CHAPTER – 1

EXECUTIVE SUMMARY

M/s. Bhadrashree Steel and Power Ltd., is a Public Limited Company, which is incorporated during 24th November 2004. Corporate office situated in "Ananda Nilaya", Jain Colony, Hosapete. Based on the steel demand, Company proposes to expand the project by adding Beneficiation Plant, Sponge Iron Plant, Induction Furnace, Captive Power Plant and Rolling Mill in the Existing Sponge Iron Plant.

The existing capacity of plant is 200 TPD Sponge Iron Unit. The proposal was made for the expansion from 200 TPD Sponge Iron Unit to Mini Integrated Steel plant. Terms of Reference was issued on 12/08/2010 for the following capacities. A copy of the Terms of Reference is enclosed as **Annexure No – 1.**

Table 1.1: Capacity for which TOR issued

Sr. No.	Unit	Capacity for which TOR issued
1	Sponge Iron plant	200 TPD
2	Captive Power Plant	AFBC - 7 MW WHRB - 8 MW Total - 15 MW
3	Induction Furnace	2 x 10 T
4	Rolling Mill	60,000 TPA

However, there were modifications in the capacities for which new Terms of Reference was requested. The details of expansion are as follows;

Table 1.2: Proposed expansion for which Revised TOR was issued

Sr. No.	Unit	Proposed expansion for which Revised TOR was requested
1	Sponge Iron plant	400 TPD
2	Captive Power Plant	No change
3	Induction Furnace	2 x 20 T
4	Rolling Mill	90,000 TPA

The proposed activity is categorized as 'Category – A' project as per Environmental Impact Assessment (EIA) Notification.

Due to the market condition and ban on iron ore mining in three Districts of Karnataka including Bellary vide MoEF OM dated 05.10.2011. Proponent could not take-up the proposal.

Consent to Operate (CFO) from Karnataka State Pollution Control Board for the existing sponge iron unit is renewed time to time. A copy of CFO is enclosed as **Annexure No – 2.**

Further, proponent intended for expansion of project by adding Beneficiation Plant, Sponge Iron Plant, Induction Furnace, Captive Power Plant and Rolling Mill the Existing Sponge Iron Plant. The capacity is given in **Table 1.1.**

Table 1.1: Proposed Manufacturing Facilities

Sr. No.	Particulars	Existing Facility	Proposed Facility
1	Sponge Iron Plant	2 X 100 TPD	2 X 100 TPD
2	Induction Furnace	--	1 X 15TPD
3	Captive Power Plant	--	15 MW (WHRB – 8 MW & AFBC – 7 MW)
4	Beneficiation Plant	--	0.6 MTPA
5	Rolling Mill	--	1,20,000 TPA

BSPL have engaged the services of **METAMORPHOSIS Project Consultants Pvt. Ltd.,** Bengaluru for preparing the Environmental Impact Assessment Report for the proposed expansion project. A copy of the Accreditation Certificate f Consultant is enclosed as **Annexure No – 3.**

CHAPTER – 2

INTRODUCTION OF THE PROJECT / BACKGROUND INFORMATION

2.1 Identification of the Project and Project Proponent

2.1.1 Identification of the Project

India was the world's third-largest steel producer in 2017. The growth in the Indian steel sector has been driven by domestic availability of raw materials such as iron ore and cost-effective labour. Consequently, the steel sector has been a major contributor to India's manufacturing output.

The Indian steel industry is very modern with state-of-the-art steel mills. It has always strived for continuous modernization and up-gradation of older plants and higher energy efficiency levels.

Indian steel industries are classified into three categories such as major producers, main producers and secondary producers.

M/s. Bhadrashree Steel and Power Ltd., is a Public Limited Company, which is incorporated during 24th November 2004. Corporate office situated in "Ananda Nilaya", Jain Colony, Hosapete. Based on the steel demand, Company proposes to expand the project by adding Beneficiation Plant, Sponge Iron Plant, Induction Furnace, Captive Power Plant and Rolling Mill in the Existing Sponge Iron Plant.

2.1.2. About Project Proponent

The promoters have rich industrial background having vivid business experience and excellent track record. The promoters have sound financial position with sufficient liquidity to promote new ventures. They have vast business network in various field of business since long and are having good business developments along with securing all availed limits enjoyed from various banks in an excellent manner. The strength of their records shows that, they are enjoying good market reputation in the business and industry related fields.

The promoters / Directors of the company are as under:

1. Mr. Mukesh Goel
2. Mr. Amit Agarwal
3. Mr. Rashid Iqbal
4. Mr. Piyush Goel

A brief profile of the directors is given below;

Mr. Mukesh Goel is a veteran player in Steel manufacturing, a graduate and a highly experienced businessman, based in Muzaffarnagar (UP.). He is Director of M/s. Cone Craft Paper Private Limited. He is also operating an Induction Furnace (capacity - 26000 TPA) in the name of Uttarayan Steel Private Limited. As he was engaged in manufacturing activities, he is well versed with the details of manufacturing and handling large projects. His family is in Steel business since last 25 years. They have installed first Induction Furnace in Muzaffarnagar (U.P.) in 1982 in the name of M/s. Vaishnav Steels Private Limited and he is the authorized signatory.

Mr. Amit Agarwal, is a well-known name in the Iron and Steel market of Hyderabad and He is into the business of iron ore & steel products for over 20 years through his concerns viz. 1) M/s. Aashirwad Mines & Minerals & 2) Adarsh Enterprises, engaged in Trading of Iron Ore with turnover of Rs. 800 lacs. He is having excellent experience in the field of Iron & Steel and is well versed in negotiating about procurement of materials etc.

Mohd. Rashid Iqbal, s/o Izhar Hussain is 48 years old. He is proprietor in N.S. Enterprises, deals in manufacturing & Trading of Electronic goods. He is Promoter Director in N.S. Infratech Pvt. Ltd., deals in development of Real Estate. Mohd. Rashid Iqbal has a good experience of Electrical & Electronic goods & good management skills.

Mr. Piyush Goel, s/o Lt. Sh. Tara Chand Goel 55 Years old has a diploma in Mechanical Engineer. He is the director in Apex Medical World Pvt. Ltd. deals in Medical, X-Rays, Ultrasound films & Machinery. Mr. Piyush Goel has a sound knowledge about business & management.

2.1.2.1 Strength of Directors

- ✓ A Team of Entrepreneurs, having ventured into Greenfield Projects and successfully established and managed the Business Ventures.
- ✓ Have come out as Champions, even in most difficult situations, having mastered the art of managing Technology & Innovations, Human Resources and Finance, the most critical factors in any successful Venture.
- ✓ Having In-Depth Knowledge of the Steel Sector, well placed to ascertain Requirements, Benefits as well as Pitfalls of the Industry.
- ✓ In-House Financial Strength, either through their Own Financial Strength or Internal Borrowings from Relatives or Friends, enabling to take quick and unanimous decisions at critical junctions.

2.2 Brief Description of Nature of the Project

2.2.1 Proposed Expansion Project

The plant location has been chosen close to the industries. The site located in the Kunikere Village of Koppal Taluk & District. The average elevation 549 MSL and is geographically located at 76^0 11' 49.28" E Longitude & 15^0 19' 27.77" N Latitude. The nearest railway station is Ginigera Railway station, which is at a distance of 8 Km. the Road connectivity is through NH - 63 located at distance of 8 Km from the plant. Hence the transportation to various sites of finished products is easy and economical. The estimated cost of the project is Rs. **225.28 Crores.**

The manufacturing capacity of the Proposed Expansion Project is given in **Table – 2.1.**

Table 2.1: Proposed Manufacturing Facilities

Sr. No.	Particulars	Existing Facility	Proposed Facility
1	Sponge Iron Plant	2 X 100 TPD	2 X 100 TPD
2	Induction Furnace	--	1 X 15TPD
3	Captive Power Plant	--	15 MW (WHRB – 8 MW & AFBC – 7 MW)
4	Beneficiation Plant	--	0.6 MTPA
5	Rolling Mill	--	1,20,000 TPA

2.2.1 Nature of the Project

The project fall under category A, section 3 (a) of EIA Notification 14th September 2006 and amendment thereof vide Notification no. S.O 3067 (E) dated 1st December 2009.

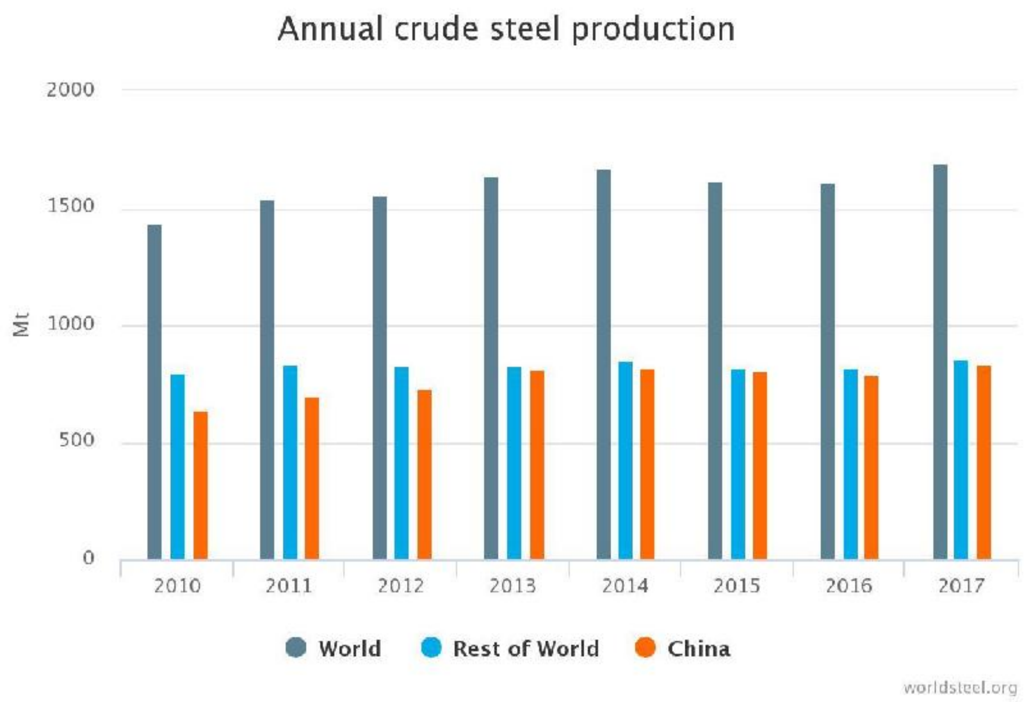
2.3 Need for the Project and its Importance to the Country

2.3.1 Global Steel Scenario

Steel is one of the world's most essential materials. It is fundamental to every aspect of our lives, from infrastructure and transport to the tinplated steel can that preserves food. It is one of the most important products of the modern world and is of strategic importance to any industrial nation. From construction, industrial machinery and transportation to consumer products, steel finds a wide variety of applications. It is also an industry with diverse technologies based on the nature and extent of use of raw materials. Steel's great advantage is that it is 100% recyclable and can be reused infinitely. The industry uses advanced technologies and techniques to increase production yield rates and to facilitate the use of by-products. As a result of the intrinsic recyclability of steel, the value of the raw materials invested in steel production lasts far beyond the end of a steel product's life.

Steel is critical simply because no other material has the same unique combination of strength, formability and versatility. Without being aware of it, society now depends on steel. Humankind's future success in meeting challenges such as climate change, poverty, population growth, water distribution and energy limited by a lower carbon world depends on applications of steel. Steel plays a critical role in virtually every phase in our lives. The rails, roads and vehicles that make up our transport systems use steel. Steel provides a strong framework and connections in the buildings where we work, learn and live. It protects and delivers our water and food supply. It is a basic component in technologies that generate and transmit energy. The World Steel Association (WSA) recently announced that the total crude steel production in 2016 was 1628 million Tons which is 8 million Tons higher than the previous year (2015) production. Steel demand in emerging and developing economies (excl. China) is expected to increase by 4.9% and 4.5% in 2018 and 2019 respectively.

The Indian economy is stabilising from the impact of currency reform and GST implementation and steel demand is expected to accelerate gradually, mainly driven by public investment. Stronger growth is held back by still weak private investment. Global steel sector has seen significant growth after the turn of present century. The steel demand and the capacity have grown almost threefold over the last two decades. This rate of growth is unprecedented in the human history. Though it has started faltering with steel demand in China moderating, there are some bright spots in the World which raises possibility of revival of growth in the medium to long run. One of the key determinants of future growth will be the economic growth of India and related infrastructure spends. The demand for steel has grown over time with increasing industrialization, from 200 MT in 1976 to more than 1000 MT in 2015. However, it was only after the turn of the century that the global steel demand has increased rapidly.



- In 2016, the world crude steel production reached 1630 million tonnes (mt) and showed a growth of 0.6% over 2015.
- China remained world's largest crude steel producer in 2016 (808 mt) followed by Japan (105 mt), India (96 mt) and the USA (79 mt).
- World Steel Association has projected Indian steel demand to grow by 6.1% in 2017 and by 7.1% in 2018 while globally, steel demand has been projected to grow by 1.3% in 2017 and by 0.9% in 2018. Chinese steel use is projected to show nil growth in 2017 and decline by 2% in 2018.
- Per capita finished steel consumption in 2016 is placed at 208 kg for world and 493 kg for China by World Steel Association.

2.3.2 Steel Industry in India

1. India has seen nearly a century of Steel making as it stands on the threshold of a new era. The face of the Indian Iron and Steel Industry is changing at such a fast pace that it is difficult to focus it now in the historical perspective. Steel is a core industry and thus its demand is strongly linked to overall level of economic activity in the country. Given the inherent long-term potential of the Indian economy and its cyclical nature, the long-term prospects of the Steel industry are fairly comfortable. Liberalization and the opening up of the economy have given a new vitality to this sector. Demand and production have been growing at a healthy rate for the past two years and forecast for the next ten years is very bright. The Indian Iron and Steel industry today displays variety in size, ownership, technology and output. The industry was traditionally divided into main producers and so called secondary sector. This division is getting blurred by latest developments fuelled by liberalization and opening up of the economy, such as:

   - Larger IF based units going on stream producing sophisticated finished products as compared to small IF/IF units producing pencil ingots.
   - Mini BF based plants being planned in the private sector.
   - Growth in induction furnace units with sizeable production.
   - High growth in Iron making sector with large gas based DRI units, coal based Sponge units and mini blast furnaces producing merchant grade pig Iron.

2. The Electric Steel industry, which initially started as a result of general Steel shortage and dual pricing policy in the country in the past, has been growing significantly in the recent years. The older units are modernizing while new units are being set up with latest technology enabling reduction in cost of production.

3. The major factors contributing to the existence and growth of the industry are as follows:

   - Lower investment cost and shorter gestation period as compared to BF-BOF route of Steel making.
   - Ability for wider dispersal.
   - Less strain on transport and other infrastructural facilities.
   - Fewer units operation.
   - Non-dependence on metallurgical coke and coking coal.
   - Less manpower per ton of Steel produced.

- Short conversion time for raw material to finished product.
- Lesser environmental and pollution problem.
- Flexibility in production of different qualities of Steel & Alloy Steel.

4. Besides the above factors, the Induction Furnace / Electric Arc furnace method of manufacturing Iron and Steel allows flexibility in the charge mix, leading to reduced electricity consumption and decreased refractory consumption, which has resulted in the manufacture of international quality Steel. ***Since India has rich reserves of coal, the technology for manufacturing Sponge Iron is no more new. Sponge Iron production seems to have a bright future.***

5. India is blessed with most of the principal raw materials in abundance, required for Steel industry and enjoys a unique position in the world in this respect. Under the programme of economic reforms introduced by the Government the approach to foreign investment has radically changed. Production and demand have started picking up as the recessionary conditions and trends prevalent earlier have now ended. However, in the new competitive environment, Steel producers have their priorities with special focus on quality, productivity, cost efficiency and also profitability on the one hand and customer-oriented market strategies and product mix on the other. In the wake of globalization most of the developing countries like India are presently undergoing structural adaptation with eagerly trying to cope up with the tides and ebbs of the current economic influences of the developed countries. And also they have modelled their way of developing through industrialization and mobilization of the potential surplus available.

6. It is worth to note that,

- After liberalization, there have been no shortages of Iron and Steel materials in the country.
- Apparent consumption of finished carbon Steel increased from 65.87 Million Tons in 2010 to 79.80 Million Tons in 2015.
- The Steel industry in general is in the upswing due to strong growth in demand particularly by the demand for Steel in Infrastructure industry.

Domestic Scenario

- The Indian steel industry has entered into a new development stage, post de-regulation, riding high on the resurgent economy and rising demand for steel.

- Rapid rise in production has resulted in India becoming the 3rd largest producer of crude steel in 2015 as well as in 2016. The country was the largest producer of sponge iron or DRI in the world during the period 2003-2015 and emerged as the 2nd largest global producer of DRI in 2016 (after Iran). India is also the 3rd largest finished steel consumer in the world and maintained this status in 2016. Such rankings are based on provisional data released by the World Steel Association for the above year.
- In a de-regulated, liberalized economic/market scenario like India the Government's role is that of a facilitator which lays down the policy guidelines and establishes the institutional mechanism/structure for creating conducive environment for improving efficiency and performance of the steel sector.
- In this role, the Government has released the National Steel Policy 2017, which has laid down the broad roadmap for encouraging long term growth for the Indian steel industry, both on demand and supply sides, by 2030-31.
- The said Policy is an updated version of National Steel Policy 2005 which was released earlier and provided a long-term growth perspective for the domestic iron and steel industry by 2019-20.
- The Government has also announced a policy for providing preference to domestically manufactured Iron & Steel products in Government procurement. This policy seeks to accomplish PM's vision of 'Make in India' with objective of nation building and encourage domestic manufacturing and is applicable on all government tenders where price bid is yet to be opened. Further, the Policy provides a minimum value addition of 15% in notified steel products which are covered under preferential procurement. In order to provide flexibility, Ministry of Steel may review specified steel products and the minimum value addition criterion.

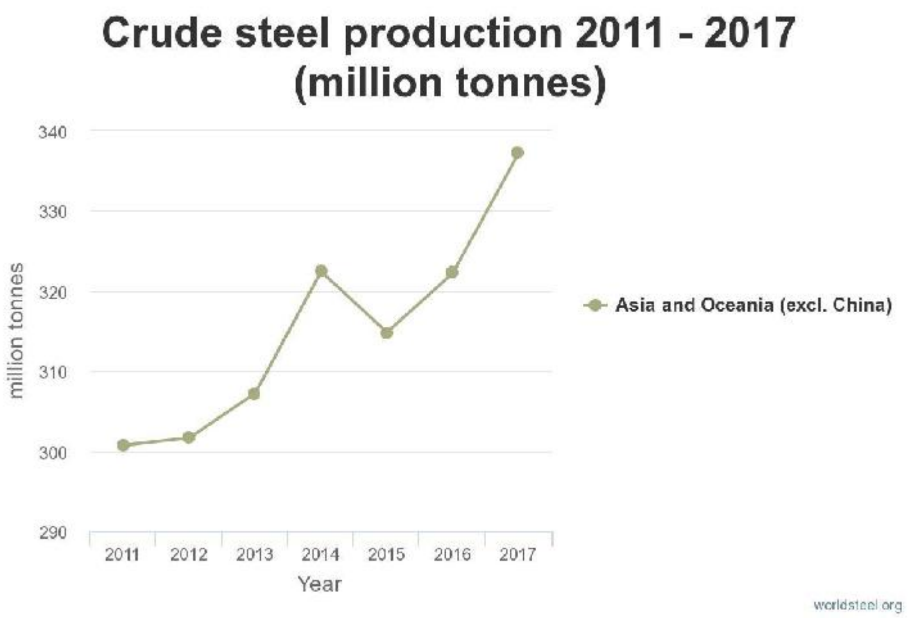
7. Production

- Steel industry was de-licensed and de-controlled in 1991 & 1992 respectively. India is currently the 3rd largest producer of crude steel in the world.
- In 2016-17 (prov.), production for sale of total finished steel (alloy + non alloy) was 100.74 mt, a growth of 10.7% over 2015-16.
- Production for sale of Pig Iron in 2016-17 (prov.) was 9.39 mt, a growth of 1.8% over 2015-16.
- India was the largest producer of sponge iron in the world during the period 2003-2015 and was the 2nd largest producer in 2016 (after Iran). The coal based route accounted for 79% of total sponge iron production in the country in 2016-17 (prov).

