

MANGANESE ORE



# Indian Minerals Yearbook 2016

(Part- III : Mineral Reviews)



**55<sup>th</sup> Edition**

## MANGANESE ORE

(ADVANCE RELEASE)

**GOVERNMENT OF INDIA  
MINISTRY OF MINES  
INDIAN BUREAU OF MINES**

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# 34 Manganese Ore

Manganese occurs as silvery grey in colour and is very hard and brittle in nature. It is always available in combination with iron, laterite and other minerals. Manganese in alloy form is an essential input in steel making and is one of the most important metals in the industrial economy. Manganese ores of major commercial importance are: (i) pyrolusite ( $MnO_2$ , Mn about 63.2%); (ii) psilomelane (manganese oxide, containing water and varying amounts of oxides of Ba, K and Na as impurities; Mn commonly 45-60%); (iii) manganite ( $Mn_2O_3 \cdot H_2O$ , Mn about 62.4%); and (iv) braunite ( $3Mn_2O_3 \cdot MnSiO_8$ , Mn about 62% and  $SiO_2$  about 10%).

Indian manganese ore deposits occur mainly as metamorphosed bedded sedimentary deposits associated with Gondite Series (Archaean) of Madhya Pradesh (Balaghat, Chhindwara & Jabua districts), Maharashtra (Bhandara & Nagpur districts), Gujarat (Panchmahal district), Odisha (Sundergarh district) and with Kodurite Series (Archaean) of Odisha (Ganjam & Koraput districts) and Andhra Pradesh (Srikakulam & Visakhapatnam districts).

## RESERVES/RESOURCES

The total reserves/resources of manganese ore in the country as on 1.04.2015 have been placed at 495.87 million tonnes as per NMI database, based on UNFC system. Out of these, 93.47 million tonnes are categorised as reserves and the balance 402.40 million tonnes are in the remaining resources category. Gradewise, Ferro-manganese grade accounts for 7%, Medium grade 11%, BF grade 28% and the remaining 54% are of Mixed, Low, Others, Unclassified, and Not-known grades including 0.17 million tonnes of battery/chemical grade.

Statewise, Odisha tops the total reserves/resources with 44% share followed by Karnataka 22%, Madhya Pradesh 12%, Maharashtra & Goa 7% each, Andhra Pradesh 4% and Jharkhand 2%. Rajasthan, Gujarat, Telangana and West Bengal together shared the remaining about 2% resources (Table-1).

## EXPLORATION & DEVELOPMENT

Details of exploration carried out for manganese ore by GSI and other agencies (State Govt Departments, MOIL Ltd etc.) during 2015-16 are furnished in Table-2.

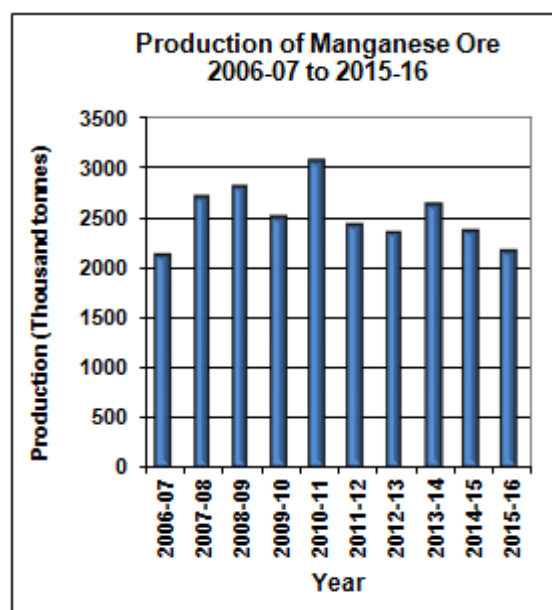
## PRODUCTION AND STOCKS

The production of manganese ore at 2,148 thousand tonnes during 2015-16 decreased by 9% as compared to that in the previous year.

