900
Total	**7524900**	**Total**	**7524900**

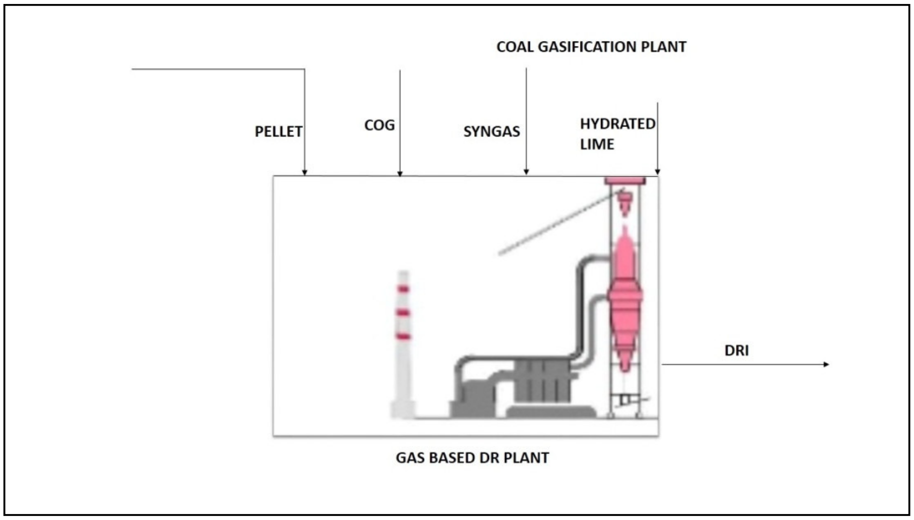


Figure 5: Process flowchart for Gas based DRI plant

B. COKE OVEN

Coal is the largest source of energy for the generation of electricity worldwide and is also used in the production of metallurgical coke as blast furnace fuel. Some smaller blast furnaces can utilize charcoal as a carbon source, but the larger blast furnaces require the strength and durability of coke.

Coke is produced by igniting bituminous coal under reduced oxygen conditions in oven batteries specially designed for this process. The coking process generates the following main volatiles as byproducts: coke oven gas, tar, ammonium sulfate, benzol, toluol and naphtha.

A coke battery is made up of multiple ovens. Coal is crushed and blended prior to being charged in a coke oven. A larry car charges the individual oven with the blended coal. In the coke oven, the coal is heated to 1,800°F for up to 18 hours. During that time, the volatiles of the coal are driven into the offgas and a pure carbon form called "coke" remains. The coke, when exposed to oxygen, will immediately ignite and begin to burn. When the coke is pushed from the oven into a railcar, it is quickly quenched to cool the coke and stop the burning process. The cooled coke is then dumped onto a coal wharf where it is taken to a facility to be screened and sized prior to being charged into the blast furnace.

Design Basis

By-product recovery type stamp charged (SC) coke ovens of 6.7 meter height have been considered for the proposed coke oven plants, having necessary pollution control measures. In first phase of the proposed project, 2 x 70 nos. of ovens with 6.7 m height will be installed to produce 2,000,000 tonnes per annum of gross coke.

In second phase, 4 x 56 nos. of ovens of 6.7 m height, with annual gross coke capacity of 3,170,000 tons have been envisaged. The coke oven plants will cater to the requirement of the proposed blast furnaces.

Gross coke production in Phase-A, TPA	.. 2,000,000
Gross coke production in Phase-B, TPA	.. 3,170,000

The basic design parameters of the coke oven battery are given below in Table below.

Basic Design Parameters of Coke Oven

a) Oven Dimension (cold):	
i) Height, m	6.78
ii) Width, m	0.570
iii) Length, m	18.64
b) Bulk Density, ton/cu m	1.1
c) Coking time, hours	24.8

The proposed coke oven plant envisages use of low ash imported coking coal in the coal blend. The degree of crushing will be about 90 per cent below 3.15 mm.

The quality of coal blend envisaged for the proposed coke oven plant is given below in Table below.

Coal Blend Quality

Proximate analysis (dry basis)	
Ash	9-10 %
Volatile matter	23-25%
Fixed carbon	By difference
Total sulphur	0.6% (max.)
Total moisture	8-10%
Mean reflectance (Ro)	1.05-1.10

The quality of coke envisaged is given in Table

Coke Quality

Analysis (dry basis)	
Ash	11.5-12.5 %
Volatile matter	1.0%
Sulphur	0.7% (max.)
Moisture	0.5% (max.)
MICUM indices	
M40	82 (min.)
M10	5.5-6.0
CSR	62-64
CRI	25 (max.)

The analyses of coal and coke are tentative and subject to changes based on finalized coal sources and quality.

Major Facilities

Coke oven battery: The major units of the coke oven batteries are given below in Table below.

Major Units of Coke Oven

Description	2x70 Ovens	4x56 Ovens
Coke Oven block	2	4
Total number of ovens	70	56
Oven machines		
-Stamping charging-cum-pusher car	2W+1S	4W+1S
-Coke transfer car	2W + 2S	4W+2S
-Gas transfer car	2W + 1S	4W + 2S
-Coke quenching car	1	2
-Coke bucket car	2W+1S	4W+2S
Coke dry quenching (CDQ) unit	260 TPH	3 x 170 TPH
Stand by wet quenching station	1	2
Coke breeze pond	1	2
Chimney	2	3
Pushing emission control (PEC) system	2 set	3 sets
On main charging system with HPLA	2 set	3 sets

Coke making process:

The blended coal is sent to a 8-hour storage capacity surge bin that will provide coal through two belt conveyors to coal bin on the Stamping-Charging-Pushing (SCP) Machine. When stamping is in operation, the coal in the coal bin will be charged via a feeder into the coal box where the coal is stamped till coal cake is formed by a full automatic hammer stamping machine installed on the SCP according to pushing schedule and charged through oven door on P.S. into the coke oven. The coal cake will be finally carbonated under high temperature to red coke and crude gas after one cooking time.

The carbonated coke will be pushed out by SCP and guided to coke bucket and then hauled by electric locomotive to CDQ crane and lifted onto the top of CDQ chamber. The red coke will be charged by distributor into the quenching chamber where the coke will meet the inert gas counter-currently for heat exchanging till the coke will meet the inert gas counter-currently for heat exchanging till the cake is cooled down below 200ºC and then discharged by vibrating feeder onto the belt conveyor and finally delivered to coke handling system. When the CDQ system is in maintenance or broken down, the stand by wet quenching system will be used i.e. the red coke will be into the quenching car and hauled by the electric locomotive till quenching tower where the red coke is quenched and cooled by sprinkling water. The quenched coke is then discharged onto coke wharf and dried up before sent to the coke handling system.

The crude gas gathers at the coking chamber top space and enters Gas Collecting System via the ascension pipe and gooseneck on C.S. where the 800ºC crude gas will be cooled by ammonia liquor down to about 85ºC and the coal tar in gas will also be condensed which will be delivered together with the COG and ammonia liquor to by-products plant.

The COG for battery heating is led into through external pipeline. The COG is preheated to 45°C and sent to the coke oven cellar and blown through dock nozzle to the bottom of the vertical flue of combustion chamber where the combustion occurs with air from waste gas box. The burnt gas enters through the jumper on top of the vertical flue and into the downward vertical flue and then into the regenerator where the sensible heat is absorbed by checkered brick and then through sole flue, waste gas box, side waste gas flue, common waste gas flue till the atmosphere.

The Blast furnace gas for the coke oven heating enters the coke oven cellar through external pipeline and it is sent via waste gas box, sole flue and regenerator to combustion chamber where its meets air and burns. The combusted waste gas will be discharged together with the burnt COG to atmosphere.

The uprising gas/ air and downward waste gas will reverse by hydraulic reversing machine.

Coke dry quenching: Coke cooling facilities will be provided to cool the red hot coke from oven at 1,000 - 1050 deg C to about 180 - 200 deg C. in coke dry cooling plant with facilities to recover the available energy in hot coke. Coke dry quenching (CDQ) units will operate for 340-345 days. Wet quenching stations are envisaged as stand-by when CDQ units will not be in operation.

By-product plant: A by-product plant will be designed to process and clean the crude coke oven gas with respect of tar, ammonia, hydrogen sulphide and benzol. In order to get compliance with prevailing environmental norms with respect to SOx and NOx, plant will be envisaged with de-sulphurisation and sulphur recovery and ammonia scrubbing, stripping and destruction plant.

The major units of the by-product plant, for cleaning of coke oven gas to the required degree, and for recovery of crude tar and sulphur will be the following:

i) Primary gas cooler and tar liquor separation section,

ii) Electrostatic tar precipitator,

iii) Coke oven gas exhauster,

iv) Desulphurisation and sulphur recovery unit,

v) Ammonia scrubbing, stripping and destruction unit,

vi) Benzol scrubbing and recovery unit,

vii) Dry type gas holder and flare stack,

viii) Phenolic effluent treatment plant.

Clean coke oven gas with calorific value of about 4,100 Kcal/N cu m will be made available for distribution at the takeover point after the by-product plant.

The by-products envisaged to be recovered are shown in Table below.

Table- 5

By-Products of Coke Oven

Description	Quantity
Sulphur (99.5%), tpy	12,900
Crude tar, tpy	232,700
Crude benzol, tpy	51,700
HP steam, tpy	2,407,900

Clean coke oven gas, x 10^6 N cu m/yr	2208

Table- 6

Material Balance of Proposed Coke Oven

Raw material	Input TPA	Product/wastes	Output TPA
Coking Coal	6893400	Coke	5170000
		Coke Breeze	310200
		CDQ Dust	51700
		Coke Oven Gas	1361500
Total	**6893400**	**Total**	**6893400**

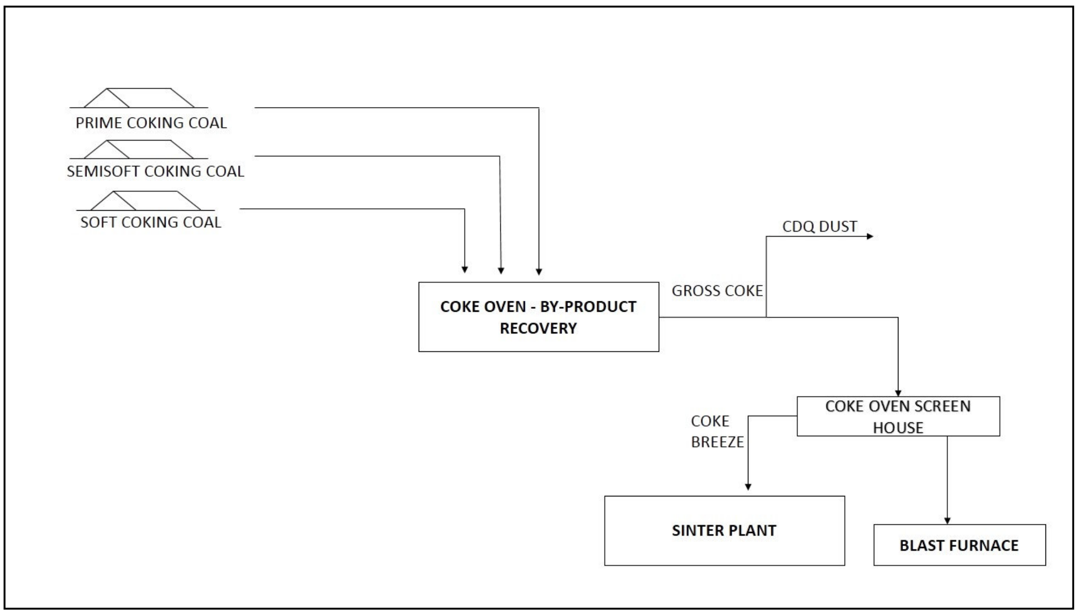


Figure 6: Process flowchart of Coke Oven

C. SINTER PLANT

Sintering process is developed mainly to utilize under size of lump ore called iron ore fines; which otherwise, could not be charged directly in blast furnace. In order to conserve these, otherwise waste material, they are compacted together and made into lumps by a process known as sintering. Sintering is defined as the agglomeration of the Iron ore fines (generally < 8mm by incipient fusion of fine mineral particles with heat produced by burning of coke breeze, uniformly distributed in raw mix bed. During the sintering process, iron ore fine particles agglomerate into a porous compact heterogeneous lumpy mass called SINTER by incipient fusion caused by the heat produced during the combustion of the solid fuel within the moving bed of loosely particles.

For the proposed project, it is envisaged that sinter will constitute around 30% of the blast furnace burden to get the advantage of lower hot metal cost, better operations and high solid waste utilization within the plant. Hence two sinter plants of around 490 sq m will be installed in two phases to cater required burden to the proposed Blast Furnaces.

Design Basis

The design basis considered for the new sinter plant is given in Table below.

Table- 7

Design Basis of Sinter Plant

Item	Quantity
	SP-2
Product sinter, tons/year	5,750,000
Charge sinter, tons/year	5,081,700
Screening at BF stock house, %	12
Operating days/year	330
Daily product sinter, tons/day	17,500
No. of strand	1
Approx. suction area, sq m	490
Product sinter size, mm	5-50
Temperature of sinter at cooler discharge, oC	100

Raw Materials

The typical analyses of input raw materials (dry basis) for sinter production are given in Table below.

Typical Analysis of Raw Materials for Sinter Production

	Fe	SiO2	Al2O3	Cao	MgO	LOI
	%	%	%	%	%	%
Iron ore fines	61-63	3-4	3-3.5	-	-	3.5-4.0
Limestone	-	4.5-5	1.5-1.7	47-48.0	2.0-2.5	41.0
Dolomite	-	28-30	0.5-0.6	28.0-30.0	19.0-20.0	45.0
Calcined lime fines	-	2.5	2.0	92.0	1.9	2.0
Coke breeze	0.5	6.75	3.5	-	-	87.5
Flue dust	37.0	6.5	4.2	3.6	1.1	38.0
Quartz	-	96.0	0.55	-	-	-
Mill scale	69.5	1.2	1.2	0.7	0.3	5.0
Pellet Fines	63.5-64.8	2.35-3	2.5-2.8	0.9-1.4	0.2-0.35	-

Sinter Quality

The indicative chemical analysis of sinter produced will be as follows:

Fe, % .. 53.0-54.0

CaO/SiO2 ratio .. 2.2-2.25

Al2O3, % .. 3.1-3.3

MgO, % .. 2.0-2.15

Envisaged physical and metallurgical properties of sinter will be as follows:

ISO tumbler index (+6.3 mm) .. 76% (min)

Reducibility index .. 65% (min)

RDI (-3.15 mm) .. 28% (max)

Sinter size range .. 5 to 50 mm

Sinter mean size .. 18 mm

1) Raw Material Storage & Proportioning, Mixing & Granulation System (IMGS) Proportioning Bins System

The bins are designed to avoid "bridging" of the raw materials within the bins and to reduce the segregation of coarse and fine particles during charging and discharging. The segregation in the bins during charging and discharging occurs differently at different filling level of the bins. The discharge of the raw materials with the dosing weigh feeders from the different bins is controlled on the bases of "real time dosing system". With this control system the desired mixture composition will be according to the predetermined ratios at all times of operation.

With this storage system, respectively charging and discharging system, combined with the Intensive Mixing and Granulation System, even a better homogeneity in the micro structure of the sinter raw mix can be achieved. Decisive for the sinter quality is the homogeneity in the area of the micro structures of the sinter raw mix, but not the average homogeneity of the sinter raw mix.

Raw materials, additives and solid fuels are discharged from the respective storage bins via dosing weigh feeders to the collecting belt conveyor. The collecting belt conveyor feeds the raw materials to the Intensive Mixing System where the raw mix is "pre mixed" to minimize fluctuation coming from the blending yards. The Sinter Return Fines are added after this "pre mixing" to ensure a higher lifetime of the intensive mixer. In the intensive mixer the material mix is homogenized. In order to adjust the required moisture content and ensure a proper mixing of the "pre-mix" with the Sinter Return fines a granulator is used. For the granulation of the raw mix a granulator is installed, with the possibility to coat the raw mix with burnt lime.

Intensive Mixing System

The sinter raw materials discharged from the proportioning bins acc. to the required ratio are fed to the mixing system by a belt conveyor. High homogeneity and permeability of the sinter raw mix are decisive for the productivity, sinter quality and energy consumption. High and stable sinter quality, which can be achieved only on the bases of high and stable homogeneity of the sinter raw mix, is an important precondition for the high performance of the blast furnaces. Intensive mixers are applied beside other application also in sinter plants, ore beneficiation plants and pellet plants. At sinter plants the requirements are similar, as also small amounts of additives have to be evenly distributed within the sinter raw mix, which can effectively be achieved only with intensive mixers.

Intensive Granulation System

The sinter raw mix is transported via belt conveyor to the granulator, where the final sinter raw mix with high permeability is produced. The granulator is situated at the bottom directly after the intensive mixer. The coarse particles of the plant return fines are the nucleus for the granulation process, which already starts in the mixer. The design of the drums basically depends on the granulation time, necessary for qualitative high-value micro particles. The final sinter raw mix discharged from the granulator is fed into the feeding hopper of the sinter machine via a shuttle conveyor.

Sinter Machine Charging

The sinter machine charging consists of hearth layer charging system and mixed material charging system.

Hearth layer thickness on the sintering strand and sinter raw mix layer thickness on the drum feeder can be adjusted during normal operation according to the requirements.

The speed of the drum feeder is controlled by the volumetric conveying capacity of the sintering machine as well as by probes.

To ensure that the sinter mix is fed to the sinter strand loosely and evenly distributed, probes monitor the material slope ahead of the mixed material charging chute on the sinter strand and control the drum feeder speed. The position of the mixed material gates at the surge hopper discharge can be adjusted accordingly.

Hearth Layer Transportation

The hearth layer, that is the 12 - 22 mm grain size fraction from the hearth layer screen, is transported to the distributor chute by a belt conveyor. It is collected from the overflow type distributor chute by a speed-controlled discharge vibrating feeder and transported via belt conveyors to the hearth layer bin.

The vibrating feeder is controlled automatically by the pre-selected filling level in the hearth layer bin. The remaining amount of the 12 - 22 mm fraction, which is not needed as hearth layer, is diverted to the sinter product conveyor line

Driving Station & Lowering Station of Sinter Machine

The driving station of the sinter machine is equipped with a planetary type gear box adequate for heavy duty requirements. The position of the loose bearing of the driving shaft may be adjusted by means of a slip-on-gear box and adjusting device, so that the straight run of the sinter machine is ensured.

The lowering station of the machine is moveable so as to be able to absorb the normal thermal expansion. When the expansion is too large, alarm or shut down, respectively, is effected by limit switches.

Due to a special design of the guide way of the pallets during discharge, the pallets are at first horizontally separated from each other and then the pallet to be emptied is lowered. Thus, the wear between the contact surfaces of the pallets is minimised. In addition easily exchangeable wear plates are bolted to the contact surfaces of the pallets. The material droppings between the pallets are collected in a chute and laterally discharged from the machine.

The sinter cake dropping from the pallets is falling onto a crash deck and then slides onto the star crusher.

To protect the adjacencies against dust, the entire charging station is covered and connected to the plant dust collecting system.

The sinter machine is driven by a heavy duty planetary gear.

Pallet Cars and Sliding Track

The design of the pallet cars is considering SIEMENS VAI unique technology for pallet width **extension. This design is applied in order to reduce the false air intake at the side walls to a minimum** possible extent.

The pallets are protected against thermal overloading by means of slip-on insulation pieces. An approx. 3 to 5 cm high hearth layer will be charged onto the pallets as an additional protection.

As protection against the penetration of secondary air in the suction boxes the pallets are sealed with sealing rails towards the supporting structure.

The sealing rails of the pallets are pressed downwards and against the static sliding rail by means of several helical springs. To avoid that the friction between sealing rail and sliding rails gets too **great and in order to reduce the** wear **at this point, lubricant is pressed between sealing rail and** sliding rail. The lubricant is supplied in a sufficient quantity from a dual-line central lubricating system via suitable distribution blocks to the various lubricating points. '

The pallets can be removed from the strand for maintenance works by a crane equipped with **a special hook device. A changeable liner is used for the end plate of pallets to prevent abrasion.**

Ignition Furnace and Radiation Hood

The heat required for the ignition is supplied by dual firing system. Mixed gas or Blast Furnace gas is used as fuel.

The whole ignition furnace chamber is lined with refractory material. Refractory lined slide gates at the inlet and outlet walls can be adjusted to match to the material layer thickness on the travelling grate.

For combustion air hot air from cooler is used. Mixed gas or BF gas and air are continuously controlled by means of butterfly valves and/or regulating dampers. Ignition of the burners is done by means of ignition burners operated with propane.

Gas and air quantities are measured and regulated by control devices. Purging of the gas mains before gasifying and after degasifying is performed by using nitrogen.

A quick-acting safety valve shuts-off the gas supply, when required.

The radiation hood is located adjacent to the ignition furnace outlet and is protecting the freshly ignited sinter surface with hot air from cooler.

Sinter Cooler

For cooling the sinter a circular trough - up draught pressure type - dip rail cooler is provided. The moving troughs with louver-type bottom plates form a ring. The cooling air is pressed through the louver-type bottom of the moving troughs. The cooled sinter is discharged by lowering the louver-type bottom at the trailing end, so that the sinter falls down into a discharging bin, which is supported on load cells for level monitoring.

The cooler is driven with 2 heavy duty planetary gears via friction drive and variable speed. The optimum filling of the circular dip rail cooler is controlled by level sensors at the feeding chute. For sinter cooling blowers are provided. Inlet silencers are provided for noise level reduction. Pallet car changing arrangement for sinter cooler is envisaged.

The sealing of the cooler is of rubber type. Support structure is of civil type.

Cold Screening and Hearth Layer System

From the cooler discharge bin the cooled sinter is withdrawn by a speed controlled vibrating feeder. The cooled sinter shall be carried by a heat resistant rubber conveyor to the sinter screening station. The conveyor that receives the sinter from the cooler discharge hopper shall be protected from damage from hot sinter by a temperature detector which will switch on a water injection if the temperature is higher than the set point.

Selective Waste Heat Gas Re-circulation System

The "Selective Waste Gas Recirculation System" is designed on the basis of the following features:

- The gas of the 1st and 3rd zone of the sinter machine is treated as waste gas and is directed to the cleaning equipment and stack. The waste gas of the 2nd zone of the sinter machine is mixed with cooler off-air and/or ambient air and is recycled to recycle hood which is situated above the sinter strand at the first part.
- Thesinterwastegasrecycledtothesurfaceofthesintermachinebedhassufficiently high oxygen content and a temperature which is well above the critical dew point.
- The recycle hood installed above the sinter machine is equipped with a special sealing system to avoid recycled waste gas continuing carbon monoxide exiting to the environment.
- CO detectors will be installed on both sides of the sinter strand.
- Target of the SWGR System

Advantages of the "Selective Waste – Gas Recycling System":

- Reduction of the waste gas volume upto 50%
- Lowerinvestmentandoperationalcostsforamodernwaste-gascleaningfacility
- Decreased solid fuel consumption due to the use of the CO-content and sensible heat in the recycled waste gas

For the selective waste gas recycle system a recirculation duct, gas mixing device and a recirculation hood will be provided. Cooler air is used to increase 02content in the recirculation hood and comprises cooler hood modification and speed controlled fresh air fan.

