

Status of Sponge Iron Industry in Jharkhand

- By V. D. Manjrekar
Geo-Mining Consultant

The State of Jharkhand is witnessing unprecedented growth of the DRI mainly sponge iron. The endeavors of various organizations related to the Sponge Iron are categorized in four variants viz :

1. Category A : Existing Units
2. Category B : Units Under Construction
3. Category C : Expansion Schemes
4. Category D : Mega Proposals

The state has operating kilns having 1.80 lakh tonness annual capacity Category A) and ten companies with cumulative annual capacity of 4.63 million tonness is under various stages of construction (Category B). Many of them are likely to be commissioned in March/April 2005.

In addition the expansion of the capacities of at least four major operators have already left the drawing and are under various stages of financial back ups. This capacity amounts to 8.51 lakh tonness/per annum. (Category C)

There are seven serious proposals being pursued by major players. The cumulative capacity of these proposals is about 30.70 lakh tonness per annum (Category D). The details of these proposals are given in Table 1.

Ore occurrences in Jharkhand

The Jharkhand state is endowed with huge deposits of Hematite, which is mainly concentrated in West Singhbhum District. The ore occurs in two horizons Viz older & newer iron ore series. The ores of what is popularly Known as Jamda-Koira Valley (or Bonai Synclinorium) contains one of the biggest iron ore deposit of the South Asia called Chiria Deposit. The ores are generally believed to be softer and useful for blast furnace route. However, recent studies have shown that the "hard" ore also occurs in area, particularly in the southern part of the eastern limb of the Synclinorium. It may however, be noted that the "hard" hematite ore constitutes only 12-18% of the total reserves in the country. The grade-wise reserves of the iron ores in the state of Jharkhand are given in Table – 2.

In addition to the Hematite, Jharkhand has few deposits of magnetite. These are concentrated as small dyke like bodies in the districts of Latehar & Palama. These are currently used as heavy media for coal washery.

Fines and their utilization

The iron ore mining produces considerable natural fines including what is called "Blue Dust". Lumpy ore may vary from as low as 40% as high as 70% later is usually in the hard ores. In addition, the sizing of the ore by crushing also produces large amount of fines. The sized ore improves in quality as compared to the ROM ore. The recovery of sized ore varies from 25% to 80% depending upon the hardness of the ore. The fines generated, therefore vary from 75% to 20% of ROM ores.

This huge quantity of "Fines" had very little market so far. Few of the plants were using part of the fine ores mainly after sintering. The palletizing plant, based on the furnace oil erected by Tata Steel in Noamundi proved to be uneconomic after the oil shock. The current trend indicates that a 3 Mty pelletization plant would be economically viable. There is a rumor as lot in the market that even 0.5 Million Pellet Plants could be made and economically run. It has been noticed that properly prepared pellets have far superior properties for DRI manufacturer as compared to the lump ores. The desired properties of a good pellet are

1. Narrow size range and minimum of fines, particularly during handling.
2. Good coal strength and resistance to degradation during handling.
3. High reducibility
4. Resistance to degradation during heating and reduction.
5. Minimum amount of swelling during reduction
6. Little or no tendency to stick and form clusters at reducing temperatures
7. High strength of reduced material

Table - 1 : Category - Wise List of Sponge Iron Manufacturers in the State of Jharkhand

Sponge Iron Projects (Categories)				
Categories	A			
Existing Units	B Norm of Iron ore Requirement = 1.6T/T of DRI (Industry)			
Under Construction	C			
Expansion Projects				
Proposals				
Category-A Units				
Sl. No.	Name of Organisation	Location of Unit	Annual Capacity In Lakh Tonnes	Investment In Rs. Crores
1	MeSS KYS Sponge Iron Ltd Adityapur, Gamharia	Gamharia	0.15	2.89
2	Chandil Industries Ltd Kurli, W Singhbhum	Chandil	0.15	3.7
3	Ashirwad Steel & Industries 1. Crow Lane Kolkata-9	Jamshedpur	0.45	7.16
4	MS Balmukund S. & Iron Ltd, 702, Lov- Kush Tower, Exhibition Road, Patna - 1	Giridih	0.3	5.50
5	MS Bisco Sponge Iron Ltd Plot no.2, Adityapur	Jamshedpur	0.3	4.8
6	MAA Chhinnmastika Sponge Iron Ltd, Expansion Hazaribagh	Hazaribagh	0.15	1.51
7	MS Chandil Industries	Jamshedpur	0.15	2.11
8	MS Vishwanath Ferro Alloys Machadih	Giridih	0.15	3.96
	Sub Total		1.8	31.71