There were 145 reporting mines during 2015-16 as against 161 in the previous year. Besides, manganese ore production was reported by six mines of iron ore, one mine each of laterite, quartz and limestone in 2015-16 as against six mines of iron ore, two mines of laterite and one mine of limestone in 2014-15. In all, 72 producers reported production of manganese ore in 2015-16. Eight principal producers operating 32 mines contributed 81% of the total production. About 76% of the total production was reported by 17 mines including one associate mine, each producing more than 40,000 tonnes per annum, while 12% was contributed by 9 mines (including two associate mines) each falling in the production range of 20,001 to 40,000 tonnes. The remaining 12% production was reported by 122 manganese ore and 6 associate mines each producing up to 20,000 tonnes.

In 2015-16, twenty three Public Sector mines jointly accounted for 50% of the total production. The contribution of captive mines was 10% of the total production.

As regards gradewise composition of production in 2015-16, 64% of the total production was of lower grade (below 35% Mn), 22% of medium grade (35-46% Mn) and 13% was of high grade (above 46% Mn). Production of manganese dioxide was 20,161 tonnes (1%) during the year as against 20,461 tonnes (1%) in the previous year.



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**Table – 1 : Reserves/Resources of Manganese Ore as on 01.04.2015**  
(By Grades/Stages)

State/Grade	Reserves										Remaining Resources					Total Resources (A+B)					
	Proved		Probable		Total		Feasibility		Pre-feasibility		Measured		Indicated		Inferred		Reconnaissance		Total		
	STD111	STD121	STD121	STD122	STD121	STD122	STD211	STD221	STD221	STD222	STD331	STD332	STD332	STD333	STD334		STD333	STD334	STD334	STD334	STD334
<b>All India : Total</b>	<b>62982</b>	<b>19715</b>	<b>10778</b>	<b>93475</b>	<b>70742</b>	<b>44606</b>	<b>73823</b>	<b>18189</b>	<b>42803</b>	<b>135722</b>	<b>16513</b>	<b>402399</b>	<b>495874</b>								
<b>By Grades</b>																					
Battery/Chemical	-	-	-	-	4	9	12	4	26	112	-	167	167								
Ferro-manganese	7069	1740	2428	11237	4241	3219	4230	1288	5236	6602	466	25282	36520								
Medium	2299	-	975	3274	11545	2053	12489	448	1333	21424	116	49409	52683								
BF	8195	873	2167	11235	29841	7823	21114	3011	10853	51731	5288	129662	140897								
Mixed	1199	3	310	1512	224	495	3361	2262	62	11988	1126	19518	21030								
Medium & BF mixed	6812	1506	1482	9800	4571	2367	4199	5215	5353	16032	221	37957	47757								
Ferro-manganese, medium & BF mixed	25038	12515	291	37844	5952	4497	11255	414	9532	10195	33	41878	79723								
Ferro-manganese & BF	580	1402	636	2618	137	8185	4811	1358	912	3317	4560	23280	25898								
Low (<)25% Mn	1087	349	469	1905	8575	743	6483	3916	4040	3547	82	27386	29291								
Beneficiable	1389	974	1423	3786	680	8401	226	-	260	1437	4560	15565	19531								
Others	8456	166	176	8798	2810	1459	1390	188	87	2845	-	8780	17578								
Unclassified	802	147	421	1370	2094	5353	4184	84	4953	5384	62	22115	23484								
Not-Known	56	39	-	95	68	-	68	-	156	1108	-	1400	1495								
<b>By States</b>																					
Andhra Pradesh	2235	637	2086	4958	675	387	773	188	3220	6987	457	12687	17645								
Goa	-	-	-	-	13954	1511	9177	48	262	9464	-	34416	34416								
Gujarat	708	-	-	708	-	-	-	-	-	2180	-	2180	2888								
Jharkhand	1840	-	328	2168	1710	795	1476	-	178	4177	1126	9461	11629								
Karnataka	9196	-	150	9346	14003	10225	11430	1498	7306	54333	2923	101718	111064								
Madhya Pradesh	20227	6760	2904	29891	5802	2779	6421	325	10481	2015	-	27823	57713								
Maharashtra	10867	1787	1055	13710	1974	4966	7207	-	5350	3369	43	22910	36619								
Odisha	16703	10528	3413	30643	32622	23942	37292	16130	15119	48764	11889	185760	216403								
Rajasthan	1051	-	647	1697	-	-	-	-	-	4030	-	4030	5727								
Telangana	156	3	196	355	2	-	46	-	886	203	76	1214	1568								
West Bengal	-	-	-	-	-	-	-	-	-	200	-	200	200								

Figures rounded off.