Table- 8

Material Balance for the proposed Sinter Plant

Raw material	Input TPA	Product/wastes	Output TPA
Iron ore fines	7922200	Sinter	11500000
Iron bearing dust	99600	Sinter Fines	1380000
Mill scales	160350	Losses	96750
Limestone	1113350		
Coke breeze	646600		
Sinter return fines	1380000		
Calcined lime	328450		
LD slag	99500		
Quartz	113900		
Pellet Fines	370450		
Calcined Dolo	104700		
Dolomite	637650		
Total	**12976750**	**Total**	**12976750**

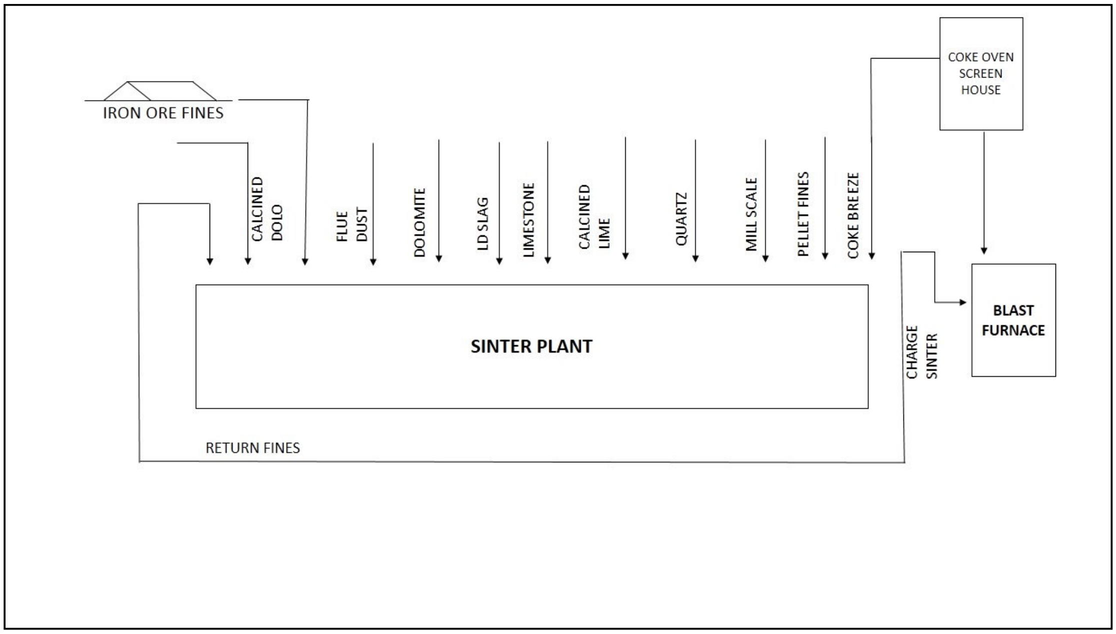


Figure 7: Process flowchart for Sinter plant

D. BLAST FURNACE

In the Blast Furnaces (BF) liquid iron (popularly termed as 'Hot Metal') is produced by the process of reduction at high temperature from raw materials like iron ore, base mix, sinter, coke, fluxes (limestone / quartzite), etc. &also air blast / O2. In blast furnace the process is also known as "Counter current process" as solid raw material is being charged from the top and hot air is being blown from bottom. During the process the impurities are removed in the form of slag and hot metal is produced. Coal is being injected to reduce consumption of main fuel coke which is a cost reduction measure. Liquid metal and slag are being separated in the area known as cast house. The liquid Hot Metal is transported in Hot Metal Ladles / Torpedoes to the Steel Melting Shops (SMS) for the production of steel by the process of oxidation of the Hot Metal in specially designed Convertors.

The project proposes to install two blast furnaces of around 5,400 cu m useful volume and one large blast furnaces of 6,000 cu m useful volume to supply hot metal to SMS.

Design Basis

The blast furnace will incorporate all the modern technological features. The design basis of blast furnace is given in Table below.

Annual Requirement of Major Raw Materials

Item	BF (2x5400 m^3)	BF (1x6000 m^3)
Volume, cu.m (42aporiz.)	5,400	16000
Production, mtpa	9	5.0
Operating days	350	350
Burden:		
Sinter, %	42	62

Pellet, %	58	38
O2, %	8	8
Coal rate, kg/thm	200	200
Coal rate, kg/thm	355	355
Coke ash, %	12.5	12.5

Raw Materials

The major raw materials for blast furnace comprises of sinter, pellet, additives and coke. Pulverized coal will be injected through tuyeres as auxiliary fuel in blast furnace. The typical analysis of raw materials envisaged is given in Table.

Typical Raw Materials Analysis (Dry basis)

	Fe	**SiO2**	**Al2O3**	**Cao**	**MgO**
	%	**%**	**%**	**%**	**%**
Sinter	53-54	5.7-5.9	3.1-3.3	10.9-11.9	2.0-2.15
Pellet	63.5-64.8	2.35 -3	2.5 – 2.8	0.9-1.4	0.2-0.35
Limestone	-	4.5-5	1.3-1.7	47-48.0	2.0-2.5
Dolomite	-	28-30	0.5-0.6	28.0-30.0	19.0-20.0
Quartzite	-	97.0	1.0	-	-
	Ash	**Moisture**	**CSR**	**CRI**	
Coke	12.5%	0.55	62% (min)	22-25%	

Coal for PCI Application:

Ash, % (dry basis) .. 9 – 10

Fixed carbon, % .. 68 – 72

Hot Metal Quality

The expected analysis is given below:

Si, % : 0.5-0.8

S, % : 0.05

P, % : 0.10

Major Facilities

i.	BF proper	xi.	Stockhouse and casthouse de-dusting system
i.	Cast House	xii.	Air blowing system
ii.	Slag granulation plant	xiii.	Plant electrics
iii.	Hot blast stoves	xiv.	Instrumentation, automation and control system

iv.	Gas cleaning plant	xv.	Communication system
v.	Stock house and charging system	xvi.	Water system
vi.	Hot metal handling system	xvii.	Utility system
vii.	Cranes and Hoists	xviii.	Air conditioning and ventilation system
viii.	Cranes and hoists	xix.	Fire fighting system
ix.	Coal dust injection system		
x.	Hot metal granulation and ladle repair shop		

Process Description

Iron oxide is charged into the blast furnace plant in the form of raw ores, pellets, or sinter.The iron ore, pellets and sinter then are charged into blast furnace to produceliquid iron, with any of their remaining impurities going to the liquid slag.

The coke is produced from a mixture of coking coals. Thecoke contain 85 to 90% carbon some ash and sulfur but compared to raw coal is very strong. The strongpieces of coke with a high energy value provide permeability, heat and gases which are required to reduceand melt the iron ore, pellets and sinter.

The other raw material in the iron making process is limestone, dolomite & quartzand charged into the blast furnace to act asflux. These fluxes help to remove out gangue fromblast furnace in the form of slag.

At the top of the furnace the ore burden (Iron Ore, Sinter, Pellets, Fluxes) and coke are charged in an alternate manner. The material are charged into the blast furnace throughtwo stages of charging system which seal the gases and distribute the raw materials evenly around thecircumference of the furnace throat in the required positions by the means of a rotor distributor.Also at the top of the blast furnace are four uptakes, where the hot dirty gas exits the furnace dome. Thisgas flows up to where two uptakes merge into an off take. This off-take is directed in to a down comer.At the extreme top of the uptakes there are bleeder valves which may release gas and protect the top ofthe furnace from sudden gas pressure surges. The gas descends in the down comer to the dust catcherwhere course particles are settle out, accumulate and dumped into a railroad car or truck for disposal. Thegas then flows through a dry gas cleaning plant. The clean gas pipeline is directed to the hot blast stove.There are usually 3 or 4 cylindrical shaped stoves in a line adjacent to the blast furnace. The gas is burnt inthe bottom of a stove and the heat rises and transferred to refractory brick inside the stove. The products of combustion flow through passage in these bricks, out of the stoves into a high stack which is shared by all the stoves.

Large volumes of air are generated from turbo blower and flow through the cold blast main upto the stoves. This cold blast then enters the stoves that has been previously heated and the heat stored in the refractory brick inside the stove is transferred to the cold blast to form hot blast. The hot blast temperature can be from 1000C to 1200C depending on the stove condition. This heated air then exits the stove into the hot blast main which runs upto the furnace There are mixer line connecting the cold blast main to the hot blast main that is equipped with a valve used to control the blast temperature andkeep it constant. The hot blast main enters into a drought shaped pipe that encircles the furnace called the bustle main. From the bustle pipe, the hot blast is directed intothe furnace through nozzles calledtuyeres. These tuyeres are equallyspaced around the circumferenceof the furnace.

These tuyeres are made of copper and are water cooled since the temperature directly in front of them isvery high, Oil, tar, natural gases powdered coal and oxygen can also be injected into the furnace at the tuyerelevel to combine with the coke to release additional energy which is necessary to increase productivity.The molten iron and slag drip past the tuyere on the way to the furnace hearth, which starts immediatelybelow tuyere level. Around the bottom half of the blast furnace the cast house encloses the bustle pipetuyeres and the equipment for casting the liquid iron and slag. The opening in the furnace hearth for casting or draining the furnace is called the iron notch. A large drill mounted on a pivoting base called the tapehole drill machine swings up to the iron notch and drills a hole through the refractory clay plug into the liquid iron. Once the tap hole is drilled open, liquid iron and slag flow down a deep trench called a trough or runner. Set across and at far end into the trough is a block of refractory, called skimmer which has a small opening. The hot metal flows through this skimmer opening, over the "iron dam" and down the "iron runner". Since the slag is less dense than iron, it flows on the top of Iron down the trough, hits the skimmer and is diverted into the slag runner. The liquid slag flows into slag granulation plant or into slag pit and the liquid iron flows into refractory lined "ladles" either of open top type or torpedo cars (called so due to their shape). When liquid in the furnace is drained down totap hole level some of theblast from the tuyeres causesthe tap hole to spit. Thissignals the end of the cast sothe mud gun is swung intothe iron notch. The mud guncylinder, which is previouslyfilled with a refractory clay,is actuated and the cylinderram pushes clay into theiron notch stopping the flowof liquid. When the cast iscomplete, the iron ladles

are taken to the steel shopsfor processing into steel It is important to cast the furnace at the same rate that raw material are charged andiron/slag produced. So liquid level is maintained in the hearth and below tuyeres. Liquid levels above thetuyeres can burn the copper casting and damage the furnace linings.

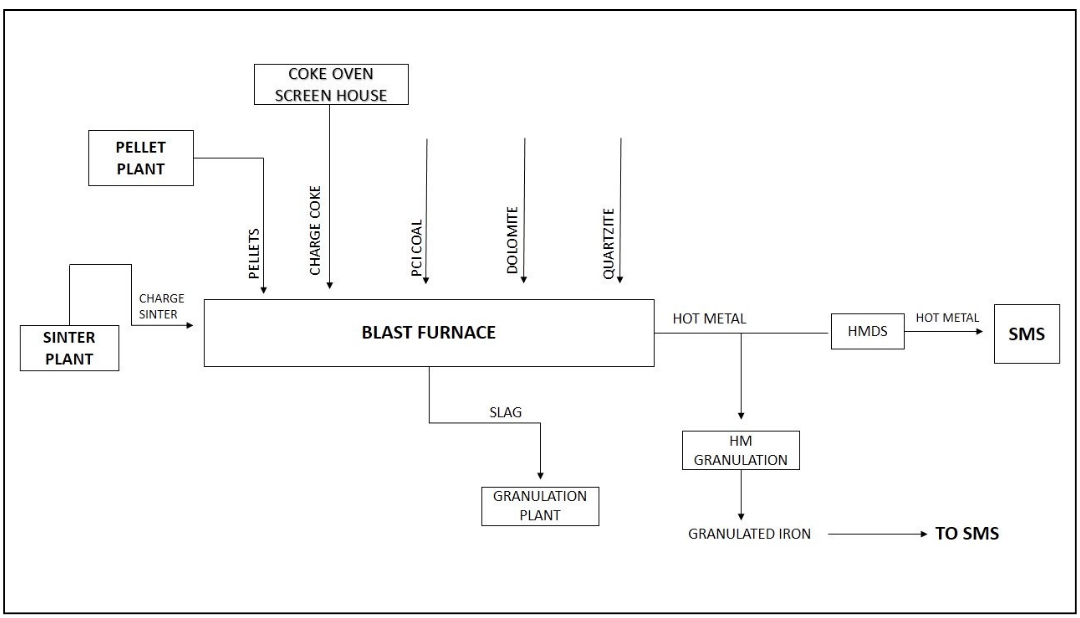


Figure 8: Process flowchart of Blast Furnace

Table- 9

Material Balance for the proposed Blast Furnaces

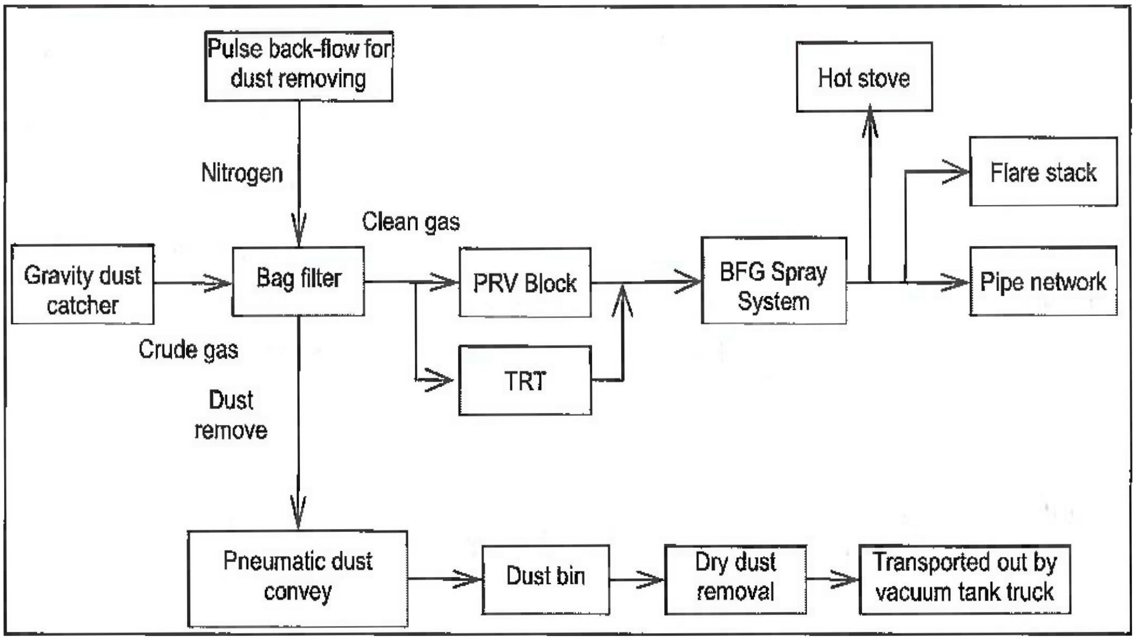
Raw material	Input TPA	Product/wastes	Output TPA
Sinter	11266600	**Hot metal**	14000000
Coke	4970000	**Slag**	4620000
Pellet	11425650	**Dust & Sludge**	3710000
PCI	2800000	**BF gas**	8974250
Quartzite	380000		
Dolomite	462000		
Total	**31304250**	**Total**	**31304250**

Gas Cleaning System

Dry type gas cleaning process with bag filters will be applied to the gas cleaning plant, which has the following characteristics:

1) The dedusting efficiency is high. In some well-operating blast furnaces equipped with bag filters, the dust contents in the cleaned gas as measured are 1-3 mg/Nm3. The low dust content in the blast furnace gas is of great significance for reducing the wear of TRT turbine blades, reducing clogging in pipes and equipment and reducing the dust contents in the combustion flue gas as well.
2) The calorific value of gas is high. Spray nozzles are provided in the pipe of the cleaned gas leaving the bag filters to cool down and remove acid. The moisture content in the gas is low, and the calorific value of the gas is high, which is conducive to increasing the combustion temperature in the hot blast stoves.
3) The energy consumption is low. Gas cleaing with bag filters does not require huge water treatment facilities, so the consumption of water and electricity is low in production.
4) The dust collected from gas is transported and handled as gas-tight. The dust discharged from the bag filters is transported with nitrogen to a large dust silo for storage. Vacuum tankers can be used to transport the dry dust discharged from the large dust silo, and the dust is completely contained in the tanker, no spillage can occur during the entire transportation process, which helps maintain a good production environment.
5) The power generation by TRT is high. The pressure loss of the blast furnace gas flowing through the bag filter system is about 3 kPa, and the temperature drop is about 10 °C. Compared with the wet dedusting process, the power generation by TRT can be 25-30 % higher, which can bring about considerable economic benefits.

Process flow is shown in below:



Crude gas from dust catcher goes into bag filter, then clean gas goes into clean gas main through TRT or pressure regulating valve.

While BF top crude gas temperature is higher than preset value, start top spray to reduce top gas temperature to 250V and below, then cleaning in the bag filter. Avoid the bag to be damaged by high temperature.

In blow-in or re-blasting phase, crude gas temperature is lower than preset value, which requires few dedusters in operation; more dedusters will be required while the gas temperature reaches above dew point temperature 20t - 30t. So it is to be considered that the dedusting effect of dedusters operated in the early stage before determining the quantity.

TRT

TRT unit is outdoor arranged paralleling with the pressure regulating valve block, the turbine host and generator are set with acoustic enclosure. TRT complete equipmentincludes turbine host, generator, power oil station, lubricating oil station, inlet/outlet cut-off valve, rapid cut-off valve, sound insulation hood, control system, high and low voltage electrical cabinets, and auxiliary equipment. When gas flows by TRT full amount, pressure reducing valve is closed, the top pressure is controlled by the turbine static leaves alone; when gas flows by TRT partly, the top pressure is controlled by turbine stationary blades and pressure reducing valve group together; when TRT is shut-down, the top pressure is controlled by the pressure reducing valve group.

E. STEEL MELTING SHOP

Steel Melting Shop (SMS) receives Hot Metal (HM) from Iron-making units and converts it into various grades of Steel and casts them into Slabs, Blooms, Billets, Beam blanks, Rounds and thin slab- HR coils. Those are delivered as products to down-stream units (Long, Section & Flat Products). SMS is the first stage in the Steel manufacturing value chain where product differentiation and customization starts.

The proposed project will comprise of setting up of Electric Arc Furnace (EAF) and Basic Oxygen Furnaces (BoF). It is proposed that two numbers of EAF will be installed with the capacity of 1x250 T and 1x360 T, and four numbers of BoF will be installed with the following configuration: 2x300 T and 2x360 T.

Electric Arc Furnace:

The electric arc furnace operates as a batch melting process producing batches of molten steel known as "heats".

The electric arc furnace operating cycle is called the tap-to-tap cycle and is made up of the following operations:

- Furnace charging
- Melting
- Refining
- De-slagging
- Tapping
- Furnace turn-around

  Modern operations aim for a tap-to-tap time of less than 40 minutes.

A break-down of the average tap-to-tap time of EAFs, indicating the duration of various activities, is given below:

Activity	Time, min
Furnace Preparation	4
Charging of scrap	2
Melting and refining	25
Superheating	8
Temperature and sampling	1
Tap-to-tap time	**40**

Major facilities in EAF

EAF	Major facilities
1x250 T	i) Scrap handling facilities. ii) Hot metal handling facilities. iii) Hot DRI charging facilities. iv) 250T/260MVA EAF and associated facilities. v) EAF gas cleaning system. vi) Secondary emission control system. vii) Flux and ferro-alloy handling facilities. viii) Liquid steel handling facilities. ix) Slag handling facilities. x) Ladle furnace.

	xi) Billet/ Slab/Thin slab caster
1x360 T	i) Scrap handling facilities. ii) Hot metal handling facilities. iii) DRI charging facilities. iv) 360 ton/330MVA EAF and associated facilities. v) EAF gas cleaning system. vi) Secondary emission control system. vii) Flux and ferro-alloy handling facilities. viii) Liquid steel handling facilities. ix) Slag handling facilities. x) Ladle furnace. xi) Billet/ Slab/Thin slab caster

Process Description of EAF-

Furnace Charging

The first step in any tap-to-tap cycle is "charging" the furnace. The roof and electrodes are raised and are swung to the side of the furnace to allow the charging crane to move a full bucket of scrap + DRI (Fine)into place over the furnace. The bucket bottom is usually a clamshell design – i.e. the bucket opens up by retracting two segments on the bottom of the bucket. The bucket charge falls into the furnace and the scrap crane removes the scrap bucket. Then hot metal is poured into the furnace by crane or lounder. After that the roof and electrodes swing back into place over the furnace. The roof is lowered and then the electrodes are lowered to strike an arc on the charge. This commences the melting portion of the cycle. Continuous charging operations eliminate the chargingcycle. Remaining DRI and flux added during operation through conveyer charging system.

Melting

Melting is accomplished by supplying energy to the furnace interior. This energy can be electrical or chemical.Electrical energy is supplied via the graphite electrodes and is usually the largest contributor in melting operations. Initially, an intermediate voltage tap is selected until the electrodes bore into the scrap. Usually, light scrap is placed on top of the charge to accelerate bore-in. Approximately 15 % of the scrap is melted during the initial bore-in period. After a few minutes, the electrodes will have penetrated the scrap sufficiently so that a long arc (high voltage) tap can be used without fear of radiation damage tothe roof. The long arc maximizes the transfer of power to the scrap and a liquid pool of metal will form in thefurnace hearth. At the start of melting the arc is erratic and unstable. Wide swings in current are observedaccompanied by rapid movement of the electrodes. As the furnace atmosphere heats up the arc stabilizesand once the molten pool is formed, the arc becomes quite stable and the average power input increases.Chemical energy is being supplied via several sources including Virtual Lance Burner (oxy-fuel burners) andoxygen lances. VLB burners burn HSD Oil using oxygen. Heat is transferred to the scrap by flame radiationand convection by the hot products of combustion. Heat is transferred within the scrap by conduction.Large pieces of scrap take longer to melt into the bath than smaller pieces. Oxygen can be lanced directlyinto the bath. This oxygen will react with several components in the bath including, aluminum, silicon,manganese, phosphorus, carbon and iron. All of these reactions are exothermic (i.e. they generate heat)and supply additional energy to aid in the melting of the scrap. The metallic oxides that are formed will endup in the slag. The reaction of oxygen with carbon in the bath produces carbon monoxide, which eitherburns in the furnace if there is sufficient oxygen, and/or is exhausted through the Fume Exhaust Systemwhere it is burned and conveyed to the pollution control system.

De-Slagging

De-slagging operations are carried out to remove impurities from the furnace. During melting and refining operations, some of the undesirable materials within the bath are oxidized and enter the slag phase.

It is advantageous to remove as much phosphorus into the slag as early in the heat as possible (i.e. while the bath temperature is still low). The furnace is tilted backwards and slag is poured out of the furnace through the slag door. Removal of the slag eliminates the possibility of phosphorus reversion.

During slag foaming operations, carbon may be injected into the slag where it will reduce FeO to metallic iron and in the process produce carbon monoxide, which helps foam the slag. If the high phosphorus slag has not been removed prior to this operation, phosphorus reversion will occur. During slag foaming, slag may overflow in the EAF and flow out of the slag door.