8. Resistance to re-oxidation of the reduced product.

The main advantages of the pellets are :

- Uniform size distribution within narrow range – usually 9-15 mm dia.
- High and even porosity of 25-30%
- High iron content of above 53%
- Practically no loss on ignition or volatiles
- Uniform mineralogical composition in the form of an easily reducible hematite or hematite-bearing compounds.
- High and uniform mechanical strength
- Low tendency to abrasion and good behavior during transportation
- Sufficient mechanical strength even at thermal stresses.

At present, "fines" from Jharkhand are exported mainly to China without making a value added product like pre-reduced pellets etc.

Norms of iron for utilization in sponge iron

Though the consumption norms of the iron ore/pellets will depend on various factors, yet in relation to ore it is

Table - 2 : Grade-wise Recoverable Reserves of Iron Ores in Jharkhand., mainly of Singhbhum Region (1997)

Grade	Hematite			Total
	Proved	Probable	Possible	
Lump High Grade	34.44			34.44
Lump Medium Grade	241.68	428.76	77.12	747.56
Lump Low Grade	258.10	113.34	4.60	376.04
Lumps Unclassified			62.63	62.63
Fines Medium Grade	412.41	513.25	35.15	960.81
Fines Low Grade			52.57	52.57
Lumps & Fines Medium Grade	36.08			36.08
Blue Dust	50.84			50.84
Total	1366	1194	237	2797

Special Coverage

(Table - 1 : Continued)

Sl. No.	Name of Organisation	Location of Unit	Annual Capacity In Lakh Tonnes	Investment In Rs. Crores
Category - B Units (Projects Under Construction)				
1	Thakur Prasad Sao & Sons Prince Anwarshah Road, Kolkata	Dangwaposi, Noamundi	0.36	2.2
2	MS Srisain, Sponge Iron, 7-Brindawan, Gowhati-1	Ramnagar Hazaribagh	0.3	8.54
3	MS Usha Martin Ltd Adityapur, Gamahria	Gamharia	1.25	39.26
4	MAA Chhinnmastika Sponge Iron Ltd, Expansion Hazaribagh	Hazaribagh	0.15	1.507
5	Incoremetals & Cement Jamtara	Bodma, Jamtara	0.3	6.52
6	Nilachal Iron & Power Kandra, Chandil	Ratanpur, Kandra	1.12	36.73
7	SS Samridhi S. Iron P Ltd. Ashiana Trade Center, Adityapur	Sini. S-K	0.3	6.24
8	MS Patwari Steel P Ltd. 6-A Rajendra Nagar Patna, Bihar	Noamundi	0.3	7
9	Jharkhand Ispat Pvt Ltd. Ramgarh	Hesia, Argada	0.6	14.16
10	Balajee Sponge Iron, Ramgarh	Ramgarh	0.15	2.54
	Subtotal		4.83	124.7
Category - C Units (Expansion Projects)				
1	Usha Martin Ltd	Gamahria	3.75	347.5
2	Ashirwad Steel & Indus	Ramgarh	0.6	7.5
3	Bisco Sponge Iron Ltd	Gamahria	0.8	29.72
4	Nilachal Iron & Power Ltd	Kandra	3.36	110.19
	Subtotal		8.51	494.91
Category - D Units (Proposals)				
1	Monnet Ispat Ltd, New Delhi	Hazaribagh*	10	1400
2	Shri Ballabh Steel, Ludhiana	Jamshedpur*	1	141.29
3	S/S Adhunik Steel	Gamharia*	1.2	41.5
4	Pawanjai Steel	Lohardaga*	3	91
5	Abhijeet Infrastructure, Nagpur	Chandwa*	7	205
6	Corporate Ispat Ltd, Nagpur	Latehar*	7.5	140
7	Steco Power Ltd, Kolkata	Gola, H'bfh*	1	492
	Subtotal		30.7	2510.79
* Proposals include Investment in Power, Mining, Steel Making etc.				
Grand Total			45.84	3162.1
The above list is not exhaustive as daily new names are being added.				

directly dependent on the Fe content of the ore. Taking 65% Fe as benchmark, the consumption of hematite ore at this level of Fe is placed at 1.6 times the DRI. That is, per tonnes of DRI to be produced, 1.6 tonnes of the hematite of 65% Fe will be required. The other parameters remaining same, the quantity of ore consumed will decrease or increase in direct proportion to the Fe content of ore. The consumption of pre-reduced pellets will similarly depend on their metallization content. The consumption of green

pellets will depend on Fe content in these pellets. The norms of consumption of other varieties of ores for Indian conditions are not available as all India DRI plants use hematite.

