

OVERVIEW OF IRON ORE MINING IN INDIA VIS-A-VIS STATUS OF PRODUCTION IN 2020 AD

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ABSTRACT

This paper presents overview of distribution of iron ore reserves in India and other countries along with the trend of production achieved up to 2010, and projected up to 2020 AD. Crude steel production in top ten countries in the world is enumerated. Details of iron ore reserves in the form of Hematite and Magnetite in five zones of India are presented. State wise production of iron ore and export of ore from different states of our country is illustrated. Projected demand of raw materials for the steel industry for the year 2019-20 including iron ore, coking and non-coking coal are also presented. Status of production and reserve availability in top five organizations dealing with iron ore mining ex: NMDC, SAIL,, Sesa Goa are also presented. Growth of major private companies related to iron ore mining in India are also presented with a critical appraisal on the need of further development of iron ore mining industry with modern technologies.

Overview of status of steel plants such as RSP, VSP, BKP, JSPL etc are presented. National steel policy 2005 as approved by Govt of India in Sept 2005, projected a demand of 110 mt steel production against 38 mt produced during 2004-05. Expected consumption is about 90 mt for the year 2019-20 as compared to about 36 mt only during 2004-05. Major Emphasis of the policy vis-à-vis critical Input Raw Materials: Iron Ore and Coking Coal. A very big gap in the expected demand by 2020 AD and the present rate of production from the existing mines with the available level of technology emphasizes the urgent need of innovative mining technologies to be implemented with due regards to safety, conservation and environment friendly approaches encompassing meticulous corporate social responsibility. Active participation from domestic sectors should be highly encouraged to contribute to the vision of 2020 AD for the iron ore mining industry.

1.0 INTRODUCTION

Iron is the second most abundant metallic element in the Earth's crust and accounts for 5.6% of the lithosphere. The principal minerals of iron are the oxides (Haematite and magnetite), hydroxide (limonite and goethite), carbonate (siderite) and sulphide (pyrite). Iron, like most metals, is found in the Earth's crust only in the form of an ore, i.e., combined with other elements such as oxygen or sulfur. Haematite and magnetite are the two important iron ores from which iron is extracted. Of these, Haematite is considered to be superior owing to its high grade. It is the basic raw material for iron and steel industry. Steel is an alloy that consists mostly of iron and has carbon content between 0.2% and 2.1% by weight, depending on the grade. Steel is crucial to the development of any modern economy and is considered to be the backbone of human civilization.

The level of per capita consumption of steel is treated as an important index of the level of socioeconomic development and living standards of the people in any country. It is a product of a large and technologically complex industry having strong forward and backward linkages in terms of material flows and income generation. All major industrial economies are characterized by the existence of a strong steel industry and the growth of many of these economies has been largely shaped by the strength of their steel industries in their initial stages of development. Steel industry was in the vanguard in the liberalization of the industrial Sector and has made rapid strides since then the industry has moved up in the value chain and exports have raised consequent to a greater integration with the global economy. At the same time, the domestic steel industry faces new challenges. Some of these relate to the trade barriers in developed markets and certain structural problems of the domestic industry notably due to the

high cost of commissioning of new projects The domestic demand too has not improved to significant levels. The litmus test of the steel industry will be to surmount these difficulties and remain globally competitive.

2.0 IRON ORE RESERVES AND STATUS OF PRODUCTION

2.1 International scenario:-

The world reserve base of crude iron is estimated to be 370 billion tonnes (USGS Mineral commodity summary, 2008). The reserve base of iron content of iron ore is estimated to be around 160 billion tonnes. USGS has also estimated that the world resources are estimated to exceed 800 billion tonnes of crude ore containing more than 230 billion tonnes of iron. Iron ore deposits are distributed in different regions of the world under varied geological conditions and in different geological formations. The top ten countries in the world in the order of their iron resources were the Commonwealth of Independent States (erstwhile USSR), Australia, Canada, USA, Brazil, India, South Africa, China, Sweden and Venezuela (Table 1).