Tapping

Once the desired steel composition and temperature are achieved in the furnace, the tap-hole is opened, the furnace is tilted, and the steel pours into a ladle for transfer to the next batch operation (usually a ladle furnace or ladle station). During the tapping process bulk alloy additions are made based on the bath analysis and the desired steel grade. De-oxidizers may be added to the steel to lower the oxygen content prior to further processing. Common de-oxidizers are aluminum or silicon in the form of ferrosilicon or silicomanganese. Most carbonsteel operations aim for minimal slag carry-over. A new slag cover is "built" during tapping. For ladlefurnace operations, a calcium aluminate slag is a good choice for sulfur control. Slag forming compoundsare added in the ladle at tap so that a slag cover is formed prior to transfer to the ladle furnace. Additionalslag materials may be added at the ladle furnace if the slag cover is insufficient.

Table- 10

Material Balance of EAFs

Raw material	Input TPA	Product/wastes	Output TPA
DRI	6525900	Steel	6000000
PIG IRON/ HOT METAL	492900	Slag	1320000
STEEL SCRAP	60000	Bag Filter Dust	180000
FERRO ALLOYS	108000	Losses	480000
Calcined Lime	612000		
Total	**7798800**	**Total**	**7798800**

Basic Oxygen Furnace

It is planned to set up BOF based steel melt shop with total capacity of 13.2 MTPA comprising of 2 Nos. 300 tons BOFs and 2 nos. of 360 tons BoFs with required numbers of secondaryrefining units and continuous casting facilities. A break-down of the average tap-to-tap time of BOFs,indicating the duration of various activities, is given in table below:

Activity	Time, min
Charging of scrap	3
Charging of hot metal	5
Oxygen Blowing	14
Temperature and sampling	4
Reblow	**2**
Steel tapping	**6**
Slag off	**4**
Vessel inspection	**2**
Slag splashing	**2**
Unforeseen delays	**2**
Tap-to-tap time	**44**

Major facilities in BoFs

EAF	**Major facilities**
2x300 T	i) Scrap handling facilities. ii) Hot metal handling facilities. iii) 2 x 320 ton hot metal desulphurisation & associated facilities. iv) 2 x 300 ton BOF and associated facilities. v) Dry type BOF gas cleaning plant. vi) Secondary emission control system. vii) Flux handling facilities . viii) Liquid steel handling facilities. ix) Slag handling facilities. x) 2 x 300 ton inert gas rinsing station. xi) 2 x 300 ton ladle furnaces. xii) 1 x 300 ton twin RH-OB degasser unit. xiii) 2 nos. slab caster.
2x360 T	i) Scrap handling facilities. ii) Hot metal handling facilities.

	iii) 2 x 380 ton hot metal desulphurisation & associatedfacilities. iv) 2 x 360 ton BOF and associated facilities. v) Dry type BOF gas cleaning plant. vi) Secondary emission control system. vii) Flux handling facilities. viii) Liquid steel handling facilities. ix) Slag handling facilities. x) 2 x 360 ton inert gas rinsing station. xi) 3 x 360 ton ladle furnaces. xii) 1 x 360 ton twin RH-OB degasser unit. xiii) 4 nos. slab caster including thin slab caster

BOF Converter Plant

The BOF converter will be designed including all facilities (e.g. oxygen blowing equipment, off gas system, bin system etc. Downtimes have to be considered for relining.

Two water cooled lances (one operating and one standby) will be provided for one converter. The bottom will be equipped with an inert gas stirring system.

The converters will operate with slag free tapping systems. Self propelled steel transfer cars as well as slag pot transfer cars have to handle the liquid material.

The above conditions require a hot metal input of about 80%, cooling will be provided by mainly scrap charged via scrap chute as well as DRI / iron ore feeding via bin system. The required fluxes for slag formation will mainly consist of burnt lime and burnt dolomite. The combined blowing practice will be favourable for handling the increased phosphorous content of the hot metal and allows blowing with only one slag.

The converter will be operated with a top lance for oxygen blowing and with bottomstirring of inert gases. The typical advantage of such combined blowing technique will be the close approach to the equilibrium of metallurgical reactions and the resulting smooth blowing process and benefits of material yard. The liquid steel will be tapped slag free from the BOF, in order to eliminate the negative influence of the furnace slag (FeO, MnO) during further processing and casting of the steel. The required deoxidation materials, the slag forming additions as well as deoxidation agents and ferro alloy additions. For this 1 no. on-line Argon Rinsing Stations (ARS) is installed. The ladle will be transferred to the Ladle Furnace Stations and will be positioned into one of the Ladle Transfer Cars. The BOF will be provided with dry gas cleaning system and shall have dog house with secondary fume extraction system.

Ladle Furnaces

Ladle refining refers to the metallurgical processes that occur in the ladle. These include alloying, deoxidizing, degassing, and the reheating and stirring of the bath. Ladle refining affords the steel maker with the flexibility to control the processing of heats in order to achieve greater production efficiencies and superior metallurgical traits.

The refiners provide stirring of the bath for thermal and chemical homogenization and expedite metallurgical reactions using an inert gas introduced near the bottom of the ladle by a porous plug, tuyere, or lance. In addition to adjusting temperature, the primary function of ladle refining is to finetune the steel's chemistry. This adjustment can be accomplished by means as simple as bulk alloy additions during the tapping of the melt vessel, to additions of smaller lumps or chunks added at the bath surface, to injectable or wireencased powders added below the surface.

Powders tend to be used for the more exotic or micro-alloying elements that are added in small quantities. Tighter chemistry ranges can now be attained through the iterative process of small additions and chemistry checks. Additions for other purposes such as slag formers or modifiers can be made in these ways as well.

Ladle refining stations are equipped with inprocess sampling and temperature measurement capabilities. For example, expendable immersion thermocouples are the most commonly used method of measuring temperatures, producing a reading accurate to 10'F within seconds. Immersion samplers have been developed for most common grades. The sample is sent to the laboratory where it is analyzed for selected metallic elements using x-ray fluorescence or spectrography, or gaseous elements by evaporative techniques.

In vacuum degassing, molten steel is subjected to a vacuum for vacuum control, temperature control, deoxidization, degassing (hydrogen removal), decarburization, and removal of other impurities from the steel.

The Ladle Furnaces (LF) is designed as single station furnaces. Main features of the LF process are:

- Ladle with liquid steel is placed onto the ladle transfer car.
- Bottom Purging shall be done manually.
- Bottom purging system also can get automatically connected by means of auto couplers
- Transfer car with ladle is positioned below ladle roof (after necessary interlocks are satisfied).
- Ladle roof is lowered
- Steel temperature is measured and sampling done by means of automatic or manual lance through the opening in the ladle roof.

Arcing is started in lower taps

- Necessary quantity of calcined lime is added through the FAFA system Trimming alloys are added as per grade and sample analysis requirement
- Sample is taken for final analysis
- Arcing is shifted to higher taps and done as per final aim temperature Wire feeding is done as per requirements
- Arcing is stopped, roof lifted and ladle transferred out from treatment position and lifted by EOT crane

Function of Vaccum Degassing (VD)

The tank degasser is used to remove gaseous element, non-metallic inclusion and sulphur from the steel. The removal of Non-metallic inclusion is achieved through slag metal interactions, which are promoted by strong argon flushing within the vacuum tank.

Function of RH Process

- Snorkels immersing into steel melt.

- Vacuum evacuation of main chamber.
- Steel is raising in to lower vessel equivalent to Ferro static pressure.
- Circulation effect is produced by bubbling Ar in the inlet snorkel.
- Dissolved gasses and Ar released into the vacuum.
- Steel accelerates through the inlet snorkel (~1.5m/sec or ~ 1mt/min).
- Steel returns to ladle through 2 chamber vacuum-lock and alloy chute.
- Temperature loss is low (RH-vessel preheated).

Continuous Casting Machine

Continuous casting of steel has largely replaced traditional ingot casting due to the higher yield, reduced rolling and energy costs and improved quality. Continuous casting places greater demands on steel making in that composition, temperature and the level of non- metallic inclusion. Much tighter scheduling (times) than the ingot casting.

Liquid Material Handling

After tapping, the steel ladle will be transported to the teeming bay by a steel transfer car. Further transportation to the Ladle treatment and caster will be provided by crane.

The empty ladle returning from the caster will be prepared for the next heat as follows:

- tilting to remove the remaining steel and slag
- teeming nozzle inspection/replacement
- stirring plug inspection/replacement
- preheating up to about 1,200 °C

Ladle inspection and repair stand as well as ladle preheating station will be provided for the above activities.

Gas cleaning plant

Dry Gas cleaning system will be installed for primary gas cleaning and dog house with secondary deducting system will be provided.

Table- 11

Material Balance for the proposed BoFs

Raw material	Input TPA	Product/wastes	Output TPA
DRI	420000	Steel	13200000
Pig iron/ Hot metal	13769850	Slag	2112000
Scrap	528000	Bag Filter Dust	396000
Ferro alloys	237600	Losses	1649850
Calcined Lime	1016400		
Calcined Dolo	462000		
Total	17357850	**Total**	17357850

F. PELLET PLANT

Design Basis

The design basis considered for pellet plant is given in Table

Design Basis of Pellet Plant

Item	Value
Number of units, Nos.	3
Gross pellet from each unit, tpy	7,000,000
Screening loss % at BF stock house	4
Operating days/year	330

Raw Materials

The typical analyses of input raw materials (dry basis) for pellet production are given in Table.

Typical Analysis of Raw Materials For Pellet Production

	Fe	SiO_2	Al_2O_3	Cao	MgO	LOI
	%	%	%	%	%	%
Iron Ore concentrate	63-64.5	1.7-2.5	2.3-2.7	-	-	2.9-4
Limestone	-	4.0-5.0	2.5-2.66	47.0-48.0	2.5-2.5	41.0
Dolomite	-	3.4-5	0.5-0.6	28.0-30.0	19.0-20.0	45.0

The expected quality of imported non-coking coal to be used in admixture, in addition to coke breeze, will be as follows:

Calorific value, Kcal/kg .. >6000

Ash melting temperature, 0C .. >1400

Bulk density, tons/cu m .. 0.8

Pellet Quality

The indicative chemical analysis of pellet produced is as follows:

Material	Pellet Quality
Fe %	63.5 – 64.8
CaO/SiO_2 ratio	0.3-0.6
Al_2O_3 %	2.5-2.8
MgO %	0.2-0.35

Envisaged physical and metallurgical properties of pellet will be as follows:

Size range .. 6 – 18 mm

Compressive strength .. 210 – 250 kg/pellet

Tumbling index

+6.3 mm .. 92%

-500 micron .. 6%

Process Description

Iron Ore fines will be conveyed to the pellet plant where a pelletizing feed blend of ground additives (limestone/dolomite and/or pyroxenite/olivine, bentonite, and coal/coke) and the iron ore fines will be prepared for balling feed.

Coarse limestone, dolomite, pyroxenite, olivine and coal will be delivered via a common conveyor system to storage bins in the additive grinding area. The fluxstone and coal/coke will be proportioned as required for the fired pellet chemistry. The blend of fluxstone and coal will be dried and ground in a heated dry grinding circuit. Co-ground fluxstone and coal will be pneumatically conveyed to a storage bin in the mixing area of the pellet plant.

Coarse bentonite will be received by conveyor to a storage bin in the additive grinding area. Bentonite will be dried and ground in a ring-roller mill grinding circuit. Ground bentonite will then be transported via a pneumatic conveying system to the bentonite storage bin in the mixing area.

Within the mixing area, a pelletizing feed blend of ground additives consisting of bentonite, limestone/dolomite and/or pyroxenite/olivine and coal/coke, recycled ESP and housekeeping baghouse dust, and the iron ore will be proportioned by weigh feeders and conveyed to a mixer to homogenize the blend for balling feed. The homogenized blend of iron ore and ground additives discharging from the mixers will be conveyed to balling disc feed bins.

Off-size green pellets from the balling disc roller screens and the Double Deck Roller Screen (DDRS) at the Indurating Machine, will be discharged to the mixed ore conveying system for recycle to balling, or be transferred for downstream use to a sinter plant. Coordinated belt plows are used to discharge mixed balling feed to the individual balling feed bins which feed balling discs.

The green pellets will be collected and conveyed to a reciprocating conveyor which will feed a wide belt conveyor. The green pellets will discharge from the wide belt conveyor onto a DDRS that removes oversized green pellets and green pellet fines for recycle back to the balling circuit. The on-size green pellets will be distributed onto the traveling grate for heat hardening.

During the process, the unfired green pellets are dried, preheated, and semi-indurated on a continuous traveling grate chain. The semi-indurated pellets are then discharged into a Rotary Kiln and fired at high temperature. After discharge from the rotary kiln, the fired pellets complete the induration process in the annular cooler before being discharged as product pellets. Process air from the preheat zone of the traveling grate, the rotary kiln, and the annular cooler is recirculated in a multi-pass manner to the other process zones to obtain thermal efficiency. Only relatively cool, moisture laden gases are discharged to process gas cleaning and then to the atmosphere

Support utilities (water, coke oven gas, blast furnace gas, coal tar, power, etc.) required for the normal operation of the facility will be provided to the pellet plant battery limits. A brief description of the process and facility is given in the following section.

Additive Preparation and function

Crushed coarse limestone, dolomite, and other fluxes such as pyroxenite and olivine, coal/coke, and bentonite will be received by a conveyor system and will be stored in bins in the additive grinding area.

Fluxstone(s) and coal will be dried and ground in a heated closed-circuit ball mill. Weigh belt feeders will proportion the feed to the mill. The mill power draw determines the mill feed rates. An air heater in the mill system will provide hot air for drying of the feed as it enters the mill. The air stream through the mill carries the ground product to an air classifier which separates coarse particles for recycle back to the mill for further grinding, and on-size particles in the air stream to a series of cyclones which separate the solids (as cyclone underflow) from the carrying moist air stream. An air slide will collect and transport cyclone underflow to a ground additive hopper and pneumatic conveying system. The cyclone overflow stream will be returned to the mill system fan. A slip stream from the mill system fan will pass through a baghouse and be discharged to atmosphere. Moisture from the raw additives exits the system as baghouse exhaust. The baghouse dust product will be discharged into the same air slide and pneumatic conveying system which transports the ground fluxstone(s) and coal/coke to the mixing area of the plant. The drying and grinding circuit will be sized for two (2) shifts of operation per day.

Coarse bentonite will be dried and ground in a separate circuit. A vertical roller mill with an integrated classifier/separator will dry and grind coarse bentonite to the correct size for pelletizing. Flow of material in the bentonite ring-roller mill dry grinding circuit is the same as that of the fluxstone& coal/coke dry grinding system; with cyclones and a baghouse separating the ground solids from the air stream, baghouse exhaust venting any moisture, and ground bentonite pneumatically conveyed to the mixing area of the plant.

Mixing

High intensity mixer(s) will provide a homogeneous balling disc feed. Only minor water addition, if any, shall be required in the mixer. Provisions to include space for a total of two (2) mixers will be provided in the design

Material discharge from the mixer(s) will be collected and delivered by belt conveyors to the balling disc feed bins. The level of the material in the balling disc feed bins will be controlled by a series of belt plows on the flat conveyor belt discharging into the top of the balling disc feed bins, along with load cell to measure the filled capacity of the bins.

Balling

There will be variable speed balling discs installed. The bins will be supported on load cells that monitor bin level. Bin filling will be handled by a series of belt conveyor plows that raise and lower as required to maintain the level in the balling feed bins. The belt conveyor will end in the last bin. The balling discs will be fed with conveyor belts equipped with belt scales for feed rate control.

Green pellets will discharge from the balling discs onto a short conveyor feeding onto a roller screen which will screen the fines and discharge the green pellets onto a short conveyor feeding a collecting conveyor. The collecting conveyor transports the green pellets to a green pellet conveyor which feeds a green pellet conveyor with a reciprocating head pulley mechanism.

The reciprocating conveyor will distribute the green pellets across a wide belt conveyor.

The wide belt conveyor will distribute the green pellets across a double deck roller screen (DDRS) which will screen the green pellets and discharge the on-size fraction onto the induration machine.

The off-size green pellets will be screened out by the roller screens at each balling disc and by the DDRS ahead of the indurating machine. The off-size green pellets will be recycled back to the balling circuit via the roller screen recycle return, green fines return and mixed ore conveyors. Green pellet shredders will be used to mechanically reduce the oversize pellets. The green pellet conveyors and reject conveyors shall be sized for a rejection rate of 40 percent, although recycle rates of 25% or less are anticipated.

To facilitate processing varying ore types, balling disc speed, scraper position, water sprays, disc angle, and feed point will be adjustable. Normally, only minor adjustments to water addition and disc speed will be needed to produce good quality green pellets once initial operating conditions are established. Following the initial setup for the disc, the other adjustments will be necessary only when there is a significant change in the ore characteristics.

Induration-Grate Kiln

The traveling grate will be fed continuously from the DDRS, which lays down the green pellets across the full width of the machine. The last several rolls of the DDRS will have adjustable gaps which will allow a final size separation of the green pellets as the green pellet bed is formed. The gaps will allow smaller green pellets to be laid on the grate first while the larger green pellets will form the upper portion of the green pellet bed. The upper and lower portions of the green pellet bed will each have a narrower size distribution of pellets which will improve the bed permeability and reduce the pressure drop across the bed. In addition, the larger green pellets will be in the upper portion of the bed and, therefore, will be exposed to the higher process gas temperatures for a longer period. The smaller pellets in the lower portion of the bed require less heat input due to the smaller size. The two-layer green pellet bed will result in an improvement in overall fired pellet quality.

The initial stages of pellet induration: Drying, Tempered Preheat, and Preheat; occur on the traveling grate. The anticipated total bed height of green pellets will be constant up to approximately 178 mm. The speed of the traveling grate will be variable and automatically controlled to maintain a constant bed height.

The traveling grate shall have five (5) processing zones: downdraft drying 1 (DDD1), downdraft drying 2 (DDD2), tempered preheat 1 (TPH1), tempered preheat 2 (TPH2), and preheat (PRE). In the downdraft drying zones, gas flow will remove free water from the pellet bed. The downdraft drying off-gases will be exhausted to atmosphere following dust removal. The heat for downdraft drying 1 will be recovered from cooling zone 4. The heat for DDD 2 will be recovered from the PRE zone.

The next processing zones are tempered preheat and preheat. Dried green pellets do not have the physical properties necessary to survive direct feeding to the rotary kiln and thus must be semi-indurated. For acceptable semi- induration, it is necessary for green pellets to be substantially heated and fluxstone carbonates (if used) to be substantially calcined. The heat for TPH1 will be supplied from cooling zone 3. The heat for TPH2 will be supplied from cooling zone 2. The heat for PRE will be supplied from the rotary kiln exhaust gases. Process gases from the TPH1 zone will be discarded after dust removal. Process gases from the TPH2 and PRE zones are combined and transported for use in DDD2.

After preheating, the pellets will be fed to a rotary kiln to be fired at high temperature. Preheated secondary air for the rotary kiln burner is provided from cooling zone 1 of the annular cooler. The remaining heat from the rotary kiln exhaust gases from firing of the pellets is recuperated in the PRE zone. After firing, the pellets are discharged to the annular cooler.

The annular cooler load zone is located directly below the kiln discharge area. This is the area in the cooler where pellets are discharged from the kiln to the cooler. The load wall separates the load zone from the dump zone of the cooler. The load wall is used to contain pellets in the load zone and to minimize air leakage into the load zone. A grizzly bar system will be used to direct oversize lumps away from the pellet bed and down the grizzly discharge chute. The system is air cooled by two (2) fans.

A screed wall divides the load zone from zone 1 of the cooler. The screed wall is used to contain pellets in the load zone and to ensure a level bed of pellets enters zone 1 of the cooler. It performs this by screeding the top of the bed of pellets. In order to maintain a fully screeded bed of pellet entering zone 1 of the cooler the level of pellets across the full width of the screed wall in the load zone must always be maintained above the bottom of the screed wall. A fully screeded bed in zone 1 thru zone 4 of the cooler is important to ensure that cooling air is evenly distributed through the pellet bed. The bed height in the Annular Cooler is expected to be approximately 762 mm (30 inches). The screed wall and baffle walls separating the cooler zones are air cooled by two (2) fans.

The cooled fired pellets are discharged from the annular cooler to the owner's product conveyor after completion of cooling zone 4. The product conveyor feeds a product screening bin, which feeds a vibrating product screen. Undersize pellet product discharges to a separate conveyor system for transportation to a sinter plant or fines storage stockpile(s). On-size pellet product is conveyed to pellet storage pile(s) or for direct feeding to the owner's downstream processes.

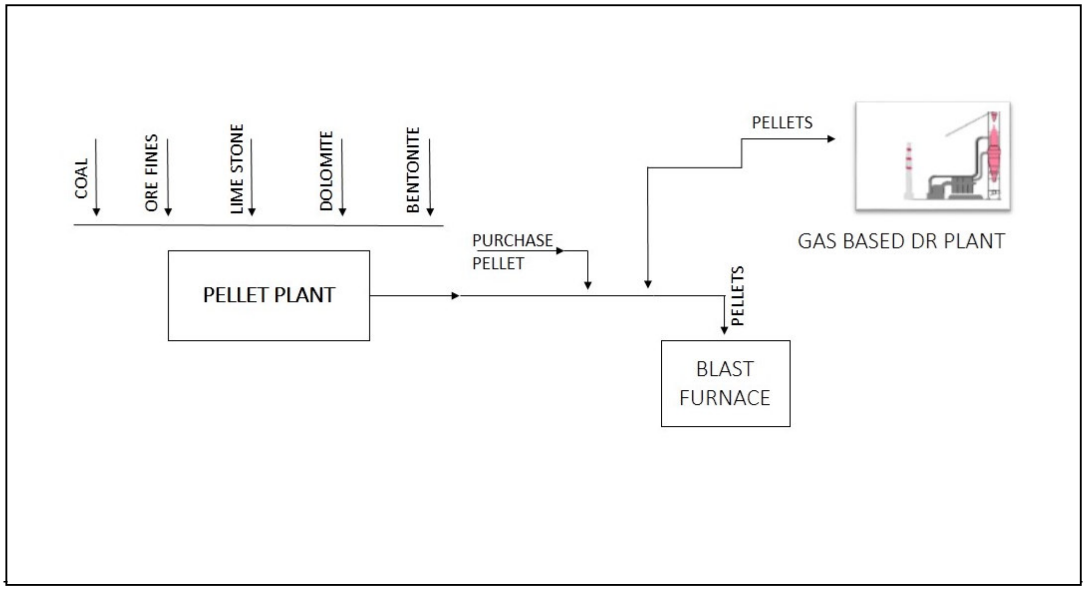


Figure 9: Process flowchart for pellet plant

The burner fuel for pelletizing will be Coke Oven Gas (COG), Mixed Gas.

Mixed Coke Oven Gas and Blast Furnace Gas at the pellet plant battery limits as follows:

1. Pressure- 850 ± 50 mm WC
2. Temperature- 30°C
3. Analysis -
   a. CO_2- 17.07%
   b. N_2- 37.61%
   c. CH_4- 7.03%
   d. H_2- 18.65%
   e. CO- 18.5%
   f. C_2H_2- 0.9682%
   g. H_2S- 0.0953%
   h. NH_3- 0.0765%

Table- 12

Material Balance for the proposed Pellet plant

Raw material	Input TPA	Product/wastes	Output TPA
Coal	315000	Pellet	21000000
Ore fines	21126000	Fines	370450
Limestone	392000	Losses	910550
Dolomite	238000		
Bentonite	210000		
Total	**22281000**	**Total**	**22281000**

G. ROLLING MILLS

Rolling mills work by using multiple rollers to manipulate the physical properties of sheet metal. In steelmaking, they offer a uniform thickness and consistency for the steel sheet metal with which they are used. Rolling mills contain rollers that squeeze and compress sheet metal as it passes through them.