- Data on production / production for sale of pig iron, sponge iron and total finished steel (alloy/stainless + non-alloy) are given below for last five years and April-May 2017
- India's finished steel consumption grew at a CAGR of 5.69 per cent during FY08-FY18 to reach 90.68 MT.
- India's crude steel and finished steel production increased to 102.34 MT and 104.98 MT in 2017-18, respectively.
- In 2017-18, the country's finished steel exports increased 17 per cent year-on-year to 9.62 million tonnes (MT), as compared to 8.24 MT in 2016-17. Exports and imports of finished steel stood at 1.35 MT and 1.89 MT, during Apr-Jun 2018.

Indian steel industry :(in million tonnes)						
Category	2012-13	2013-14	2014-15	2015-16	2016-17*	April-May 2017*
Pig Iron Production for sale	6.870	7.950	9.694	9.228	9.391	1.53
Sponge Iron Production	23.01	22.87	24.24	22.43	24.39	4.23
Total Finished Steel Production for sale (alloy/stainless + non alloy)	81.68	87.67	92.16	90.98	100.74	17.48
Source: Joint Plant Committee; *prov.						

8. Pricing & Distribution



- Distribution controls on Iron & Steel removed except 5 priority sectors, viz. Defense, Railways, Small Scale Industries Corporations, Exporters of Engineering Goods and North Eastern Region.
- Allocation to priority sectors is made by Ministry of Steel.
- Government has no control over prices of Iron & Steel.
- Open market prices are generally on rise.
- Price increases of late have taken place mostly in long products than flat products.

9. Opportunities for growth of Iron and Steel in Private Sector

The New Industrial policy has opened up the Iron & Steel sector for private investment by (a) removing it from the list of industries reserved for public sector and (b) exempting it from compulsory licensing. Imports of foreign technology as well as foreign direct investment are freely permitted up to certain limits under an automatic route. Ministry of Steel plays the role of facilitator, providing broad directions and assistance to new and existing Steel plants, in the liberalized scenario.

The New Industrial Policy Regime

The New Industrial policy opened up the Indian iron and steel industry for private investment by (a) removing it from the list of industries reserved for public sector and (b) exempting it from compulsory licensing. Imports of foreign technology as well as foreign direct investment are now freely permitted up to certain limits under an automatic route. Ministry of Steel plays the role of a facilitator, providing broad directions and assistance to new and existing steel plants, in the liberalized scenario.

The Growth Profile

(i) Steel: The liberalization of industrial policy and other initiatives taken by the Government have given a definite impetus for entry, participation and growth of the private sector in the steel industry. While the existing units are being modernized/expanded, a large number of new steel plants have also come up in different parts of the country based on modern, cost effective, state of-the-art technologies. In the last few years, the rapid and stable growth of the demand side has also prompted domestic entrepreneurs to set up fresh green-field projects in different states of the country.

Crude steel capacity was 126.33 mt in 2016-17 (prov.), up by 3.6% over 2015-16 and India, which emerged as the 3rd largest producer of crude steel in the world in 2016 as per provisional ranking released by the World Steel Association, has to its credit, the capability to produce a variety of grades and that too, of international quality standards. The country is expected to become the 2nd largest producer of crude steel in the world soon.

(ii) Pig Iron: India is also an important producer of pig iron**.** Post-liberalization, with setting up several units in the private sector, not only imports have drastically reduced but also India has turned out to be a net exporter of pig iron. The private sector accounted for 92% of total production for sale of pig iron in the country in 2016-17 (prov.). The production for sale of pig iron has increased from 1.6 mt in 1991-92 to 9.39 mt in 2016-17 (prov.).

(iii) Sponge Iron: India, world's 2nd largest producer of sponge iron (2016, prov.), has a host of coal based units located in the mineral-rich states of the country. Over the years, the coal based route has emerged as a key contributor and accounted for 79% of total sponge iron production in the country. Capacity in sponge iron making too has increased over the years and stood at around 43 mt (2015-16).

10. Investments

Steel industry and its associated mining and metallurgy sectors have seen a number of major investments and developments in the recent past. According to the data released by Department of Industrial Policy and Promotion (DIPP), the Indian metallurgical industries attracted Foreign Direct Investments (FDI) to the tune of US$ 10.84 billion in the period April 2000–June 2018.

Some of the major investments in the Indian steel industry are as follows:

- JSW Steel will be looking to further enhance the capacity of its Vijayanagar plant from 13 MTPA to 18 MTPA. In June 2018, the company had announced plans to expand the plant's production capacity to 13 MTPA by 2020 with an investment of Rs 7,500 crore (US$ 1.12 billion).
- Vedanta Star Ltd has outbid other companies to acquire Electrosteel Steels for US$ 825.45 million.
- Tata Steel won the bid to acquire Bhushan Steel by offering a consideration of US$ 5,461.60 million.

- JSW Steel has planned a US$ 4.14 billion capital expenditure programme to increase its overall steel output capacity from 18 million tonnes to 23 million tonnes by 2020.
- Tata Steel has decided to increase the capacity of its Kalinganagar integrated steel plant from 3 million tonnes to 8 million tonnes at an investment of US$ 3.64 billion.

2.4 Demand – Supply Gap

Industry dynamics including demand – availability of iron and steel in the country are largely determined by market forces and gaps in demand-availability are met mostly through imports.

- Interface with consumers exists by way of meeting of the Steel Consumers' Council, which is conducted on regular basis.
- Interface helps in redressing availability problems, complaints related to quality.

2.5 Domestic / Export Markets

2.5.1 Import

- Iron & steel are freely importable as per the extant policy.
- Data on import of total finished steel (alloy/stainless + non alloy) is given below for last five years and April-May 2017:

Indian steel industry : Imports (in million tonnes)						
Category	2012-13	2013-14	2014-15	2015-16	2016-17*	April-May 2017*
Total Finished Steel (alloy/stainless + non alloy)	7.93	5.45	9.32	11.71	7.23	1.06
Source: Joint Plant Committee; *prov.						

2.5.2 Export

- Iron & steel are freely exportable.
- India emerged as a net exporter of total finished steel in 2016-17 (prov.)
- Data on export of total finished steel (alloy/stainless + non alloy) is given below for last five years and April-May 2017

Indian steel industry : Exports (in million tonnes)						
Category	2012-13	2013-14	2014-15	2015-16	2016-17*	April-May 2017*
Total Finished Steel (alloy/stainless + non alloy)	5.37	5.99	5.59	4.08	8.24	1.38
Source: Joint Plant Committee; *prov						

2.6 Karnataka Industrial Policy 2014-18

2.6.1 Introduction

Karnataka is one amongst the industrially developed States in the Country. The State has potential to stand out on the fore front and has been focusing on development of industries, trade and service sectors.

The State Government understands that the challenges posed due to global economic recession have to be addressed to promote economic growth of the State. A stimulus to boost economic activities needs to be given to sustain the current pace of over all development. Further, the state is endowed with rich natural resources across the State and such resources need to be optimally utilized for the benefit of local people.

Value addition to resources is one of the efficient ways of optimizing the locally available wealth. This will also help to ensure uniform spread of industries and economic activities throughout the state and will accelerate the pace of development especially in the district of North Karnataka. Through these measures, the Government would be able to readdress the serious issue of regional imbalances in development.

The state government realizes the limitation of agriculture sector to generate large scale employment to the local youths. About 56% of the state's workforce is estimated to contribute 19.13% of the GSDP. It is agreed that, the implementing sector has high potential to create maximum employment that too, to all sections and level of the aspirants. In order to provide suitable environment for investors, the state government has already enacted Karnataka Industries (Facilities) Act, 2002. Due to the progressive measure and pro-active mind set of the government, today, the Karnataka has been recognized as one of the preferred investment destination both for domestic and overseas investors.

The state government has introduced Industrial Policy 2006-11 with an aim to increase the growth of GDP, strengthen manufacturing industries, increase share of exports from Karnataka, to generate additional employment of at least 10 lakh persons in the manufacturing and service sectors, reduce regional imbalance and ultimately aim at overall socio-economic development of the state.

In the meantime, the Government of India enacted Micro, Small and Medium Enterprises Development Act, 2006 and requested all the States to provide required support and encouragement to make MSMEs more competitive. In order to make the state more attractive and investors friendly, there was a need to focus more on inclusive industrial development, comprehensive HRD programme's special attention towards development of sector specific zones, classification of Taluks according to Mr. D M Nanjundappa Committee Report, attractive package of incentives and concessions, encouragement for existing industries to take up expansion, modernization and diversification etc.

The state also understands the need to provide stimulus measures for industries to combat the prevailing financial crisis. Keeping these points in view, the state intends to formulate a new Industrial Policy with a determination to provide required platform for all the investors.

This policy is framed with the broad guiding principles of creation of employment development of backward regions and value addition to local resources.

2.6.2 Vision

To build prosperous Karnataka through development of human & natural resources in a systematic, scientific and sustainable manner.

2.6.3 Mission

- To create enabling environment for the robust industrial growth.
- To ensure inclusive industrial development in state.
- To provide additional employment for about 10 lakh person by 2014.
- To enhance the contribution of manufacturing sector to the state's
- GDP from the current level of 17% to 20% by the end of policy period.

2.6.4 Strategies

- Thrust on provision of world-class infrastructural facilities for industries with active participation of private sector/industry.
- Development of sector-wise industrial zones for optional utilization of local natural and human resources so as to minimize migration of people to urban centers.
- Simplification of land acquisition procedures with emphasis on inclusive development.
- Safeguarding the socio-economic interests of both farmers and investors while acquisition of land.
- Referential treatment for MSME sector enabling to meet the global Challenges.
- Attractive employment and performance linked package of incentives and concessions to attract investments to backward regions and also to provide leverage to MSME sector.
- Thrust on development of MSME sector through attractive package of incentives & concessions.
- Tailor made package of incentives to larger projects having wider positive implication on the state's economy to leverage a better edges over other competing states.
- Additional incentives for entrepreneurs belonging to under privileged sections of the society to bring them to the main stream in order to achieve much needed inclusive growth.
- Focus on skill development in order to enhance the employment ability of youth especially women and also to make ready-to-employ human resource to the industry.
- Inculcate entrepreneurial qualities amongst local youth in general and women in particular and motivate them to take up self employment by extending handholding support.
- Create level playing environment for all investors/private sector players by enhancing the facilitation mechanism enabling to do their business with ease and less transaction cost.
- Appropriate provision for the protection of environment and to encourage energy & water conservation measures in industry / project through go-green strategy.

2.7 Government Initiatives

Some of the other recent government initiatives in this sector are as follows:

- An export duty of 30 per cent has been levied on iron ore^ (lumps and fines) to ensure supply to domestic steel industry.
- Government of India's focus on infrastructure and restarting road projects is aiding the boost in demand for steel. Also, further likely acceleration in rural economy and infrastructure is expected to lead to growth in demand for steel.
- The Union Cabinet, Government of India has approved the National Steel Policy (NSP) 2017, as it seeks to create a globally competitive steel industry in India. NSP 2017 targets 300 million tonnes (MT) steel-making capacity and 160 kgs per capita steel consumption by 2030.
- The Ministry of Steel is facilitating setting up of an industry driven Steel Research and Technology Mission of India (SRTMI) in association with the public and private sector steel companies to spearhead research and development activities in the iron and steel industry at an initial corpus of Rs 200 crore (US$ 30 million).

2.8 Employment Generation (Direct and Indirect) due to the Project

During the construction & operation phases of the proposed expansion project, both direct & indirect deployment of local work force would be facilitated. The nature of employment opportunities would involve contractual & casual labor work for semi skilled & unskilled local skilled staff and direct employment for skilled locals.

It is estimated that there would be a requirement of around 200 casual and contract workers, during the phase of construction. Subsequently in the operation phase, approximately 500 employees would be directly employed.

Sr. No.	Units (considering 3 shifts)	No. of Employee
1	Ore Beneficiation Plant	62
2	Sponge Iron Plant	112
3	Induction Furnace	120
4	Rolling Mill	120
5	Power Plant	85
	Total	**499**

CHAPTER – 3

PROJECT DESCRIPTION

3.1 Type of Project including interlinked and interdependent projects, if any.

The proposed project is a brown field expansion project involving the expansion by adding ore beneficiation plant, sponge iron plant, induction furnace, rolling mill and captive power plant in the existing sponge iron plant within the existing land 30 Acres area available with BSPL. Land documents are enclosed as **Annexure No – 4.**

3.2 Location of the Project

The plant location has been chosen close to the industries. The site located in the Kunikere Village of Koppal Taluk & District. The average elevation 549 MSL and is geographically located at 76^{0} 11' 49.28" E Longitude & 15^{0} 19' 27.77" N Latitude. The nearest railway station is Ginigera Railway station, which is at a distance of 8 Km. the Road connectivity is through NH - 63 located at distance of 8 Km from the plant. Hence the transportation to various sites of finished products is easy and economical. Location of the Project is given in **Figure No – 1** and Google Map is given in **Figure No – 2**. Site photographs are given in **Photo No – 1**.

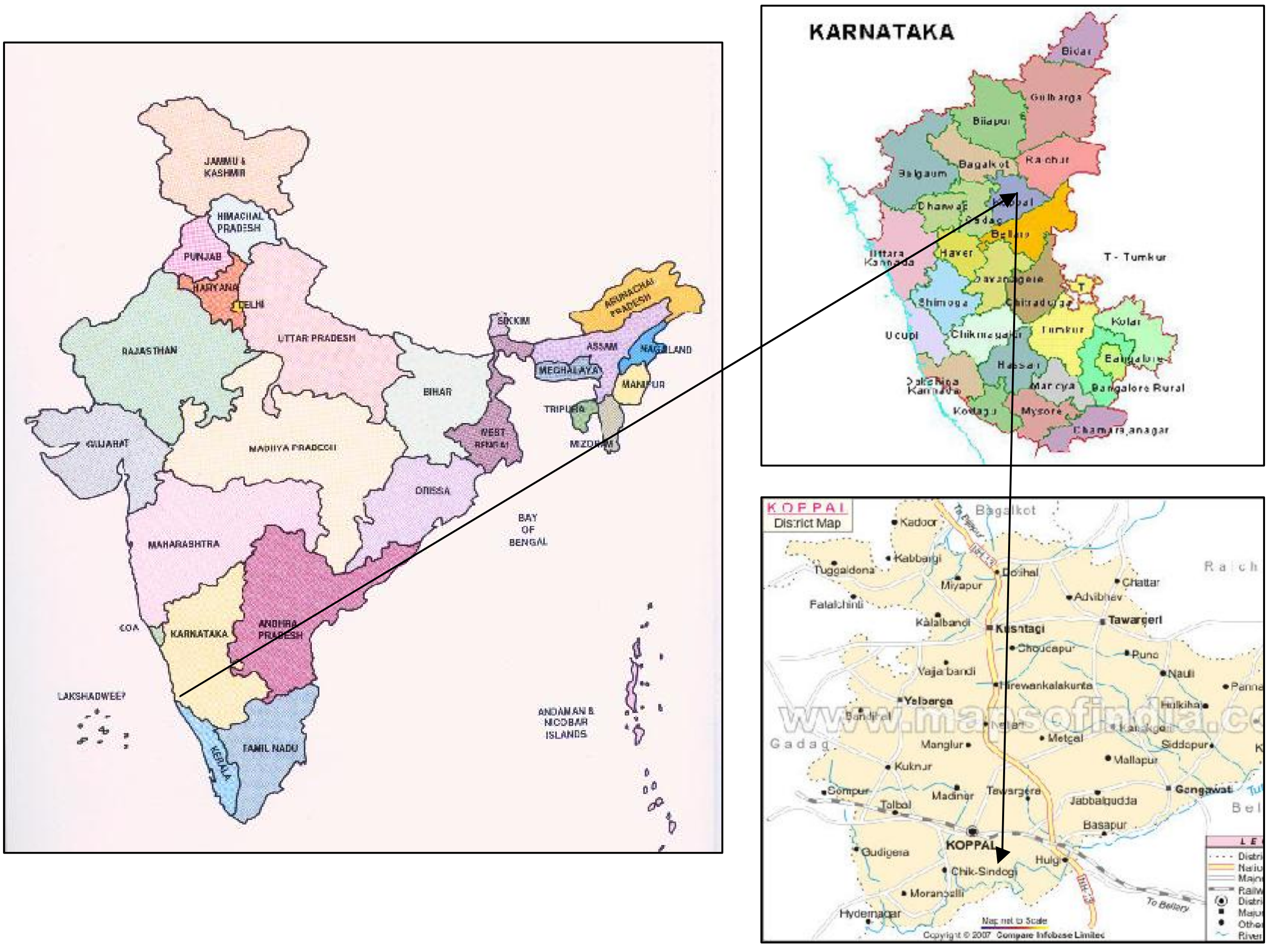


Figure No – 1: Location of the Project

Figure No – 2: Project Site Showing – Google Map

Photo No 1: Existing Sponge Iron Plant

3.3 Details of Alternate Sites Considered and the Basis of Selecting the Proposed Site

The expansion of Sponge Iron Plant is being planned by adding Beneficiation Plant, Sponge Iron Plant, Induction Furnace, Captive Power Plant and Rolling Mill. This is a brown field expansion, within the available land area of 30 acres and utilizing existing infrastructure. Hence, Alternative site was not examined.

3.4 Size or Magnitude of Operation

The proposed expansion project after its completion will facilitate in production along with value added long and flat steel products to meet the increasing demand of the customers and country`s infrastructure development. The proposed facilities will be set up within the area of about 30 acres.

3.5 Project Description with Process Details (a schematic diagram/flow chart showing the project layout, component of the project)

Plant Layout with all the component if the project is enclosed as **Drawing No – 1.**

3.5.1 Beneficiation Plant

Beneficiation process is always designed for a particular quality of feed and that too after conducting extensive laboratory tests. Since low grade ore/fines are to be procured from mines/market, there is little control on sustained quality, which is an important factor in designing an efficient & cost effective beneficiation plant.

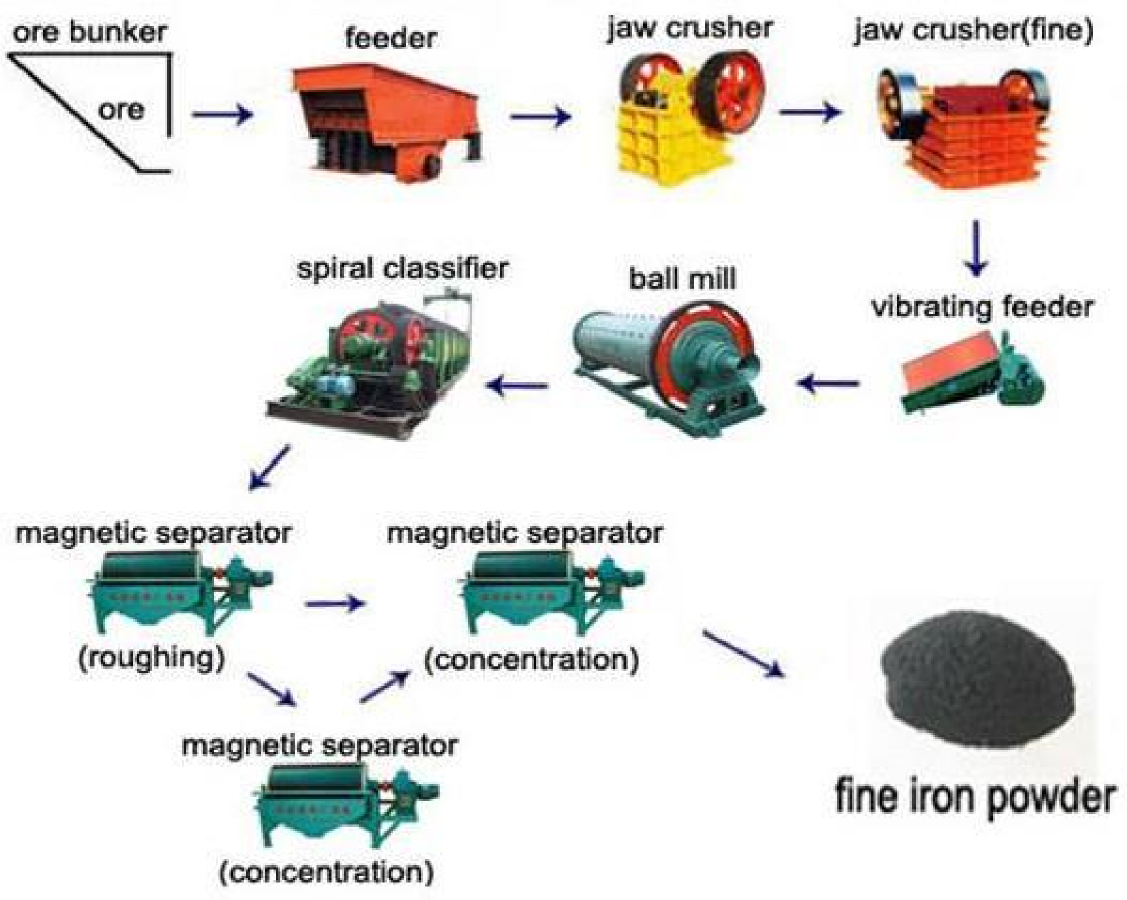
The high levels of silica and clay within this feed reduces the overall Fe value of the material which is a barrier to the cost effective use of this material in steel production for the reasons stated earlier. Therefore, any method which can remove contaminants such as silica, clay and alumina is attractive. Those who operate within the market have a long history of washing iron ore reserves as a means of improving the Fe grade of the material, thus creating greater efficiencies in production.