Table 1: World resources of iron ore by principal countries (source:USGS 2008)

	Qty: Million tonnes			
	Crude ore		Iron content	
	Reserve	Reserve base	Reserve	Reserve base
United States	6900	15000	2100	4600
Australia	15000	45000	8900	28000
Brazil	23000	27000	16000	14000
Canada	1700	3900	1100	2500
China	21000	46000	7000	15000
India	6600	9800	4200	6200
Iran	1800	2500	1000	1500
Kazakhstan	8300	19000	3300	7400
Mauritania	700	1500	400	1000
Mexico	700	1500	400	900
Russia	25000	56000	14000	31000
South Africa	1000	2300	650	1500
Sweden	3500	7800	2200	5000
Ukraine	30000	68000	9000	20000
Venezuela	4000	6000	2400	3600
Other countries	11000	30000	6200	17000
World	160,000	37,000	79,000	160,000
Total (rounded)				

Total production of iron ore in the world was 2.4 million tons in 2010. Ranking of iron ore producing countries was the Commonwealth of Independent States, China, Brazil, Australia, USA, India, Sweden, Canada, South Africa and Venezuela (Table 2). India stands at fourth position with a total iron ore production of 0.26 million tons.

Table 2: iron production in top 10 countries (UGS,2010)

Rank	sovereign state	by	Country	Iron ore production (thousands of tonnes)	year
			World	2,400,000	2010
1			China	900,000	2010
2			Australia	420,000	2010
3			Brazil	370,000	2010
4			India	260,000	2010
5			Russia	100,000	2010
6			Ukraine	72,000	2010

7	South Africa	55,000	2010
8	United States	49,000	2010
9	Canada	35,000	2010
10	Iran	33,000	2010

2.2 Indian Scenario

India is an important producer of iron ore in the world contributing more than 7% of the production and ranking fourth in terms of quantity produced following China, Brazil, and Australia. As per UNFC system as on 1.4.2005, India possesses total haematite resources of 14,630 million tonnes of which 7,004 million tonnes are reserves and 7,626 million tonnes are remaining resources. Major haematite resources are located mainly in Jharkhand-4036 million tonnes (28%), Orissa-4761 million tonnes (33%), Chattisgarh-2731 million tonnes (19%), Karnataka-1676 million tonnes (11%) and Goa-713 million tonnes (5%). The balance resources are spread over the states of Maharashtra, Madhya Pradesh, Andhra Pradesh, Rajasthan, Uttar Pradesh and Assam and altogether contain around 4% of haematite. Total resources of iron ore in India as on 1.4.2010 is about 28,562 million tons (Table 3). Magnetite is the other principal iron ore occurring in the form of oxide which is either of magmatic origin or metamorphosed banded magnetite silica formation, possibly chemogenic sedimentary origin.

Table 3: Resources and reserves of iron ore in India as on 1.4.2010 (IBM, 2010)

(Million Tonnes)			
Grade	Reserves	Remaining Resources	Total Resources as on 1.4.2010
Haematite	8093.5	9788.6	17882.1
Magnetite	21.8	10622.3	10644.1
Total	8115.3	20410.9	28526.2

(Source: Indian Bureau of Mines, Ministry of Mines)

The magnetite resources are placed at 10,619 million tonnes of which only 58 million tonnes constitute reserves, located mainly in Goa. A major share of magnetite resources is located in Karnataka- 7812 million tonnes (74%), Andhra Pradesh-1464 million tonnes (14%), Rajasthan-527 million tonnes & Tamil Nadu-482 million tonnes (5% each), and Goa-214 million tonnes (2%). Assam, Jharkhand, Nagaland, Bihar, Madhya Pradesh and Maharashtra together account for a meager share of magnetite resources. The most important magnetite deposits are located in Babubadan, Kudremukh, Bellary, Anadurga and Bangarkal areas of Karnataka, Goa region - Ongole and Guntur dist. of Andhra Pradesh etc. Other deposits are also located in Jharkhand , Bihar, Tamilnadu, Kerala and Assam.