It is envisaged that the plant product-mix will include both long products and flat products. The required input material for rolling mill would be available from SMS.

Product Mix

The product-mix (size range and grades) considered for the project is given in Table.

PRODUCT-MIX OF ROLLING MILL

Product	Size Range mm	Grade
Wire rod	5.5-22/25 dia	Low, medium, high carbon steel, low alloy steel, cold heading quality steel, spring steel, free cutting steel, bearing steel and case hardening steel.
Hot rolled coil -Width - Thickness	800-2050 1.2 – 25.4	Carbon Steel (Low, Medium, High carbon), IF steels, API Grades, HSLA, Dual phase Steel.
Cold rolled coil - Width - Thickness	800 – 1880 0.2 – 2.50	CQ, DQ, DDQ, EDDQ, BH, IF, DD, HSS, HSLA, DP

Based on the product-mix and the production programme, the following mills have been selected.

Mills for Long Products

Wire rods: Considering the production requirement one wire rod mill of 1.2 MTPA capacity have been selected. The excess billet available within the plant will be utilized in the wire rod mill

Mills for Flat Products

HR coil: While a part of the HR coil production will be sold directly, a part will be sent to cold rolling mills for finishing to various cold rolled and surface treated products. Various facilities for HR finishing for production of HRPO and HRSPO will be installed as well.

Keeping the production requirement and capacity of modern hot strip mills (HSM) in view, it is proposed to install three hot rolling mills viz. 2 Hot strip mills and 1 Thin Slab Casting and Rolling millin the proposed project. The proposed project the will also comprise of th Along with hot strip mill facilities for production of HRPO and HRSPO will be installed as well along with cut-to-length line, slitting line and coil dividing lines. Number of the finishing facilities will be finalized during implementation depending on market requirement**.**

Cold rolled flat steel products: Three CRM complexes of about 2.5 MTPA capacity will be installed to convert the HR coils to CR product. The CR product will comprise of annealed coil, galvanized coil and color coated coil. The complex may include tin plating lines as well, which will be decided during execution depending on market requirement. Suitable nos. of finishing facilities i.e. recoiling and inspection lines, slitting line, shearing lines and packaging lines will also be installed.

Rolling mills work by using multiple rollers to manipulate the physical properties of sheet metal. In steelmaking, they offer a uniform thickness and consistency for the steel sheet metal with which they are used. Rolling mills contain rollers that squeeze and compress sheet metal as it passes through them.

It is envisaged that the plant product-mix will include both long products and flat products. The required input material for rolling mill would be available from SMS.

Hot Rolling mill

Process description

Walking Beam Furnaces

Walking-beam furnaces for cold charging are provided for heating up the slabs. The feeding arrangement and logistics in the slab yard shall be planned in such a way that one furnace can be charged with cold slabs and the other furnace with hot charging and vice versa. Two Walking-beam furnaces are being planned in the HSM layout. For disposal of defective slabs or for the purpose of running the furnace empty in case of trouble, there is a slab back transport provided by means of a slab reject roller table.

Roughing Mill

A high pressure water descaler is arranged behind the furnaces to remove the scale from the slab surface. Two fixed bottom headers and two height adjustable top headers are arranged within the descaler hood. From the descaler the slabs are transported via the roller table to the 2-high reversing rougher combined with the attached edger. Here the slab will be rolled mostly in 3 reversing passes. From there the strip will be forwarded to the 4 high reversing roughing mill stand with an attached edger. The strip will be further rolled down in 3 to 5 passes to the required transfer bar thickness. Suitable strong side guides are fitted ahead and behind the roughing stand for properly guiding the slabs in the course of the rolling passes. The edgers will incorporate hydraulic roll gap adjustment for short stroke control and automatic width control so as to make sure that reduced width tolerances over the whole length of the strip are obtained.

The edger will be equipped with 2 main drive motors each with the motor shafts being vertically arranged. The 2 high reversing roughing mill stand is equipped with a fully hydraulic screw down system.

The 4 high reversing roughing stand is equipped in addition to the mechanical screw down system with hydraulic roll gap setting cylinders in order to improve the thickness tolerances of the transfer bar and to achieve straight transfer bars. Furthermore the roll gap setting cylinders will act as overload protection.

After the slabs have been rolled to transfer bar size as required to suit a given strip product thickness, this transfer bar will be carried to the finishing mill across the delay roller table downstream of the four-high roughing stand. Tilting heat retention covers are installed on this roller table. The installation of these heat covers reduces temperature drop rates from transfer bar head end to transfer bar tail end.

A cobble pusher with lateral depositing grid is provided in the area of this delay roller table for pushing off cobble bars to the side. In order to cope with the thin gauge rolling and ultra-thin gauge rolling process requirements, a Coilbox and inductive heating equipment is arranged in front of the crop shear.

Crop shear and finishing mill descaler

The transfer bar will be transported via the delay roller table downstream to the crop shear in front of the finishing mill. Adjustable entry guides are arranged ahead of the crop shear and are ensuring a centric strip entry. The shear will be of the drum-type. At the shear the transfer bar is cropped at its head and tail end. The scrap produced will be disposed into removable scrap buckets via a chute.

Prior to entering the finishing mill, the transfer bar will pass another high pressure water descaler to remove the secondary scale from the transfer bar surface. Cobble retraction from the finishing mill can be actively supported by the strong entry pinch rolls.

Finishing mill

In the finishing mill stands the transfer bar will be rolled down to the target strip thickness. The finishing mill consists of several 4-high finishing stands in tandem arrangement. All stands are equipped only with hydraulic roll gap setting systems in order to obtain close thickness tolerances in conjunction with an AGC system. Entry and exit guides arranged in front and behind the roll gap afford guiding of the strip as it passes the stands. To allow the operation of the hydraulic roll gap setting cylinders in an adequate stroke range as well as for top roll wear compensation within certain limits and for quick opening of the roll gap in case of roll change, remotely stepped spacers are arranged between the mill housing top cross head and the hydraulic roll gap setting cylinder at all stands. All stands of the finishing mill are equipped with CVC® plus systems for the axial shifting and bending of the work rolls.

For the targeted setting of strip profile and control of strip profile and flatness, the work rolls of the first stands will have a CVC® plus grind (CVC = Continuously Variable Crown). The work rolls of the last stands will have CVC® plus roll grinds or conventional roll grinds which are required for the control of flatness and contour of the strip and for SFR (Schedule Free Rolling). The control of the CVC® plus system will be provided by the PCFC-Model (profile-contour-flatness-control). Further closed loop control systems together with thickness-, profile-, width-, temperature- and flatness measuring devices behind the last stand, ensure best tolerance results. Low-inertia-type hydraulically actuated loopers ensure that the tension between the stands can be kept constant.

Work rolls will be cooled by spray headers arranged on entry and exit side of each mill stand. Additionally, anti-peeling headers will be installed for the mill stand F1 – F4, interstand descaling at F1 exit side. Roll gap lubrication systems are provided at all mill stands. Interstand water spray beams at top and bottom behind stands F1 – F6 allow for strip temperature control in case of a mill power speed-up for an increased production Arising dust and fumes will be minimized by dust suppression headers arranged behind F4 – F7. Exhaust channels will be arranged between the mill housings of stands F4 – F7, which can be connected to a fume exhaust system. Work roll changing is performed by means of a multiple quick-changing device, allowing a simultaneous work roll change at all stands in a manually initiated automatic sequence control mode. Back-up roll change is performed individual for each stand

Run-out roller table with laminar cooling

Downstream the finishing mill, the strip rolled to final thickness is transported to the down coiler on the run out roller table. The roller table design will be made to provide optimized conditions for transportation of thin gauge strips. During this transport, the strip will be cooled down to the required coiling temperature by applying water onto top and bottom side from a laminar water cooling system disposed in and above the run out roller table.

The top spray beams of the laminar cooling system can be swiveled up, if required, in an emergency case and for easy maintenance of run out roller tables. The laminar cooling line is sufficiently finely structured into multiple cooling zones and at the end equipped with high-response trimming zones to ensure that the coiling temperature can be properly met. With an appropriate control system the cooling strategy can be selected according to the corresponding requirements. Among others, early and late cooling is possible. Different cooling rates are possible with interrupted cooling within the laminar cooling section.

Down Coilers

The coilers will be of the three-wrapper-roller type. As the strip approaches the down coilers, it is centred and guided by means of adjustable side-guides in front of the coiler. Side guides will be hydraulically adjustable and can be operated in position control mode or in force control mode. A low-friction-type pinch roll unit ahead each coiler guides the strip head end to the coiler mandrel which firmly coils the strip in co-action with three wrapper rollers. The top pinch roll is hydraulically adjustable in order to ensure the best coiling results and to avoid damage to the strip surface. Top and bottom rollers are set parallel during the calibration procedure. Prior to coiling, the gap is set in position control mode. After the strip head end has entered the pinch roll unit, the rollers will be adjusted in force control mode, thus ensuring straight guidance of the strip.

The coilers are equipped with direct hydraulically operated wrapper rolls allowing the application of a step control system to prevent damages of the surface of the inner and outer wraps and overloads at the wrapper rolls and their adjustment system. Behind the last coiler a strip catcher for emergency cases is arranged.

Coil Conveying system

The coils will be removed by the coil stripper car from the coiler mandrel and transferred to a coil saddle. The coil axis is in horizontal position. Here the coils will be banded by means of automatic strapping machine, then a second coil car will take-over the coil and places it on a coil pallet, which will run the coil individually towards the coil yards adjacent to the mill bay. On their way coils will pass additional strapping machine for circumferential and eye-strapping, marking- and weighing devices and processed accordingly. Also handling of selected coils at a coil inspection station is possible. Further coil conveyor details are described in the relevant section of this technical specification.

Fuel:

Fuel for the reheating furnace shall be mixed gases from the coke oven and blast furnace.

Raw material	Input TPA	Product/wastes	Output TPA
Slabs	19080000	HR Coils	18000000
		Reject	504000
		Mill Scale	576000
Total	19080000	**Total**	19080000

Cold Rolling Mill:

PROCESS DESCRIPTION

Pickling &Cold Rolled Steel Strip/ Coils.

The reduction of thickness of material at room temperature, by passing the unheated metal through rolls is termed Cold Rolling/Cold reduction. The cold reduction is carried out on a single stand reversing mill or on a multi stand tandem cold mill by reducing the thickness of starting material in each pass by relatively large amount.

The Cold Rolling of Low Carbon Steel is carried out in a sequence of operations starting with removal of scale of Hot Rolled Strip by acid pickling and then cold reduction up to final thickness or to some intermediate gauge. These operations is termed as Cold Rolling and the product is termed Cold Rolled Steel Strip or CR Strip.

By Cold reduction/Cold Rolling the mechanical properties of steel gets improved and a smooth and dense surface is obtained due to cold working of metal under tension Depending upon the degree of draw steel is able to take the low carbon CR Strips are classified as Ordinary, Drawing, Deep Drawing and Extra Deep Drawing grades.

Cold Rolled Steel Strip of low carbon have found applications in a wide variety of uses mainly due to the smooth and dense surface, improved strength and mechanical properties. The CR Strips have applications as per grades and temper like full hard, half hard, soft and skin passed etc. The major consumption of CR Strip is in manufacturing of Galvanised Steel Sheets in construction industry. The other application areas are tube and furniture industry and many general applications.

Galvanised Steel /Al-Zn Coating/ Color Coated Strips / Coils.

The process of coating steel with zinc through furnace technology without use of flux and lead bath is known as Pure Zinc vaporization and the zinc coated steel is known as *Lead Free*Galvanised steel. As Steel corrodes at a rate of about 0.05 to 0.125 mm per year when exposed to air and the corrosion rate in polluted industrial or marine atmospheres is still higher. The corrosion rate of zinc is only 3 to 8 percent that of steel. Therefore, steel is coated with zinc to increase its life.

Galvanised/Al-Zn coated/ Color coated sheets find a number of applications in the industrial and domestic sector mainly in Building Construction, Domestic applications, Industrial applications, Agriculture Sector and Transport sector. In addition to the above, Coated sheets are used and becoming popular in automobile sector as well as a substrate in manufacturing of pre-painted sheets.

Mainly the company proposes to produce High quality Cold Rolled Steel Strips and Galvanised/Al-Zn Coated/ Color Coated steel strips in form of coils and sheets. The basic raw material used is Hot Rolled Steel Strip in form of Coils

PRODUCTION PROCESS

Cold Rolled Steel Strip (CR Strip) & Galvanised/ Al- Zn / Coated Steel is manufactured in a sequence of steps. Following are the various process steps involved.

PROCESS STEPS

- Descaling/Pickling of HR Strip.
- Cold Reduction of HR Strip/Cold Rolling.
- Galvanising / Al-Zn Coating of CR Strip/ Coil.
- Continuous Annealing Line
- Colour Coating Line.

DESCALING / PICKLING

The HR strip is covered with a layer of Iron Oxide (scale) which has to be removed before cold rolling. There are two basic process available for scale removal, namely mechanical and chemical. Pickling is a chemical process of the scale removal which has been followed conventionally in cold rolling mills all over the world. The process essentially consists of making HR strip covered with scale to react with acid (usually hydrochloric acid). The scale is removed by the HCL acid dissolving the iron oxide layer leaving the strip free of scale.

COLD ROLLING

Cold Rolling is a generic term applied to the operation of passing unheated metal through rolls for the purpose of reducing its thickness, producing a smooth and dense surface and developing controlled mechanical properties. In Cold Rolling the starting material is reduced by relatively large amount in each pass through a single stand reversing mill or in a series of passes through multi stand tandem mill. There are several types of Cold Rolling Mills which vary in design from single stand reversing 2-high, 4-high, 6-high or multi roll (up to 20 rolls) units to continuous type multi stand tandem mills of 4-Hi and 6-Hi configuration. The mills currently being installed for Cold Rolling are of 6 Hi configurations: Single Stand and PLTCM.

CONTINUOUS GALVANISING LINE / Al- Zn Coating Line

The continuous process consists of processing Cold Rolled Steel in the form of a continuous strand unwounded from coils and passed continuously through the line including coating bath. The continuity of operation is achieved by joining the trailing end of one coil to the leading end of next coil. The process has Furnace for strip cleaning and annealing of strip. The Preheat Section, RTF, Soaking, Jet cooling section followed by zinc/ Al-Zn Alloy.Pot containing molten zinc. Excess zinc wiped by air pressure. Strip gets passivated in Chemical solution to avoid white rust on strip and finally strip get rewound on recoiler.

CONTINUOUS ANNEALING LINE

This line facility changes the crystal structure of steel sheet by heat treatment, and improves properties such as hardness, strength, and elongation. It integrates the 5 processes of cleaning, cooling, heating, temper rolling, and refining, and carries them out in a single line, thus saving space and lowering costs.

COLOR COATING LINE

Colour coating is a term used to describe the application of a decorative and/or protective organic coating to steel substrate supplied in coil form. Colour coated steel is also called as pre-painted steel. Colour coatings are paint coatings and are specialty products, which are used to give the steel a long term protection under a broad range of corrosive conditions, extending from atmospheric exposure to full immersion in strongly corrosive solutions. A colour coating provides little strength to the substrate steel, yet it protects the steel so that its strength and integrity can be maintained. Colour coating usually refers to the application of liquid paint coat over the substrate in an automatic, continuous process after pre-treatment. The pre-painted colour coated steel is a very high value-added product that combines the best properties of both substrate and organic coating, additionally imparting it an aesthetic finish, high degree of durability and high corrosion resistance.

The major Raw Material required for the production of CR Strips &vaporized steel strips are Hot Rolled Steel Strip in Coil form. Besides other consumables like Hydrochloric Acid, Rolling Oil, zinc, alloy etc. The requirement of major raw material viz. HR Coils is worked out as per product mix envisaged to be manufactured and the manufacturing standard. The process loss is considered for HR Coils in form of coil tail ends sheared for smooth feeding and gripping in Coiler on pickling line and CR Mill. The losses are in pickling line in order to remove the scale by dissolving in the acid solution, in form of side trimming after rolling to prepare the required edge finish. The major loss accounts for production of CR Strip from HR Strip is through off gauge rolling at the end of coils mainly due to distance between coilers and roll bite and acceleration/ de-acceleration of rolling speed in each pass.

PRODUCT

Cold Rolling is a generic term applied to the operation of passing unheated metal through rolls for the purpose of reducing its thickness, producing a smooth, dense surface and developing controlled mechanical properties. The Cold Reduction is a process in which the thickness of the starting material can be reduced by relatively large amounts in each pass through a single-stand reversing Cold Mill or in a series of passes through a tandem cold mill. In production of cold rolled strip the cold reduction process is employed to reduce the thickness of the starting material i.e. Hot Rolled Coils up to 90 percent. Cold reduction of strip is carried out in a sequence of operations like removing the scale of Hot Rolled Strip viz raw material usually by pickling and then cold reduction on either single stand reversing mill or on multi stand tandem mills. The strip may be cold reduced to final thickness or to some intermediate gauge where it is annealed and further cold reduced to obtain the desired temper and gauge. This series of operation is termed Cold Rolling and the product is termed COLD ROLLED STEEL STRIP or CR Strip/Sheets. Steel of low carbon content (0.04 to 0.15 percent) are mainly used for production of CR Strip/Sheets. Depending on the degree of draw steel is able to take, the low carbon CR Strip is classified as ordinary/commercial grade (O/CQ) drawing grade (D) and deep drawing/extra deep drawing grade (DD/EDD).

Cold Rolled Steel Strip of low carbon have found applications in a wide variety of uses. Because of the smooth, dense surface and improved strength and mechanical properties, CR Strips are used in automobile industry and engineering industry. The Galvanised steel industry is a major consumer of CR Strips. CR Strips have applications as per the grade like O, D, DD/EDD and temper like full hard, half hard, quarter hard, dead soft and skin passed etc.

The ordinary grade low Carbon Steel (Mild Steel) CR Strip also known as commercial grade (CQ) strip is mainly vaporize for the production of following. This quality of CR strip has non uniform chemical and physical properties.

1. Galvanised Steels (Construction industry)
2. Precision Tubes.
3. Furniture

The CQ grade CR Strip, for production of Galvanised sheets used in various tempers like full hard, and skin passed depending upon the process of Galvanising, thickness of sheet and end use of product.

The drawing grade CR Strip including deep drawing and extra deep drawing grades are produced from semi killed and fully aluminium killed quality of Hot Rolled Strip. The desired physical properties are achieved by subsequent annealing and temper rolling. These strips are generally termed as CRCA strips and mainly used in applications involving severe cold working like engineering and automobile industry.

GALVANISED/ AL-ZN COATING COILS/ SHEETS

It is important to provide protection against corrosion for Steel Articles having light section like Steel Sheets to extend the service life. Coating of the Steel Sheets with Zinc is a very effective and economical means of accomplishing this end. Steel corrodes at a rate of about 0.05 to 0.125 mm per year when exposed to air. The corrosion rate in polluted industrial or marine atmosphere are still higher. The corrosion rate of Zinc is only 3 to 10 percent that of Steel. Zinc has the property by virtue of electro-chemical action of protecting even adjacent areas of exposed steel surface, as zinc is anodic to steel in the galvanic series of metals. Thus in addition to protecting the surface it covers, zinc offers what is defined as sacrificial protection to adjacent exposed areas. This means that in the event of any vaporized break down in the coating, zinc corrodes in preference to steel. In addition to this Zinc coating has the following advantages.

- A chemical bond is formed at the interface of the zinc coating and the Steel, which ensures that the entire surface is positively protected.
- The formability of Zinc Coating is excellent.
- It imparts a clean appearance to the steel surface.

Zinc coatings are commonly applied by dipping or passing the steel sheet to be coated through a molten bath of the zinc. This operation is termed Galvanising or Hot Dip Galvanising and the product is termed GALVANISED STEEL SHEETor Hot Dip Galvanised Steel Sheets. Zinc coated steel sheets (Galvanised Sheets/CI Sheets) have found applications in a wide variety of uses. Because of the intrinsic property of the Zinc to resist corrosion to the base metal, Galvanised steel sheets are widely used in roofing, farm equipment, air conditioning and a host of other uses. For roofing, vaporized corrugated (CI/GC) sheets provide a non-combustible, termite-proof, strong and durable protection, which compares better with conventional roofing material like Asbestos Cement Sheets. Galvanised sheets are used in two forms, namely, Galvanised Plain (GP) and Galvanised Corrugated (GC/CI). GP sheets find a number of applications in the industrial and domestic sector while GC/CI sheets are used mainly for roofing and cladding of houses and industrial sheds.

COLOR COATED COILS/ SHEETS

The consumers of colour-coated steel products include the construction, home appliance, furniture, consumer goods and automotive industries. Colour-coated coils are most widely used in construction, which consumes more than half of the amount produced worldwide. The coating type directly depends on the exposure conditions. Colour-coated steel is used in various interior finishing work and I elements. In the automotive industry, colour-coating is used for corrosion protection, noise attenuation, and insulation. Such steel is also used to manufacture dashboards and windscreen wipers for cars, etc.

Table- 13

Material Balance for CRM Complex

Raw material	Input TPA	Product/wastes	Output TPA
HR coils	7653100	PLTCM	7500000 (CRCA- 4374400, Color coated coil- 1492500, Cold Rolled Galv. Coil- 1420500)
		Losses	153100
Total	7653100	**Total**	7653100

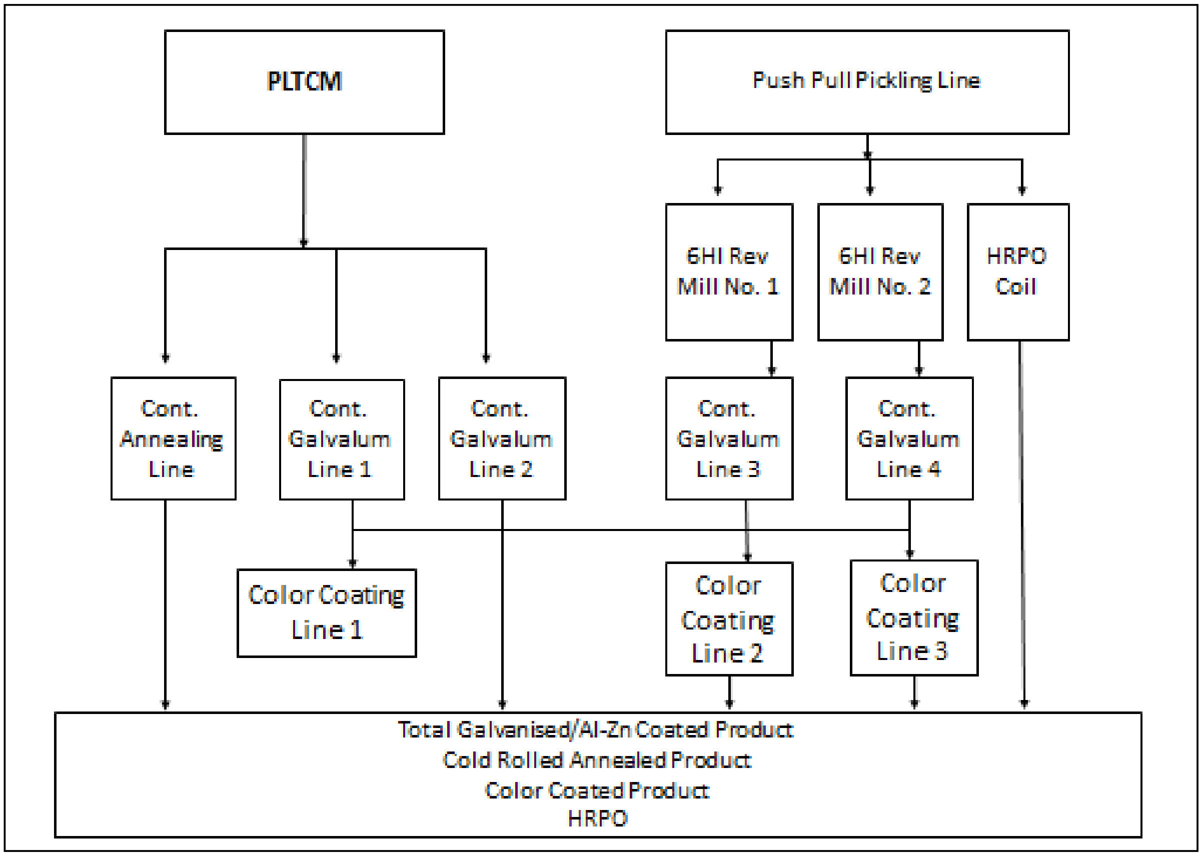


Figure 10: Process flowchart for CRM Complex

Wire Rod Mill:

A wire rod mill of 1,200,000 tons per year capacity has been proposed in the project. Billets, which shall be the input material, will be charged directly from the billet caster to enable the hot charging system. The mill will produce wire rods in coils in the size range of 5.5 mm to 20 mm diameter.