The washing process involves the removal of surface contaminants from the iron ore particles. The extensive research we have conducted into the nature of the feed material has shown that the highest levels of contaminants exist in the finest particle sizes. What we also know is that the contaminants are of a much lower density than the target product – silica and alumina have a much lower mass than iron. Therefore by efficiently removing the -60 micron material we will also remove a high level of silica, alumina and clay. The direct result of this is that the Fe value as a percentage of the total feed is significantly higher than before the material was washed.

The ore washing systems outlined here are specifically for the washing of the surface of the iron ore particles. It is the case that virtually all ores have residual low grade fines on the surface and therefore can be improved by the type of washing process outlined here. The results that can be achieved will be determined by the level of external contamination of the iron ore particles by the contaminants such as those outlined earlier.

This process has been proven on a number of ore washing installations throughout World and with this process the Fe value increases from 45% to 65%, which brings considerable efficiencies when the material is subsequently processed to extract the ore oxide. This process offers significant advantages for steel producers, as the commercial value of the ore is substantially increased as a result of the increase in Fe value

Iron Ore Beneficiation Process Flow chart



3.5.1.1 Physical and Chemical Characterization Studies

The size analysis of the received Iron ore sample, were carried out by wet sieving techniques to know the average particle size of the sample. The different size fractions thus obtained were subjected to chemical analysis to ascertain the different quantitative elemental composition of the sample. The complete chemical analysis of the ore and different size fractions were carried out by X-ray florescence technique and wet chemical analysis. The XRF analyses were carried out against the standard calibrated samples of similar values. The loss on ignition (LOI) of Iron ore samples was determined by igniting around 2.0 gm of sample at about 1000 C for four hours in a muffle furnace in silica crucible.

Closed sized classified samples were examined under stereomicroscope by preparing the corresponding grain slides for identification of different minerals. The X-ray diffraction studies of selected samples were also carried out using a Philips model diffract meter with CuK radiation. The bulk sample was crushed to below 1 mm size and wet sieved into different size fractions. The size fractions were mounted in resin with hardner and polished following standard procedures. The polished sections were studied under reflected light microscope and the particles of different typologies were counted.

3.5.1.2 Grinding Studies

In order to increase the grade of Iron ore and for the subsequent liberation of Iron values from the locked particles, the samples were subjected to wet grinding to generate different size particles. A standard ball mill with required weight of balls as per Bonds formula at 45% filling was used. The grinding was carried out in batch prior to different beneficiation studies. The objective is to achieve the maximum liberation of the Iron particles from the associated gangues due to reduction in size. The large-scale continuous grinding studies were also produce samples for further investigations and to establish grinding parameters. All the grinding studies were carried out at 40% solids consistency in the ball mill.

3.5.1.3 Beneficiation Studies

Beneficiation studies using various techniques such as hydrocyclone, spiral, magnetic separation, flotation etc. were carried out to develop a suitable process flowsheet as a step towards the upgradation of Iron values and to reduce the gangue content. The required separation technique was selected based on particle size and the properties for effective separation. Initially, the Iron Ore ore fines were ground to required size and then subjected to separation. The sample was ground to below 1.0 mm size for Iron Ore fines and less than 100 microns for BHQ ore.

3.5.1.4 Spiral

The spiral concentrator was used to enrich the Iron content of the classified sample (hydro-cyclone underflow). The spiral is an energy saving gravity equipment where large quantities of sample can be fed for pre-concentrations. In the spiral study, the Iron ore sample was fed to the centrifugal pump at the required solids consistency and the slurry was kept re-circulating for a predetermined time. The entire concentrate and tailings were collected after attaining the steady state. The concentrates in some cases were cleaned to improve the grade of products. All the products thus obtained were dried, weighed, and analyzed.

3.5.1.5 Wet High Intensity Magnetic Separation

The wet high intensity magnetic separator (WHIMS) and high gradient magnetic separator (HGMS) were used at different magnetic field intensities to recover the fine Iron values from the hydrocyclone over flow or spiral tailings. Both the separators have provision for different magnetic groves of width and matrix with variable currents to provide different magnetic intensities. A desired concentration of solids was passed through the magnetic separator. In some cases the magnetic products were cleaned in second stage to enhance the quality of the product from first stage separation.

3.5.1.6 Floatation

Batch flotation studies were carried out to select either direct or reverse flotation technique to optimize reagent combination and to establish the number of stages of operations. Denver D-12 sub-aeration flotation machine was used for the batch flotation studies. Both cationic (dodecyl amine) and anionic (oleic acid) reagents were used as collectors while MIBC was used as the other collector. The column flotation studies were carried out by using glass column designed and fabricated at our laboratory. The column was operated at nominal capacity of 20 kg of Iron ore fines per hour with the help of a peristaltic pump. Both the concentrate and tailings were collected separately after attaining the steady state and analyzed for Iron content.

3.5.2 Sponge Iron Plant

Generally in sponge iron process, reduction is conducted in a refractory lined rotary kiln. The kiln of suitable size generally inclined at 2.5 % slope rest on four support stations. The transport rate of materials through the kiln can be controlled by varying its slope and speed of rotation. There are inlet and outlet cones at opposite ends of the kiln that are cooled by individual fans. The kiln shell is provided with small sampling ports, as well as large ports for rapid removal of the contents in case of emergency or for lining repairs. The longitudinal positioning of the kiln on its riding rings is controlled hydraulically.

The coal and Pellet (iron) are metered into the high end of the inclined kiln. A portion of the coal is also injected pneumatically from the discharge end of the kiln. The burden first passes through a pre-heating zone where coal de-volatilization takes place and Pellet (iron) is heated to pre-heating temperature for reduction.

The product (DRI) is discharged from the kiln at about 1000°C. An enclosed chute at the kiln discharge end equipped with a lump separator and an access door for removing lumps transfers the hot DRI to a rotary cooler. The cooler is a horizontal revolving cylinder of appropriate size. The DRI is cooled indirectly by water spray on the cooler outer surface. The cooling water is collected in troughs below the cooler and pumped to the cooling tower for recycling along with make-up water. Solids discharged to the cooler through an enclosed chute are cooled to about 100°C without air contact. A grizzly in the chute removes accretions that are large to plug up or damage the cooler discharge mechanisms. The product is screened to remove the plus 20 mm DRI. The undersize a mix of DRI, Dolochar and coal ash is screened into +/- 4 mm fractions. Each fraction passes through a magnetic separator. The non-magnetic portion of the plus 4 mm fraction is mostly char and can be recycled to the kiln if desired. The nonmagnetic portion of - 4 mm fraction mostly spent lime, ash and fine char is discarded. The magnetic portion of each fraction is DRI. The plus 4 mm fraction can be used directly for steel making and the finer fraction can be briquetted / collected in bags.

The kiln waste gases at about 950°-1100°C pass through a dust settling chamber where heavier dust particles settle down due to sudden decrease in velocity of gases. The flue gases then pass through an after burning chamber where un-burnt combustibles are burnt by blowing excess air. The temperature of the after burner chamber, at times, is controlled by water sprays. The burnt gases then pass through a down duct into evaporation cooler where the temperature is brought down and through pollution control equipment namely GCT/ WHRB, ESP, Bag filter and Wet Scrapper where balance dust particles are separated. Then the gas is let off into the atmosphere through stack via ID fan.

Coal based large plant is equipped with waste heat recovery system, the flue gases after the After Burning Chamber pass through an elbow duct to waste heat boiler where sensible heat of the gases is extracted. The gas is then let off into the atmosphere after passing through pollution control equipment like ESP, ID fan and stack. In solid based processes, the non-coking coal and Pellet (iron) which are at intimate contact start reacting at the prevailing temperature.

For high Kiln efficiency the reheated zone is made as short as possible usually 40 to 50% of kiln length. Reduction begins when the charge reaches temperature in excess of 900°C when the carbon gasification reaction starts generating carbon monoxide. To maintain a uniform reduction zone temperature by burning combustibles released to form the bed, air is blown by shell mounted fans, feed air into the freeboard gas stream, through burner tube space uniformly along the length of the kiln. Air is introduced axially in to the kiln and additional combustion air is blown into the kiln through a central burning airport of the discharge end.

The solids are discharged forms the rotary kiln via transfer chute into a sealed rotary cooler. Water sprays (indirect cooling) on the cooler shell reduces the temperature of solids to about 95 °C in a non-oxidizing atmosphere.

External lifter aide heat transfer in the cooler discharge material that are continuously separated into DRI, DRI fines, non-magnetic by a system of screen and magnetic separation. Char is separated from the waste by gravity separation and utilized as Raw Material for AFBC Boiler.

The SL/RN process kilns are now equipped with nozzles for under-bed injection of about 25% of the process air in the preheating zone of kiln. The air is available for combustion of the volatile matter in the coal within the bed in the preheating zone. As a result, the length of preheating zone of the kiln is reduced because of improved heat transfer and fuel utilization. More of the kiln length can therefore be used as a reduction zone.

Reaction mechanism

$3Fe_2O_3 + CO \longrightarrow 2Fe_3O_4 + CO_2$

$Fe_3O_4 + CO \longrightarrow 3FeO + CO_2$

$FeO + CO \longrightarrow Fe + CO_2$

Thus the iron in the ore gets reduced to its metallic from. The sum total of the above a reaction is endothermic. So to carry out these reactions to completion additional source of heat is required. This additional heat is obtained by burning the coal in the gas phase, which transfers the heat to the bed material.

Coal contains sulphur in it. During the decomposition of the coal the sulphur is released in the form of Iron sulphide. During the reduction process of Pellet (iron) the sponge iron picks up sulphur by the following reaction:

$FeO + H_2S \longrightarrow FeS + H_2O$

The iron sulphide (FeS) has deleterious effect in the steel making and is to be removed. So Lime Stone is used to prevent the sulphur pick up by the sponge iron. The reaction occurring is:

$FeS + CaO + CO \longrightarrow Fe + CaS + CO_2$

All the above reactions are possible only in the presence of CO. The generation of the CO is most important reaction, which is called the Boudard reaction. The Boudard reaction is as given below:

$CO + CO_2 \longrightarrow 2CO$

The reaction is highly endothermic which is also reversible. The conditions favourable for the forward reaction i.e. the generation of CO are:

- ✓ The higher temperature favours the production of CO.
- ✓ The concentration of the reactants has to be high so that the forward reaction occurs.
- ✓ Low pressure favours the CO generation.

All the above reactions occur in the bed phase. In the gas phase the following reactions occur:

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$
$$2CO + O \longrightarrow 2CO_2$$
$$C + O_2 \longrightarrow CO_2$$

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

The product quality is defined by the degree of metallization. The degree of metallization iron is defined as the ratio of the metallic iron to the total iron present.

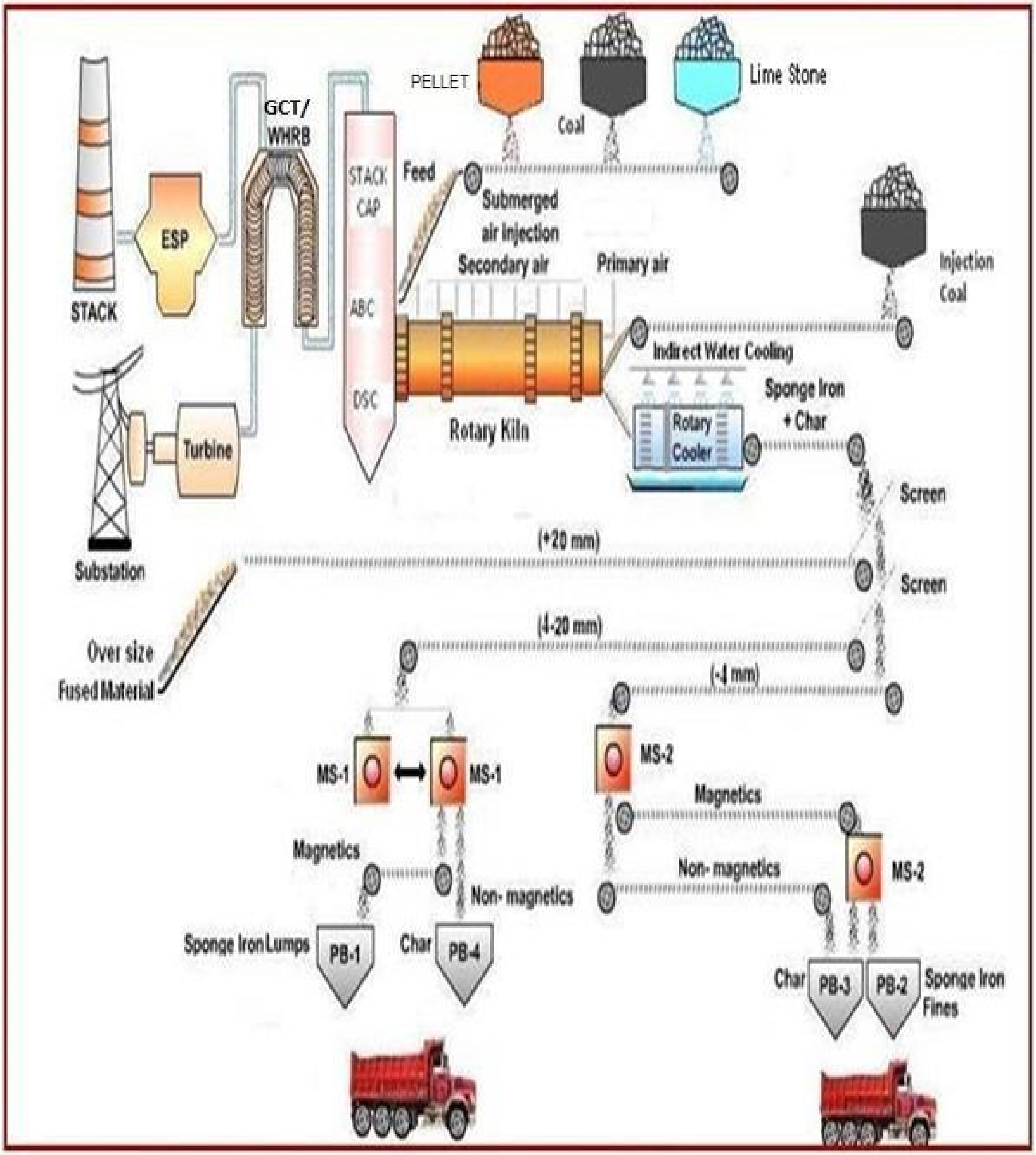
$$\text{Degree of Metallization} = \frac{\text{Fe (metallic)}}{\text{Fe (total)}} \times 100$$

The reduction of Pellet (iron) is topo-chemical i.e. the reduction proceeds from the surface in the core. The Pellet (iron) on partial reduction has all the different stages of the reduction.

The hot material, after the reduction is complete, is transferred to the total cooler via the transfer chute. The cooler is 3.2 meters in diameter and 44 meters long and made up of Mild Steel sheet. It is also inclined at 2.5% approximately. The water is sprayed on the top of the shell which cools the material inside the cooler indirectly. By this the material gets cooled to 80°-90°C. and is discharged on the belt conveyor by the double pendulum valve. The double pendulum valve acts as the seal for the prevention of the atmospheric air into the kiln cooler system.

The gases, which flow in the counter current direction of the material, go to the dust-settling chamber where the heavier particles settle down. These particles are continuously removed by the wet scrapper system. The gases then pass to the after burner chamber where the residual carbon or CO are burned by the excess air available. The gases are at high temperature and have lot of heat energy, which can be utilized for the power generation through the waste heat recovery boiler. The hot gas after the heat recovery boiler gets cooled at 150°C. The gases are then scrubbed and let of to the atmosphere at 135°C through the chimney.

Process Flow Chart



The following major areas are envisaged for the proposed Sponge Iron Unit.

a. Raw materials preparation, Storage, and handling,
b. Kiln and Cooler axis,
c. Product Separation,
d. Utility Services,
e. Waste gas Cleaning system,
f. Power Supply and Distribution,
g. Quality Control Facilities,

The raw material storage is located close to the raw material handling plant and the day bins. The kiln cooler building is also located close to the raw material handling plant. A well planned and laid out road network is proposed inside the plant connecting all the units of the plant. Provision has been kept in the layout for providing future expansion and downstream.

3.5.2.1 Raw material preparation, storage and handling

Iron Ore, Coal and sized Lime Stone would be received from the mines/ suppliers directly by road, and unloaded and stacked in the raw material yard. Raw material handling is consisting two circuits namely, Iron Ore Circuit and Coal Circuit, which containing crushing, screening, conveying and storage Coal circuit and separately conveying and storage of Iron Ore circuit.

The material would be transported by means of Tippers/Dozers and unloaded into the Ground Hoppers. Adequate weighing facilities would be provided for all the incoming materials to the storage yard and outgoing materials from the storage yard.

3.5.2.2 Vibrating Feeders

All vibrating feeders shall be of electro-mechanical design driven by unbalanced motors. The vibrating force shall be generated by rotation of eccentric mass of motor. The length, width, slope etc., of the pan shall be so selected that material from the storage bin do not flow out when the gate is open but the feeder is not in operation.

3.5.2.3 Belt Conveyors

The selection and design of belt conveyors shall generally be guided by Indian standards unless otherwise stated in the specification.

The belt conveyors shall be designed such that similar components of various belt conveyors are interchangeable to the extent feasible. Special emphasis shall be given for standardization of belt, pulley, idler, bearing, drive unit components i.e. motor, coupling, gear box and brake/hold back. All components of the belt conveyor shall be designed for starting with material (corresponding to design capacity) of belt.

3.5.2.4 Vibrating Screen

All linear motion vibrating screen shall be of unbalanced motor driven type design and of adequate size to achieve desired separation of materials.

The screen body shall be fabricated from steel plates and structural of adequate strength. All welded parts shall be stress relieved and all holes shall be drilled. Sharp edge on the screen body shall be avoided and adequately reinforced at supporting points where vibrating mechanism is connected. It shall be provided with suitable back plate at feed end to prevent spillage of material. The screen shall be supported by adequate number of springs to give rigidity to the equipment preventing minimum transmission of dynamic force to the supporting structure. The spring shall have uniform spring constant throughout its operating range.

The material of screen cloth shall be selected based on type and physical properties of materials to be handled. The clamping arrangement for screen cloth shall be suitable to retain proper tension and also to allow easy replacement of screen clothes.

3.5.2.5 Crusher & Screen House (Coal)

From ground hopper Coal is conveyed to Coal Crusher & Screen House for crushing & screening here there are two stage crusher viz. Primary & Secondary and two screens Raw Coal Screen & Crushed Coal Screen. The sized Coal is conveyed to Surge Hopper and oversize Coal is carried to Junction House through return conveyor, which is again feed to Coal Crusher & Screen House.

