Use of Lower Quality Iron Ore
Need of the Hour

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With the rapid development of infrastructure and manufacturing sector, the iron and steel industry is poised for an accelerated growth. In order to meet the steadily growing steel demand in the country, domestic steel producing capacity is required to be higher than 150 mtpa by the year 2019-20. Utilization of low grade ore and fines and indigenous coals has to play an important role in this growth. As hard ore reserves is depleting day by day, lump generation suitable for blast furnace operation is coming down resulting in production of large amount of surplus fines. Alternative iron making processes can enable the use of ores which could not be utilized earlier. As fines forms considerable part of iron ore resources, value addition to the iron ore fines through various activities such as beneficiation, pelletisation is the need of the hour.

Raw Materials: Concern for Indian Steel Industry

Raw materials are crucial in determining the competitive growth of any industry. This is more so for an input-intensive extractive industry like steel. The issues related to problems of degradation of environment, displaced population and of developing transportation network are bound to impact indigenous availability, cost of production and usage pattern of all steel making raw materials. For sustained & planned growth of steel industry, it is necessary to have long term planning. Accordingly, projected requirement of major raw materials based on projected demand of steel in next five years as predicted by 12th FYP is given in table 3

Table 3: Raw materials Requirement for Projected Iron and Steel Production (Base Case) (million tonnes)

	2012-13	2013-14	2014-15	2015-16	2016-17
Crude Steel Production	85.9	94.5	104	114.5	125.9
Pig Iron for Sale	6.88	7.66	8.54	9.38	10
Iron Ore	135.7	149.43	166.66	185.24	206.18
Coking Coal	52.29	57.91	67.49	77.23	90.16
Non-Coking Coal (For Sponge Iron)	37.86	36.5	34.71	33.92	28.41
PCI Coal	2.4	2.66	3.2	3.83	4.54
Manganese ore	2.96	3.4	3.98	4.57	5.19
Chromite	2.9	3.19	3.52	3.93	4.31
Ferro Manganese	0.51	0.57	0.64	0.7	0.74
Ferro Silicon	1.42	1.56	1.74	1.94	2.16
Silico Manganese	0.26	0.28	0.31	0.34	0.38
Refractories	1.29	1.42	1.56	1.72	1.89

Iron Ore Reserves & Availability

Iron ore is one of the most important raw materials for the steel industry. It accounts for average, for 25-30% in cost of steel. Out of two varieties of iron ore found in the country, viz. Hematite and Magnetite, the domestic steel industry is mainly using Hematite ore. Domestic steel industry has been traditionally

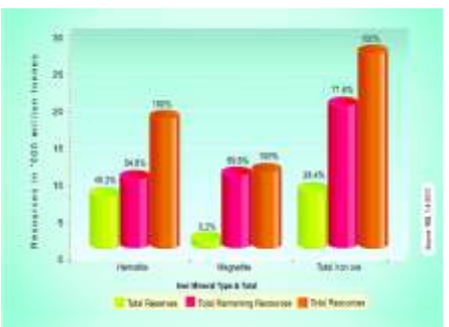

Fig.1: Total resources of iron ore in India as on 1/04/2010

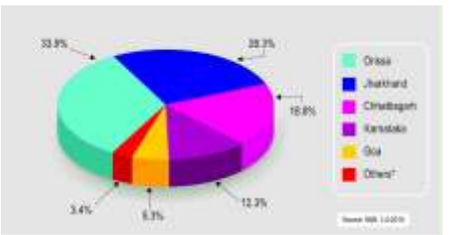

Fig.2: State wise total resources of Hematite ore in as on 1/04/2010

enjoying a strategic advantage of domestic availability of good quality Hematite iron ore. The total iron ore reserve in India and its state wise distribution is indicated in figure 1 & figure 2.

Need for Optimum Utilization of Iron Ore Fines

There is an increasing trend in the generation of fines to 58% out of total production of iron ore in the year 2009-10 as against 52% in 2006-07[5] (figure 3). Generation of fines in India currently exceeds the domestic demand resulting in exportable surplus. There has already been a shift in increased use of fines by steel makers by utilizing agglomerated iron ore fines. Action is also in hand to make use of higher percentage. Greater emphasis needs to be given on setting up of beneficiation & pelletisation facilities, both by steel producers as well as by merchant miners. It is required to explore possibility of introducing statutory provisions for making beneficiation and

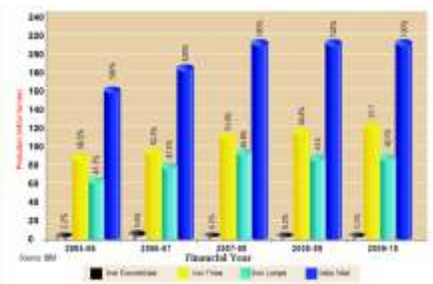

Fig. 3: *Production of iron ore lumps, fines & concentrates in India*

pelletisation / agglomeration mandatory to certain extent as part of conditions of mineral concessions.