Billets will be charged to the furnace by billet charging skids and billet charging conveyor. A billet discard skid will be provided for reject billets. Billet reheating furnace will reheat the incoming billets to an exit temperature of 1150o C to 1250o C. From the RHF, the charged billets will pass through breakdown mill which improves the quality of the product as the increased number of elongations minimizes segregation, porosity and inclusions. The billets will be rolled through a continuous roughing mill train. The alternate horizontal and vertical rolling stands are fabricated for controlled movement of rod during rolling to prevent detrimental surface defects like rolling laps and stickers in the final product. Due to less stress generation, the product adheres to close dimensional tolerances. A crop and cobble shear will be installed after each rolling train for crop and cobble cutting. Following the intermediate train, a No-twist mill will be provided. The No Twist Mill (NTM) is used for getting high dimensional accuracy at high speeds. It is designed for controlled temperature rolling to produce superior gain structure and more uniform scale. From the NTM, it passes through the Reducing and Sizing mill· The Reducing and Sizing Mill (RSM) helps in giving high dimensional accuracy to smaller sizes of wire rods. The thermo mechanical cooling process produces high precision wire rods with a fine grain structure which eliminates the requirement for further heat treatment.

The finished wire rods will pass through a water-cooling system and will thereafter enter a laying head which will form coil loops of the wire rod. The wire rod loops will be air cooled in a conveyor. Wire Rods are stored in closed area stacks and in open areas as per importance of finished product qualities. Finished products shall be dispatched through rail and road ways.

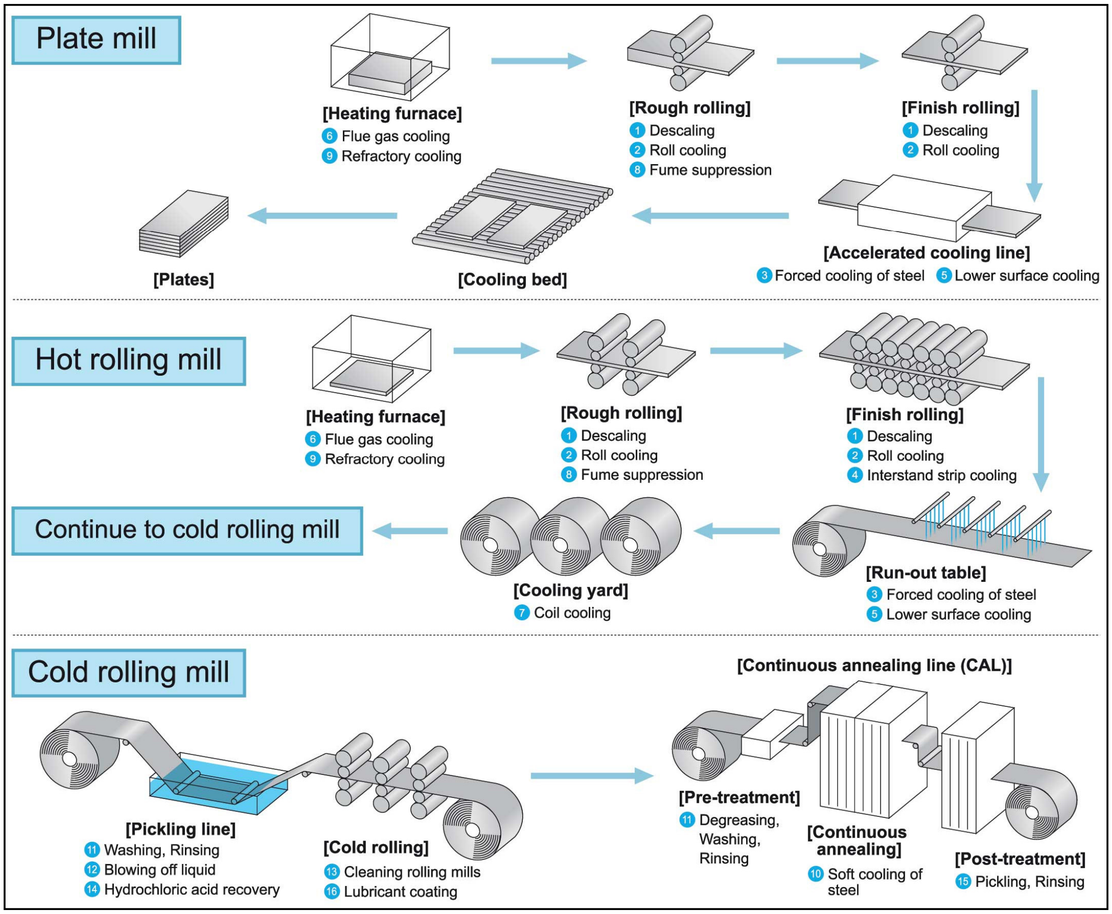


Figure 11:Process flowchart for Rolling Mills

Table- 14

Material Balance for WRM

Raw material	Input TPA	Product/wastes	Output TPA
Billets	1237200	Wire Rods	1200000
		Rejects	13200
		Mill Scales	24000
Total	1237200	Total	1237200

H. L

IME & DOLO CALCINATION PLANT

The calcining plant produces flux (lime and dolime) to be used in steel melt shop. The calcined product will be screened before dispatching the sized material to SMS and the undersized fraction of lime will be used in sinter plant. The proposed project will comprise of 12x600 TPD kilns for the production of lime and dolime.

The size of lime will be 10 to 60 mm. Flux material will be screened to separate out (–) 10 mm sizes before conveyed to steel melt shop.

1. Kiln Capacity

It is proposed to install vertical shaft kiln of proven design to produce soft-burnt highly reactive lime. The annual net working days of calcining plant works out to be 330 days considering plant availability, repair & maintenance work and major shutdown.

The calcination of limestone is a simple chemical process: CaCOs + heat – Ca0 + CO2

The calcination temperature depends upon the partial pressure of the 002. At the atmospheric pressure and CO2 concentration of 25 %, the dissociation starts at about 810 °C. Some components in fact (e.g. Nal-ICO3 or KI-1003) dissociate at low temperatures (2001-300 °C) already in the preheating zone; some other like NaCO3 or K2CO3 dissociate at 800+900 ‘C in the calcining zone, thus forming Na20 and K20 which sublime to Na and K vapors.

In the traditional sucked vertical lime kilns, the combustion air is preheated by the product lime and the fuel is introduced in the lower part of the burning zone. Using this process the combustion air cannot be heated to a high temperature, since the lime heat content is much lower than the heat required to preheat the combustion air.

On the other side, the heat content that could be recovered from the waste gases in the preheating zone of the kiln is much higher than the quantity that can be absorbed by the limestone. Due to this situation, the traditional lime kilns, consume more heat to preheat the combustion air, while the exhausted gases leave the kiln with a large heat content that could be recovered. This situation causes high specific heat consumption.

In addition, fuel feeding in the lower part of the kiln (terminal burning zone) creates overheating and therefore over-burning of the lime and a shorter refractory life.

The_CIM-REVERSY kiln is based on the regenerative heat recovery technology and has two shafts, which are alternatively under combustion and preheating respectively.

In the regenerative kilns, the heal exchange between the combustion gas at the kiln outlet and the combustion air is realized using the limestone of the preheating zone of the kiln (second shaft) as a heat accumulator. During the combustion cycle the limestone absorbs the heat from the exhaust gas and in the second cycle gives it back to the combustion air. This process is possible due to the use of two or more intercommunicating shafts in which the combustion and the flow direction of the gases is periodically inverted.

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In addition, fuel feeding in the lower part of the kiln (terminal burning zone) creates overheating and therefore over-burning of the lime and a shorter refractory life.

The CIM-REVERSY kiln eliminates all the above problems, since the combustion air is preheated in the upper part of the kiln i.e. the preheating zone.

The heat transfer between the combustion gas at the kiln outlet and the combustion air is effected

using the limestone contained in the preheating zone of the kiln (second shaft) acting as a

regenerative heat exchanger. During the first cycle the limestone absorbs the heat from the exhaust gas and in the second cycle gives it back to the combustion air. This process is possible due to the use of 2 or more intercommunicating shafts in which the combustion preheating, then the flow direction of the gases is periodically reversed.

The combustion flue gas, parallel flowing in the shaft, allows a mild burning of the limestone without over-burning. This is possible because the combustion then the higher temperatures are attained in the kiln burning zone where the still mostly unreacted limestone is able to quickly absorb the heat.

The limestone moving downwards, from the fuel feeding area to the cooling zone of the kiln, is gradually transformed into lime, decreasing its capacity and velocity to absorb heat.

The combustion gases also moving downwards with the burned limestone, continuously release heat decreasing their temperature, until the limestone is completely burnt at about 850-1,100°C only.

The fuel injection and distribution system to the cross section area of the kiln, is realized using lances placed inside the mass of the limestone and permits the use of either gas, fuel oil, or P.F (Pulverized Fuel).

The heat recovery by the regenerative system can release the gas from the kiln at a relatively low temperature so separating the dust contained in the gases with a normal bag house filters.

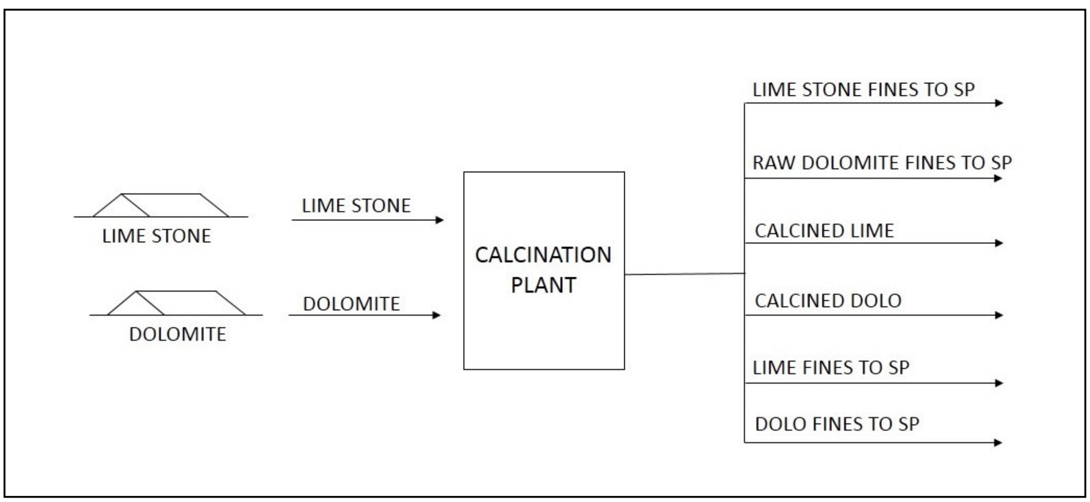

Figure 12: Process flowchart for Calcination plant

Table- 15

Material Balance for the Calcination Plant

Raw material	Input TPA	Product/wastes	Output TPA
Limestone	4184200	Calcined Lime	1628400

Dolomite	1187300	CalcinedDolo	621000
		Limestone fines	853600
		Dolomite fines	236600
		Lime fines	287300
		Dolo fines	81600
		Losses	1663000
Total	**5371500**	**Total**	**5371500**

I. OXYGEN PLANT OR AIR SEPARATION PLANT

An air separation plant separates atmospheric air into its primary components, typically nitrogen and oxygen, and sometimes also argon and other rare inert gases. The most common method for air separation is fractional distillation.

To meet the requirement of industrial gases like Oxygen, Nitrogen and Argon for various process facilities of the steel plant under expansion scheme, one centralized Air Separation Plant/Oxygen Plant of suitable capacity is proposed to be installed at the end of each Expansion Phase.

Capacity of oxygen plant to be installed is 2 x 2700 TPD and 2 x 2800 TPD in the proposed project.

Process Description (ASU):

i. Air Compression and Pre-Cooling

The process air is cleaned from dust and other particles in an intake air filter system and then compressed to the required process pressure by a multistage inter-cooled air compressor without direct oil contact.

To reduce the water content the compressed air is sent to Air water exchanger cooled down by chilled water from the water chiller tower.

In the water chiller tower water enters at the top whilst dry nitrogen is sent to the bottom. In the tower the water is cooled which is taken up by the dry nitrogen gas. The water is recovered at the bottom of the water chiller tower.

ii. Purification

An adsorption-type purification system is provided for removal of water and carbon dioxide from the air feed before entering the cryogenic section.

The system is made up of two vessels containing alumina and molecular sieve adsorbents. By means of a set of automatically controlled switching valves, the compressed air passes alternately through one adsorber or the other.

Moisture, carbon dioxide, and most of the other impurities are removed by adsorption. At the end of each period, the air is switched and the adsorber containing the adsorbed impurities is regenerated by passing a heated waste nitrogen stream through the bed. The regeneration gas is purged to the atmosphere. The sequence is such that once the desired heating duration is reached, heating is stopped, and the adsorber is cooled back down ready for the next switch of adsorber beds.

iii. Turbine-Boosters, Heat Transfer, Cold Production

The main stream of the purified air enters the cold box. It is cooled in the heat exchanger to about liquefaction temperature against the gas streams leaving the cold box. Downstream the heat exchanger the main air stream is fed into the bottom section of the high pressure column.

A part of the air is compressed by boosters mechanically linked to expansion turbines and cooled and liquefied in the heat exchanger, where it serves as heating medium to vaporize and warm up the internally compressed products. Downstream the heat exchanger the stream is expanded into the distillation column.

iv. Air Separation

The air, being cooled in the heat exchanger, feeds a double column rectifier in which the separation into pure nitrogen and pure oxygen takes place.

In the high pressure column the air is separated into nitrogen gas yielding at the top and into oxygen enriched liquid air yielding at the bottom.

Gaseous nitrogen from the top of the high pressure column is condensed in the main condenser/reboiler against boiling oxygen, which is provided as descending liquid from the low pressure column. On the other side of the main condenser/reboiler the vaporized oxygen is fed back into the low pressure column as ascending gas.

A part of the liquid nitrogen coming from the main condenser/reboiler is drawn from the high pressure column, sub-cooled in the exchanger and sent into the external liquid nitrogen storage as well as reflux to the low pressure column. The remaining liquid nitrogen from the condenser provides the required reflux for the high pressure column.

Another stream is drawn as liquid from the column, sub-cooled and fed to the low pressure column where it serves as reflux.

Oxygen enriched liquid air from the high pressure column sump is expanded to the low pressure column.

The final separation into pure oxygen, as a bottom product, and impure nitrogen, yielding at the top, takes place in the low pressure column. Part of the bottom product is sent to the liquid oxygen storage tank.

Impure nitrogen gas from the upper section of the low pressure column transfers its cold content to the incoming fluids in the main exchanger and the sub cooler. One part of the impure nitrogen is used as regeneration gas for the molecular sieve unit. The other part is sent to the nitrogen water tower where it will be saturated with water.

v. Oxygen and Nitrogen Production

Liquid oxygen is withdrawn from the distillation column. It is brought to the required product pressure by internal pumping. High and medium pressure liquid oxygen is vaporized and warmed up in the main heat exchanger against high pressure air. It leaves the cold box at the required product pressures and flows.

A liquid nitrogen flow is taken from the distillation column, pumped to the required pressures and sent to the main heat exchanger where it is vaporized and warmed up. The high pressure gaseous nitrogen product is delivered directly at the outlet of the cold box at required pressure.

6. Argon Purification (For Train1 only)

In order to produce argon, a stream of gas from intermediate level of the low pressure column (K02) is fed into the crude argon column (K10), where it is stripped of its oxygen content. Reflux for this column is produced by evaporating rich liquid in the overhead condenser (E10).

Liquid crude argon stream is fed into the pure argon column (K11) where it is stripped of its nitrogen content.

Pure liquid argon product is taken from the bottom of the column and sent to the LAR storage V30.

7. Liquid Oxygen, Nitrogen and (Argon only for one ASU) Production

Liquid oxygen, which is withdrawn from the sump of the low pressure column, is pumped to the required product pressure by the internal compression pumps and is evaporated and warmed up in the main heat exchanger against the boosted air stream. It leaves the cold box at the required product pressure and flow.

Control valves shall be provided for constant gaseous oxygen flow from air separation unit. During normal operation the vent control valve shall be closed, and opening of the feeding line control valve to oxygen main shall be maintained. The decreasing of the oxygen flow requirement shall be sequentially closing the vent valve and feeding control valve to oxygen main. Both control valves shall be shutdown in the event of plant trip.

To match customer nitrogen needs with the lowest energy and the highest reliability, the nitrogen needs are produced by internal pumping.

Pure liquid nitrogen yielding at the top of pressure column is withdrawn, pumped and warmed in the main heat exchanger against the feed air. Similar to the oxygen, control valves shall be provided for constant gaseous nitrogen flow from air separation unit.

Liquid nitrogen is withdrawn downstream the condenser/ reboiler and fed to the liquid nitrogen tank through insulated lines

Liquid argon is withdrawn from the sump of the pure argon column (K11) and is fed to the low pressure storage tank.

J. POWER PLANT

2 new Captive Power Plants (CPPs) with capacity of 275 MW each is proposed to be installed to partly cater to the power requirement of the proposed plant**. The boilers will be by-product gas fired.**

Also, about 109 MW of power can be generated from Coke Dry Quenching (CDQ) boilers, about 122 MW of power can be generated from Blast Furnace Top Recovery Turbine (BF TRT), about 12 MW of power can be generated from the DRI Turbo Expander and about 4 MW of power can be generated from Sinter Cooler machine in Sinter Plant.

All the steam generated in the by-product gas fired boilers, CDQ boilers and the sinter cooler boiler will come (through a common steam header) to the steam turbine – generator sets to generate power.

The CPPs will consist of requisite number of by-product fuel gas fired boilers together with Turbo-generator sets, Condensers, Boiler Feed Pumps, Steam and Utility pipe work, Electrics and Instrumentation.

K. FERRO ALLOY PLANT

Ferroalloys have been developed to improve the properties of steels and alloys by introducing specific alloying elements in desirable quantities in the most feasible technical and economic way. Ferroalloys are namely alloys of one or more alloying elements with iron, employed to add chemical elements into molten metal. Not a single steel grade is produced without ferroalloys. Ferroalloys production is an important part of the manufacturing chain between the mining and steel and alloys metallurgy.

The process comprises of continuous smelting of ore, coke and quartz in smelting electric furnace. Submerged Arc Furnaces of varying sizes as tabled below will be installed to produce ferro alloys.

S No	Plant Configuration	Capacity (MTPA)
1.	1x18 MVA	0.376
2.	1x6 MVA	
3.	2x15 MVA	
4.	4x45 MVA	

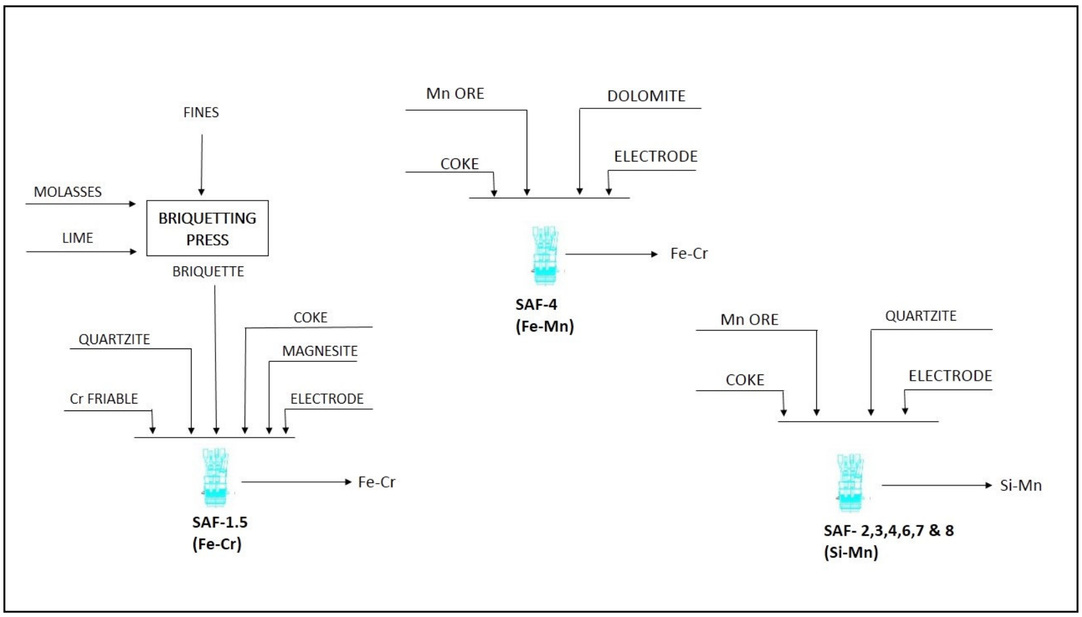

Figure 13: Process flowchart of Ferro Alloy Plant

Jigging plant and Briquetting plant will be installed in Ferro alloys plant complex for separating particles based on the specific gravity of ore and for manufacturing briquettes of fine particles of ore for further processing in the submerged arc furnaces.

Table- 16

Material Balance for Ferro-alloys plant

Raw material	Input TPA	Product/wastes	Output TPA
Manganese ore	766900	Fe-Cr	376000
Coke	223900	Si-Mn	

Chromium Ore	20400	Fe-Mn	
Briquettes	114700	Slag	333372
Quartzite	103500	Losses	534331
Magnesite	3900		
Dolomite	1300		
Electrode	9103		
Total	**1242403**	**Total**	**1242403**

L. CEMENT PLANT

It is proposed to install cement grinding units of 12.5 MTPA capacity including packing and dispatch facilities. Production of Ordinary Portland Cement (OPC) through grinding followed by mixing with Ground Granulated Blast Furnace Slag (GGBS) is envisaged to produce Portland Slag Cement (PSC) or Portland Composite Cement of 10.5 MTPA capacity in totality to use up the entire amount blast furnace slag to be generated in the iron making units.

At the same time, Portland Pozzolona Cement (PPC) plant of 2.0 MTPA capacity is also envisaged to be installed to consume the fly ash to be generated from the coal based captive power plant of JSPL.