3.5.2.6 Stock House

From Surge Hopper raw material is being brought to the Day Bin or Stock House housing for storing various raw materials like Coal, Pellet (iron) & Limestone the bunkers shall be designed to store 1 day requirement to feed into kilns. It is recommended to fill all the bunkers by 90% of its capacity.

3.5.2.7 Weigh Feeders

Weigh Feeders are provided below the raw material bins for weighing. So, that predetermined quantities of Pellet (iron), Coal and Limestone from the bins shall be conveyed to the Kiln Feed Building by means of feed conveyor.

3.5.2.8 Kiln & Cooler Axis

The raw material from Stock House is being feed into the Kiln from inlet through Feed Tube. A portion of fine coal will be injected from the discharge end of the kiln using rotary air lock feed and coal throw pipe. The coal is injected with the air supplied by Twin lobe Compressor specially designed for this purpose.

3.5.2.9 Kiln

The kiln can be divided in three zones i.e. Kiln Inlet Zone (Pre Heating Zone), Reaction Zone & Kiln Outlet Zone. Inside the kiln, the raw materials would be dried and heated to the reduction temperature of approx. 1000° C. Reducing carbon monoxide inside the kiln would reduce the iron oxides of the ore to metallic iron. The heat required for the process would be supplied by controlled combustion of carbon monoxide and volatile matter available in the coal. Thermocouples would be located along the length of the kiln shell for temperature measurement in various zones. The temperature would be regulated by controlling the amount of combustion air admitted from Air Tubes provided at particular location on the Kiln through Shell Air Fans mounted on the kiln shell which is driven by speed controller Dampers.

A variable speed Twin Main Drive has been provided to rotate the kiln at desired speeds. For initial starting and during emergency operation an Auxiliary Drive has been provided which would rotate the kiln at a lower RPM.

3.5.2.10 Cooler

A horizontal rotary Cooler is where indirect Cooling of Sponge Iron takes place. Inside indirect cooling through water-cools the Cooler Sponge Iron & Char. Water is spread over the cooler and water is collected in pond below the cooler. Water is re-cycled after cooling down. A Cooling Tower is also provided near the water sump to cool down the water collected below the Cooler.

At outlet of Cooler a double pendulum valve is provided to take care & to prevent false air entry to avoid re-oxidation. The rpm of cooler is directly proportional to the retention time required.

3.5.2.11 After Burning Chamber (ABC)

ABC (after burning chamber), it is located at kiln inlet. Its main function is to allow waste gases to pass through it. After reaction gets completed inside the kiln, waste gases passes through ABC. Additional air is injected inside the ABC through ABC Fans so as to convert balance CO (carbon monoxide) present in the gases, to get converted into CO (Carbon di-oxide). During this process temperature of gases becomes high, to reduce the temperature atomized water is sprayed with the help of Water Nozzle & high pressure pump on the waste gases and dust get settled at DSC (Dust Settling Chamber).

3.5.2.12 Dust Settling Chamber

Any coarse, mechanically entrained dust particles are separated from the kiln off-gas stream in a spacious dust settling chamber by reducing the gas velocity.

The first dust settling chamber hopper collects kiln fee material penetrating through the small gap between the rotating kiln and the stationary retaining wall. The material is discharge via a motorized double pendulum flap. Kiln back flow material is collected in the second hopper and discharged via a double pendulum valve. Any coarse dust particles and the ash of the after combusted waste gas are collected in a third hopper and led via a chute to the wet scraper.

3.5.2.13 Product Separation

Finished Product (Sponge Iron / DRI) are conveyed through conveyor form CD Building to Product Housing. And it is separated from Coal Char. And ultimately stored and dispatched form Bunkers provided in PSB.

3.5.2.14 Product Separation Building

The product consisting of Sponge Iron (Lumps and fines) & Coal Char. which has to be screened through Product Screen so, that lumps & Fines gets segregated. Then Lumps are passed through Belt Type Concentrator (Lumps) and fines through Belt Type Concentrator (Fines) thus the product is separated to their sizes and then stored in the

Hoppers respectively. Magnetic fraction will be conveyed to Sponge Iron Storage Bin. The non-magnetic fraction will be stored in Char Bin. Here there are enough Hoppers are provided for Lump Sponge Iron, Sponge Iron fines & Coal Char for storage purpose. After the product is being separated they can be directly loaded to the Trucks.

3.5.2.15 Utility Services

Water: Water will be required for cooling of Sponge Iron cooler and quenching and scrubbing unit of air pollution control system of kiln emission. Water will also be required for human consumption for drinking & sanitary usages. To economize the water consumption rate, reuse of water after the process of cooling is also necessary, Water recycling system may be for re-circulating of industrial water required mainly for Sponge Iron cooler and pollution control device.

Compressed Air: Compressed air will be required for operation of pneumatic equipment and tools, pneumatic actuators for chutes and gates in material handling system, control instrumentations and in bag filter of air pollution control system for cleaning of bags, other miscellaneous purposes including cleaning and de-dusting process.

Waste Gas Cleaning System: The waste gases from ABC will then pass through a GCT/WHRB, where the temperature of waste gas will get down from 950-1100°C to 180° – 220° C with the help of GCT/WHRB. These gases from GCT/WHRB is then passed through ESP (Electro Static Precipitator) where the excess dust is settled down and clean air is blown into the atmosphere through Chimney with the help of I. D. Fan.

Power Supply and Distribution: The Power shall be made available at plant site by Electricity Board; Power received would be stepped down to 0.433 kV by means of (33 KV) / 0.440 KV. The transformer for DRI plant located nearby DRI Plant and would be fed into the low tension switch board.

Power Factor Correction: Capacitor bank of adequate rating would be connected to the 0.43 KV switch board to improve the overall plant power factor 0.85 to 0.90.

Transformer: The transformer would be mineral oil filled with suitable cooling. It would be designed for temperature rise not exceeding 45° C in windings and 35° C in oil over ambient temperature.

Diesel Generator Set: Diesel Generator Set is standby arrangement to cope up the Power failure. Otherwise because of Power failure all the supporting equipment's through which Kiln parameters like temperature & draft being maintained shall get disturbed. To restore the same it takes time, and during the period quality of the product gets deceased. That's why we kept an arrangement of Diesel Generator to operate the plant without loss of production whenever there will be a power failure from State Electricity Board.

Control Room: A centralized control room would be provided with metering and control instruments besides interlocking and protection schemes. The room will be centrally air-conditioned.

Cabling: Power inside the plant would be distributed by insulated cables, which would be generally laid underground. The cables used for LT power distribution would be of 1100V grade, heavy duty with Copper / Aluminium conductors.

Electric Drive Control Room:

Drives: AC / DC motors will normally be used in all areas of plant except in places where the speed control and torque requirements call for DC motors like the kiln/cooler drive. In all other cases, squirrel case induction motors have been considered. The motors would be suitable for direct on line starting with full voltage on.

Controls: The control systems would be confirmed as a distributed hierarchical concept with the following three control levels.

- Individual drive control level
- Functional group control level
- Technological plant control level

For this purpose the contactors and relays techniques would be adopted for individual drive control at the bottom level in hierarchical structures. These will essentially take care of the connection (ON), disconnection (OFF) and individual error signalling of a drive.

Earthing and Lightning Protection: All electrical equipment would be provided with two distinct earth connections as per electricity rules. A ring main earthing system shall be provided for each shop/unit for this purpose. All buildings would be provided with necessary lightning protection arrangements. GI strips/ flats and GI electrodes will be used for earthing and lightning protection.

Illumination: The illumination level envisaged for the different areas indoor and outdoor will be as per international norms for industrial production units to ensure comfort and safety. High pressure, coloured vapour /sodium vapour lamps with reflectors will be used for high bay lighting and road lighting. Flood lighting will be used for open storage areas. Florescent lamps with reflector/enclosures will be used for low bays of production departments, office building, control rooms, electric rooms, laboratory and stores. Emergency lights along with batteries will be provided for strategic units and control rooms to ensure safety.

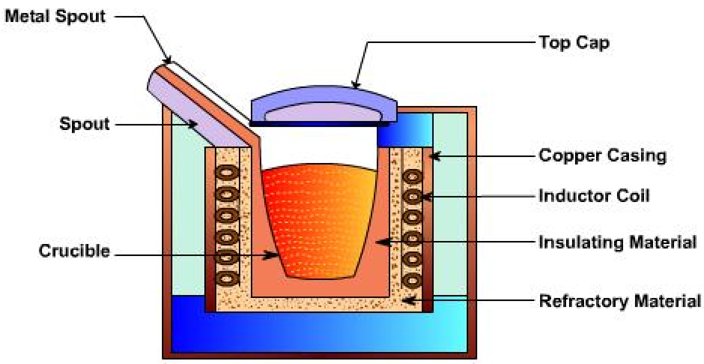
3.5.3 Steel Melting Shop (SMS)

Induction melting is a melting method. The melting by the induction method occurs when an electrically conductive material is placed in a varying magnetic field. Induction melting is a rapid form of melting in which a current is induced directly into the part being heated. Induction melting is a non-contact form of melting.

The melting system in an induction furnace includes:

- ✓ Induction melting power supply,
- ✓ Induction melting coil,
- ✓ Water-cooling source, which cools the coil and several internal components inside the power supply.

The induction melting power supply sends alternating current through the induction coil, which generates a magnetic field. Induction furnaces work on the principle of a transformer. An alternative electromagnetic field induces eddy currents in the metal which converts the electric energy to heat without any physical contact between the induction coil and the work piece. A schematic diagram of Induction Furnace is shown in adjacent figure.



The furnace contains a crucible surrounded by a water cooled copper coil. The coil is called primary coil to which a high frequency current is supplied. By induction secondary currents, called eddy currents are produced in the crucible. High temperature can be obtained by this method. Induction furnaces are of two types: cored furnace and coreless furnace. Cored furnaces are used almost exclusively as holding furnaces. In cored furnace the electromagnetic field heats the metal between two coils. Coreless furnaces heat the metal via an external primary coil.

Manufacturing Process

The process of manufacturing billets from raw materials such as Scrap, Pig Iron and Sponge Iron can be broadly classified as:

- Melting of Raw material in Induction Furnace
- Working up of the molten metal to the required grade & quality of steel
- Casting of molten metal onto the Continuous Casting Machine

Melting of Raw-material

(a) Selection of Raw-material

The input materials for the Medium Frequency Induction Melting Furnace are sponge iron, pig iron/cast iron, scraps and consumables like ferro silicon, ferro manganese, silico manganese, aluminium shorts, etc.

(b) Charging and loading of raw material into furnace

The raw materials are stored right next to the furnace for easy of operation. They are weighed in the right proportion and charged into the furnace by using an electro magnet attached to an overhead crane. This ensures lifting of sizable amount of material which saves time, energy and cost. The crane used is called an E.O.T Crane. It replaces the need and dependence on manpower.

An induction furnace is the cheapest and is used in mini steel plants very economically. In an induction furnace, certain inclusions like Carbon and Ferro-alloys can be added to the molten metal for producing good quality of steel.

3.5.4 Induction Furnace

The process of manufacturing billets from raw materials such as sponge iron, pig iron and scrap can be broadly classified as:

1. Melting of Raw material in Induction Furnace.
2. Transfer of molten metal into Ladle Refining Furnace.
3. Casting of molten metal onto the Continuous Casting Machine.

1. Melting of Raw-Material

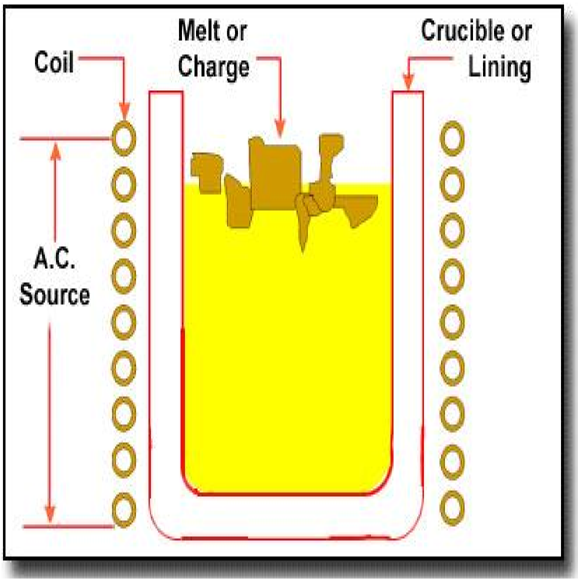
(a) Selection of Raw-material

The input materials for the Medium Frequency Induction Melting Furnace are sponge iron, pig iron, scraps and consumables like ferro silicon, ferro manganese, silico manganese, aluminium shorts, etc. To get a ton of finished product about 0.750 tons of sponge iron, 0.200 tons of pig iron, 0.100 tons of scraps and about 0.025 tons of consumables are required.

(b) Charging and loading of raw material into furnace

The raw materials are stored right next to the furnace for easy operation. They are weighed in the right proportion and charged into the furnace by using an electro magnet attached to an overhead crane. This ensures lifting of sizable amount of material which saves time, energy and cost. The crane used is called an E.O.T Crane. It replaces the need and dependence on manpower. For the proposed plant, 10 EOT cranes shall be required to handle different functions besides charging of materials into the furnace; to handle the ladles, remove the billets, etc.

(c) Selection of Furnace:



There are three types of furnaces that are available for melting of scrap into steel. These are - a rotary electric furnace, an electric arc furnace and an induction furnace.

A rotary furnace is mostly used for melting pig iron and gray casting. An Electric Arc Furnace is highly competent equipment for the purpose of steel melting. It not only can melt efficiently but also allows time for analysis of the molten metal and effect adjustment in the constituents of the molten metal. However Electric Arc Furnace is an expensive equipment and unsuitable for small operations. This equipment is therefore used in case of manufacturing special quality steel. It is not economical in case of mini steel plants. An induction furnace is the cheapest and is used in mini steel plants very economically. In an induction furnace, certain inclusions like carbon and ferro-alloys can be added to the molten metal for producing good quality of steel.

An induction furnace is highly sophisticated equipment consisting of a crucible with a lid. The coreless induction furnace is composed of a refractory container, capable of holding the molten bath, which is surrounded by water cooled helical coil connected to a source of alternating current. Figure shown is a simplified cross section of a coreless induction furnace. The principle of operation of the induction furnace is the phenomena of electro-magnetic induction. Heat is generated by the induction of medium frequency electricity. The induction (generation) of the electrical current in a conductive metal (charge) placed within a coil of conductor carrying electrical current is known as electromagnetic induction of secondary current. The alternating current applied to the coil produces a varying magnetic field which is concentrated within the helical coil. This magnetic field passing through the charge induces secondary current in the charge piece. The current circulating in the charge produces electrical (I^2R) losses which heat the charge and eventually melt it. The furnace is equipped with the necessary control panel, which receives electrical power at normal 50 Hz frequency and converts the same to DC power (This process is called Rectification or Conversion). The DC power generated is again converted to AC power (This process is called Inversion) of medium frequency, which induces the heating effect to the furnace. In addition to the control

panel, the entire furnace system is thoroughly cooled for protection. A separate water supply system along with cooling tower is installed to feed the furnace continuously with dematerialized cool water. The furnace can also be tilted to pour out the molten metal. The inside surface of the crucible is normally coated with castable ceramics and fire clay in intervals of 7 days. This practice protects the crucible and gives a longer life to the furnace. The proposed plant shall have 2 furnaces of 12 tons of melting capacity each per heat. Each furnace will be subjected to about 14 heats per day.

d. Melting Process

The furnace crucible is charged with the requisite quantity of scrap and sponge iron and the lid are put on. Power is introduced and the furnace gets hot and the steel starts to melt. Heating is continued till the entire metal mass melts to liquid state. At this stage, a little time is available for adding inclusions like ferro alloys and carbon, if necessary. A sample of molten metal is sent to the laboratories for analysis. Based on the analysis report, ferro alloys and other alloys materials are added after proper weightment. The temperature of the metal bath will be adjusted suitably by adjusting power into the furnace to ensure proper mixing of alloys in the bath. After sometime, when the metal bath has reached the appropriate temperature, sample is send to the laboratories and the process is repeated till the desired is quality is obtained. The molten metal is now ready for pouring into the moulds.

In the process of heating, the furnace crucible is charged with the requisite quantity of sponge iron and other materials and the lid is put on. Power is introduced and the furnace gets hot and the steel starts to melt. Heating is continued till the entire metal mass melts to liquid state. This molten metal is then poured onto ladles and carried away to be deposited in the Ladle Refining Furnace (LRF).

2. Ladle Refining Furnace and Quality Control

Ladle Refining of liquid is a proven technology to obtain clean steel. A Ladle Refining Furnace or LRF is a very crucial component in a continuous casting set-up as is required in this project. Regarding the ladle, it traditionally has been employed as a transfer vessel, moving heats of steel weighing 20 to 350 tonnes from the Steel making furnace to the continuous casting machine. In this project a ladle of 15 ton capacity shall be used. However, increasingly the ladle is being used as a reactor in ladle furnaces or ladle-treatment stations, installed between the steelmaking furnace and the caster. In these operations, the composition and temperature of the steel can be adjusted to meet final specifications. In this way, the productivity of the steelmaking furnace can be increased, since its primary functions are reduced to melting scrap and decarburization.

A Ladle Furnace is used to relieve the primary melter of most secondary refining operations, and its primary functions are;

- ✓ Reheating of liquid steel through electric power conducted by graphite electrodes.
- ✓ Homogenization of steel temperature and chemistry through inert gas stirring.
- ✓ Formation of a slag layer that protects refractory from arc damage, concentrates and transfers heat to the liquid steel, trap inclusions and metal oxides, and provide the means for desulphurization.

Secondary functions that can be included with a ladle furnace are:

- ✓ Alloy additions to provide bulk or trim chemical control.
- ✓ Cored wire addition for trimming or morphology control.
- ✓ Provide a means for deep desulphurization.
- ✓ Provide a means for dephosphorization.
- ✓ Act as a buffer for down stream steelmaking equipment.

The function of the porous plug is to provide gas stirring of the molten metal to promote homogenization. Normal stirring operations are performed by percolating argon gas through a purge plug arrangement in the bottom of the ladle. A top lance mechanism serves as a back up means for bath stirring in the event the plug circuit in the ladle is temporarily non-operational. The gas supply connection to the ladle is automatically made when the ladle is placed on the transfer car. Fumes and particulates generated during heating and alloying operations at the LF will exit the water-cooled ladle roof through the various openings in the roof. These emissions will be captured (i.e. entrained) in ambient air drawn into a lateral draft type fume collection hood mounted on supporting structures above the ladle roof. The ladle roof is typically a water-cooled design with a refractory center or delta section and is configured to coordinate with existing ladles such that the roof will completely cover the top portion of the ladle when in the operating (i.e. fully lowered) position.

In transferring steel from the steelmaking furnace to the caster, a major problem is oxygen absorption from the air, furnace slag and the ladle refractory lining. Thus, as the demand for steel quality increases, steps have been taken in many operations to minimize oxygen pickup during each transfer step. Slide-gate valves have been attached to the tap hole of the steelmaking furnace to shut off the flow of oxidized furnace slag into the ladle at the end of the tapping operation. In some electric furnaces, the taphole has been located eccentrically at the bottom of the furnace to facilitate the containment of furnace slag and the attachment of a refractory pouring tube to protect the steel from the air during transfer into the ladle. The surface of the steel in the ladle is covered with a synthetic slag, again to prevent oxygen absorption from the air and also to absorb nonmetallic inclusions and to minimize heat losses. In some operations the ladle is covered with a lid. Finally, when located over the casting machine, the ladle is usually equipped with a refractory pouring tube to prevent oxygen pickup as the steel is poured into the tundish. Flow of steel from the ladle to the tundish is controlled with a slide-gate valve, and in some operations the weight of the ladle is continuously measured with load cells.

Generally, the inert gas is injected into the steel in the ladle prior to its transfer to the caster, either to inject alloy additions or to homogenize the steel temperature. The latter is necessary because temperature control, as mentioned earlier, is vital to the control of the cast structure and, moreover, to the prevention of operating problems such as the formation of large skulls in the ladle and tundish if the steel is too cold, or breakouts of molten steel below the mold if the steel is too hot. The flow rate and duration of injection must be controlled since the gas discharging from the steel brings it into contact with air unless special measures are taken.