Iron ores are generally classified as haematite, magnetite, limonite and siderite. in India, iron ore mostly occurs as haematite or magnetite and the former is about 75% of the total. with recoverable reserves of 13460 million tonnes, India ranks sixth in the world in terms iron ore resources and is a leading producer and exporter after brazil and Australia. The state wise recoverable reserves are shown in Table 4.

Table 4: State wise reserves of hematite and magnetite found in India (in million tonnes).

State	Recoverable Reserves		Total
	Haematite	Magnetite	
Andhra Pradesh	47	418	465
Bihar(Jharkhand)	2967	5	2972
Goa	762	165	927
Karnataka	929	2518	3447

Kerala	-	35	35
Madhya Pradesh (Chattisgarh)	2045	-	2045
Maharashtra	176	-	176
Orissa	2667	-	2667
Rajasthan	9	1	10
Tamil Nadu	-	1	1
Total	9602	3143	12745

About 12% of haematite deposits are of high grade(fe:+65%), 44% are of medium grade(fe-63 to 65%)and 28% are of low grade(fe:-62%) Indian iron ores are characterized by adverse alo₃ to sio₂ ratio. bluedust is over 1% of the deposits. rest is unclassified/not known. as regards magnetite ore, about 47% is metallurgical grades and rest is unclassified.

2.2.1 Production, Exports and Imports.

During the period 1995-2000, exports constituted over 40% of the production, imports were mainly by the steel plants in western India. During 1998-99 and 1999-2000, public sector accounted for 53 to 55%of total production and the rest was by private sector (Table 5). Captive production was around 50% in case of public sector and about 20% in case of private sector.

Table 5: Production, Exports and Imports of Iron ore during last five years (in'000t)

Year	Production	Export	Import
1995-96	67418	31719	879
1996-97	68161	27627	853
1997-98	75723	29496	372
1998-99	72230	29587	149
1999-00	73475	29963	-

3.0 DEMAND OF RAW MATERIALS

The long-term goal of the national steel policy is that India should have a modern and efficient steel industry of world standards, catering to diversified steel demand. The focus of the policy would therefore be to achieve global competitiveness not only in terms of cost, quality and product-mix but also in terms of global benchmarks of efficiency and productivity. This will require indigenous production of over 100 million tonnes (mT) per annum by 2019-20 from the 2004-05 level of 38 mT. This implies a compounded annual growth of 7.3 percent per annum.

The above strategic goal is justified on the ground that steel consumption in the world, around 1000 mT in 2004, is expected to grow at 3.0 percent per annum¹ to reach 1,395 mT in 2015, compared to 2 percent per annum in the past fifteen years. China will continue to have a dominant share of the world steel demand. At home, the Indian growth rate of steel production over the past fifteen years was 7.0 percent per annum. The projected growth rate of 7.3 percent per annum in India compares well with the projected national income growth rate of 7-8 percent per annum, given an income elasticity of steel consumption of around 1.

In terms of consumption of steel, defined as production plus imports minus exports, the present equation is 38+2-4 = 36 mT in 2004-05. The following table gives the equation for 2019-20 and the projected compounded annual growth rates for production, imports, exports and consumption. Cumulative raw

material requirement for projected crude steel production indicates demand of 702 million tons of coking coal during 2019-20, and 8,065 million tons during 2040-41 (Table 7).

Table 6: Critical inputs for steel Production (Anon, 2005) (in million tonnes)

	Iron Ore	Coking Coal	Non-Coking Coal
2019-20	190	70	26
2004-05	54	27	13

Table 7: Cumulative raw material requirement for projected crude steel production (in Million Tonnes)