It is proposed to install cement grinding, mixing and bagging units to utilize the granulated blast furnace slag produced at the iron- making unit as well as the fly ash generated at the captive power plant of the integrated steel plant of JSPL. Ground granulated blast furnace slag will be mixed with clinker and gypsum, sourced from outside and fly ash sourced from the captive power plant of the integrated steel plant of JSPL to produce Portland slag cement.

In order to utilize the granulated blast furnace slag available from the iron-making unit of the integrated steel plant, the estimated production capacity of the Portland slag cement unit will be 10.5 MTPA at the completion of the proposed steel plant. Adequate storage of raw materials and products will be considered. Three modules of equal capacity of 3.5 MTPA each will be considered for production of Portland slag cement. Clinker will be sourced from gulf countries through vessel to the nearest port and will be transported to the raw material storage yard of the integrated steel plant through railways. Clinker from the storage yard as well as the blast furnace slag from the iron making unit will be taken to the cement plant through conveyors.

In each module of Portland slag cement production unit, two separate grinding lines consisting of vertical roller mill (VRM) of adequate capacity will be installed to grind granulated blast furnace slag and the mixture of clinker, gypsum and fly ash respectively. Ordinary Portland Cement (OPC) produced by grinding clinker, gypsum and fly ash in the ratio of around 15:1:2 will be mixed with ground slag in a paddle mixer in around 44: 56 ratio to produce Portland slag cement. Bagging, packing, truck loading, bulk loading and wagon loading facilities will be considered for the cement plant.

It is also proposed to install an another line of cement grinding, mixing and bagging units to utilize the fly ash generated at the captive power plant of the integrated steel plant of JSPL. Fly ash will be mixed with clinker and gypsum in ration around 35: 63: 2 to produce Portland Pozzolona cement.

Relevant raw material and product handling system along with bagging packing etc. will also be considered. Requirement of raw materials for the proposed capacity of the cement plant is tabulated in Table:

CAPACITY AND RAW MATERIAL REQUIREMENT FOR CEMENT PRODUCTION

Production capacity (MTPA)	Module size, MTPA	Clinker requirement, TPA	Granulated BF slag requirement, TPA	Gypsum requirement, TPA	Fly ash requirement, TPA
10.5	3.5	3,832,500	5,880,000	262,500	525,000
2	2	1,250,000	-	50,000	700000

The manufacturing process details are given below:

- **Clinker Storage & Handling**

  Clinker will be received at the plant mostly by rail and unloaded through a wagon tippler. From the wagon tippler, clinker will be taken through belt conveyors to a transfer tower - from here clinker will be taken to a Clinker silo. Clinker will be transported by road, if it necessitates in emergency situation. The clinker would be transported from silo to the feed hopper for cement grinding mill through DPC/ belt conveyor system. Clinker will also be received through road.

- **Gypsum, Fly Ash & Pond Ash Storage, Handling and Transport**

  Gypsum will be sourced from Rajasthan or open market and Fly ash will be sourced from adjacent ISP of JSPL. Gypsum shall be unloaded from railway wagons by wagon tippler and transported to covered linear storage. Part of the transport system will be common for clinker as well as gypsum. However, by road also possible in emergency, whenever it is necessitated. Dry fly ash, received in bulkers will be unloaded in silo pneumatically.

  Gypsum shall be fed from stockpile through a Hopper and transported through belt conveyors to the new cement mill feed hopper. Dry Fly ash will be received in bulkers and conveyed to a Fly Ash Silo through pneumatic unloading system. Fly ash by rail also considered and accordingly, will have system for the same. Fly ash from silo shall be conveyed to a bin located near mill through mechanized transport system and fed to the mill through Roto-Scale & rotary feeders.

- **Cement Production & Storage**

  Total Cement Production Capacity will be 12.5 MTPA. From the feed hoppers, clinker and gypsum shall be fed to the mill through weigh feeders below respective bins and common belt conveyors. The cement grinding system includes most modern & energy sufficient Vertical Roller Mill (VRM), bucket elevator, separator, bag house and fan.

- **CementPacking and Dispatch**

  Cement would be packed in 50 kg bags. A Check Weigher with facility to reject underweight / overweight bags, bag slitter, bag stamping unit are part of the system considered. Bags discharged from the packers would be transported through belt conveyors to the truck loading area.

From the cement silos, cement will be transported to the packing plant through a combination of bucket elevator and air slides for packing cement in bags for dispatch.

The process flow sheet is given below:

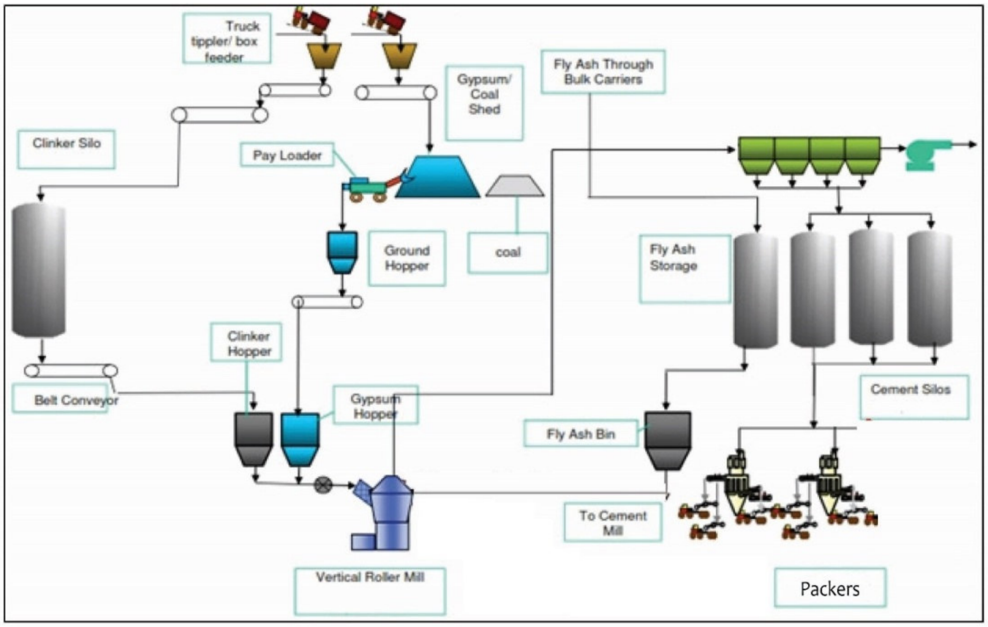

Figure 14:Process flowchart for Cement Plant

M. IRON ORE CONCENTRATE SLURRY RECEIVING AND DE-WATERING/FILTERATION FACILITIES

Slurry pipeline with capacity of 2x18 MTPA will be established by Jindal Steel & Power Ltd. (JSPL) from Barbil to Angul.

It is envisaged that the entire quantity of iron ore concentrate (dry solids - 36 MTPA) in the form of slurry (average solids concentration – 65% by weight) will be received at a designated location within the premises of the ISP at Angul through long distance slurry pipelines in two phases i.e. Phase-A (18 MTPA dry solids/concentrate) and Phase-B (18 MTPA dry solids/concentrate). Approximately 1000 cu m/hr of water will be drawn from Barbil (Baitarani basin) for the slurry transport in each phase of expansion as envisaged by JSPL.

For the above, the Company intends to set-up 2 x 18 MTPA long distance slurry pipelines connecting Barbil and ISP at Angul. The major slurry pipeline parameters for 18 MTPA (dry solid basis) capacity are indicated below:

Slurry Pipeline Length .. approx. 200 km

Slurry Pipeline Diameter ..approx. 26 inch (about 660 mm)

Solids Concentration in Slurry .. 63 to 67 % by weight (average 65 %)

After receiving the slurry within the premises of ISP at Angul, the same will be dewatered through de-watering /filtration plant to produce desired filter cake for feeding to the proposed pellet plants and the recovered water will be treated and reused in Angul plant. The dewatering plant in each phase (18 MTPA dry solids) is proposed to be located nearer to their respective pellet plants. The design basis and brief description of the envisaged facilities for receiving of concentrate in slurry form and subsequent filtration in pressure filters to form dewatered pellet feed concentrate/filter cake, are discussed in this section.

Design Basis for De-watering/Filtration Plant

For determination of the capacity of the filtration unit, the following assumptions have been made:

Annual handling of concentrate, million tons (dry solids) in each phase .. 2 x 18

Number of effective working days per year .. 330

Number of working hours in three shift operation .. 24

Based on the above assumptions, the effective annual working hours come out to be about 7,920. Accordingly, the average hourly throughput rate to the slurry receiving and filtration unit is estimated to be about 2,275 TPH.

Iron ore concentrate in slurry form will be received in slurry holding tanks (each phase having 6 nos. tanks with 18 m dia. and 18 m height). The physical characteristics of the received slurry would be as follows:

Avg. Per cent solids in slurry, %w/w .. 65

Specific gravity of the slurry .. 2.01

The plant feed materials shall have a size of 100 per cent passing through 100 mesh (150 micron) and 80 per cent passing through 325 mesh (45 micron).

The filtration facility would produce dewatered iron ore concentrate/filter cake averaging 10 percent moisture.

Process Concept

The incoming slurry will have specific gravity in the range of 2 to 2.2. The incoming slurry will be transferred either directly to slurry holding tanks, in case of specific gravity >2 or via high rate thickener, in case of specific gravity <2 based on the density meter reading placed at the pellet plant site. If the reading is <2, the incoming slurry will be transferred to a high rate thickener for its thickening to achieve the desired specific gravity. After achieving desired specific gravity, thickener, underflow will be pumped back to the slurry holding tanks.

The iron ore concentrate slurry with average 65 per cent solids (w/w) stored in the slurry holding tanks will be dewatered using pressure filters to obtain the final product (filter cake), the residual moisture in the filter cake not exceeding 10 per cent. This filter cake will be conveyed to pellet plant and/or to a ground stockpile through appropriate conveying system.

The water recovered from the pressure filters as well as the thickener will be received in a filtrate water sump, from where the water will be pumped to the water treatment plant for necessary treatment for subsequent use in the steel plant at Angul.

The major equipment and facilities proposed for the slurry receiving and filtration facilities at pellet plant site are as follows:

a) Slurry holding tanks with agitator

b) High rate thickener

c) Filtration unit

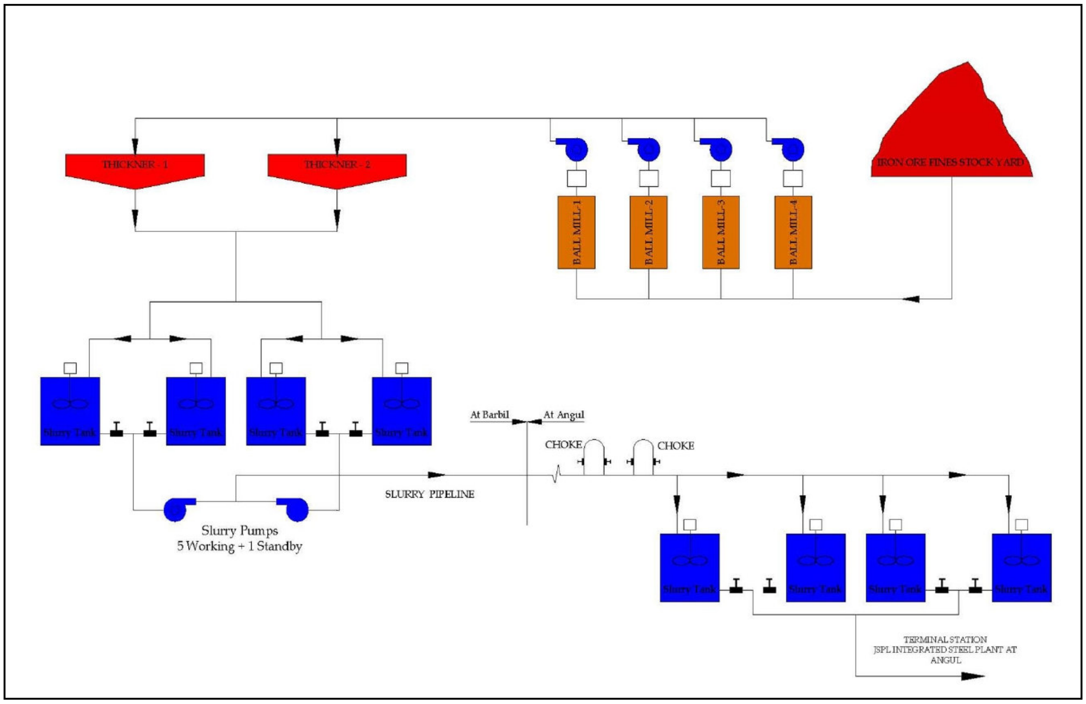

Figure 15:Process flowchart for Iron slurry unit

1.8 DETAILS OF EFFLUENT TREATMENT PLANT

Waste water generated from the different areas of the plant are treated in suitable treatment facilities and recycled back to the process to attain 'zero' discharge, facilitating adequate re -use of water in the respective recirculating systems and economizing on the make-up water requirement. Waste effluent and blow down from the recirculating water systems will be sent in the waste water pit where the suspended solids, oil etc will be removed. The supernatant water will be utilized in low end application such as sprinkling, gardening etc. The sewage generated from the toilet blocks of different area will be collected by means of suitable sewer system for treatment in package type Sewage Treatment Plant (STP). The treated sewage will be used in low end applications such as greenbelt maintenance. Treated water from the CETP will be reused in the plant make-up water system. Rejects and wash water from CETP and ultra-filtration units containing high dissolved solids will be fed to the evaporator to form crystallisation and residual solids. Details of wastewater generation from various units:

Name of Unit	**Wastewater Generation (m3/hr)**
Raw material Handling	-
Coke Oven	385
Pellet Plant	75
Sinter Plant	16

BF	60
DRI	240
SMS	475
HSM	320
WRM	37
CRM	250
CPP	475
Oxygen Plant	205
Cement Plant	50
Ferro Alloy Plant	7
DM Plant	90
Softening Plant	28
Misc	45
Total	**2758**

1. Acid Regeneration Plant – CRM

The waste acid generated from plant shall be recovered in acid regeneration plant. The process of regeneration is as below:

Gas Cooling and Pre-concentration

From the storage tank the waste acid is filtered to remove particles and undissolved residues and is then directed into the separator of the pre-concentrator. A circulation circuit transfers the waste acid from the separator to the venture. There the hot gases from the roaster come in contract with the circulated liquid and evaporate approximately 25% of the liquid volume while cooling the gas stream from approx. 4000ºC toapprox. 950ºC and simultaneously deducting. This interaction results in droplets which flow to the diffuser and in turn are separated from the gas in the separator. From the pumping circulation of the Pre-concentrator, a partial current of the pre-concentrated waste pickle acid is conveyed to the reactor spraying system via the reactor feed pump.

Thermal Process

After a filter station, the concentrated acid is pumped to the spray booms on the top of the roaster. The roaster is a steel vessel lined with refractory material and directly heated by burners, which are tangentially located at the circumference of the shell. The burners charge the interior with hot combustion gases, thus producing a rotating flow. The chamber geometry and the combustion parameters are designed to ensure proper mixing of heat and particles by inducing a vortex in the roaster. The droplets produced by the nozzles are caught by this flow and intensively mixed with the atmosphere. They dry up and are pro-hydrolysed according to the following reaction equations :

$2\ FeCl_2 + 2\ H_2O + ½\ O_2 \qquad Fe_2O_3 + 4\ HCl$

$2\ FeCl_3 + 3\ H_2O \qquad Fe_2O_3 + 6\ HCl$

A certain amount of excess air delivers the oxygen required for a roasting reaction. The roasting gases consisting of the combustion gases, water vapour and hydrogen chloride leave the roaster at the top and pass through a cyclone which separates part of the Fe_2O_3 dust. The separated cyclone oxide is discharged through a rotary valve and fed back to the roaster.

The solid iron oxide-particles will fall down to the lower cone of the reactor in the form of powder and are discharged through a rotary valve which keeps gases inside of the reactor separated from the outside atmosphere. Above the rotary valve a lump breaker is installed to break any possible oxide agglomerates. Powders obtained by spray roasting pyro-hydrolysis exhibit a typical hollow-spherical structure comprising agglomerated mico crystals. After leaving the roaster and the cyclone the hot gas is directed to the venture of the pre-concentrator, where it is used to heat incoming waste acid.

Oxide Conveying / Storage

The Fe_2O_3 powder is discharged by a rotary valve at the bottom of the roaster and from there is transported to the oxide storage bin. This conveying system operates under a slight negative pressure to prevent the dust from escaping to atmosphere. A bag filter mounted on the top of the oxide bin cleans the air used for Fe_2O_3 transport before escaping to the atmosphere. The Fe_2O_3 powder is discharged at the bottom of the bin via a rotary valve to a bag filling device.

Absorption

Downstream of the separator of the pre-concentrator, the cooled roast gas enters the absorber column. Rinse water from the pickling line and wash water from the exhaust gas fan is sprayed onto the top of the packing to produce hydrochloric acid by adiabatic counter current absorption. The regenerated acid leaves the bottom of the absorber and flows to the regenerated acid storage tank by gravity.

Exhaust Gas Cleaning

After the absorber the roast gas enters the exhaust gas cleaning which consists of :

Exhaust Gas Fan

The gas is conveyed through the plant by the variable speed exhaust gas fan which controls the negative pressure in the plant. Thus neither fugitive gases nor dust can escape from the system. The impeller of the fan is sprayed with water for additional scrubbing of the exhaust gases. A drop separator is installed downstream of the fan. The separated liquid is accumulated in the collecting bin.

Collecting Bin

Rinse water from the pickling line and liquids from the exhaust gas cleaning section are accumulated in the collecting bin and fed as absorption liquid to the top of the absorption column.

Alkali as Scrubber

Further downstream the exhaust gases enters a column scrubber which is charged with an caustic soda / sodium thiosulfate (HaOH / $Na_2S_2O_3$) solution to remove hydrogen chloride (HCl), chlorine (Cl_2) and dust. The reactions are as follows:

$HCl + NaOH \quad\quad NaCl + H_2O$

$Cl_2 + H_2O \quad\quad HClO + HCl$

$4\,HClO + Na_2S_2O_3 + 6\,NaOH \quad\quad 4\,NaCl + 2\,Na_2SO_4 + 5\,H_2O$

Tank Farm

Waste acid and rinse water are supplied by pumps of the pickling line into the tank farm of the ARP. Regenerated acid is supplied to the pickling line by the regenerated acid pumps. Fresh acid is supplied into the fresh acid tank by truck discharge.

2. EFFLUENT TREATMENT PLANT AND RO PLANT- CRM Complex

Treatment scheme based on the inlet parameters consists of the following steps:

1. Oil removal
2. Chromium Treatment
3. Equalisation and Settling

Oil Removal

Oily roll coolant effluent from collection tanks is first transferred to holding tank provided with manual skimmer to remove floating oil. From holding tank effluent is pumped to Dissolved Air Floatation unit (DAF) to remove oil. To break emulsion alum, HCl and polyelectrolyte is dosed using pipe flocculator. The treated effluent is taken to collection tanks

Chromium Treatment

The chromating effluent from collection tank is pumped to Reaction Tank, which is provided with agitator. In Reaction Tank pH is lowered to 2 by dosing H2SO4. Hexavalent chromium is then reduced to trivalent chromium with sodium bisulphate or metabisulphite. Effluent with trivalent chromium is then taken to collection tanks for further treatment.

Quench Tank Water Effluent

Quench tank water effluent will be collected in Quench effluent collection tank. It is then pumped to settling tank. Settled effluent is taken to collection tank 1&2 and settled sludge is dewatered in filter press.

Equalization and Settling

Oil removed effluent, effluent with trivalent chromium, rinse water and scrubber water is equalized in collection tanks .This effluent is pumped to Reaction Tank, which is provided with agitator. In Reaction Tank lime solution is dosed to raise pH from day lime solution tank (DLST) for precipitation. This effluent is then transferred to clarifier for settling precipitated iron and chromium. Overflow from clarifier is treated with sulphuric acid for final pH correction. Static mixer is provided for mixing. The settled sludge is dewatered with filter press.

Flocculation/flotation system:

At a controlled flow effluent is pumped into the flocculator. First a coagulant is dosed to coagulate colloidal matter and subsequently a polyelectrolyte is dosed to form floc, which can be separated by dissolved air flotation.

From the flocculator, the water enters the flotation unit. In the flotation unit, the pre-treated water is mixed with a recycled stream from the effluent compartment. The steam is transferred through a special pump and air saturation system in order to achieve a very fine air dispersion in the water, which will stick to the impurities.

The air/particles-conglomerates float to the surface of the system where a continuous de-hydration takes place before discharge into a collecting storage. Heavy particles like sand, etc. are intercepted in the on-build sediment trap and are intermittently removed by hand-operated valves. The flow can for example, be led to a sand drain gutter, from which the water can flow back into the pump pit. The treated water flows from the effluent compartment into the discharge system.

Flotation Unit

The flotation unit is a high-built open tank separator for dissolved air assisted separation of floc from water. The water enters the inlet compartment via a distribution system, which regulates and stabilizes the flow before entering the plate pack zone.

Dissolved air is already dosed before the water enters the compartment. Heavy particles will settle down and are collected in a sludge cone, under the plate-packs. Dissolved air is dosed at the beginning of the unit to provide sufficient air bubbles to give buoyancy, to the floc and to create an air cushion under the floating layer. The floc is collected in the floating layer (sludge) and water leaves the separator via a retention baffle and over flow weirs.

At the outlet of the flocculator the pre-treated water is being mixed with recycled water in which very finely dispersed air bubbles are contained. These attach themselves to the floc and thus impart a strong buoyancy to them. After being homogeneously mixed the liquid is evenly distributed over the whole width of the separation basis. The rapidly rising floc accumulate instantly in a floating surface layer while the slower rising floc are being separated in the plate pack and rise counter currently to the flow and are collected in the float layer. A unique system of rotating blades is used to provide sufficient energy for sludge to de-water partially, and also due to the directions of rotation the sludge is also pushed forward. A sludge skimmer removes a relatively dry sludge.

Part of the treated water is recycled for aeration purpose. Air is dosed in the suction side of a specially designed pump and mixed with the water in the pump. The pump vaporized the air-water mixture to 4-6 bars at which the air will dissolve into the water.

Further dissolving of air in water as well as separation of dissolved air will take place in the aeration header. From the aeration header, the air-water mixture is dosed to various points of the unit, through a set of deaeration valves.

The de-pressurization takes place in specifically designed devices, as a result of which fine air bubbles of 30-50 micron are formed. The size of the air bubbles is essential for the efficiency of the flotation unit. Small bubbles easily adhere to equally sized or larger particles.

When flocculator is installed before the flotation unit, part of the recycle flow will be dosed into the flocculator to mix air bubbles with the floc before the water enters the flotation unit. Thos gives added buoyancy to the air particles.

The sludge removal by the sludge de-watering/skimming device can be adjusted by level adjustment. Adjustable outlet weirs are provided to set the level in the flotation unit to the optimum position. Heavy sludge is removed from the sludge cones at the bottom of the separation compartment. Sludge drain valves are installed, subject to application. These valves can be time controlled and pneumatically operated. Alternatively, heavy sludge can be manually removed from time to time.

The flotation unit is provided with FRP plate packs. In general function of plate packs and its arrangements is similar to TPI, units. The emulsified oil of the wastewater is destabilized by coagulation with alum and de-oiling polyelectrolyte in pipe Flocculator. The above process converts emulsified oil into free-floating oil of size more than 50 micron.