Thus, in transferring the steel from the furnace to the caster, there are opportunities to control the cleanliness, composition and temperature of the molten metal. In some operations these opportunities are not seized, so that the steel delivered to the casting machine is dirty and too hot or too cold. Then the achievement of quality in the cast product is a much more difficult task.

3. Casting on the Continuous Casting Machine

In the process of steel making, the molten metal is further heated to a particular temperature, to give it a stirring effect, so that the non-metallic parts which are lighter that the metal float forming a slag. After controlling the composition and temperature, and removing non-metallic inclusions, the molten steel is transferred into a ladle and poured into a mould, where it solidifies to produce semi-finished or finished products. In the past, the ingot casting and rolling (slabbing, blooming, or billeting) processes were commonly used. In this process, the molten steel was poured into many fixed cast-iron ingot moulds and, when the solidification was complete, the ingots were taken out, reheated, and rolled by a slabbing, blooming (known as Primary Mills), or billeting mill (known as Secondary Mills). This is basically a batch process.

The concept of continuous casting process, has now virtually replaced this earlier method. In continuous casting, the molten steel in the ladle is poured into an intermediate vessel (tundish), released into a hollow water-cooled copper mould, and continuously withdrawn from the bottom of the mould as a shell begins to form around the molten metal. The reasons for this change include: (i) the reheating and slabbing process can be done away with, because the cast strand has a near-net shape similar to that of the semi-finished product; (ii) the yield is much higher because the continuously cast strand has only two small end portions, in contrast to the tops and bottoms which must be cropped from every ingot; (iii) solute element segregation and non-metallic inclusions are much lower; and (iv) advanced technologies have improved the productivity and surface quality of the cast pieces greatly, to such an extent that productivity has become compatible with that of the converter and hot rolling processes, thus providing balanced continuity among these processes.

The continuous caster allows a cast strand to be withdrawn at high speed (1.5-2.8 m/min) from the mould in the form of a core of molten steel encased by a thin solidified shell. This high withdrawal speed ensures that casting productivity is matched to that of the converter. As the cast strand descends from the mould, its surface is cooled by a water spray or water mist, and the thickness of the shell increases progressively as the material solidifies. However, the ferrostatic pressure of the molten steel rises at the same time. The cast strand is therefore supported by rolls so that the solidified shell does not bulge. If the solidified shell is deformed due to thermal strains or ferrostatic pressure, cracks form on both the surface and in the interior due to the low ductility and low strength of the shell at high temperatures. An analysis of heat transfer between the molten steel/solidified shell/mould or spray is necessary to increase productivity and prevent deformation and cracking. In addition to this analysis, it is imperative to analyse stress, strain, and deformation in the solidified shell when it passes through both the mould and the support rolls. Progress has been made in the analyses of the heat transfer, elastic-plastic thermal stress, and creep-behaviour of the cast strand by use of the finite difference and finite element method, and various computational programs simulating these phenomena have been developed. The measurement of the dynamic behavior of steel at elevated temperatures necessary for such computations has also been carried out.

The continuous caster is composed of a tundish, a mould, a mould oscillator, a group of cast-strand supporting rolls, rolls for bending and straightening the cast strand, rolls to pinch and withdraw the cast strands, a group of spray nozzles, a torch cutter for cutting the cast strand, a dummy bar for extracting the cast strand at the start of casting, and other components. The continuous billet caster casts round or square strands of small cross-section, and the continuous bloom caster casts strands of large cross-section. Both are used to produce materials for long products such as wire rod, bars, shapes, and pipes. The continuous slab caster produces wide rectangular strands of large cross-section, which are cut off as slabs for use as material for flat products such as sheet and plate. Slabs for flat-rolled products are usually cast with a thickness of 100 to 250mm. In recent years, however, continuous casters which produce thinner slabs 30-80mm in thickness have been introduced. The thin slab caster eliminates the need for a roughing mill in the hot-rolling process. However, the steel throughput is limited to 1 million ton/year per strand in this process by the thin slab thickness even at higher casting speed, which is currently limited to about 7m/min. Consequently, the thin slab caster is usually combined with an electric furnace of matching output. This combination has been favorably adopted by mini steel plants.

The types of continuous casters include: (i) the vertical type, in which the mould and support rolls are arranged vertically; (ii) the vertical-and-bending type, in which the solid shell of the cast strand is bent in the horizontal direction at the position where solidification is sufficiently complete; (iii) the curved type, in which a curved mould and support rolls are arranged on an arc of the same radius, and the cast strand is straightened horizontally at the end of solidification; (iv) the vertical-and-progressive-bending type, in which the mould and a group of upper support rolls are arranged vertically and the cast strand still with a liquid core is progressively bent, and then progressively straightened to the horizontal position at the end of solidification; and (v) the horizontal type, in which the mould and support rolls are arranged horizontally. The vertical type is used to cast high-grade steels because it promotes the separation (by flotation) of nonmetallic inclusions poured into the mould, although the construction of the caster building becomes tall and hence expensive. The curved type is mainly applied for mass production of conventional products, because building costs can be reduced by the lower height. The vertical-and-progressive-bending type, which combines the advantages of the vertical and curved types, is being used increasingly for large sized slab casters which require improved quality and productivity. The horizontal type is used to produce billets on a small scale because the equipment and the building costs are comparatively low.

The productivity and yield that are so important for operating a continuous caster can be markedly improved by casting many heats continuously without interrupting casting. This is called continuous-continuous casting or sequence casting, and has the advantage of eliminating the need for preparations for starting the casting over and over again. Consequently, productivity is increased and the amount of the cast strand which must be cropped at the initial and final casting positions due to poor quality is decreased. Techniques have been developed for sequence casting, which allow the mould width to be changed and different steel grades to be cast without interrupting casting operations. These allow more than one strand of different width and grade to be cast continuously without interruption.

The sequence of the casting operation starts with inserting the dummy bar into the mould to seal the bottom end. Molten steel is then poured into the mould from the tundish while taking great care to prevent contact with the air. The withdrawal of the cast strand is started by pulling the dummy bar downward. The molten steel flowing into the mould is rapidly cooled and forms a thin solidified shell composed of fine granular crystals on the surface and an array of fine columnar dendrites inside. The solidified shell becomes thicker due to the growth of columnar dendrites as it descends through the mould. A lime silicate flux is added to the molten steel surface in the mould to prevent heat loss from the molten steel surface and absorb non-metallic inclusions as they surface. This flux also infiltrates between the mould and the cast strand, and provides lubrication which also prevents sticking of the cast strand to the mould during the oscillation of the mould. At the same time, the layer of mould flux between the steel and mould reduces heat transfer and avoids a rapid decrease in the temperature and resulting deformation and crack formation of the strand.

Surface defects are formed on the cast strand when the level of the steel bath fluctuates in the mould. The level is therefore measured with a sensor and kept as constant as possible by controlling the flow rate of molten steel from the tundish. Electromagnetic braking of the melt flow in the mould is now a representative technique for meniscus level control. The cast strand, which still contains unsolidified molten steel, exits the mould and is withdrawn downward while being supported by a group of rolls and water-cooled with the sprays. During this process, columnar dendrites continue to grow, and equiaxed dendrites are finally formed to complete solidification. At this time, the solidified shell is subjected to high thermal strain, shrinkage, and transformation caused by cooling, and to ferrostatic pressure. Since the hot solidified shell is substantially lower in strength and toughness, the cast strand is susceptible to surface and internal cracks. Consequently, during spraying the cooling pattern is carefully controlled to prevent the growth of cracks due to strain while ensuring solidification by cooling. This pattern control involves controlling the intensity of the water-mist spray along the width wise and drawing direction of the cast strand as required by the steel grade. Reduction is then applied to the cast strand at the crater bottom to reduce centre segregation. After cutting to length with gas torches, the cast piece, or slab, is delivered to the hot-rolling process.

Casting Process: Liquid steel taken into ladle is refined at LF is placed over the turret arm and ladle SG is fixed. Then one shroud is fixed at the bottom of the ladle collector nozzle so that no stream of liquid steel comes in contact with the atmosphere and no spillage occurs. This liquid steel gradually fills the tundish and from there liquid steel leaves tundish nozzle through SEN into the mould. Initially steel rests on the DUMMY BAR head on which some chillers are placed to get the liquid steel freeze/solidifies quickly then the m/c starts & casting powder is to be sprayed continuously at a certain mould level. The process continues after the DUMMY BAR head is disconnected as it reaches at its particular position. Length of the slab/billet is maintained by using cutting torch/ shearing blades.

Schematic of Induction Furnace Process: Conceptual Scheme of Induction Furnace Process arrived at by the Company based on Test Results on Samples.

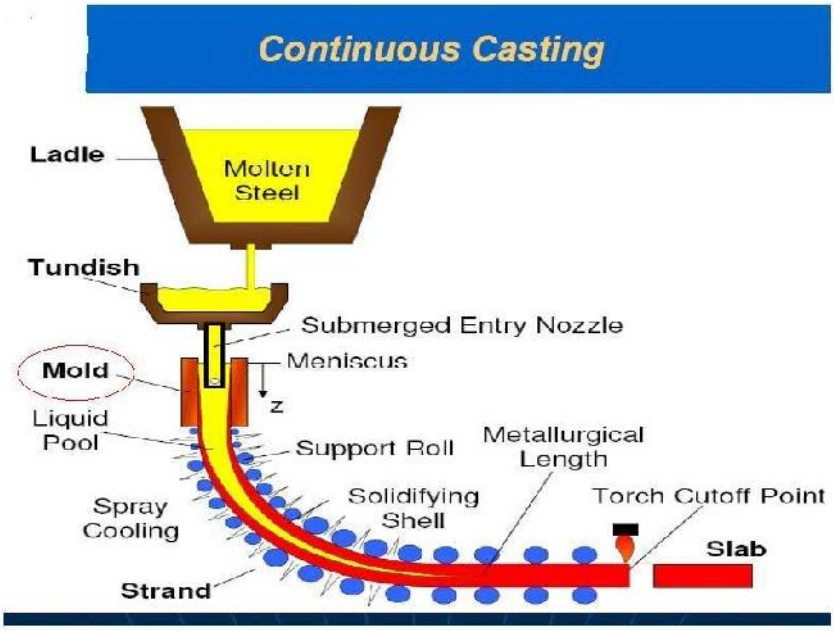


Fig.: Process Flow Chart – Induction Furnace

Continuous Casting of Billet: Continuous casting has emerged as a tool for increasing productivity and improving quality of billets in the steel industries over the past decade. The main advantages associated with continuous casting process are:

- Improved yield by 10% to 12% and reduced the production cost by over 20% over the conventional ingot-casting route.
- Less manpower due to fewer production steps in the way from molten metal to finished product.
- Possibility of fully continuous and highly automated operation.

  Because of these inherent merits, the popularity of CC is steadily rising along with improvements in product quality and leading to find application in areas, which were earlier reserved for ingot casting.

Billet sections are the most widely used primary material in the production of ultra-clean, high strength carbon wire, special forgings, cutting-edge automo-tive engineering steel, ball-bearing steel and stainless steel products. The high quality of Billetss produced using SMS Concast Billet casters ensures fine steel products with the very best properties. The same applies if the final products have large dimensions, such as axles for trucks, crankshafts, springs, rails, or power-generation shafts. Rectangular Billet sections can be up to 600 mm in width and up to 450 mm in height. Billet casters can be built with up to eight strands and a typical machine radius of between 10 and 18 m, or even as fully vertical casters.

Round Billets feature the most homogeneous cross section in terms of both temperature distribution and internal structure. As with rectangular Billets, round Billet casters can be designed for up to eight strands. SMS Concast supplies curved casters for round Billets with a diameter of up to 1000 mm.

Process Description

The molten metal obtained from above process is taken in refractory lined metal ladle. After undergoing any ladle treatment, such as “S” removal and gentle stirring with nitrogen or argon gases to degassing, removing inclusions and alloying, the ladle is shifted to the top of the casting machine. Usually, one or more ladles sit in the slots in a rotating turret on top of the casting machine; one ladle is casting while the others are made ready, and are switched to the casting position once the first ladle is empty.

From the ladle, the hot molten metal is transferred via a refractory shroud to a holding vessel called tundish. The tundish allows a reservoir of metal to feed continuously the casting machine and also acting as a buffer of hot metal while ladles are switched, as well as smoothing out flow, regulating metal feed to the mould and cleaning the metal. Liquid steel is poured from the tundish through another nozzle into water cooled and vertically oscillating copper mould tubes and continuously withdrawn from the bottom of the mould at the casting speed. The liquid steel in mould is generally controlled by metering nozzle or stopper rod in the tundish or through slide gate system Casting powder or rapeseed oil also added on the top of the metal in the mould to prevent sticking and to trap any slag particles, oxides, scale etc.

In the forced water cooled mould the metal layer next to the mould walls solidifies before the central portion of the metal, (here after called strand) exits the base of the curved mould into a spray chamber. In this stage the bulk of the metal within the solidified shell of the strand is still molten. The exiting strand is immediately supported by closely spaced foot rolls and large quantity of water is sprayed on the strand uniformly from all four sides to increase the rate of cooling and solidification of the strand.

In the spray chamber, the covered exiting strand from the mould is guided to horizontal position by the support rollers in the spray chamber. The strand then passes through the straightening and withdrawal rollers. The strands are as such taken to the cooling bed through a battery of rollers after cut into predetermined lengths by mechanical shearing or by traveling oxyacetylene torch and pushed on the rails in the cooling bed by the pushers and allowed to cool. Later it is marked for identification and then sent to stockpile or to the next forming process.

Steel pertaining to specific grades is melted in suitable furnace, and then tapped in to a ladle. The ladle is lifted up by EOT crane and brought to the casting platform and placed on the ladle platform. Bellow the ladle tundish properly lined with refractory bricks and adequately suited nozzle is placed on a tundish car which can be moved on rail. The position of the tundish nozzle is aligned with respect to the mould in such a way that the liquid steel falls directly into the mould. The bottom of the mould is plugged with dummy bar head, whose tail end passes through the withdrawal rollers. The mould assembly consists of four mould plates of which three sides are adjustable.

The oscillation is necessary to prevent molten metal sticking on to the wall during casting.

At the start of casting the withdrawal rollers move and dummy bar gradually brings the Solidified portion of the cast slab out of the mould while metal stream falls in to the mould constantly. The slab follows the curved path over a strand carrier consisting of five segments each possessing paired rollers on the outer and inner surface of the slab. The slab is constantly sprayed by water through-out the length of the apron through spray nozzles. Soon after the dummy bar head with the meta solidified on it comes out of the withdrawal, a dummy bar disconnecting device detaches the slab end from the dummy bar head. The dummy link rolls on to a cage shifts it paving way for the slab. The slab passes over the series of rolls arranged up to the end of the skid rails. The slab is cut manually or by auto cutter (Optional) in to required length and the slab reaching the end of the skid rails is pushed on the rail by action of the pusher.

In this way liquid metal is cast continuously in to slabs and are cut in to required length and stored on the skid rails till the ladle and tundush becomes empty casting comes to an end.

3.5.5 Rolling Mill

Rolling is one of the most important industrial metal forming operations. Hot Rolling is employed for breaking solid into wrought products such as Billet blooms and slabs which are subsequently, rolled to produce Bars, channels, angles, beams and plates.

Rolling is the plastic deformation of materials caused by compressive force applied through a set of rolls. The cross section of the work piece is reduced by the process. The material gets squeezed between a pair of rolls, as a result of which the thickness gets reduced and the length gets increased.

Then adequately heated solid pieces are introduced in to rolling mill stands in which a number of carbon steel and chilled steel rolls works successfully, The hot metal is passed through number of rolls which are run with the help of a motor and fly wheel and the sizes gradually decreases and after passing through last stand the required rolled size is obtained. Products of desired cross section can be obtained by adjusting the roll passes and designs the desired shape of the product is obtained from the last of finishing rods.

While hot rolling produces is on, continuous cooling water from the water tank is pumped out and by special jets is poured between the rolls by which the rolls get strengthen and also life gets increased. After the final passing the finished product will be kept over the cooling bed for the cooling process. The cooling of the hot rolled products is normally done on a cooling bed which is nothing but a simple platform open to the atmosphere.

The proposed rolling mill in this project shall be produced with different final products in the form of TMT Bars. The TMT Rolling process in which rolling is done above re-crystallization temperature. It is called TMT Hot Rolling procedure.

The TMT basic process shall be basically classified into following heads:-

A. Re-Heating
B. Roughing
C. Intermediate Rolling
D. Finished Shape Rolling
E. Cutting & Stamping
F. Finishing
G. Inspection
H. Dispatch

A) Re-Heating: The Re-heating of input is done to make the material basically deformable pliable for rolling to give the desire shape and size. It is done such that the rolling gets completed above re-crystallization temperature.

B) Roughing: Roughing is also called Cogging is done to give the input a rough shape. The maximum reduction is cross section is given in roughing mill.

C) Intermediate Rolling: Intermediate rolling takes the roughing mill output as its input. Output of the intermediate rolling is sent to finishing Mill.

D) Finished shape rolling: In furnace Mill the finished profile shape is made. It takes metal from intermediate stands as its input, the reduction given in this stands is lesser compared to roughing and intermediate mill. Finished shape rolling is Quality critical as the final out put shape is made in theses stands. In case of TMT bars thermos mechanical treatment of the bars is done in this area.

E) Cutting and Stamping: The finished bar is cut to desire length as per customer requirement. Other activities performed here are cropping of ends, cutting of samples for profile dimensional checking and cutting of samples for destructive tests.

F) Finishing: The finishing is done after the bar has been cooled to ambient temperature finishing activities at different mills may involve following steps:-

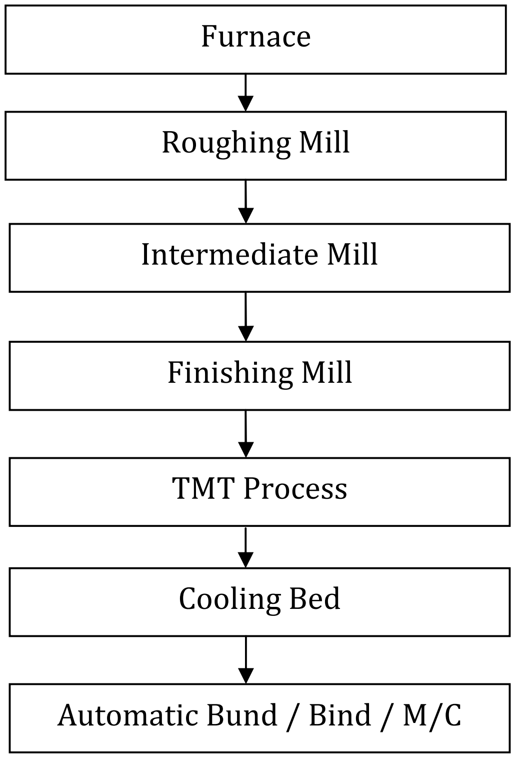
- End finishing either by milling or cold cutting.
- Non-line non-destructive of defects.
- Bundling is to be done according to the requirements.

G) Inspection: Inspection is carried out by the Quality control in house/third party to inspect the product and ensure no defective products are available. Depending on the specifications and customers' requirements the inspection is done in all or few of the following parameters:-

- Dimensional tolerance
- Length
- Straightness
- Surface qualities
- Branding, colour coding and stamping

H) Dispatch: The products are sent to the required destinations primarily by rail and road. Being as the final product the dispatch activities involves documentation like invoices, test certificates, clearances etc.

Process Flow Chart of TMT Rolling Mill



Major Equipment involved in the TMT bar process:-

- Re-heating Furnace
- Stands
- Accessories of Stands
- Drives
- Shears/Cutting saws
- Straightening Machines
- End finishing equipment
- Online testing equipment
- Auxiliaries

Equipment Descriptions

a) Reheating furnaces: The heating of inputs is done in reheating furnaces. In the integrated steel plants the fuel used is primarily a mixture of coke oven and blast furnace gases Primary long product mills use batch type furnaces (Soaking pits) for reheating of ingots. Finishing mills use continuous furnaces (either pusher type or walking beam type) for reheating of inputs.

b) Stands: Equipment in which rolling is done are called stands. They may consist of all or few of the following components. – Rolls, housings, bearings, chocks, couplings with drives, manipulators, tilters, screw down mechanisms. The stand may have horizontal rolls or 89 vertical rolls or combination of both types of rolls. In some cases descaling of bar is done for scale removal to obtain better surface finish.

c) Accessories of stands: Accessories of stands consist of mainly roll cooling arrangements, guards, guides, tackles and grease systems etc. Guards strip the rolled bar of the roll and avoid its wrapping around the rolls. Guides guide the bar into and out of the passes. Water cooling of passes, rolls, bearings is very important in hot rolling to avoid roll breakages, bearing failures and reduce roll wear out.

d) Drives: In most of the mills reversible electrical drives of high ratings are required to drive the rolls. In certain cases the drives give their output directly to rolls through spindles. In other cases when multiple rolls are driven by a single motor the transmission of torque to rolls may be through a pinion stand and spindles.

e) Shears / Cutting Saws: Shears are used to cut heavier sections (Blooms/Billets) in primary mills. Cutting saws are used to cut products of finishing mill to desired lengths, cut crops and samples.