Requirement of iron ore for sponge iron units of Jharkhand

As would be seen from the table No. 2, the ultimate capacity of all the categories of plants for DRI would be

Table - 3 : Parameters of Coal required for sponge iron manufacture : As per Sponge Iron Manufacturers of India. (On equilibrated basis)

Category	St.No.	Parameters	Percentage
A	1	Ash	22+/-2
	2	Volatile Matter	32
	3	Fixed Carbon	40 Minimum
	4	Moisture Total	8% Max
B	5	Size	0-20 mm
C	6	Reactivity	2.2cm ² of CO/gm of carbon/%c minimum
D	7	Gross Calorific Value	5200 Kcal/Kg Minimum
E	8	Initial Deformation Temperature of Ash	1200°C

45.34 lakh tonnes. These plants would require about 75 lakh tonnes of hematite ore of about 65% Fe. If the Fe% goes down in the ores, this requirement will further increase.

Out of above, 6 companies are trying to have their own iron ore mines. The cumulative requirement of these companies including expansion & proposals is 46.5 lakh tonnes per annum. The demand of small entrepreneurs thus work out to be 28.5 lakh tonnes per annum. Thus, mines having a capacity to produce about 3 million tonnes of finished products are required to sustain these sponge iron plants. The ROM capacity of mines, assuming 40% yield of size product would be about 7.5 million tonnes. This production, apart from yielding sized ore will produce 4 million tonnes of fines & blue dust. These fines can be considered for production of at least 3 Mt/Yr pellets.

The total proved reserves of such an endeavor to produce 7.5 Mt/Yr ore will be about 225 million tonnes of Iron ore of High quality. This types of deposits is only available in Jharkhand in the Chiria region near Manoharpur.

Coal for DRI

Major parameters to be considered for selection of the Coal for the DRI process as given in table 3 are

- A. Chemical Properties
- B. Size Distribution
- C. Reactivity
- D. Gross Calorific Value and
- E. Initial Deformation Temperature & Ash Fusion Characteristics

The above specifications indicate that

- a. The coals should be non-caking,

- b. Should have comparatively low ash and high FC,
- c. Should have good reactivity, and
- d. Should have Calorific Value nearing to Grade B/C coals.

Reactivity of Coal : A measure of the rate at which residual char from a given coal will react with CO₂ under arbitrary and fixed conditions of temperature and gas composition. The term is used for rough comparison and is expressed as a weight loss per unit time or time to achieve a fixed weight loss.

Initial Deformation Temperature of Ash : (IDT) : When the first rounding of the cone occurred. Softening Temperature (ST) is when cone is fused down to a spherical lump.

Hemispherical Temperature (HT) is when the cone has fused down to a hemisphere.,

Fluid temperature (FT) is where the fused mass has spread out nearly flat layer.

Ash Fusion Temperature (FT) (Coal & Coke) :

The temperature at which triangular pyramids (Cones) prepared from the Coal or Coke ash attain and pass through certain defined stages of fusing and flow when heated at a specified rate in controlled, mildly reducing and when desired, oxidizing atmospheres.

The above requirements restrict the coals that can be used in DRI to following coalfields in the State of Jharkhand:

1. Western Part of North Karanpura Coalfield.
2. Daltonganj Coalfield (Only available & Viable Block Allocated)
3. Hutar Coalfield, (block under Palamu National Park)
4. Auranga Coalfield
5. South Karanpura Coalfield
6. Rajmahal Group of Coalfields, (Logistically not good)
7. Jayanti Coalfield (Small business with very low reserves)

The only coalfields that be targeted on the basis of availability of coal reserves, and logistics are Auranga & South Karanpura. The block in all other Non-Caking Coal bearing fields have either been allocated or applications are pending.