The wastewater after de-emulsification as above is received in the DAF unit by gravity, where oil globules already formed by de-emulsification is subjected to air flotation as follows:

A steam of recycle waste water supersaturated with air is allowed to flow to the DAF unit, where micro bubbles of air is released which helps increase the buoyancy of oil globules which then gets floated to the surface of the unit. Moving surface skimmer traps the oil collected on the surface. The oily scum and sludge, which settle at the bottom, are conveyed to oily sludge tank by gravity.

Rinse water discharge, scrubber water discharge and degreasing concentrate

The Effluent coming from will be collected in the other Equalisation tank along with the pre-treated effluents of previous stream. The Equalised Effluent will then be pumped at a constant rate into reaction tank – II where 10% Lime solution will be dosed to raise the pH around 5.5 to 6.0. This partly Neutralised effluent will be taken to reaction tank-III where Lime will be dosed & pH will be further raised in the range of 8 to 9 and the precipitation of the ferric salts will be brought about. Oxygen required in form of air for Oxidation of Ferric ions will be provided by the diffuser grid, which will be also helpful in ensuring complete mixing of lime.

The Effluent from the reaction tanks will then be passed on to the Solids Contact Clarifier for setting of the sludge. The Solids Contact Clarifier is a high rate water treating clarifier which in minimum time and space and using minimum of chemicals produces effluent of highest quality. Influent water enters the central draft tube above the Recirculator impeller where it is mixed with treatment chemicals.

Sludge recirculation will be accomplished by variable speed impeller which pumps large volume of sludge at low speed. Polyelectrolyte and Alum dosing will be carried out to aid in coagulation and settling.

The clear water will be collected by means of collector pipes and the sludge settled at the bottom will be taken for disposal. The clarified water will flow by gravity to clarified water tank.

The sludge settled at the bottom of the Colids Contact Clarifier will be collected in a sludge sump and then pumped to a rotary vacuum drum filter for mechanical de-watering. The filtrate from the rotary filter will aporize back to the Equalisation tank and the sludge from the rotary drum vacuum filter will be taken for further use.

The effluent, from Clarified Water Tank is pumped into Dual Media filter (DMF). Dual Media filter would be provided complete with filter backwash arrangement to ensure reduction & Suspended solids & turbidity at the outlet of the DMF. This filtration step reduces the suspended solids, before taking it to downstream membrane systems.

The filtration bed consists of fine sand of specified size over a layer of gravels. Water flows downwards through the filter bed and the suspended solids are retained on the sand surface and between the sand grains immediately below the surface. The filtered water is evenly collected by header lateral type bottom collecting system.

At a pre-determined pressure drop the backwash of filter is initiated manually to clean the filter bed. The backwash water at high flow rate is pumped through the filter bed in upward direction to facilitate expansion of the filter bed.

Once the backwash cycle is completed, filter is taken online for service after a final rinse with service flow rate.

The water will be passed through Ultra Filtration System. Ultra-filtration will be a low-pressure membrane process for the removal of colloidal silica and colloidal particles. The feed water flows from the inside of the fibres, permeates through the membrane and is removed as the product from the shell side.

The treated water from Ultra-filtration system will be collected into the RO feed tank for temporary storage & the treated water will be transferred to Reverse Osmosis System through pump for further treatment as well as it will be used during cleaning of Ultra- filtration system.

Effluent after passing through Ultra filtration is taken into reverse osmosis feed tank from where it is pumped to RO system. Sodium Bi-sulphite and Antiscalant will be dosed in RO feed water prior to Cartridge Filter for trouble free and efficient operation of the RO system.

· Antiscalant Dosing System – The Antiscalant Dosing System is provided to prevent precipitation of sparingly soluble salts and hence to inhibit scale formation on RO membranes.

· Sodium Meta Bi-sulphite dosing system – The SMBS Dosing System is provided to remove traces of chlorine present in raw water to protect the membranes.

The Reverse Osmosis system provided with Cartridge filter & High pressure pump.

Cartridge Filters are used to further reduce suspended solids to a level acceptable to the downstream Reverse Osmosis Membranes.

Reverse Osmosis Skid shall be fed with high pressure feed water from RO High Pressure pumps. The RO High Pressure pumps shall be an inline pump made of Stainless Steel.

RO skid shall be an integrated assembly of high-strength thermally cured fiber glass reinforced epoxy pressure tubes housing the RO membrane elements, feed, product and concentrate piping, all mounted on a high-strength steel structure. Pressure tubes shall be arranged in a series/parallel array to achieve the desired water recovery. RO skid shall be equipped with valves, piping work, flushing and cleaning connections, instrumentation and control console.

The membrane elements shall be spiral wound composite polyamide membrane elements. Product water tube shall be fibre glass reinforced epoxy pipe. High-pressure alarm system shall be provided to prevent excess pressure on the feed side.

Provision shall be made for flushing the system after each shut down so as to prevent the precipitation sparing soluble materials on the membrane surface during periods of shut down.

There shall be a membrane-cleaning system in the RO plant by chemical recirculation when the pressure drop across the system exceeds the preset value. The cleaning system shall comprise chemical holding tank, chemical recirculation unit and cartridge filter. The RO system will be PLC operated. Cleaning will be manual operation. In case of any parameter exceeds the preset values or designed system values, PLC will trip the RO system automatically and the feed water will be drained out to the system, till the inlet condition are restored.

The Permeate Water will be collected in Permeate Water Storage Tank and reject water will be going to the Reject water storage tank.

The Reject Water shall be used in Slag Quenching/ Gardening/ Ground Spray for Dust Control.

The Roll Coolant from the Mills will be collected in the tank as the Major effluent will be discharged once in 6 months. The Equalisation tank will be provided to thoroughly mix the effluent before it is pumped to the oil and grease tank. The Equalisation tank will also ensure that the effluent will be pumped at a constant head to the oil and Grease removal tank.

A slotted pipe is provided for oil removal, which will remove the oil that will remove the oil that is floating in the tank. The effluent will then be passed to the other Equalisation tank and the combined effluent will be treated according to the treatment scheme of other stream.

3. **ETP for treatment of Blow down water from all units**

Waste water generated from the different areas of the plant are treated in suitable treatment facilities and recycled back to the process to attain 'zero' discharge. The blowdown from these units will be taken to Common Treatment plant.The ETP basically consists of Ultra filtration (UF) system and Reverse Osmosis (RO) system. Before the effluent is taken to the ETP it is stored in a Guard pond. From there it is taken a clarifier through a equalization tank. The clear effluent from clarifier is taken to dual media filter and then fed to Ultra-filtration unit. From UF unit it is taken to the RO section. In the RO the permeate which is of quality as raw water is used as make up water in the plant. The reject water from the RO which is high in phenol and ammonia is taken to the surge pond to be fed to the Bio ETP along with the CGP effluent.

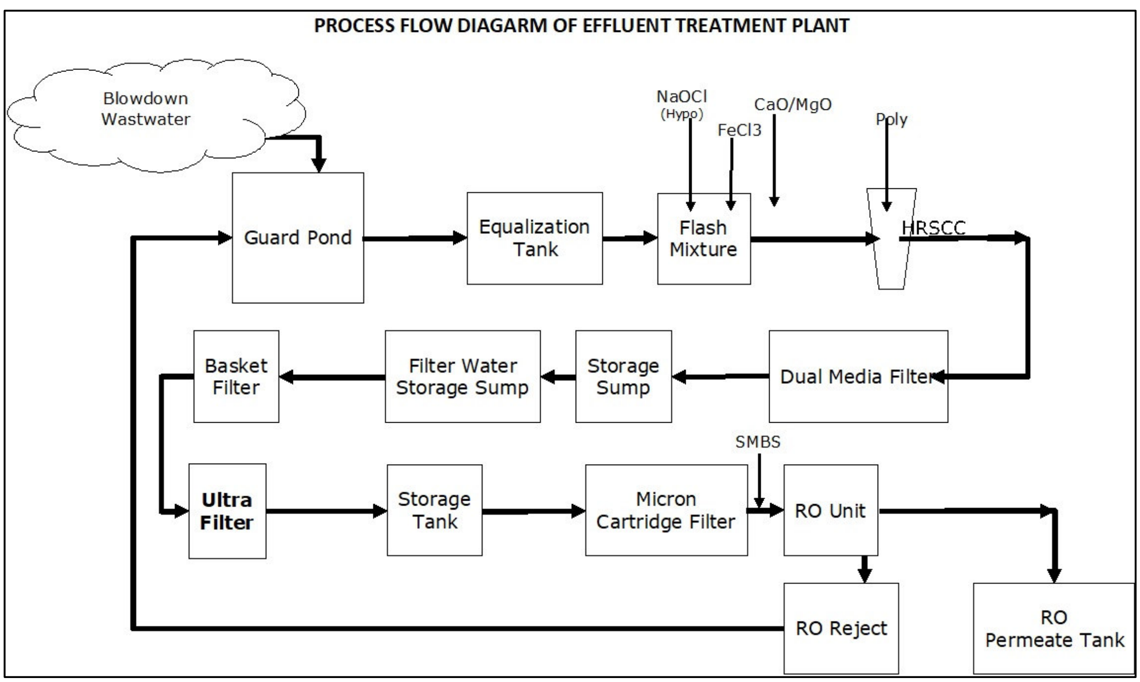

Figure 16: Process flowchart for ETP

4. Bio ETP –Coke Oven

The effluent treatment system for treatment of wastewater from the Coke Oven mainly consists of a Bio Effluent Treatment Plant (Bio ETP) and a Tertiary Effluent Treatment Plant (TETP).

The Bio ETP is designed to treat coke oven effluent. Apart from oil removal, the process employs cyanide and sulphide removal technologies and advance Biological treatment (ABT) where several stages of anoxic and aeration significantly reduce BOD, COD, TKN , trace phenols and cyanides. The effluent is further subjected to tertiary treatment process which meet the discharge standard specified by the SPCB.

Combined effluent is collected in equalization tank and transferred to oil removal tank where oil is skimmed from top and tar collected at bottom. After removal of oil effluent is passed through heat exchanger and transferred to surge pond. From surge pond the effluent is sent to flash mixer where $FeCl_2$ and lime dosing is done. Then effluent is transfered to sedicell to remove cyanide and fluoride in form of sludge and oil collected in tank. Sludge is sent to belt filter press and sludge cake is collected in container and will be disposed at hazardous waste disposal site.

Then the effluent from sedicell enters biological treatment system consists of two stage anaerobic and aerobic microorganism based treatment facility where ammonia, phenol and other organic contaminants are removed from water. After biological treatment water enters in secondary clarifier where biological sludge is removed from water and returned to biological treatment tank. Clarifier overflow water is transferred to oxidation tank where H_2O_2 added with water to remove COD and residual cyanide. Then water passes through MGF & ACF to remove suspended solids and organics. The treated water collected in treated water collection tank will be sent to process for usage within the system.

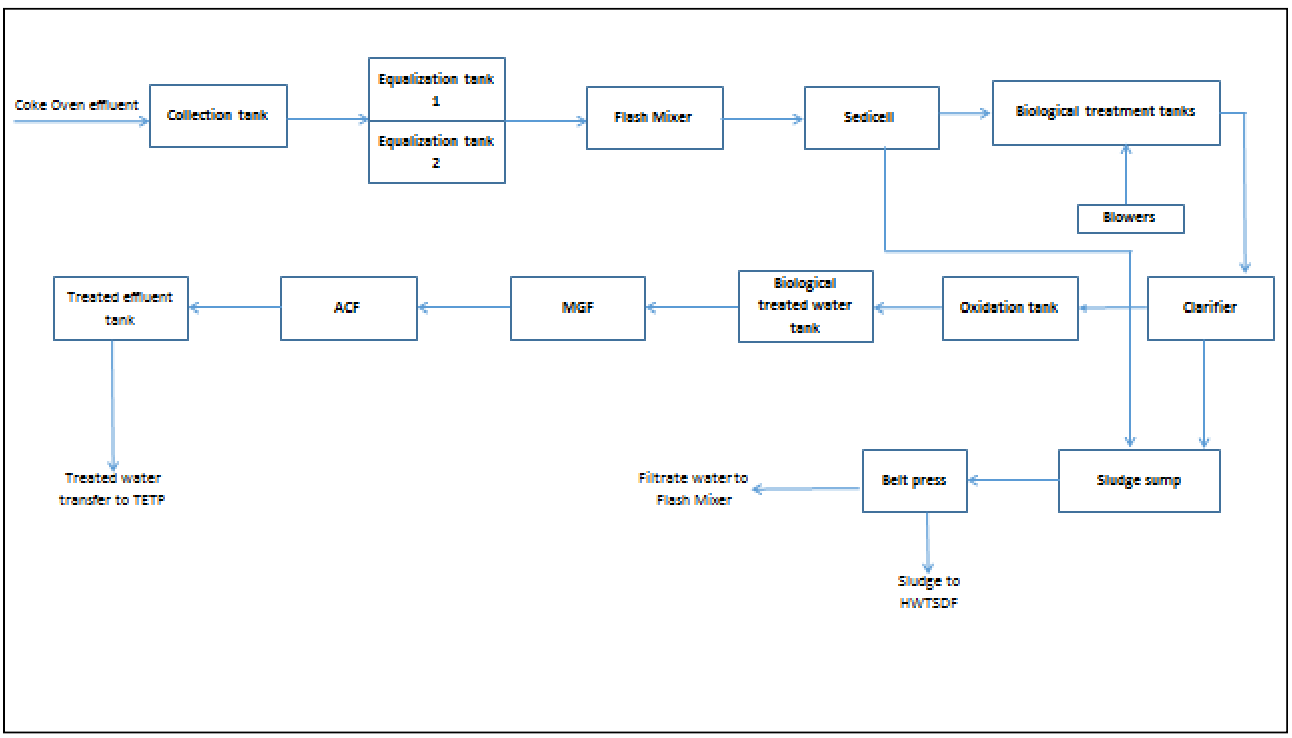

Figure 17: Process flowchart for Bio ETP

Table 17

Characteristics of Inlet and Outlet of all ETPs

S. No.	Parameters	ETP inlet	ETP Outlet	Bio-ETP Inlet	Bio-ETP Outlet (CGP & Coke Oven)	STP Outlet
1.	pH	7.0-8.0	5.5-9.0	8-9.5	5.5.-9.0	6.5-9.0
2.	Total Suspended Solids (TSS) in mg/l	<250	<100	<3000	<100	<100
3.	Biochemical Oxygen Demand (BOD) in mg/l	<50	<30	<2500	<30	<30
4.	Chemical Oxygen Demand (COD) in mg/l	<500	<250	<3500	<250	-
5.	Oil & Grease in mg/l	<30	<10	<50	<10	-
6.	Fe in mg/l	<10	<3.0	<20	<3.0	-
7.	Total Cr. In mg/l	<5	<2.0	<20	<2.0	-
8.	Phenolin mg/l	-	-	<800	<1.0	-
9.	Cyanide in mg/l	-	-	<20	<0.2	-
10.	NH3N2in mg/l	-	-	<200	<50	-
11.	Fecal Coliform					<1000

Sewage Treatment Plants

Wastewater/sewage generated from domestic usage of water like toilet blocks &kitchen wastewater will be would be collected by means of suitable sewer system for treatment in Sewage Treatment Plant (STP). It is proposed that compact/ small size sewage treatment plants will be installed at individual units of the ISP to treat and recycle the domestic wastewater from these units. Biological solid waste generated from STP would be used as manure for development of greenery. Chemical sludge and salt would be sent to near-by secured landfill site.

(vii) Raw material required along with estimated quantity, likely source, marketing area of final products, mode of transport of raw material and finished product.

(a) Raw Material Requirement

The basic raw material for the manufacturing of Steel is Iron Ore which will be sourced from Barbil- Joda, Odisha and also from M/s NMDC Limited through auction and will be transported by rail/road. Details regarding quantity of raw materials required their source along with mode of transportation for project have been tabulated below.

Table - 18

Raw Materials Requirement, Source & Transportation

S. No.	Raw Materials	Estimated gross annual quantity (in TPA)	Source of Raw Materials	Mode of Transportation	Distance from Project Site (Km)
1.	Coking Coal	7,729,576	International Market (Mozambique, Australia and Canada)	Sea, Rail	220 KMs from Paradeep Port
2.	Iron ore fines	8,883,404	Procured from the Joda-Barbil regions of Odisha and also from NMDC Limited through auction	Rail/Road	215 Kms
3.	Coal	315,000	Coal mines of JSP at Talcher	Road/conveyor	9 kms
4.	Limestone	5,918,315	SMS grade - Middle East Countries (UAE and Oman). BF grade - Jukehi-Katni-Niwar area in Central India or the quarries located in Jaggayyapetta region, Andhra Pradesh or imported from international market	Sea, Rail	955 Kms
5.	Dolomite	222,599	Jaggayyapetta region, Andhra Pradesh or mines in Katni-Bilaspur region, Central India	Rail/Road	955 km
6.	Quartz	659,455	Domestic	Rail/Road	1800 km
7.	Anthracite	353,218	Domestic	Rail/Road	220 KMs from Paradeep Port
8.	Bentonite	1,55,550	Domestic	Rail/Road	2000 Kms
9.	PCI Coal	3,139,718	International market (Australia, South Africa and	Sea, Rail	220 KMs from Paradeep Port

S. No.	Raw Materials	Estimated gross annual quantity (in TPA)	Source of Raw Materials	Mode of Transportation	Distance from Project Site (Km)
			Indonesia)		
10.	Iron Ore Slurry	34,000,000	Procured from Barbil regions of Odisha	Slurry Pipe	215 Kms
11.	Lump Iron Ore	412,088	JodaBarbil region	Rail/Road	215 Kms
12.	Mn Ore	858,570	Domestic	Rail/Road	250 Kms
13.	Cr Ore	143,670	Domestic, Sukinda region	Road	120 Kms
14.	Clinker	5,729,500	Domestic/International market	Sea, Rail, Road	-
15.	Gypsum	312,500	Domestic	Rail/Road	1800 Kms
16.	Purchased Pellet	5,861,850	Domestic	Rail	215 Kms

JSPL is operating TRB iron ore mines with capacity of 3.1 MTPA and Kasia Iron Ore mine with capacity of 7.5 MTPA in Odisha. Iron ore and iron ore fines will be sourced from these mines and will be transported by rail and road. Balance quantity of iron ore will be bought from the merchant iron ore mines in Odisha. The list of non-captive iron ore mines along with their production capacity is given below:

Sl.	Sector	Lessee	Mining Lease	Capacity in MTPA
1.	Joda	Tarini Minerals Pvt. Ltd (D R patnaik)	Deojhar	2.00
2.	Joda	Tarini Prasad Mohanty	Naibaja	0.60
3.	Joda	Indrani Patnaik	Unchabali	4.00
4.	Joda	O.M.C. Ltd.	Guali	5.70
5.	Joda	O.M.C. Ltd.	Jilling	6.28
6.	Koira	Geeta Rani Mohanty	Raikela (Geeta Rani)	2.99
7.	Koira	Jain Patnaik	Bhanjali	0.09
8.	Koira	Rungta & Sons P Ltd.	Oraghat	8.35
9.	Koira	Rungta & Sons P Ltd.	Sanindupur	8.02
10.	Koira	S.N. Mohanty (KJST-Jaldihi)	KJST,Jaldihi	2.00
11.	Koira	S.N. Mohanty	Raikela	0.30
12.	Koira	Korp Resources (P) Ltd.	Tantra	0.12
13.	Koira	M.G. Mohanty	Patabeda	0.80
14.	Koira	M.G. Mohanty	Patabeda-19.425 HA	0.18
15.	Koira	MGM Minerals Ltd.	Patabeda	0.80
16.	Koira	Penguin Trading and Agencies Ltd.	Raikela (PTA)	1.08

17.	Koira	National Enterprises	Raikela (NE)	0.50
18.	Koira	National Enterprises	Sanindupur	0.41
19.	Koira	O.M.C. Ltd.	Kurmitar Pahar	6.00
20.	Jajpur Road	O.M.C. Ltd.	Daitari	6.00
21.	Keonjhar	O.M.C. Ltd.	Gandhamardan -A	0.35
22.	Keonjhar	O.M.C. Ltd.	Gandhamardan -B	9.12
23.	Joda	O.M.C. Ltd.	Roida C	0.46
24.	Joda	O.M.C. Ltd.	Tiring Pahar	0.46
25.	Joda	R. B. Das	R. B Das	0.14
26.	Joda	K C Pradhan	Nayagarh	0.08
27.	Joda	JSW Steel Ltd	Nuagaon	5.60
28.	Joda	JSW Steel Ltd	Jajang	16.50
29.	Joda	Serajuddin	Balda	15.15
30.	Koira	ESL Steel Limited	Nadidih (BICO)	9.00
31.	Koira	ESL Steel Limited	Nadidih (Feegrade)	7.50
32.	Koira	Patnaik Minerals	Mahulsukha	0.04
33.	Koira	Yazdani Steel & Power Ltd	Kolmong	0.04
34.	Joda	Debabrata Behera	Siljora-Kalimati	0.14
35.	Joda	Jagat Janani Services Private Ltd.	Jururi	2.10
36.	Koira	Agrasen Sponge Pvt Ltd	Katasahi	0.02
37.	Koira	P.M. Granite Export Private Ltd.	Kanther - Koira	0.02
38.	Baripada	Ghanshyam Mishra & Sons Private Limited	Gorumahisani	0.75
39.	Baripada	GM Iron and Steel Ltd	Badam Pahar	1.50
		Total (A)		**135.76**

Dispatch of Raw Material to Various Consuming Units from Raw Material Handling Yard:

Dispatch of raw material to blast furnace:

1. Limestone, dolomite and quartzite will be received at junction house located in stockpile area of Raw Material Handling yard. The aforesaid materials will be transported through conveyor system to the bins of stock house of blast furnace.
2. PCI Coal received in the aforesaid junction house through conveyor system after reclaiming from storage yard shall be conveyed to PCI bin building of blast furnaces.
3. Prime coke and nut coke after screening in coke oven plant shall be conveyed to stock house of blast furnaces through conveyor system and tripper conveyor.
4. Sinter generated in sinter plant shall be conveyed to BF stock house through conveyor system and tripper conveyor.

5. Pellet generated in pellet plant shall be conveyed to BF stock house through conveyor system and tripper conveyor.

Dispatch of raw material to sinter plant:

1. Iron ore fines received in the aforesaid junction house through conveyor system after reclaiming from respective storage yard shall be conveyed to the proportioning bin building of sinter plants.
2. Limestone and dolomite received in the aforesaid junction house through conveyor system after reclaiming from respective storage yard shall be conveyed to the proportioning bin building of sinter plants after crushing and screening.
3. Coke breeze from coke oven plant shall be conveyed to the bins of sinter plant through a set of conveyors after crushing and screening.
4. Return fines from blast furnaces, SMS shall be conveyed to the proportioning bin building of sinter plants through conveyor system.
5. Calcined lime from LCP shall be transported to the proposed Lime grinding unit in the vicinity of sinter plant by lime tankers and the same will be fed to sinter plants.

Dispatch of raw material to pellet plant:

1. Iron ore concentrate from the filtration plant shall be stored in stock pile through travelling tripper.
2. Iron ore concentrate received after reclaiming by portal reclaimers from respective storage yard shall be conveyed to the raw material bins of pellet plant through a set of conveyors.
3. Anthracite, limestone and dolomite received in the aforesaid junction house through conveyor system after reclaiming from respective storage yard shall be conveyed to the raw material bin of pellet plant.