	2011-12 to 16-17*	2011-12 to 19-20		2011-12 to 25-26		2011-12 to 35-36		2011-12 to 40-41	
		7.0%	8.0%	7.0%	8.0%	7.0%	8.0%	7.0%	8.0%
Crude Steel Production	598.5	1035	1044	2277	2378	6163	6937	9558	11220
Pig Iron for Sale	48.59	83	84	177	183	448	496	671	770
Iron Ore	958.24	1672	1687	3698	3862	10008	11254	15497	18168
Coking Coal	388.33	702	708	1598	1672	4411	4971	6865	8065
Non-Coking Coal (for Sponge Iron Sector)	206.71	311	313	637	669	1762	2009	2789	3321
PCI Coal	18.58	34	35	80	84	224	253	350	413
Manganese Ore	21.72	37.57	37.89	80.84	86.32	223.71	251.80	346.95	407.28

4.0 GROWTH OF MAJOR PRIVATE COMPANIES

India's production capacity of crude steel was expected to reach about 110 Mt/yr by December 2012 from the current 72 Mt/yr. The brownfield steel projects could add 36 Mt/yr of capacity whereas a greenfield project could add 3 Mt/yr. In addition, Essar Steel Co. Ltd.'s and Tata Steel Ltd.'s greenfield projects were likely to be delayed after 2012. Iron ore production by public sectors during 2006 was almost half of the production from private sectors. The contribution of the private sector in crude steel production in the country during the last five years was three times more than the production from public sector (Table 9).

Table 9: indian crude steel production (million tonnes) (JPC, 2012)

	2006-07	2007-08	2008-09	2009-10**	2010-11*	2011-12* (Apr-Dec.)
Public Sector	17	17.09	16.37	16.71	16.99	12.26
Private Sector	33.81	36.77	42.07	49.13	52.67	41.10
Total Production	50.81	53.86	58.44	65.84	69.57	53.36
Share of Public Sector (%)	33	32	28	25	24	23

Source: JPC; * =Prov. ** Revised figures

5.0 STATUS OF STEEL PLANTS IN INDIA

The Steel PSUs are in the midst of the capacity expansion plans. The major thrust of the modernization and expansion plans is to adopt the best modern technology, which in addition to being cost effective should also be energy efficient and environment friendly. The progress of the expansion of SAIL, RINL and NMDC

is monitored on a regular basis in the Ministry. As a consequence of monitoring, a number of systemic improvements have been put in place in project implementation. Major steel manufactures in India were classified into three groups; Main, Major and Mini producers (Table 10). During 2010-11 total contribution of the PSU was Rs 4,093 Crores, and SAIL was leading with Rs 2,452 Crores (Table 11).

Table 10: Major steel manufactures in India (IBEF, 2010)

Steel manufacturers		
Main producers	Major producers	Mini plants
<ul style="list-style-type: none"> Steel Authority of India Ltd (SAIL) Rashtriya Ispat Nigam Ltd Tata Steel Ltd 	<ul style="list-style-type: none"> JSW Steel Ltd Essar Steel Ltd Ispat Industries Ltd Jindal Steel & Power Ltd 	<ul style="list-style-type: none"> Electric arc furnace (EAF) based units —33 working units Induction furnace-based units — 970 working units MBF*-ETF** based units — two units

Table 11: Contribution of the steel PSU to the state Governments (Ministry of Steel, 2012)

(₹ in crore)

Sl. No.	PSU/ Company	2008-09	2009-10	2010-11	2011-12* (Apr-Dec)	2011-12 (Jan-Mar Estimated)
1	SAIL	2021.00	2160.00	2452.19	1909.00	NA
2	RINL	372.25	340.36	333.49	337.65	112.55
3	NMDC	239.68	454.09	1114.43	939.00	250.00
4	MOIL	90.84	93.79	109.29	54.84	25.61
5	MSTC	NIL	97.53	28.40	20.20	9.00
6	FSNL	0.47	0.53	0.32	0.73	0.24
7	SIIL**	1.32	Merged with NMDC			
8	MECON	0.61	1.51	4.95	5.90	1.72
9	KIOCL	6.10	4.13	8.25	18.00	10.00
10	HSCCL	118.87	1.04	26.03	20.00	6.00
11	BGC	13.23	9.47	16.53	4.46	0.06
	Total	2864.37	3162.45	4093.88	3309.78	415.18

*Provisional, **SIIL was merged with NMDC during 2010.