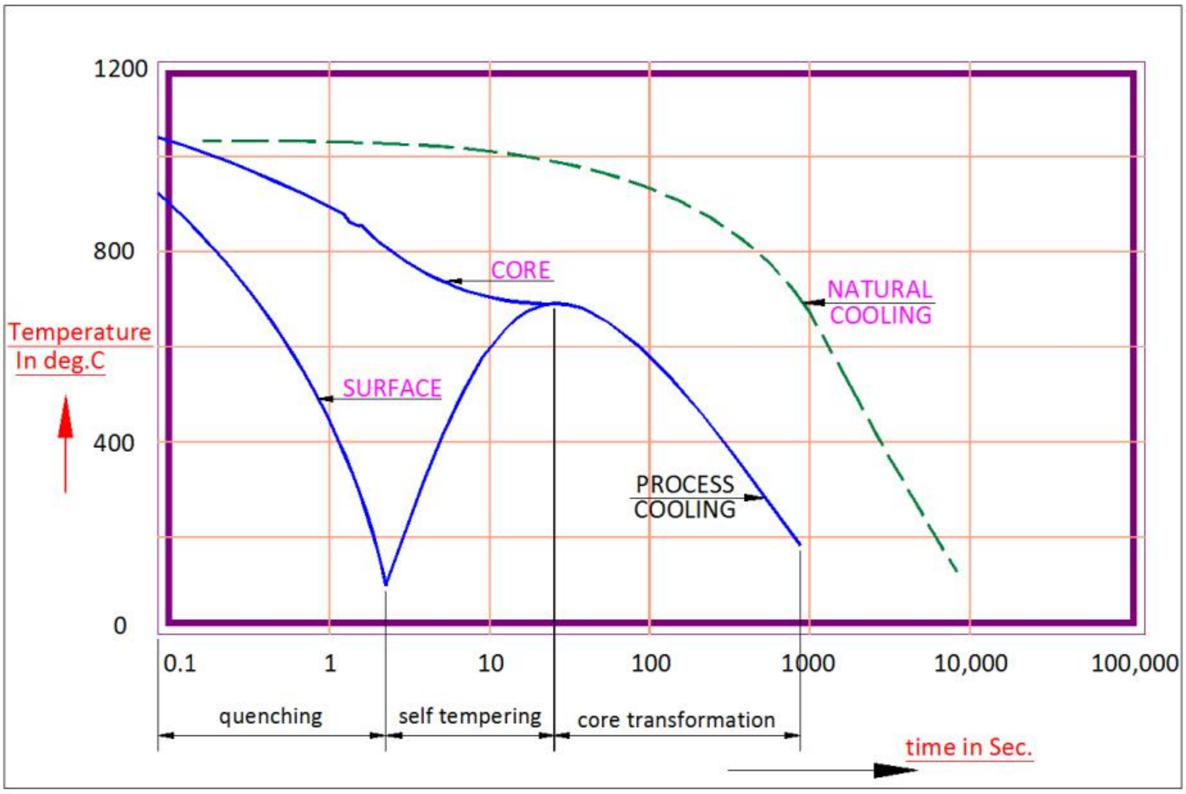
f) Straightening machines: Two types of straightening machines are in use in finishing mills. Roller type in which the products are straightened by alternately bending the products in opposite directions between rotating rollers as exhibited in figure. In case of lighter profiles the straightening is done by pulling from both the ends.

g) End finishing equipment: Ends with square cut and good surface finish required in some finished products is achieved by milling or cold cutting with carbide saws.

h) Online testing equipment: In some finished products online nondestructive testing is done by ultrasonic testing machine (for inside defects) and eddy current testing machine (for surface defects)

I) Auxiliaries: Auxiliaries such as cranes, roll tables, material handling equipment etc., are very important for integrated functioning of mill.

Thermo Mechanical Heat Treatment



Under thermos-mechanical treatment, the steel bars are passed through a specially designed water-cooling system where they are kept till the outer surface of the bars becomes colder while the core remains hot. This creates a temperature gradient in the bars. After the intensive cooling, the bar is exposed to air and the core re-heats the quenched surface layer by conduction, therefore tempering the external marten site. When the bars are taken out of the cooling system, the heat flows from the core to the outer surface, further tempering of the bars, which helps them attain higher yield strength. The resulting heat-treated structure imparts superior strength and toughness to the bars.

The pre-determined cooling of the bar periphery transforms the peripheral structure to marten site and then annealed through the heat available at the core. The peripheral and core temperature difference finally equalizes at around 600°C and the resultant bar structure is of tempered marten site at the periphery and of fine-grained ferrite-pearlite at the core. Generally speaking, the resultant soft core forms about 65-75 per cent of the area (depending upon the desired minimum yield strength) and the rest is the hardened periphery. The equalizing temperature together with the final rolling temperature is the most important parameter to achieve the required mechanical properties. Finally, when the bar is discharged on to the Cooling Beds, the remaining austenite transforms into a very fine-grained pearlite structure.

3.5.6 Captive Power Plant

1. Technical Features

Fluidized bed boilers are designed on the basic principle that when air is allowed to flow through a bed filled with fine grains at low velocity, the solid matter remains in a state of rest. As the velocity of the air is increased the pressure losses rise by the square till a state is reached wherein pressure losses do not rise with further increase in velocity. At this stage the bed is characterized by high turbulence with high mass and heat transfer co-efficient. The grains are held in partial suspension and this characteristic makes the "fluidized bed" perform many functions simultaneously. Fluidised bed works as:

- Combustion chamber, where carbon is changed into carbon monoxide and carbon dioxide.
- Heat exchanger in which the heat is transferred to furnace and the bed tubes.

A. Power Cycle Configuration

In the conventional steam system operating on Rankine cycle, the main equipments are the steam generator, steam turbine and the condenser with their auxiliaries. The utility system includes fuel handling, plant water, fire water, compressed air systems etc. the following factors have influenced the selection of major equipments:

- The efficiency of steam power cycle improves with the increase in the inlet steam temperature and pressure, as has been established by thermodynamics.
- The basic power cycle configuration chosen for the 15 MW would be with pressure of 64 ATM and temperature of 490±5° C at turbine inlet
- The proposed power plant is intended to be operated as a base load plant with high availability.

B. Selected Configuration

Boiler: The selected configuration would consist of one (1) no. FBC boiler with a maximum continuous rating of 60 TPH and (4) Nos. of WHR Boilers connected to a single turbo-generator of 15 MW nominal capacities.

Turbine: In order to optimize the cycle efficiency, the concept of regenerative feed heating is adopted. The 15 MW size turbines are having axial length of approx. 7 meters. Hence it shall be possible to provide One (1) no. of steam tap off nozzles in the turbine for feed heating making the turbine a single extraction cum condensing type.

Following aspects are considered while selecting the type of fuel firing system:

- The boiler type and size are to be chosen considering the fact that the Coal quality.
- The combustion method to be adopted with respect to the type of fuel to be fired.
- Economy of installation and operation.

2. Selection Recommendations

Based on the above, following configurations shall be adopted:

Steam Generators

A	No. and ratings	One (1) no. 60 TPH
B	Type of Boiler	Atmospheric Fluidised Bed Combustion (AFBC)
C	No. of boiler fans	1 x 100 % for ID, FD & 2 x 100% PA fan
D	Type of pollution control system	Electro static precipitator (ESP)

WHRB

A	No. and ratings	Four (4) no. 10 TPH
B	Type of Boiler	Waste Heat Recovery Boiler (WHRB)
C	No. of boiler fans	4 x 100 % for ID
D	Type of pollution control system	Electro static precipitator (ESP)

Steam Turbine Generator

A	No. and ratings	1 no. of inlet parameters 64 ATA & 490±5°C
B	Capacity (rated)	15 MW Maximum continuous rating
C	Capacity (VWO Condition)	15.5 MW
D	No. of controlled extractions	One (1)
E	Type of Exhaust steam cooling	Air Cooled Condenser (ACC)

Steam Generators

Atmospheric Fluidized Bed Combustion Boiler

The steam generator will be atmospheric fluidized bed, outdoor, natural circulation and balanced draft type with direct crushed coal firing. The steam generator unit will be sized for about 60 TPH steam flow at 67 ata steam pressure and 495±5 Deg C steam temperature at MCR with design Indian Coal. This will ensure adequate margin over the requirement of turbine at 100% MCR to cater for.

The steam generator design parameters shall be as follows:

I	Maximum continuous rating (MCR)(T/hr)	60
II	Peak capacity of the boiler as a percentage of MCR capacity %	110%
III	Super-heater outlet pressure [ATA]	67
IV	Super-heater outlet temperature (°C)	495±5
V	Feed water inlet temperature (°C)	126
VI	Excess air (%)	Not more than 20
VII	Boiler outlet flue gas temperature (°C)	100 (max.)
VIII	Dust concentration at chimney (mg/Nm^3)	<50 (max)

The boiler shall be formed of by water cooled, gas tight fin welded/membrane walls with refractory lining up to the end of free board. The lower section of the first boiler pass consists of the combustion chamber with the fluidized bend and free board above, while the upper section is made up of a convection pass with part of the heating surfaces.

The boiler shall be capable of operating with an output 110% of the MCR rating for a period of 30 minutes in each of an Eight (8) hour shift. All components and equipment of the boiler shall be designed to operate under this peaking load requirement without any design or operational limitation.

The boiler shall be designed for fully automated operation from the distributed control system from the central control room. Most of the valves required to be operated during the starting or the normal running of the boiler shall be with electrical motor actuators. The start-up of the boiler shall be with LDO firing and suitable burners shall be provided for start up. The boiler shall be basically designed for under bed feeding of Indian Coal and char.

Steam drums: Furnace water wall & Bed Evaporator system and superheated system & Re-heater system including headers and Connecting pipes

Economizer system: Together with all required headers, integral piping, interconnecting piping, valves, fittings, supports, etc. shall be provided.

The circulating system essentially comprising of the drums, water walls, furnace tubes, in-bed evaporator tubes, down comers and relief tubes shall be designed to provide an adequate circulation ratio in the system. The down comers and the relief tubes shall be sized and routed to offer minimum pressure drop and to aid the improvement in the circulation ratio. The sizing of the circulation system components shall be adequate to ensure safe circulation ratios even under peak loading conditions.

Steam Drum: The boiler shall be provided with steam drum of fusion welded type. The steam drum shall be liberally sized to assure low steam space loading with adequate space to accommodate the internals. The drum design pressure shall have a minimum margin of 6% over drum operating pressure.

Furnace Water Wall and In-Bed Evaporation System: The Furnace envelope shall be constructed of fully water-cooled membrane/fin welded walls and adequately supported. The design shall be such as to prevent distortion of steel work due to thermal expansion.

The Combustor area of the furnace shall also be of membrane wall/fin welded wall construction with refractory lining on the inside perimeter, for a height more than the expanded bed height. The spacing and arrangement of the bed evaporator coils, preferably with an in-line arrangement, shall be optimized to minimize high local velocities and to avoid erosion. The arrangement of the in-bed coils shall also take into consideration the removal of clinkers in the event of clinker formation. The in-bed tubes shall be given adequate protection against erosion by high density stud welding on the tubes both on the straight and bend portions of the tubes. The water wall panel fin thickness and width shall be such that the fin tip to base temperature differential does not exceed 70 Deg C.

Super heater System: The super heater (SH) system shall be of two (2) stage design with inter stage de-superheating to achieve the rated steam temperature over 60% to 100% load range. The super heater shall be of convection or a combination of convection and radiation type or a combination of convection and in-bed type. The super heater pressure drop, the inlet and outlet header sizing, arrangement and sizing of their respective inlet and take off connections shall be so as to give minimum unbalance and the tube element material selection shall be based on the actual metal temperature calculations.

Attemperator System: The attemperator system, to control the temperature of the final superheater outlet steam temperature, within the specified value, shall be provided in between the two stages of the superheaters. The interstage attemperator shall be of the spray type, using the boiler feed water tapped off at the outlet of the boiler feed water pumps, to control the final steam temperature between 60% to 100% MCR load.

Economizer: The Economizer shall be located in the second pass of boiler. The design shall be of bare tube construction with inline, counter flow, and drainable arrangement. The economizer shall be designed for an inlet feed water temperature of 126 Deg C. The economizer shall be arranged such that there is space for the future addition of about 15% of the installed heating surface area without disturbing the existing economizer coils. The coil arrangement shall take care of proper calculated end gaps to avert pas bypassing and the consequent erosion of the element tubes. No gas side or water side bypass arrangement shall be provided.

Air Heater: The air heater shall be arranged as the last heat recovery section downstream of the economiser. The Airheater shall be recuperative type with flue gas flowing inside the tubes and the combustion air flowing over the tubes. The airheater shall be arranged with the tubes in the vertical direction. The inner diameter of the tubes shall be a minimum of 50 mm and the minimum thickness of the tube shall be 2.2 mm. The tubes except those required for staying purposes shall be expanded into the tube sheets on both ends.

Fuel Feeding System: The fuel feeding system shall facilitate smooth, easy and metered distribution of the fuel into the Atmospheric fluidized bed combustor. The layout of the fuel feeding system shall be such that each system is easily approachable and maintainable.

The fuel storage bunker of rectangular cross section with adequate capacity to hold the Indian Coal & Dolo Char requirement of 16 hours of maximum continuous rating of the boiler shall be provided in front of the boiler. Prepared fuels from the crusher house will be delivered to the bunker through a tripper conveyor.

The feeders shall be of either air lock rotary type or drag chain type and shall be of proven design. The number of feeders shall depend on the capacity of each of the feeders, the number of fuel feed points to the combustor and the branching and routing of the fuel pipes from the feeders to the feed nozzles. However there shall be a minimum of three feeders each with a capacity each of a minimum of 40% of the MCR requirement.

Draft System: The draft system for the boiler shall be suitable of producing a balanced draft with sub atmospheric pressure conditions in the furnace. There shall be 1 x 100% capacity Induced Draft Fan, 1 x 100% Forced Draft Fan and 2 x 100 % capacity Primary Air Fan making up the complete draft system for the boiler. The fans shall be basically sized using adequate margins over the calculated values of the flow volume and the pressure using the maximum continuous rating condition.

Ducting System: All ducts shall be rectangular in cross section and will be of welded construction properly stiffened and reinforced. All the air ducts shall be fabricated from steel plates of minimum 4 mm thick and all flue ducts shall be of minimum 6 mm thick. The duct plate material shall conform to IS 226 / IS 2062. Carbon steel plates shall not be used for ducting system if the operating temperature of flue gas exceeds 425°C. The duct corners shall be stitch welded internally and full welded on the outside.

Boiler Start up System: The boiler shall be started from the start up compartment using the hot gas supplied to the start up compartment. The start up system include the duct mounted LDO burner system, located in the fluidizing air supply duct to the start up compartment, the internally lined ducting leading the hot gases to the start up compartment wind box, oil storage day tank, oil piping, valves, control valves, trip valves, instrumentation and controls suitable for operation from the DCS etc. The burners system shall consist of the air atomized oil burner, electric arc ignitor, burner management system etc.

Chemical Dosing System: The boiler shall be provided with a common tri-sodium phosphate based High Pressure (HP) dosing system and a hydrazine and ammonia based Low Pressure (LP) dosing system. The HP dosing system shall add the chemical to the boiler water to take care of the ingress of the hardness salts and to increase the boiler water pH. The LP dosing is done to the feed water preferably at the outlet of the deaerator to scavenge the last traces of oxygen and to increase the feed water pH. HP dosing system sizing shall be with one percent (1%) concentration of tri-sodium-phosphate.

Blow Down Tank: One continuous blow down (CBD) tank and one intermittent blow down tank (IBD) shall be provided for the boiler. The flash steam from the CBD tank outlet shall be piped to the deaerator and the outlet of the IBD tank shall be vented to atmosphere. The level control system and the safety valve for the CBD tank, required supports, drain valves, level gauges, and necessary piping etc., for both CBD and IBD tanks shall be provided.

A) Waste Heat Recovery Boilers

The WHRB shall be sized and designed to extract maximum sensible heat energy contained in the waste gases emanating from the Direct Reduction kiln. The major technical parameters of WHRB are given below:

Technical features of Steam Generator (WHRB)

- The steam generator consists of membrane type Radiant chamber, superheater, evaporator and economizer.
- Pressure Parts
- The complete system of boiler pressure parts, covering:
- Steam drums
- Water wall / radiant chamber
- Evaporator
- Superheater
- Economizer
- Together with all required headers, integral piping, interconnection piping, valves, fittings, supports, etc. will be provided.

The circulating system essentially comprising of the drums, water walls, etc will be designed to provide an adequate circulation ratio. The sizings of the circulation system components will beadequate to ensure safe circulation ratios even under peak loading conditions.

Steam Drum: The boiler will be provided with steam drum of fusion-welded type. The steam drum will be liberally sized to assure low steam space loading with adequate space to accommodate the internals. The drum design pressure will have a minimum margin of 6% over drum operating pressure.

The steam drum will be provided with internals of proven design, will be bolted type, and of size that will enable removal through the man ways.

Evaporator: Evaporator section has horizontal, inclined, inline type arrangement with top and bottom headers for easy flow of steam water mixture. It is connected to the steam drum through adequately sized down comers and risers.

Economiser: The design will be of bare tube construction with inline, counter flow, and drainable arrangement. The coil arrangement will take care of proper calculated end gaps to avert bypassing and the consequent erosion of the element tubes. No gas side or waterside bypass arrangement will be provided.

Gas Circuit: Waste gases from Post combustion Chamber of Kiln enters the radiant chamber, then gas passes through the superheater section, evaporator and economizer section. From economizer section it goes to ESP. There will be one (1) x100% capacity Induced Draught Fan per Boiler, which will draw the cooled exhaust gas and sends to Chimney.

Common Blow down Tank: One blow down tank will be provided for the boiler. The flash steam from the tank will be piped to the deaerator and the outlet of the tank will be vented to atmosphere. The level control system and the safety valve for the tank, required supports, drain valves, level gauges, and necessary piping etc., for tank will be provided.

b) Steam Turbine Generator Unit

Steam Turbine: This project envisages one (1) no.15 MW extraction- cum- condensing turbo-generator. The turbine shall be designed for the operation with the inlet steam parameters at 64 ata and 490 C and shall be with automatic controlled extraction steam.

The turbine shall be horizontal, single extraction-cum-condensing type for 15 MW. All casings and stator blade carriers shall be horizontally split.

The low pressure casing shall have a bottom exhaust arrangement configuration and the exhaust casing shall be suitable for connection to the air cooled condenser without air leakage and suitable for maintaining the condenser vacuum. The turbine exhaust hood shall be provided with exhaust water spray system to protect the turbine against excessive temperature due to windage at no load and low load conditions.

Gland Sealing System: The glands shall preferably be of labyrinth type and sealed with steam. The gland packing shall be of 13% chromium stainless steel. The labyrinths shall be of multi-section spring backed type which would allow for any temporary deformation of the rotor shaft without overheating the rotor due to friction. The gland sealing system design shall permit the examination of and replacement, if necessary, of the glands without lifting the upper half of the turbine casing.

Bearings: The turbine shall be provided with liberally rated hydrodynamic radial and thrust bearings. The radial bearings shall be split for ease of assembly and of the sleeve or pad type, with steel shell backed, babbitted replaceable pads. These bearings shall be equipped with anti-rotation pins and shall be positively secured in the axial direction.