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**Table – 2 : Details of Exploration Activities for Manganese Ore, 2015-16**

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
<b>GSI</b>							
<b>Odisha</b>							
Angul	Bhagwanpur- Santipur and Tentalapani	-	-	-	-	-	G-4 stage investigation was carried out to identify potential zones of manganese ore bands. Manganese ore occurs as WNW-ESE trending 0.5-3 m wide discontinuous bands with low to moderate dip towards north. Four discontinuous bands have been exposed in the trenches. Pyrolusite and psilomelane are the major minerals found in the ore. Strike continuity has been established for 8 m, 10 m, 15 m and 30 m approximately. Analytical results of trench samples show manganese and phosphorous concentration from 5.81-23.11% and 0.28 to 3.23% respectively.
Balangir	Gudighat- Barbandha	-	-	-	-	15	G-3 stage investigation was carried out to identify potential zones of manganese ore bands. Manganese ore occurs as WNW-ESE trending discontinuous bands with 52° dip towards SW. Mn ore occurring as pyrolusite and psilomelane is exposed on isolated mounds over 1 km with an average width of 10 m. Most of the ores are hard, compact and fragmented in nature. Analytical results of trench samples showed manganese and phosphorous concentration from 3.05-21.90% and 0.25 to 0.72% respectively.
<b>MOIL</b>							
<b>Madhya Pradesh</b>							
Balaghat	Bharveli Mine	-	-	16	9264	-	As on 01.04.2016, the total manganese ore reserves/resources were estimated at about 24.84 million tonnes with grade (30-50% Mn), out of which 11.23 million tonnes were placed under reserves and 13.61 million tonnes were placed under remaining resources.
	Ukwa Mine	-	-	-	-	-	As on 01.04.2016, about 13.99 million tonnes reserves/resources were estimated, out of which 5.63 million tonnes were placed under reserves and 8.36 million tonnes were placed under remaining resources.
	Tirodi Mine	-	-	03	575	-	As on 01.04.2016, about 0.91 million tonnes reserves/resources were estimated, out of which 0.52 million tonnes were placed under reserves and 0.39 million tonnes were placed under remaining resources.

(Contd.)

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Table-2 (Concl'd.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
	Sitapatore & Sukli Mines	-	-	-	-	-	As on 01.04.2016, about 0.16 million tonnes insitu manganese ore reserves/resources were estimated, out of which 0.03 million tonnes were placed under reserves and 0.13 million tonnes were placed under remaining resources.
<b>Maharashtra</b>							
Bhandara	Dongri-Buzurg Mine Teh. Tumsar	-	-	01	300	-	As on 01.04.2016, about 11.12 million tonnes insitu manganese ore reserves/resources were estimated, out of which 4.31 million tonnes were placed under reserves and 6.81 million tonnes were placed under remaining resources.
	Chikla Mine Post- Sitasaongi Teh. Tumsar	-	-	03	415	-	As on 01.04.2016, about 4.55 million tonnes of manganese ore reserves/resources were estimated, out of which 2.70 million tonnes placed under reserves and 1.85 million tonnes were placed under remaining resources.
Nagpur	Gumgaon Mine Vill. Teghai Teh. Saoner	-	-	03	384	19	As on 01.04.2016, about 5.76 million tonnes of manganese ore reserves/resources were estimated, out of which 5.04 million tonnes were placed under reserves and 0.72 million tonnes were placed under remaining resources.
	Kandri Mine Teh. Remtek	-	-	03	973	-	As on 01.04.2016, about 8.38 million tonnes of manganese ore reserves/resources were estimated, out of which 1.39 million tonnes were placed under reserves and 6.99 million tonnes were placed under remaining resources.
	Mansar mine Teh. Ramtek Taluka-Parseoni	-	-	-	-	-	As on 01.04.2016, about 5.74 million tonnes of manganese ore reserves/resources were estimated, out of which 2.05 million tonnes were placed under reserves and 3.69 million tonnes were placed under remaining resources.
	Beldongri incl. old & New satuk Taluka-Parseoni	-	-	03	130	-	As on 01.04.2016, about 0.80 million tonnes of manganese ore reserves/resources were estimated, out of which 0.34 million tonnes were placed under reserves and 0.46 million tonnes were placed under remaining resources.