6.0 PRODUCTION AND CONSUMPTION BY 2019-20

6.1 Production

Iron ores produced in India go mainly either into export or into domestic consumption. India is a major global player in iron ore production and third in the world trade of iron ore after Australia and Brazil. Export of iron ore which was 62.5 million tonnes in 2003-04 was increased to 91.43 million tonnes in 2006-07 and again decreased to 68.47 million tonnes in 2007-08. The growth of steel industry in India during last three/four years also registered a significant upward trend and expected to swim depending on overall economic growth rate. Iron ore demand depends on the production of iron and steel which in turn depends largely on the domestic demand for the same. The prospective investors like Tata steel, Tata-Corus,

Jindal Power and Steel, Global steel giants POSCO, Arcelar Mittal and other major industrial houses are to invest in steel sector in India. Recent UNCTAD report states of 375 million tonnes new production capacity round the world is likely to be on board by 2007-09. According to the 11th Plan Working Group on Steel, demand for iron ore would rise to 130 million tonnes by 2011-12. The national steel policy has envisaged the target of steel production at 110 million tonnes by 2019-2020 which will be requiring ~170 million tonnes of iron ore. A target set in the **National Steel Policy-2005** suggests a production of 300 million tonnes of iron ore by 2019-20 to meet export and domestic demand.

6.2 Strategic Goal as per National Steel Policy-2005

The long-term goal of the **National Steel Policy-2005** is that India should have a modern and efficient steel industry of world standards, catering to diversified steel demand. The focus of the policy would therefore be to achieve global competitiveness not only in terms of cost, quality and product-mix but also in terms of global benchmarks of efficiency and productivity. This will require indigenous production of over 100 million tonnes (mT) per annum by 2019-20 from the 2004-05 level of 38 mT. This implies a compounded annual growth of 7.3 percent per annum.

The above strategic goal is justified on the ground that steel consumption in the world, around 1000 mT in 2004, is expected to grow at 3.0 percent per annum¹ to reach 1,395 mT in 2015, compared to 2 percent per annum in the past fifteen years. China will continue to have a dominant share of the world steel demand. At home, the Indian growth rate of steel production over the past fifteen years was 7.0 percent per annum. The projected growth rate of 7.3 percent per annum in India compares well with the projected national income growth rate of 7-8 percent per annum, given an income elasticity of steel consumption of around 1. In terms of consumption of steel, defined as production plus imports minus exports, the present equation is $38+2-4 = 36$ mT in 2004-05.

6.3 Consumption

The projected compounded annual growth rates for production, imports, exports for 2019-20 is 110, 6, and 26 million tone , respectively (Table 12). Steel producers have signed 222 MoUs with various states (Orissa, Jharkhand, Chhatisgarh ,West Bengal, Karnataka,Gujarat And Maharashtra) for a planned capacity of about 488.66 million tones during 2011-12 (Table 13). Forecast of steel production and iron ore demand in 2019-20, is about 220, 280 million tons, respectively. Steel production and iron ore demand forecasted for 2079-80, is about 1,040, 1,300 million tons, respectively. Crude steel production in India from the trend of 1950-2011 was estimated to be 200 MT in the year 2019-20 (Ibef,2010) (Fig2).

**Table 12: Production, Imports, Exports and Consumption of Steel
(in million tonnes)**

	Production	Imports	Exports	Consumption
2019-20	110	6	26	90
2004-05	38	2	4	36
CAGR*	7.3%	7.1%	13.3 %	6.9 %