Availability of Coal in Auranga & South Karanpura Coalfields

As per latest report (Oct. 2002) of the CMPDI, compiled on the basis of all available data with different agencies, the block-wise reserves and their quality parameters are given in the table No.3.

There are other coal blocks in the region which are not in the captive or CIL list.

Norms of coal consumption in DRI

The standard norms of coal consumption per tonnes of DRI are placed at 1.2 tonnes of coal. However, CMPDI takes 1.6 tonnes of Coal per tonnes of DRI. The total requirement of the coal as per categories described earlier is given in the Table – 4.

Out of above 44.91 lakh (CMPDI Norms)/ various companies will obtain 33.88 lakh of coal by their captive resources. Thus, at least 28.28 lakhs (21.31 lakhs) tonnes of annual demand shall remain uncovered. Most of this

Table-4 : Coal Requirement For DRI in Jharkhand

Category	DRI to be	Coal Required in Lakhs	
	Produce in Lakhs	As per CMPDI	As per SIMA
A	1.80	2.88	2.34
B	4.83	7.73	5.80
C	8.61	13.62	10.21
D	30.70	49.12	36.84
Total	45.84	73.34	65.19

demand will be for small entrepreneurs and some of applicants who are major players may also not get the "Captive Coal" blocks and ultimately will fall in the category of gap of coal.

Proposal

It would be seen from the above discourse that the requirement of the coal for those units which have not been allocated coal blocks or do not have leases of Iron ore are as under :

- Coal = about 3 million tonness of processed coal per annum
- Iron Ores = 3 Million tonness of processed ore

Assuming nearly 40% Run of Mine Ash from the mine to be identified for the supply of 23-25% ash coal, the yield after washing would be nearly 40%. Thus, to have an output of 3 Mt of processed coal for DRI, the ROM coal required would be 7.5 Mt per annum. Assuming a life of 30 years the total recoverable reserves 225 million tonnes or a block having nearly 280 mt of "Mineral Reserves" is required. About 350 Mt of "Geological Reserves" are likely to give these mineable reserves. As most of the large non-caking blocks now available in the state of Jharkhand have high ash. The method of mining has to be "Opencast" for economic feasibility. These reserves if available in single block would help immensely in the logistics as well as have economy of scales.

Without consideration Raw Material (Coal or Iron Ore) or the quality of the essential inputs that are required to make sustainable production of DRI. There is no doubt

that there are large numbers of "Fly By Night" operators who have flocked in Jharkhand with a view to exploit the mineral resources for their own profit. Some of them have promised moon in terms of investment but have not even invested on ground a single penny. The Government of Jharkhand should enunciate a policy for grant of lease in such a way that the investors are first compelled to put the money in projects. A policy similar to the allocation of captive coal blocks by Government of Orissa is needed. There are many major issues are to be solved in case of raw material front. Some of them are enumerated below :

1. What should be the norm for calculation of reserves of iron ore allocation for captive use ? Should non-captive use (Trading) be encouraged at the cost of Industry ?

2. What is the assurance of reliability of the data mentioned in the lease application ? None of the blocks in Ghatkuri region have been even examined by preliminary prospecting by the applicants and data given in the lease applications are unreliable.

3. How to utilize the "Fines generated" (both natural and process related) ? It must be borne in the mind that Iron Ores of Jharkhand are generally "Soft". Should the JSMDC go for a pellet plant to meet the needs of small industrialist ?

4. Should small operators be given leases or JSMDC should be re-organised to shoulder higher responsibilities of supplying raw material to small entrepreneurs to sustain their production ? Coal India Ltd has singularly failed to provide coal to the industries of Jharkhand. The gap is almost 5 Million Tonness of Coal. Further, the country has hardly and low ash coal reserves and coal beneficiation to supply 25% ash coal is a must to produce quality DRI and have longer "Champaign Life" of Kiln. Who will make investment to produce low ash coal to supply to small entrepreneurs ?

Is it O.K. to make most basic value-added product like Sponge Iron or should the entrepreneurs be helped to produce higher value products ? It would not be out of place to mention here that one of the organization produces value added iron product from iron ore of Rs. 600/t to Rs. 200,000/t right here in Jharkhand. Why not others are also helped to produce higher value added products rather than only sponge iron ?

This article is extracted from the presentation made by the author at Ranchi, Jharkhand recently.