Dispatch of coal to coke ovens:

Various types of coking coals received at the stockyard shall be conveyed to the coke oven plants though conveyor system after blending and crushing.

Dispatch of pellet to DR plant: Purchased pellet received at the stockyard shall be conveyed to the DR plant though conveyor system after screening.

Dispatch of raw material to lime calcining plant (LCP): Limestone and dolomite stored in the stockyard shall be dispatched to the kiln feed building through conveyor system after screening.

Dispatch of raw material to steel melt shop:

1. DRI from DR plant shall be conveyed to storage bunkers of SMS shop through existing screening and conveying system.
2. Hot metal from Blast Furnace shall be transported through Torpedo.
3. Lime and do-lime from storage building shall be conveyed to the storage bunkers of BOF shops though series of conveyors after screening.
4. Ferro alloys stored in the ferro alloy stores shall be conveyed to the storage bunkers of SMS shops though series of conveyors.

Dispatch of raw material to cement plant:

1. Granulated BF slag from storage area shall be transported to cement plant through wagons.
2. Clinkers and gypsum stored in the stockyard shall be dispatched to the storage bins of cement plant through

conveyor system.

3. Fly ash received in closed tankers shall be conveyed to the storage silo of cement plant through pneumatic conveying.

Design basis of raw material handling system:

i) Storage capacity of all imported materials shall be considered as 30 days.

ii) Storage capacity of indigenous materials shall be considered as 15 days.

All major raw materials shall be considered as rail bound. However, truck unloading facility shall be provided as contingency.

(vii) Resources optimization/ recycling and reuse envisaged in the project, if any, should be briefly outlined.

The proposed expansion would be carried out using state-of art technologies for optimum consumption of energy & other resources. By product fuel gases would be reused within the plant as in-plant fuel and also to produce power in the CPP. Power would also be produced from the CDQ of Coke ovens and TRT of BF. In addition, compact layout has been designed for the expansion to enable utilisation of land, which is another critical resource. By utilising the fines and scrap generated during the process within the plant for the production process, usage of raw materials is utilised. Water consumption would also be utilized by treatment of water to the extent possible and recycle of treated water as make-up in the network. Solid byproducts would be reused to the extent feasible. BF slag and fly ash would be used to produce cement in captive cement manufacturing unit.

(ix) Availability of water it's source, energy /power requirement and source should be given.

(a) Water Requirement and Source

Existing water requirement for the Pellet plant and Hot Strip mill is 1095 m3/hr. Total Water requirement for proposed plant will be 14060 m3/hr out of which 11020 m3/hr will be sourced from River Brahmani and the balance water requirement will be met through recycled/ treated water. The existing infrastructure of JSPL which consists of water off take facility at the river and pipeline from the river will be used by JSO to transfer water from the river. At the Plant premises JSO will have its own water reservoir, water treatment facility and water distribution network

Table – 19

Proposed water requirement

Name of Unit	Total Water Requirement(m3/hr)	Wastewater Generation (m3/hr)
Raw material Handling	475	-
Coke Oven	1140	385
Pellet Plant	390	75
Sinter Plant	100	16
BF	1420	60
DRI	800	240

SMS	2225	475
HSM	1650	320
WRM	125	37
CRM	700	250
HM Granulation	160	0
CPP	1900	475
Oxygen Plant	820	205
Cement Plant	500	50
Ferro Alloy Plant	75	7
DM Plant	600	90
Softening Plant	260	28
Fire water	50	-
Misc	450	45
Drinking	220	-
Total	**14060**	**2758**
Recovery from treated effluent and blow down from the system	1770 m^3/ hr.	
Recovery of water from slurry in Slurry dewatering plant	1790 m^3/hr.	
Fresh Water requirement	10500 m^3/hr.	
Raw water demand	**11020 m^3/hr.**	

(b) Fuel Requirement

The proposed steel plant facility will generate large quantities of by-product fuel gases i.e. Blast Furnace (BF) gas, Coke Oven (CO) Gas and LD Gas. These by-product fuel gases will be first utilized as fuel for various heating applications (BF stove heating, rolling mi ll furnaces, sinter plant, etc.) of the steel plant. Balance available gases will be utilised for steam and power generation in the power plant. The by-product fuel gas generation and consumption figures are given in Tables.

By Product Gases	Generation (Nm3/hr)	Consumption in various units (Nm3/hr)	Balance available for power generation (Nm3/hr)
BF gas	5625001	3861002	1763999
Coke Oven gas	576784	535284	41500
LD gas	295909	125342	170567

(c) Power Requirement and Source

Existing power requirement for the existing facilities viz Pellet plant and Hot Strip mill is 185 MW. Additional 1760 MW will be required for the proposed expansion. Thus, after expansion power requirement will be 1945 MW which will be sourced from Captive Power Plant (550 MW) & Captive Power plant of JSPL of 810 MW at Angul. The balance power requirement will be met from Grid.

(x) Quantity of waste to be generated (liquid and solid) and scheme for their management/disposal:

The details are tabulated below: -

Table 20

Solid & Hazardous Waste Quantity & Management Scheme

S. No.	Particulars	Quantity (TPA)	Management Scheme
1.	BF Slag	4,620,000	Granulation in Slag granulation plant and used in the captive cement manufacturing plant to produce Portland slag cement. Dry slag would be used for construction purpose.
2.	BOF Slag	2,112,000	Use in construction purposes mainly for filling of low-lying areas & road sub grade preparation. Proposed use in railway ballast, construction aggregate etc. after accelerate weathering
3.	EAF Slag	1,320,000	Used as construction aggregate and as road sub grade
4.	BF Flue dust	3,710,000	Use in Sinter plant
5.	SMS Flue Dusts	576,000	Reuse in Agglomeration and external sale
6.	Mill Scales	600,000	Reuse in agglomeration
7.	Chrome sludge (Hazardous waste)	180 m3	Transferred to authorized agency for treatment and safe disposal in HWTSDF
8.	BOD Sludge	1,500	Recycled to coke ovens
9.	Coal tar sludge	2,500	Recycled to coke ovens
10.	CETP Sludge	1,500	RO rejects will be treated in MEE and the crystallized solids which have no commercial value will be transferred to authorized agency for disposal. Carbon bearing sludge would be recycled back to Coke Oven
11.	Waste oil	5 kl	To be transferred to eternal agencies

Other solid wastes like clarifier sludge, ESP/Bag Filter dust, refractory debris etc. will be generated from the steel plant. These would be reused/recycled within the plant to the extent possible and the balance would be transferred to Authorized agencies for reuse/recovery of materials/disposal as per prevailing regulations.

4.0 SITE ANALYSIS

(i) Connectivity

The project location has good connectivity in respect of road& rail. The plant site is bounded by SH-63 on the east and NH-42 on the west. The nearest railway station is Kerjang located on the southern side of the plant site. It is proposed to take railway siding for the plant during the proposed expansion from Boinda station and mid-section of Anguland Kerjanga station. Also, to facilitate inbound and outbound logistics, railway connections have been envisaged from project site toBarbil, JSOL to Dhamra port and JSOL to Raigarh.

The nearest airport is at Bhubaneswar about 150 km fromthe plant site. The nearest seaport is at Paradeep about 220 km awayfrom the site.

(ii) Land from Land use and Land ownership

The total land required by JSOL for existing and expansion project is about 3609 acre out of which the existing plant facility viz Pellet plant and Rolling mill will cover about 86.68 acres and additional 3522.05 acres would be required for the expansion project. Out of the total 3609 acres, 2726.61 acres area is already acquired by JSPL and the same will be sub-leased/ transferred to JSOL. The balance area of 882.12 acres will be acquired by JSOL. The land consists of government land, private land and forest land as shown in Table.

Land Category	Land already acquired and to be sub-leased by JSPL to JSOL	Land to be acquired	Total
Forest	332.64	0	332.64
Govt. Land	577.57	115.433	693.00
Private land	1816.4	766.682	2583.08
Total	2726.61	882.12	3608.73

Revenue and Disaster Management Department, Govt. of Odisha vide its letter dated 21.06.2022 has already allowed JSPL to sub-lease the land measuring 2120.325 acres to JSOL for setting up of 19.2 MTPA Steel plant and 12.5 MTPA Cement plant.

Already diverted forest land involved in the proposed project is 332.64 acres. Forest Clearance for 415.70 acres (168.232 ha) forest land granted to JSPL by MoEF&CC vide letter dated 8-75/2008-FC dated 28.10.2010. The FC for the said land will be transferred to JSO as per the Forest Conservation Act, 1980 for which application vide letter dated 30.06.2022 has been submitted.

(iii) Topography

The project area & its surrounding fall under Brahmani-Baitarani basin and have wide physiographic variations. The northern part consists of hill blocks which are isolated but arranged in a way that the hill ranges from three broken chains running in east west direction across the river Brahmani. The central part is mostly plain with rugged& irregular contours and consist of steep rock hill sides and deep ravines. The southern part consists of hills & forest ranges.

The district forms part of northern extension of Deccan plateau and are underlain by Precambrian rocks. The area is tectonically very stable.

The topographic features of the project area may be seen from Survey of India OSM Topo Sheet No. F45S13.

(iv) Existing land use pattern

The area required for expansion is located adjacent to the present plant facilities on its western side of the existing plant. The existing land use pattern of the expansion site mostly consists of barren land with some vegetation cover.

(v) Existing Infrastructure

The plant site is flanked by SH-63 on the east and NH-42 on the west. SH-63 is located adjacent to the plant boundary location at about 500 m away whereas NH-42 runs along south western boundary ofthe plant at a distance of 5 km. The nearest Railway station Kerjang is located about 2 km south of the plant. There are connecting roads from the plant to the major road & railway

(vi) Soil classification

The soil of the project area is mostly sandy loam prone to holding and slighltly acidic in nature. The organic content is moderate. The available nitrogen content is high but available potassium &phosphorus content is moderate.

(vii) Climatic data from secondary sources

The general climate of the site is tropical. During winters, daily mean minimum and maximum temperature hovers around 14^{O}Cand 27^{O}C respectively. May is the hottest month of the year with daily mean minimum temperature of 27^{O}C and daily mean maximum temperature of 41^{O}C. In other times of the year, daily mean minimum &maximum temperature varies between 25^{O}C to 30^{O}C respectively. The airin the area is generally dry except during the monsoons when the maximum humidity rises to 85 per cent.

The wind blows predominantly from West throughout the year. During the monsoons & winters wind also blows from South &North respectively. The mean wind speed ranges between 5 kmph to8.1 kmph during all seasons. Average annual rainfall is around 1,330 mm, of which the bulk of rainfall occurring around the July-September period.

Social Infrastructure available

a) The district of Angul is inhabited by tribal community of '*Ho'* and Particularly Vulnerable Tribal Group (PVTG) of the '*Juangs'*.

b) 2011 Census Data of the district indicates that 53% of the population is engaged in agriculture. The major crops grown in the district are *Paddy, Maize, Ragi, Oilseeds, Pulses* and *Small Millets*. *Wheat, maize, fieldpea, sunflower, garlic, ginger, potato, onion, tobacco, sugarcane* and *coriander* are also grown.

c) The district is characterized by predominant reserves of coal especially that of steam coal. Hence mining and industry operations chiefly contribute towards local income.

d) The various public sector undertakings that are operational within the district are National Aluminium Company Limited (NALCO), Mahanadi Coal Fields Limited (MCL), National Thermal Power Corporation (NTPC), Talcher Thermal Power Station (TTPS), Super Thermal Power Station (TSTP) at Kaniha and Heavy Water Plant at Vikrampur in Talcher.

e) The varied small and medium scale industries operational in the district and contributing to the State Revenue are that of Engineering units, Rice Mills, Fly Ash Brick units, Stone Crushers Service units, Bleaching units, Tyre Retreading units, Flour Mills, Spice Grinding units, Beedi manufacturing units, Kalistitching units and Bamboo basket production units. The State Government through Odisha Khadi and Village Industries Board assist the house hold industries.

f) Few of the prominent educational institutions of the district are Saint Lawrence School, Amar Vani School, Bachpan A Play School, Chinmaya Vidyalaya, DAV Public School- Kalinga Area and Jawahar Navodaya Vidyalaya. The educational programmes initiated by the Government in the district are Sarva Shiksha Abhiyan (SSA), Total Literacy Campaign, Post Literacy Campaign, Continuing Education Programme and National Child Labour Project.

g) Prominent Private Colleges and Educational Institutes operational in the district are government Autonomous College, Government Polytechnic, Kalinga Institute of Mining Engineering and Technology (KIMET) in Chhendipada, Women's College, Narayani Institute of Engineering & Technology (N.I.E.T); Raneswar Institute of Management and Information Technology; Angul Adarsh Engineering College, Purna Chandra Institute of Engineering and Technology Chhendipada, Pabitra Mohan Institute Of Technology in Talcher, Sri Chandrasekhar Mahavidyalaya in Bantala, Anchalik College in Talmul and Jadunath Sanskruta Mahavidyalaya.

h) Prominent Technical Educational Institutes functional in the district are Police Training College (PTC) and Forest Rangers College.

i) Angul is equipped with medical centres suchas Kalinga Eye Hospital in Amalapada, District Headquarters Hospital, NALCO Hospital in Nalconagar, Samal Care in Banarpal, Pradhan Nursing Home, Chandan Nursing Home, Omm Life Care and Central Hospital in Talcher.

j) The district is well connected in terms of roads &railway. The connectivity of the plant has been detailed in the earlier sections.

5.0 PLANNING BRIEF

(i) Planning Concept (type of industries, facilities, transportation etc.) Town and country Planning/ Development authority classification.

The steel plant would be located in Tehsil Banarpal and Chhendipada in, Angul district, Odisha. Most of the raw materials and finished products would be transported by rail for which a railway siding is proposed. The raw materials to be transported by road would be covered fully during the transportation to avoid spillage & fugitive emissions. The transportation load would not add much to the existing load on the said road network. The proposed steel plant involving semi-mechanized operations would be a labour intensive one. Local construction labourers as well as direct & indirect labourers would be engaged for the operation.

Suitable plantation programme would be undertaken to cover the boundary areas with thick & tall plants to arrest the air-borne pollutants within the plant premises. The total green cover of the plant would be 35 per cent of the plant area.

(ii) Population Projection

The census data of the Angul district for the years 2001 and2011 indicate a total population of 11,40,003 and 12,73,821respectively. The decadal growth is 11.74 per cent. Hence the projected population of the district for the year 2021 is around 14,23,370.

(iii) Land use planning

The total area for steel plant would be about 3609 acres post expansion. The area would house the following facilities:

i. Raw material storage yard
ii. Sinter plant
iii. Pellet plant
iv. DRI plant
v. Coke Oven Byproduct Plant
vi. Blast Furnace
vii. SMS complex
viii. Air separation plant
ix. Rolling Mills
x. Captive power plant
xi. Cement plant

Apart from the process units, area would be reserved for Greenbelt, Administrative building, temporary waste storage area, Water reservoirs, Water treatment units, MRSS & other transformer buildings, Workshops, Canteen, In plant roads etc.

(iv) Assessment of infrastructure demand (Physical & Social)

a) High levels of mining and industrial activities in the region due to the presence of Coal Mines, Thermal Power Plants, Aluminum Smelting Units, Iron & Steel Plants and Sponge Iron Plants contribute to elevated dust pollution. This negatively impacts the health of local populace through increased incidents of skin allergies and respiratory ailments. Hence along with adoption of air pollution mitigation measures and regular preventive health care facilities (like PFT tests),social forestry programs would be undertaken.
b) Provision for sanitation measures in local villages.
c) Employment opportunities and vocational training for youth of Particularly Vulnerable Tribal Group (PVTG).
d) Provision for Mobile Health Units and Medical Camps to ensure regular health care facilities.
e) Provision for potable water facilities for the locals and promotion of localized rain water harvesting programs.

(v) Amenities/Facilities

All infrastructure facilities such as education, health facilities and other social facilities are adequate at nearest populated area.

6.0 PROPOSED INFRASTRUCTURE

(i) Industrial Area (Processing Area)

The proposed expansion project will include dedicated railway siding, raw material storage area, water reservoir, sub-station, utilities, separate truck parking area, etc. The land use of the industrial/ plant area of the proposed project is given below:

S. No.	Particulars	Total area (Ha)
1	Plant & machinery	701.06
2	Green Belt	511.19
3	Water Reservoir	56.66
4	Truck Parking	10.12
5	Roads	20.45
6	Railway Siding	43.30
7	Raw material Yard	93.08
8	Slag Processing yard	8.50
9	Utilities	10.52
10	Open area	5.67
Total Area		**1460.51**

(ii) Residential area (non-Processing area)

JSPL already has township 'Jindal Nagar' for the existing employees at village Nisha, Angul, Odisha adjacent to the plant. The township having built –up area of 93.25 acres accommodates families of employees of various hierarchies. There are G+11 and G&F type buildings in the township. The township is well equipped with all necessary amenities and services such as water supply, underground sewerage, electricity, roads etc with easy maintenance provisions. Other amenities such as school, community center, guest house, health center, hospital, shopping complex, post office, bank, park, playground, prayer houses etc are present.

For the proposed expansion, the present township would also undergo expansion for accommodating the additional manpower due to the expansion. There would also be augmentation of the existing infrastructure & services adequately to cater to the additional requirements.

(iii) Greenbelt

There is a binding regulation to develop dense greenbelt area in plant area to the extent of 35 per cent of the plant area. Greenbelt prevents fugitive dust emissions and also improves the peripheral appearance of the plant from aesthetics point of view. The existing plant already has foliage cover, which would be strengthened during the expansion.

Depending on the type of soil suitable for growth, higher survival rate in the region, large leaf index area, nativity of the species and pollution load, following are the proposed species of trees which maybe planted as greenbelt:

Common name	Scientific name
Akashmoni	Acacia auriculiformis
Cassia	Cassia siamea
Bakul	Mimusops elengi
Bakain-nimb	Melia azedarach

Copperpod	Peltophorum pterocarpum
Jamun	Syzygium cumini
Kanchan	Bauhinia purpurea
Kadam	Anthocephalus cadamba
Karabi	Nerium oleander
Mahogany	Swietenia mahagoni
Neem	Azadirachta indica
Sisoo	Dalbergia sissoo

(iv) Social Infrastructure

- Support towards provision of regular health care facilities through Mobile Health Units (MHUs), medical camps and strengthening of existing Primary Health Care (PHC) Centres
- Support towards promotion of collaborative social forestry programmes
- Support towards provision of sanitation facilities in local villages
- Provision of employment opportunities and vocational training for youth especially of Particularly Vulnerable tribal Group (PVTG)
- Support towards provision of potable drinking water through water tankers (especially during summer season), construction of bore wells and installation of water pipelines
- Support towards promotion of localized rainwater harvesting programmes

(v) Connectivity

The project location has good connectivity in respect of road & rail. The plant site is bounded by SH-63 on the east and NH-42 on the west. The nearest railway station is Kerjang located on the southern side of the plant site. It is proposed to take railway siding for the plant during the proposed expansion from Boinda station and mid-section of Angul and Kerjanga station. Also, to facilitate inbound and outbound logistics, railway connections have been envisaged from project site to Barbil, JSOL to Dhamra port and JSOL to Raigarh.

The nearest airport is at Bhubaneswar about 150 km from the plant site. The nearest seaport is at Paradeep about 220 km away from the site.

(vi) Drinking Water

The total water requirement for drinking & sanitation would be 220 cu m/hr post expansion, which is proposed to be drawn from the plant water system.

The drinking water will be supplied to the water requirement of the following purposes:

i) Drinking and sanitary

ii) Laboratories

iii) Make-up in the air-conditioning

iv) Other process requirement in the plant

The treated water from plant make-up water system will be filtered and chlorinated to convert it into drinking quality water. The drinking water system will comprise pumps, pressure filters, chlorinator, overhead tank and distribution piping network. The drinking water will be collected in a overhead storage tank from which drinking water will be distributed to the various consumers.

(v) Sewage Treatment System

Open type drain has been envisaged for the plant stormwater drainage. The drains will be laid generally by the side of the roads. Storm water run-off, collected through arterial and trunk drain, will be discharged to water treatment plant for treatment and treated water will be discharged to pond. Overflow water from pond will be discharged to the existing re-routed canal of the plant. Sanitary faecal sewage will be collected from the ablution blocks through pipeline and the same will be connected to a sewage treatment plant. The effluent from sewage treatment plant will be utilized for the development and maintenance of greenery.

(vi) Industrial Waste management

The proposed project would generate various types of wastes including liquid effluents and solid wastes, which have been discussed earlier.

(vii) Solid Waste Management

Major solid wastes produced in the ISP would be namely blast furnace slag, SMS slag and sludge from CRM among others. The solid waste management has been discussed in details in Chapter -3.

(viii) Power requirement and source

The estimated power requirements & source for the proposed expansion has been detailed in Chapter-3.

7.0 REHABILITATION AND RESETTLEMENT (R & R) PLAN

(i) Policy to be adopted (Central/State) in respect of the project affected persons including home oustees, land oustees and landless labourers (a brief outline to be given).

The proposed project entails the aspects of Land Acquisition, Rehabilitation and Resettlement (LARR). The land ownership details have been elaborated in Chapter-4.

In accordance to the Socioeconomic Surveys (SESs), a total of 423 Project Displaced Families (PDFs) have been identified in the already acquired area for resettlement and additionally about 100 PDFs have been identified in the additional area to be acquired.

The addressal of following Rehabilitation and Resettlement(R&R) issues for the expansion is currently under process:

i) Identification of Schedule Caste and Schedule Tribe PDFs and PAFs

ii) Determination of details regarding R & R colony

iii) Identification PDFs and PAFs applying for self relocation or relocation in R&R colony

iv) Determination of compensation categories and employment support

8.0 PROJECT SCHEDULE AND COST ESTIMATES

(i) Likely date of start of construction and likely date of completion (time schedule for the project to be given).

It is envisaged that the project will be completed within a period of Eighty Four (84) months from "Go Ahead". The schedule has been developed on the basis of the estimated quantum of work, expected delivery and installation period of equipment and commissioning of the plant facilities in shortest possible time.

(ii) Estimated project cost along with analysis in term of economic viability of the project.

This section presents the capital cost estimates for the project.

The order-of-magnitude capital cost is projected in this section. This comprises as erected mechanical and electrical equipment including related civil and structural steelwork and cost towards design, engineering and consultancy and administration during construction.

Provision has also been considered for contingency, margin money, preliminary & preoperative expenses and IDC for arriving at the total capital cost.

The estimate is based on information available with CONSULTING ENGINEERS for similar facilities. Applicable taxes and duties have been considered in all of the estimated costs.

- Total cost of the Expansion Project: Rs. 119,952 Crores
- Cost for Environment Protection Measures:
  - Capital Cost: Rs. 4280Crores
  - Recurring Cost/annum: Rs. 290Crores / Annum

9.0 ANALYSIS OF PROPOSAL

(i) Financial and social benefits with special emphasis on the benefit to the local people including tribal population, if any, in the area.

The proposed brownfield project would:

I. Generate local direct & casual employment opportunities
II. Augment the growth of ancillary small-medium scale industries, trade & commercial establishments and local entrepreneurship thereby contributing towards local income
III. Contribute to national and state exchequer through
    a) GST
    b) Road Tax
    c) Income by registration of trucks & trailers
    d) Income & Corporate Tax

The peripheral development activities that would be undertaken by the proposed project under socio economic development activities would focus on marginal communities and attempt to bring forward an overall socioeconomic development with emphasis in the areas of education, training, health and social & physical infrastructure.