Lubrication and Control Oil System: A pressure lubrication and control oil system shall be provided for the turbo generator unit to supply oil at the required pressure to the steam turbine, gear box, generator and governing system. The lubrication oil system shall supply oil to the turbine generator under all the load conditions, including the turning gear operation. The oil system of the turbo-generator shall be designed with adequate redundancy and emergency provisions such that a failure of a single active component will not prevent the safe operation or a safe shutdown of the turbo-generator.

The Oil System shall include the following:

Oil Coolers: The oil coolers shall be water cooled with a duplex arrangement and changeover valves. The coolers shall be of shell and tube type with removable tube bundle. The cooler shall be constructed in accordance with TEMA class C. The provided surface area shall be adequate to cool the oil with 32 Deg.C inlet cooling water temperature even with 15% of the tubes plugged.

Filters: Full flow twin oil filters shall be used, for the lube oil, downstream of the coolers and shall be piped in a parallel arrangement with a continuous flow transfer valve filter size shall be 40 microns nominal for the lube oil. Filter cartridges shall have a minimum collapsing differential pressure of 3.5 kg/sq.m. The minimum design pressure for the filters shall be the maximum discharge pressure of the oil pumps. Differential pressure gauge with alarm shall be provided across the filters.

Oil Purifier: A centrifugal type oil purifier shall be provided for the removal of water, sediments and other oxidation products from the lube oil system on a continuous basis. The purifier shall be a separate complete package, mounted on a skid, complete by itself with drive motor, piping, valves and fittings. The capacity of the purifier shall be at least two (2) percent of the rate of normal flow through the reservoir. Feed to the purifier shall be from the drain end of the reservoir and its operation shall be independent of the oil system.

Emergency Oil Tank: Emergency gravity lubricating system shall be provided to assure the lubrication at the time of emergency due to the failure of the DC operated lube oil pump. This system shall draw lube oil from a overhead tank, under gravity, and shall be designed to supply oil for the coasting down period of the machine. The overhead tank shall be SS lined and the complete piping shall be of SS 304 material. The tank elevation shall be finalized based on the oil pressure requirements at the bearings.

Steam Turbine Governing System: The turbine governing system shall be electro-hydraulic designed for high accuracy, speed and sensitivity of response. The governor shall ensure controlled acceleration of the turbo generator and shall prevent over speed without tripping the unit under any operating condition or in the event of maximum load rejection. The governor shall have linear droop characteristics with a suitable range for stable operation and shall have provision for adjusting the drop in fine steps.

Thermal Insulation and Lagging: The steam turbine and the other high temperature parts, including piping supplied, shall be insulated with low conductivity inert material, where required, reinforced by stainless steel wire net between applied layers. The insulation shall be so arranged that it can be removed for access to the flange bolting, control valves and other parts that require periodic maintenance. The insulation shall be designed, such that the outer surface temperature of the insulation does not exceed 20 Deg.C above the ambient temperature.

Performance Parameters

The following gives the performance requirements for the turbo generator:

Sr. No.	Description	Parameters
1	Turbine Type	Single Extraction, Bleed cum Condensing
2	Inlet Steam Parameters Pressure (Ata) Temperature (°C) Flow (Kg/Hr)	 64 490 ± 5 67500
3	Air cooled Condenser Operating Pressure (Ata) for 15MW	0.18
4	The economical steam rate required at percentage load (%)	80-100
5	Rating at the generator terminals (MW	15
6	Power factor (lagging)	0.8
7	Generation Voltage (kV)	15.75
8	Ambient temperature for electrical equipment design (°C)	50
9	Duty Requirements	8000 Hours
10	The minimum continuous load at which the TG is expected to operate as a percentage of the MCR load (%)	15
11	System Frequency (Hz) (All components of the turbo generator system shall be designed to operate in this frequency range)	50 + 5%

Condensate System: Condenser shall be of Air cooled condenser, designed for operating with atmospheric air for condensing the exhaust steam from the steam turbine. Condensate from the condensate storage tank will be pumped by one of the two (2) 100% capacity condensate pumps for each circuits through a gland steam condenser, inter/after coolers and to the deaerator.

Condensate Drain Pumps: Two numbers for each circuit of hundred percent (100%) capacity condensate Drain pumps to pump the condensate from the Drain storage tank shall be provided. The pump shall be selected for a normal continuous flow rate equivalent to the maximum steam flow to Ejector, Gland Sealing under all the operating conditions. The margin on the pump capacity and discharge pressure shall be of minimum 15%, over and above the 100 percent capacity.

Deaerator and Condensate Storage Tank: One (1) Deaerator for each circuit of deaerating capacity equal to twenty percent (20%) higher than the gross MCR steam generation capacity of the boiler with a deaerated water storage tank of net useful capacity (normal water level to low water level) equivalent to twenty minutes (20 minutes) of MCR generation capacity of the boiler shall be provided. The material of the deaerator, deaerated water storage tank is SA 515 Gr 70/IS: 2002 Gr 2.

The condensate from the turbine air cooled condenser and the make up DM water @ 32 C, shall be piped to this feed water storage tank. The tank shall be complete with all the fittings and mountings like the vents, drains, inlet & outlet nozzles, gauge glasses etc. The High Pressure Feed water heaters condensate is directly let into the Deaerator.

Boiler Feed Water Pumps: Three (3) Nos. of 50% capacity boiler feed water pumps for each circuit shall be provided, with Two (2) operating and the other remaining as standby, shall be provided to supply feed water to the boiler. The feed water pump will take suction from the deaerator. The pump shall be single suction, multi stage centrifugal type with drive motor of suitable rating coupling common base frame, foundation bolts automatic recirculation valves etc.

Condensate Extraction Pumps: Two (2) Nos. (2x100% capacity with one working and one standby) condensate extraction pumps for each circuit shall be provided to supply feed water from the condensate storage tank to the deaerator. The pump shall be single suction, single stage centrifugal type with drive motor of suitable rating, coupling, common base frame, foundation bolts etc. Each transfer pump shall be capable of meeting 110% of the deaerator capacity. The design margin on the head shall be 10% of its maximum discharge pressure requirements for the continuous operation of the deaerator.

D) Air Cooled Condenser

- Technical features of Air Cooled Condenser
- The finned tube bundles are fixed on a “roof" type structure with an angle of 60 °.
- Such an Air-cooled condenser is made of cells each cell consists of:
- The structure supporting the cells and bundles;
- The finned tube bundles;
- The main stream manifold feeding the bundles;
- The fan units with drive assembly and protection guards at the bottom of the A frame;
- The air inlet rings at an elevated level above the ground in order to provide a sufficient air inlet area;

- Condensate extraction pump and Hotwell drain pumps;
- Wind wall for prevention of air recirculation.

Fin Tube Bundles: Finned tubes bundles are rigid, self supporting and designed for handling as a complete assembly with lifting lugs.

The main components are:

- ✓ The finned tubes
- ✓ Tube sheet.
- ✓ C-frame

Tube bundles are made of extended surface fin tubes with 4 rows of circular carbon steel tubes wounded with helical tension wrapped LL-shape (Overlapped) fins.

Condensate System (Wet System)

Condensing system comprising of:

- Shell & Tube type, horizontal, divided water box type condenser with integral hot well
- Steam jet air ejector system complete with :
- Twin stage main ejectors(1 working + 1 standby)
- Start ejector with silencer
- Inter and after condensers
- Condensate extraction pump (CEP) with motors.
- Rupture disc for condenser protection
- Expansion bellow with spool piece between turbine exhaust and condenser inlet
- Condensate piping from hot well through CEPs & ejector condensers up to specified battery limits (i.e. up to outlet flange of bypass line level control valve) complete with pipe supports, strainers, steam traps, drains, vents and isolation provisions.
- CW line Rubber expansion bellow at inlet & outlet connection

E) Auxiliary Cooling Tower

In the proposed plant the Auxiliary cooling tower envisaged to cool the water which is used to cool the equipment like Alternator, Oil cooler, Boiler feed pump, ash vessels and the sample cooler. The cooling water is circulated by Auxiliary cooling water circulating pump.

3. Features of Other Systems

Overviews of the major systems are furnished below. These are tentative and likely to change during the detailed engineering stage.

a) Fuel Handling Systems: The Fuel handling system is designed based on the Indian Coal & Dolo Char. The Coal & Char required for AFBC boiler is fed by means of Fuel handling system which contains ground hopper, crushing unit and screening unit. Requirement of Coal at MCR for the 15 MW power station shall be 11.70 TPH considering GCV as 3000 Kcal/Kg and the requirement of Char at MCR for the 15 MW power station shall be 8.28 TPH considering GCV as 1816 Kcal/Kg. The raw Coal & Char which is stored in yard is unloaded in the ground hopper by suitable movers. The ground hopper contains vibratory feeder and conveying belts. The Coal & Char is transferred to crushing unit through belt conveying system. The raw Coal & Char is crushed by crushers to required size in two stages by primary & secondary crushers.

b) Plant Water System: The water plays an important roll in the power plant. In the proposed project the raw water is taken from various locations nearer to the site. The raw water may contain unwanted foreign matters, suspended solids, dissolved solids and pathogenic contents so the raw water should be treated at RO/DM plant and fed to boiler and softener.

In RO/DM plant the raw water is treated at various stages to remove the contaminants in the raw water. The RO/DM plant consists of Multi grade filter, Softener, Ultra filtration, chemical dosing systems, RO systems, mixed bed. The raw water is fed to Multi Grade Filter (MGF) to remove suspended particles in the raw water. The water from Multi Grade Filter will be passed through the softener for removal of hardness. Minerals like calcium, Magnesium, will be removed in softener with the exchange of sodium.

c) Compressed Air System: Two numbers of air compressors with 1W+1S combination will be provided. To cater for the plant compressed air requirements it is proposed to install Air compressor for the instrumentation air system and plant service air. It is rotary, screw type non-lubricating type, complete with inter cooler, after cooler. The compressor will be oil free type.

Heavy-duty dry type intake air filter, conveniently located for quick and easy replacement with cyclonic separation and arrangement for pre filter separation. The dryers shall be provided with a control system for precise control indications and safety features

d) Ventilation and Air Conditioning System: For proper functioning of the equipment controls & accessories as well as to provide the right environment for operation & maintenance of the plant, adequately sized ventilation and airconditioning system is proposed for the plant as described below.

Power house buildings will be provided with roof extractors to exhaust hot air from the machine room. Switchgear and MCC rooms will be provided with pressurized ventilation system to eliminate ingress of dust from outside and to dissipate the heat generated. Dust extraction system will be provided from outside at transfer points of coal handling plant; conveyor gallery above raw coal bunkers; as well as in the crusher house.
Collected dust from these sources will be cleaned in dry/wet type cyclone/scrubber. The air after cleaning will be exhausted into the atmosphere while the dust with heavy particles would be put back into the system. To avoid coal dust spreading in the stockyard, sprinkler water ring main around the coal stock in the yard with swivelling nozzles will be provided to moisten the coal particularly during periods of high wind.

e) Fire Protection System: For protection of the plant against fire, the plant, coal reject yard, oil storage area, transformer area shall be protected by combination of Hydrant and sprinkler system. Fire water pumps for hydrants and high velocity spray sprinkler system will be installed at the clarified water storage. Two (2) electric motor driven fire water pumps, shall be provided which would be brought to operation automatically when fire signals are received. One (1), diesel engine driven fire water pump, shall also be installed as statutory standby.

f) Power House EOT Crane and hoisting equipment: To handle the main turbo – generator set and its auxiliaries housed in the TG Building, One (1) EOT Crane with the capacity of 25 / 5 Tones will be provided. The crane will move to entire TG floor to handle the equipment during maintenance.

Box girders shall be provided with end plates for sealing. Full depth diaphragms or stiffeners shall be furnished at motor supports and below line shaft bearings. Short diaphragms shall be furnished where required to transmit the trolley wheel loads to the web plates. All diaphragms shall bear against the top cover plate.

4. Electrical System

All Electrical equipment shall conform to relevant IS/IEC standards and recommendations of IEEE standards.

Fault level at 15.75 kV is 40 kA for three seconds
Fault level at 433 V is 50 kA for one second.
Low voltage motors have class 'F' insulation with temperature rise limited to class 'B' offering high electrical and mechanical stability.

Motor Control panels comprises of Low voltage Switchgear such as Air circuit breakers, Fuses, Fuse-Switches, Contactors, Bimetal Overload Relays, Electronic Timers, Motor Starters, Push buttons and Miniature circuit breakers. Cables shall be suitable for laying in conduits, ducts, trenches, trays or for direct burial in ground in both wet and dry locations.

1) Plant Electrical Systems: The Plant Electrical System is covering major equipment such as Generator, Unit Auxiliary Transformer (UAT), Generator Transformer, Breaker panels, MCC, Switchyard, Earthing, lighting and cables.

2) Generator: The rating of the Generator would be 15 MW at 15.75 KV. The Generator winding would be star connected with phase and neutral terminals brought to an accessible position. The star point of the Generator would be connected to earth through Neutral Grounding Resistor. Necessary protection for various parameters shall be provided as required.

The Generator will be air cooled with Brushless Excitation. Generator would be provided with class-F insulation and temperature rise will be limited to Class-B level to ensure longer life. The main parameters of the Generator are as follows

MW rating	:	15 MW
Voltage Rating	:	15.75 KV
Rated power factor	:	0.80 Lag
Related frequency	:	50 Hz
Voltage Variation	:	±10%
Frequency Variation	:	±5%

3) **Unit Auxiliary Transformer (15.75KV/433V)**

One Unit Auxiliary Transformer shall be provided to feed unit auxiliary loads. The Transformer shall be designed to withstand electrical impulses and dynamic stresses. Solid Earthing shall be provided in secondary winding of Transformer. Necessary protection for various parameters shall be provided as required.

4) LTPCC and MCC

LTPCC acts as a Power Distribution Board, which comprises of 4-pole draw out Air Circuit Breaker in its incoming feeder and 3 poles ACB and MCCB in outgoing feeders. Necessary protection such as Earth fault and Over Load Relay shall be provided in all incoming and outgoing feeders.

The various auxiliaries will be supplied at the following nominal voltages depending upon their ratings and functions:

The 433V, 50Hz, 3-phase, 4-wire supply for auxiliaries will be obtained from 15.75kV/ 433V Transformer through LTPCC. The 433V system will be Solidly Earthed.

230 V, 50Hz, 1- phase AC supply for lighting, Space Heaters, single phase Motors, etc.

5) 15.75kV HT breaker panel

The 15.75 kV generated voltage from Generator is given to the Indoor HT breaker panel by XLPE (UE) cables. The HT breaker offered is Vacuum Circuit Breaker. The parameter of VCB is given below.

Circuit Breaker type	:	VCB
Short Circuit Current	:	40 kA for 3 sec.

The Generator switchboard is housing four breaker panels, one for Generator, one for Auxiliary Transformer, one for Power Transformer and one as spare. All the breakers are provided with necessary protection and metering features. The breaker can be operated by manually or motorized, with trip free Mechanism.

6) Cabling System

The following types of cables will be used:

For 15.75 kV System: 15.75 kV unearthed grade, stranded Aluminium Conductor, cross linked polyethylene (XLPE) Insulated, PVC inner sheathed, Galvanized single steel wire armored for three core, or Aluminium wire armored for single core and overall extruded PVC sheathed cables.

For Low Voltage System: Power cables of 1100 V grade, stranded Aluminium conductor, PVC insulated, PVC inner sheathed, galvanized single steel wire armour for three core or aluminium wire armour for single core and overall black PVC sheathed Cables conforming to IS:1554.

For Control Applications: 1100 V grade annealed high conductivity stranded copper conductor, PVC insulated, PVC inner sheathed armour and PVC outer sheathed control cables conforming IS: 1544.

For Instrumentation Applications : Stranded high conductivity annealed tinned copper conductor, PVC insulated, flexible, twisted pair /triplets, individually and overall shielded (for low level analog signals) and only overall shielded for digital signals, PVC inner sheathed, galvanized steel wire armour and overall PVC sheathed cables.

7) Safety Earthing System

The plant safety Earthing consists of a buried grid provided to alternator, transformer and other outdoor areas interconnected with earthing grids provided in various plant buildings. The buried Earthing grid will be connected to suitably located Earth Electrodes.

8) Plant Lighting System

The Lighting system comprises of Lighting Distribution Board which distributes the supply to Main Distribution Board at corresponding Location. The appropriate lighting equipment such as sodium Vapour lamp, High bay lamp, etc will be provided based on the illumination requirement.

9) Instrumentation and Control System

The plant will be designed with Distributed Control System (DCS) to co-ordinate and control Boiler, STG and Balance of Plant operation from control room. Air compressors, DM plant, and Ash Handling Systems shall be controlled from their respective local control panel. Important parameters and status indications of these systems will be made available on the operator station in the control room.

10) DCS Features

The DCS will include the necessary system and application software to achieve control and monitoring functions and data acquisition functions like logs, reports, trends, curves, performance calculations and historical storage.

DCS incorporates the latest technology to provide functionally distributed architecture and reduce the risk associated with the failure of any single control units. They provide hierarchical system structure to facilitate the task of integration, co-ordination and operation of the plant equipment / sub-systems.

DCS functions include

- Data acquisition for measurement monitoring and control:
- Historical data logs
- Trending
- Reporting
- Data conditioning and processing.
- Control functions such as:
- Binary control (open loop control) – on/off logic and protection logic
- Sequential Control.
- Analog control – Closed loop control
- Supervisory control and monitoring functions for plant utilities.
- Measurement & Monitoring functions
- Annunciation & Alarm reporting
- The control system will be provided with 230 V AC UPS. Uninterruptible Power Supply (UPS) will be provided to cater the 230 V AC, Single phase, 50Hz, 2 Wire power supply requirements of the DCS system.

Control Philosophy: The operation and monitoring of the complete plant will be from the control desk /panel located in Control Room. The operator will perform the following operations from the control desk TFTs. Operation of pumps, Fans, Motors associated with the SG, TG, Coal Handling System, Cooling Water System and their Auxiliaries.

Operation of all control valves, dampers of the SG, TG and their auxiliaries. Carry out associated control operations with the aid of Plant overview, group display, individual loop display etc.

11) Monitoring Instruments

They include electromagnetic type indicators, electronic indicators digital display units, drum level Indicator, Ammeters, Voltmeters, Frequency Meters, Power Factor Meters and Energy meter which are essential for starting, loading, running and shutting down of the unit.

Local Instruments: Local instruments will be provided to enable local operators to supervise and monitor equipment/ process.

- All transmitters for measurement and control will be electronic type of two wire system with 4-20 mA DC output-SMART version
- All thermocouples will be duplex type and signal transmission through compensating cables
- All temperature inputs for control will be taken to the system through temperature
- transmitters.
- All RTD inputs will be directly wired to Temperature scanner.

3.6 Raw Material required along with estimated quantity, likely source, Marketing Area of the final product/s, mode of transportation of the raw material and finished products.

3.6.1 Raw Material Requirement

Table 3.1: Raw Material Required for Beneficiation Plant

Sr. No.	Particulars	Per Day	Per Month	Per Annum
1	Iron Ore	3,000	75,000	9,00,000

Table 3.2: Raw Material Required for Sponge Iron Plant

Sr. No.	Particulars	Per Day	Per Month	Per Annum
1	Iron Ore	320	8,000	96,000
2	Coal	240	6,000	72,000
3	Dolomite	10	250	3,000

Table 3.3: Raw Material Required for Induction Furnace

Sr. No.	Particulars	Per Day	Per Month	Per Annum
1	DRI	262.50	6,562.50	78,750
2	Pig Iron	75.00	1,875	22,500
3	MS scrap	37.50	937.50	11,250

Table 3.4: Raw Material Required for Rolling Mill

Sr. No.	Particulars	Per Day	Per Month	Per Annum
1	Billet	420	10,500	1,26,000
2	Coal – Optional (For Gasification)	32	800	9,600

Table 3.5: Raw Material Required for Power Plant

Sr. No.	Particulars	Per Day	Per Month	Per Annum
1	Coal (RB-1)	77	1,925	23,100
2	Coal (Indonesia/local)	116.20	2,905	34,860
3	Dolo-Char	92.90	2,322.50	27,870

3.6.2 Transportation of Raw Material / Final Products

The probable sources of major raw materials (indigenous/imported) for meeting the production requirements by road/sea/rail. The plant would produce both long and flat products, which would have potential for sale in national as well as international markets.