Notes: * Compounded Annual Growth Rate

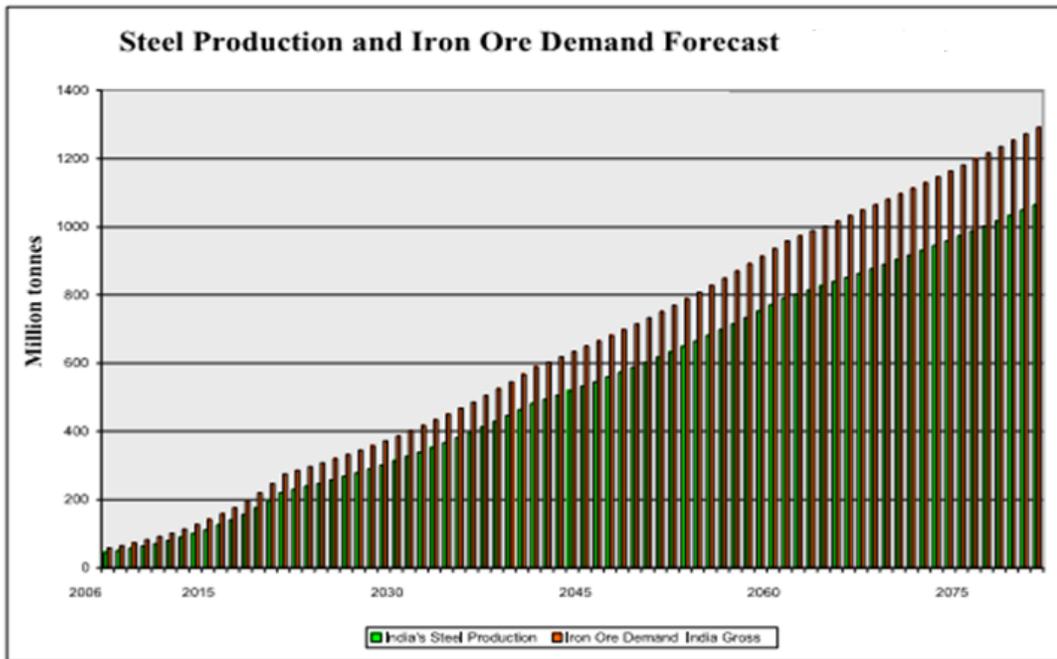


Fig 1: Steel production and iron ore demand forecast (IBEF, 2010)



Fig2: Crude steel production in India from 1950-2020 (estimated)(inMT) (IBEF, 2010)

India has become 4th largest producer of crude steel in the world as against the 8th position in 2003 and is expected to become the 2nd largest producer of crude steel in the world by 2015.

**Table 13: list of states up for new projects and project capacity
(Ministry of Steel Annual Report 2011-12)**

State	No. of MoUs signed	Approx. Capacity (in million tonnes per annum)
Orissa	63	81.16
Jharkhand	49	105.11
Chhattisgarh	76	60.00
West Bengal	16	39.40
Karnataka	57	173.00
Andhra Pradesh	18	11.79
Other States	22	18.20*
Total	301	488.66

*estimated

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7.0 CONCLUSION

India stands at 8th position with 9,800 million tons of iron ore resource out of 37,000 million tons of ore resource in the world as per the statistics of 2008. Production of iron ore during 2009-2010 was 260 million tons in India standing in 4th position as compared to 2,400 million tons in the world. Government focused approach and interventions are facilitating fast track growth. Contribution of PSU was regularly decreasing in crude steel production as compared to private sectors over the years. Private sectors contribution was double the production of PSU during 2005-06, while it was about three times during 2010-11. Steel producers have signed 222 MoUs with various states (Orissa, Jharkhand, Chhattisgarh, West Bengal, Karnataka, Gujarat And Maharashtra) for a planned capacity of about 488.66 million tones during 2011-12. Initiatives for simplification of procedures related to development of mining activities in India are in progress. In view of the ever increasing demand of steel and associated raw material, the following challenges need to be met in near future to fulfill the vision of 2020 AD:

- i. Synergy in meeting iron ore and coking coal requirements
- ii. Joint Ventures and Equity participation abroad by steel and coal companies for augmenting supplies of coking coal
- iii. Investments in beneficiation of non-coking coal as well as establishing Natural Gas as an alternative source for usage in sponge iron industry.

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