Need For Adoption of Agglomeration Techniques for Fines Utilization

Sintering and Pelletisation are two main methods of agglomeration of iron ore fines. Increasing percentage of sinter in the burden, say from 20-30% to about 60-70% (often considered to be optimum) have marked beneficial influence on blast furnace performance.

Similarly, use of pellets gives rise to improved permeability in blast furnace as compared to lumpy ore or sinter. This leads to better solid-gas contact resulting in higher productivity at low coke rate. At present, 15-20% pellets arc used in many furnaces along with sinters & lump ore. Higher percentages of pellets are however avoided because of high cost, tendency of pellets to swell when gas pressure is developed in the pores during reduction. It is a fact known world over that no hot metal can techno-economically be produced without agglomerates in the charged burden.

Need of Beneficiation of Iron Ore

Hematite ore is considered to be the most important iron ore because of its high-grade quality & lumpy nature, which is consumed by a large number of pig & sponge iron industries in India. Magnetite deposits are not exploited so far for domestic use on account of their poor grade lumps (40% Fe). However, it can be utilized after beneficiation at a finer size followed by pelletisation.

The detail of the total iron resources in India is presented in Fig 4.

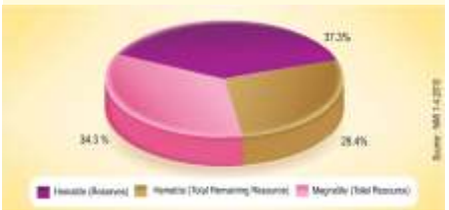

Fig 4 : *Total resources of iron Ore in India as on 1/4/2010 (Source: NMI)*

Domestic iron ore production is mainly in the form of lumps and fines in the ratio of around 2:3. Of these, domestic consumption in iron & steel making is only around 40-45% in the form of lumps & sinters, the remaining is exported. The bulk (around 90%) of the iron ore fines get exported, as they cannot be utilized in iron making without agglomeration.

Indian hematite, though rich in iron content have higher percentage of alumina (Al2O3 1 to 7%) and low silica content i.e., high alumina: silica ratio (1.5—3.0 for lumpy ore and 3-4 for fines). This adverse alumina to silica ratio is detrimental to blast furnace as well as sinter plant productivity and should be less than 1.5 and preferably below 1. Hence, beneficiation/ processing of iron ore are necessary to reduce alumina, silica and other gangue materials in the feed.

Necessity of Alternative Routes of Iron Making

The blast furnace has remained the traditional route & would continue to dominate iron making in India. However, in view of the high investments, limited availability of metallurgical coke, there is an increasingly growing awareness that the blast furnace route needs to be supplemented with alternative iron making processes.

Over the past two decades, alternative technology to produce solid iron in the form of sponge iron also referred to as Direct reduced iron (DRI), based both on coal and gas as well as to produce hot metal (liquid) without using high-grade coke via reduction smelting (SR) route have played a significant role in iron making technology in India. It is pertinent to note that today India is the largest producer of DRI (sponge iron) in the world. In India there are many steel producers which are using these alternative processes to economically produce iron by utilizing lower quality iron ore and non coking coals.

Need of the Hour

- Presently, most of the steel plants wash and (partially) beneficiate their primary raw materials particularly, iron ore and coal. Adoption of the modern and suitable beneficiation techniques, yield and the quality of the prime output can be improved.
- The generation of fines during mining is continually on the rise and hence the agglomeration processes such as pelletisation and sinter making are becoming quite essential for Indian steel plant.
- Up gradation of coal washeries and development of processes to reduce coal ash and improve the yield is vital for the Iron and Steel.

In the light of aforesaid, it can be emphasized that, steel making necessitated the 'whole gamut' of activities right from mining of r.o.m. iron ore at the threshold value of 45% Fe (35% Fe for siliceous hematite ore) to value addition/beneficiation of iron ore, sintering & pelletisation followed by iron and steel making through Blast furnace cum BOF/LD or DRI cum EAF/IF of processes.

Conclusions & Recommendations

To keep pace with the likely growth of steel industry it is very much required to implement the following aspects in time bound manner.

- Immediate processing of' sinter fines (classifier underflow) being used for sinter making by ISPs, for making of quality sinter grade material.
- Immediate utilisation of available stacked fines (-10 mm) and stacked sub-grade/marginal grade ore through deployment of appropriate beneficiation technology.
- Improving the processing capacity of existing beneficiation facilities to produce quality product & introduce the concept of total beneficiation of r.o.m. ore at 45% Fe cut-off (for quality lumps, sinter & pellet fines) for optimum utilization of available reserves.