3.7 Resource Optimization/Recycle & Reuse Envisaged in the Project

The plant has been designed with state-of-art technology for optimum consumption of energy & other resources. By product fuel gases would be reused within the plant as in-plant fuel and al so to produce power in the CPP.

3.7.1 Sponge Iron Unit

Nature	Uses
Char/Non-Magnetic	⊙ Char should mixed with coal and used as a fuel in Fluidized Bed Combustion Boilers for additional power generation other than WHRB. ⊙ Char can be sold to local entrepreneur for making Coal Briquettes.
Kiln Accretion	⊙ Kiln Accretion is heavy solid lumps and can be used as sub-base material for road construction or land fill.

3.7.2 Induction Furnace

Nature	Uses
Runners & raisers	It can reuse in Steel Melting as a Scrap.
Slag	It can be discharged into land filled.
Dust	It can be discharged into land filled.

3.7.3 Rolling Mill

Nature	Uses
Return Scrap	It can reuse in Steel Melting as a Scrap.

Process water will be recycled back in the process, hence zero discharge.

3.8 Availability of water its source, Energy / Power Requirement and Source

3.8.1 Water Supply

Iron and steel making is a heat intensive process wherein a considerable quantity of cooling water is required for control of metallurgical process as well as for recovery of heat from unutilized heat. In order to conserve fresh water, water economy has been an underlying criterion for selection of plant and equipment.

Water recirculation systems have been planned to cater extensive recycling and reuse of return water from plant processes. The company has opted for Air Cooled Condenser for its proposed Power Plant which will minimize use of water. Industrial quality water as obtained from the source will be used in the secondary side of plate heat exchangers for cooling of process water in the primary side and also for direct cooling circuits. For the primary side, soft water will be re-circulated in closed circuits. Suitable treatment facilities have been planned for open contaminated circuits to render the return water from the unit reusable. Evaporative cooling towers will be provided for cooling industrial water in open circuit recirculation systems. Total water Requirement for the proposed expansion project is 62,500 KLD which will be met by the Bore wells in the project site.

3.8.2 Power Supply

Power Supply will be met from State Electricity Board (GESCOM), Substation of 15 MW and once the plant becomes operation, the power generated within the plant will be utilized back to the plant. The excess will be given to State/National Power Grid.

3.9 Waste Generation and Management

3.9.1 Solid Waste

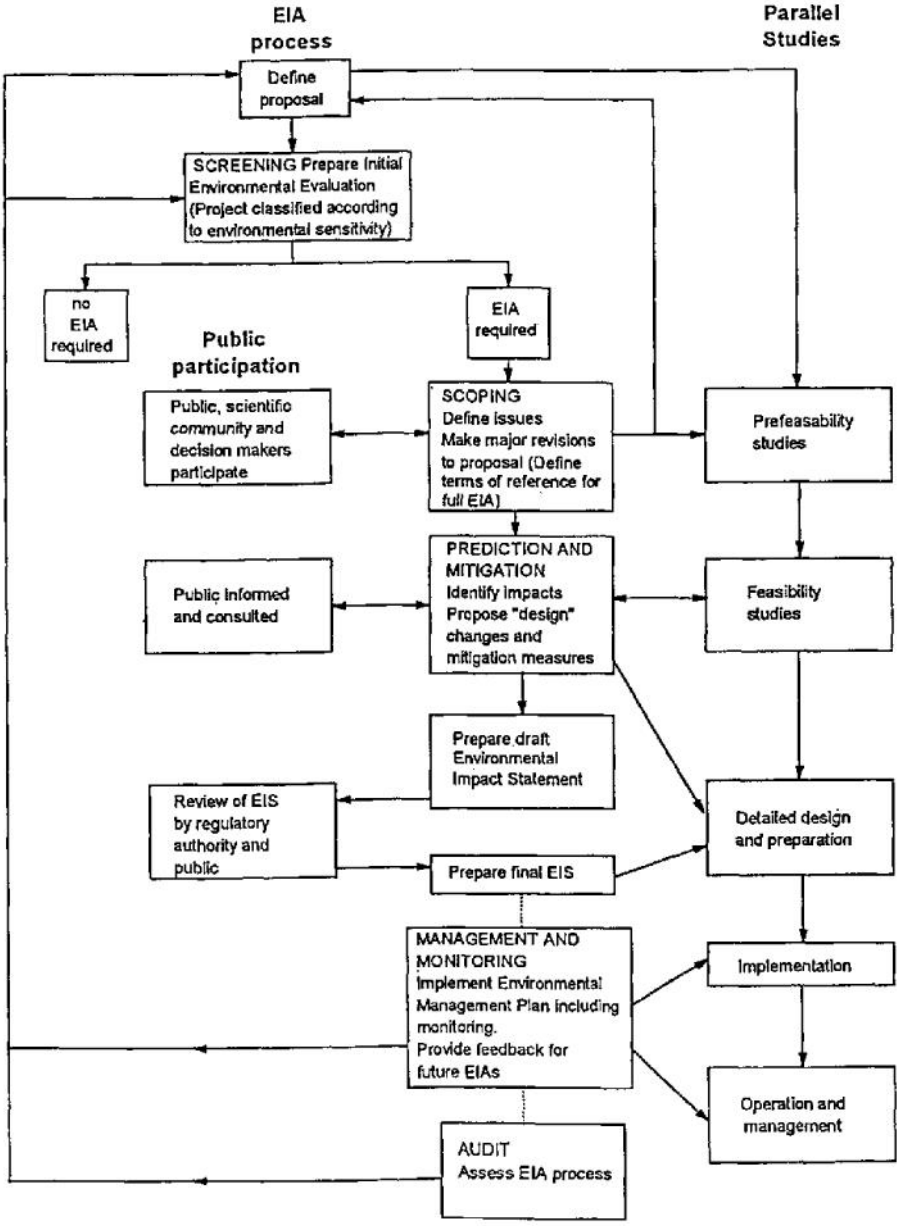
Partial solid waste resource optimization/Recycle & Reuse of in the project is explained in **section 3.7.** Partial solid waste management scheme and disposal is given in below table.

Plant	Waste	Scheme for Management / Disposal
Sponge Iron (DRI Kiln)	Waste Solids	Shall be sold to brick making factory
Captive Power Plant	Fly Ash	Shall be sold to brick making factory
Beneficiation Plant	Tailings	Shall be sold to brick making factory and also cement plants.
Tunnel Kiln/RHF	Fly Ash	Shall be sold to brick making factory

3.9.2 Hazardous Waste

Plant	Waste	Scheme for Management / Disposal
Generator/ Lubricants	Used oil	Shall be sold to the CPCB approved recycler
Gasifier	Coal Tar	Shall be used in road making
DM and RO Plant	Used Ion Exchange Raisin	Shall be sent to the nearest TSDF site

3.10 Schematic representations of the feasibility drawing which give information of EIA purpose.



CHAPTER – 4

SITE ANALYSIS

4.1 Connectivity

4.1.1 Road Accessibility

Road connectivity is through National Highway - 63 located at distance of 7.5 Km from the Project Site.

4.1.2 Rail Accessibility

The nearest railway station is Ginigera railway station which is about 8.0 Km from the site. No problems are envisaged in accessibility and transportation of heavy equipment to site by rail.

4.1.3 Sea Port

The eastern port of Chennai is 710 km and western port of Goa i s 272 km. Mumbai is about 697 km on the North West.

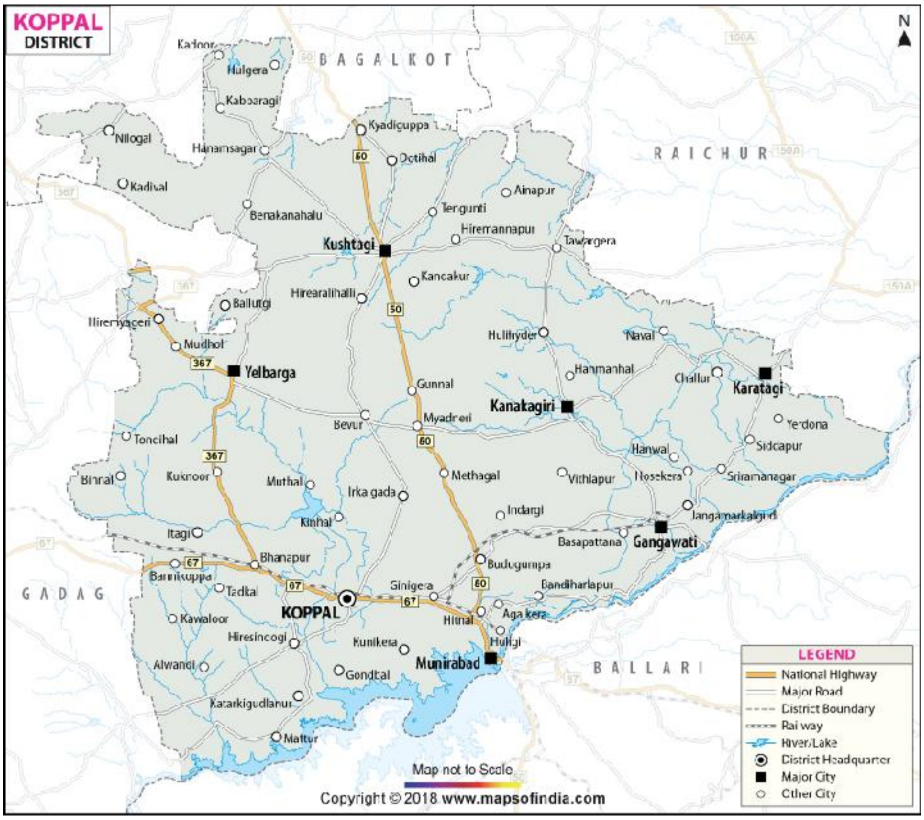


Figure 4.1: Road and Railway Connectivity of Koppal District

4.2 Land Form, Land Use and Land Ownership

The proposed site for setting up of the brown field project is located within the jurisdiction of Kunikeri Village of Koppal Taluk & District in Karnataka. The existing Sponge iron plant is situated between 76^0 11' 49.28" E Longitude & 15^0 19' 27.77" N Latitude.

The land is agricultural land and converted into industrial purpose and is currently in the ownership of BSPL. Proposed expansion is located over an area of about 30 acres within the overall plant area, utilizing the existing infrastructure and utilities.

4.3 Topography

The study area falls in the Tungabhadra river basin. The area is marked with undulating topography with granite hills and a few chains of hills composed of Dharwar schists. The main tock types found in the region are;

- **Pleistocene and Recent:** Reddish, light green, reddish brown and black soils
- **Precambrian: Kaladgi series:** Sandstone and conglomerate basic dyke
- Archaean
- **Penisular Complex**: Granite porphyritic, red syenite, pink genesis, Gray genesis
- **Dharwars:** Chlorit schists, Talc chlorite schist

4.3.1 Hydrogeology

The joints and other openings in the gneiss and granite, the pore spaces in the zone of weathering and bedding planes of the metamorphosized sediments determine the rate of percolation of the water into sub-surface and the yield of wells in the regions. Black cotton soils allow water to infiltrate slowly, whereas red loams/sandy soils have relatively higher percolation rate which is due to high porosity and permeability. Occurrence of groundwater thus, is mainly controlled by water table conditions. The recharge of groundwater is mainly due to the rainfall which is scant in the region. Therefore, depth of water table in the area is between 7m to 10 m below the surface.

4.4 Existing land use pattern (agriculture, non agriculture, forest, water bodies – including CRZ), shortest distances from the periphery of the project to periphery of the forests, national park, wild life, sanctuary, eco sensitive areas, water bodies (distance from HFL of the river), CRZ. In case of notified industrial area, a copy of Gazette notification should be given.

Existing land is already broken and 2 x 100 TPD sponge iron plant is under operation.

There is no forest, national park, wild life sanctuary, eco sensitive areas in surrounding 10 Km of the plant boundary. However, project site is located at a distance of 2.0 km (aerial distance) from the Tungabhadra Reservoir.

4.5 Existing Infrastructure

Required infrastructure like office building, canteen, laboratory, weighing bridge, storage yard for raw material and finial product, etc., is available.

4.6 Soil Classification

The soil is generally formed due to slow process of weathering of rocks. The normal mineral compositions of plant are altered by alteration in soil condition. Existence of flora & fauna depends upon the quality of soil in the area. The soil characteristics like physical, chemical, erosion index, soil fertility has bearing on the surrounding environment. Therefore the quality of soil play a major role in planning proper mitigative measures like plantation program and green belt development by the project proponent and also for the construction of building for different purposes. The normal mineral composition of plants is altered by alteration in soil condition. Soil could well represent the topsoil cover, which is rich in nutrient content.

4.7 Climatic Data from Secondary Sources

The area has a Tropical hot and dry. In July and October heavy rainfall is intense, and there are often showers into November. Yearly rainfall is 572 mm, average temperature of 37 °C (99 °F), ranging from 11 to 18 °C (53 to 65 °F), with the highest temperatures occurring in April and May, Relative Humidity is about 40%.

4.8 Social Infrastructure available

The project site is located approximately 1.5 km from the human settlement (village: Kunikeri). Basic amenities of life are easily available in the area. Primary health centre, school, drinking water, electricity, communication, road network, transportation facility is available in the vicinity. The existing infrastructure is sufficient to cater the additional load due to the proposed expansion project.

CHAPTER 5

PLANNING BRIEF

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

The proposed brown field expansion project would be sited near Kunikeri Village, Koppal Taluk & District. The total land area of the project would be about 30 acres within the overall land area available with BSPL.

5.2 Population Projection

The population break-up of all the villages falling with-in the buffer-zone, as per 2011 census data is given below, it is seen that the total population with-in the buffer-zone is 37,512 vide census of 2011.

The proposed expansion project as per applicable regulations would employ local workers. However due to foreseen employment opportunities in the proposed project and increase in ancillary economic activities, growth in mi grant population is anticipated during construction stages.

5.3 Land Use Planning

The total area f r steel plant would be about 7742.06 acres, consisting of tentatively the following:

- Built up facilities in terms of buildings, shops, yards etc :
- Roads way corridors
- Drainage channels
- Green Cover
- Others:

33% of the total area is earmarked for green belt development. The layout would also house canteen, administrative buildings, workshops, laboratories, stores, in-plant roads, etc.

5.4 Assessment of Infrastructure Demand (Physical & Social)

The following infrastructure development in the area is being carried out to support the growth of the steel plant and for its sustainable operation.

- Provision of safe potable water facilities in surrounding villages is being implemented by BSPL.
- Provision of medical facilities in the project influence area with special emphasis on primary health care through private Mobile Health Units, Government Public Health Centers and medical camps.
- Industrial and Vocational training to local youth groups (both girls & boys) for diversification of skills and enhancement of livelihood.
- Provision of social infrastructure like that of community toilets, playgrounds, community halls with basic amenities.

CHAPTER – 6

PROPOSED INFRASTRUCTURE

6.1 Industrial Area (Processing Area)

The plant location has been chosen close to the industries. The site located in the Kunikeri Village of Koppal Taluk & District. The average elevation 549 MSL and is geographically located at 76^0 11' 49.28" E Longitude & 15^0 19' 27.77" N Latitude. The nearest railway station is Ginigera Railway station, which is at a distance of 8 Km. the Road connectivity is through NH - 63 located at distance of 8 Km from the plant. Hence the transportation to various sites of finished products is easy and economical.

The production facilities in the proposed expansion will be located within the existing plant area of 30 acres.

6.2 Residential Area (Non- Processing Area)

BSPL is having existing housing for workers which will be expanded. Canteen is also proposed to set up.

6.3 Green Belt

Company is committed to develop dense green belt area in project site as per government rules. Green belt is proposed to develop 33% of the total area. Following are the species of trees which are planned to be plant.

- Ashoka trees
- Neem trees
- Mango trees
- Gul-mahor

6.4 Social infrastructure

Basic amenities of life are easily available in the area. Primary health centre, school, drinking water, electricity, communication, road network, transportation facility is available in the vicinity.

6.5 Connectivity (Traffic and Transportation Road/Rail/Metro/Water Ways etc)

BSPL is well connected to other parts of the country by Road and Rail.

6.6 Drinking water Management (Source & Supply of water)

Required water shall be obtained from bore well within the project site.

6.7 Industrial Waste Management

In the process of steel process and non-process wastes and effluents are generated and the sane has been discussed in **Chapter - 3.**

6.8 Solid Waste Management

The major solid wastes generated in the proposed expansion project, its management and disposal has been discussed in **Chapter - 3.**

6.9 Power Requirement and Supply/Source

Power Supply will be met from State Electricity Board, Substation of 15 MW and once the plant becomes operation, the power generated within the plant will be utilized back to the plant. The excess will be given to State/National Power Grid.

CHAPTER 7

REHABILITATION AND RESETTLEMENT (R & R) PLAN

The proposed expansion project is a brown field project with all the proposed facilities coming up with in the existing land area of the existing sponge iron plant complex.

The project entails use of existing water allocation, power facilities with zero liquid discharge. Further, all the solid wastes are proposed to be recycle or sold.

In view of this, there are no R & R issues.

CHAPTER – 8

PROJECT SCHEDULE AND COST ESTIMATION

8.1 Project Implementation Schedule

The Schedule of Implementation for all Plants is as follows.

Table 8.1: Project Implementation Schedule

Sr. No	Plant	Time Period
1	Sponge Iron Plant	14 Months
2	Induction Furnace	10 Months
3	Captive Power Plant	14 Months
4	Beneficiation Plant	12 Months
5	Rolling Mill	10 Months

8.2 Project Cost Estimation

The estimated capital cost for the land, plant & equipment worked out for all the facilities are presented in **Table 8.2.** The total project cost is **225.28 Crores** for proposed expansion project.

Table 8.2: Details of Project Cost Break-up

						Amount in : Crores
Sr. No.	**Particulars**	**Beneficiation Plant**	**Sponge Iron Plant**	**Induction Furnace**	**Rolling Mill**	**Power Plant**
1	Land Development (incl. boundary wall, roads, drainages, etc.)	7.00				
2	Civil Work	1.98	2.50	1.65	2.10	7.00
3	Structural Work	2.10	6.25	6.19	5.25	0.50
4	Erection & Fabrication of Structural Buildings	0.90	1.65	2.10	1.05	0.15

					Amount in : Crores	
Sr. No.	**Particulars**	**Beneficiation Plant**	**Sponge Iron Plant**	**Induction Furnace**	**Rolling Mill**	**Power Plant**
5	Plant & Machinery	19.76	22.76	18.18	19.76	61.75
6	Erection & Commissioning	3.96	3.20	3.64	3.95	6.00
7	Design & Drawings	0.35	0.35	0.25	0.20	0.45
8	Project Management	0.50	0.50	0.20	0.20	0.70
9	Working Capital	3.00	2.00	2.25	2.50	0.50
	Sub Total	**32.55**	**39.21**	**34.46**	**35.01**	**77.05**
	Total	**225.28**				

CHAPTER 9

ANALYSIS OF PROPOSAL

9.1 Financial and Social benefits with special emphasis on the benefit to the local people including tribal population, if any in the area.

9.1.1 Financial Benefits of the Project

The financial benefits accrued from the project would improve the profitability of the promoter company, but also strengthen the economy of the state due to revenues from taxes and duties derived from sale of value added products. Installation additional facilities in terms of state-of-art steel plant with captive power plant, add huge impetus to the growing economy of the state and the country.

9.1.2 Social Benefits

The proposed brown field expansion in a relatively backward part of the state of Karnataka would help in

- Further enhance local direct and indirect employment opportunities in the project influence area
- Promote the development of ancillary industries, medium-small scale trade & commercial establishments, local entrepreneurship and diversification in skill set
- Generate local income, boost the local purchasing power and promote an increase in land prices & rent
- Contribute to the local economy and the state revenue.

The peripheral development activities that would be undertaken by the proposed expansion project will focus on vulnerable communities in the project influence area. The project would bring forward an overall socio-economic development with emphasis in the areas of employment, education, training, health and infrastructure.

for **METAMORPHOSIS Project Consultants Pvt. Ltd.,**

Dr. Shanth A. Thimmaiah
EIA Co-ordinator

for **Bhadrashree Steel & Power Limited**

Bhadrashree Steel & Power Ltd. HOSPET

Mudit Goel
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