Madhya Pradesh being the leading manganese ore producing State accounted for 36% of the total production in 2015-16. Next in the order of production were Maharashtra (29%), Odisha (18%), Andhra Pradesh (9%) and Karnataka (7%). The remaining one percent production was reported from Telangana, Rajasthan and Jharkhand (Tables- 3 to 7).

The mine-head closing stock for the year 2015-16 was at 1,320 thousand tonnes as against 1,114 thousand tonnes in the previous year (Tables - 8 (A) and 8 (B)).

The average daily employment of labour strength in manganese ore mines was 12,213 in 2015-16 as against 15,504 in the previous year.

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**Table – 3 : Principal Producers of Manganese Ore, 2015-16**

Name & address of Producer	Location of mine	
	State	District
MOIL Ltd, MOIL Bhavan, 1A, Katol Road, Chhaoni, Nagpur- 440 013.	Madhya Pradesh Maharashtra	Balaghat 1. Bhandara 2. Nagpur
Tata Steel Ltd, Bombay House, 24, Homi Mody Street, Fort, Mumbai- 400 001. Maharashtra.	Odisha	1. Kendujhar 2. Sundargarh
The Sandur Manganese & Iron Ores Ltd, No. 9, Ballari Road, Sadashiv Nagar, Bengaluru- 560 080 Karnataka.	Karnataka	Ballari
RBSSD & FN Das Garividi- 535 101, Shreeram Nagar, Distt. Vizianagaram, Andhra Pradesh.	Andhra-Pradesh	Vizianagaram

(Contd.)

Table-3 (Concl.)

Name & address of Producer	Location of mine	
	State	District
Mangilal Rungta, Rungta office, Main Road, Barbil, Dist. Kendujhar, Odisha-758 035.	Odisha	Kendujhar
Orissa Manganese & Minerals Ltd, Lansdowne Towers, 6 <sup>th</sup> floor, 2/1A Sarat Bose Road, Kolkata-700 020. West Bengal.	Odisha	Sundargarh
Krishnaping Alloys Pvt. Ltd, 579, Tharsa Road, Kanhana-441 401 Madhya Pradesh.	Madhya Pradesh	Chhindwara
J.K. Minerals, Main Road, Ward No. 15, Balaghat-481 001 Madhya Pradesh.	Madhya Pradesh	Balaghat

**Table – 4 : Principal Producers of Manganese Dioxide, 2015-16**

Name & address of Producer	Location of mine	
	State	District
Tata Steel Ltd, 24, Homi Mody Street, Fort, Mumbai- 400 001, Maharashtra.	Odisha	Kendujhar
Mangilal Rungta, Rungta Office, Main Road, Barbil-758 035, Kendujhar, Odisha.	Odisha	Kendujhar
Orissa Manganese & Minerals Ltd, Lansdowne Tower, 6 <sup>th</sup> floor, 2/1A, Sarat Bose Road, Kolkata- 700 020, West Bengal.	Odisha	Sundargarh
Rungta Mines Ltd, 8A, Express Tower, 42A, Shakespeare Sarani, Kolkata-700 017, West Bengal.	Odisha	Sundargarh
MOIL Ltd, MOIL Bhavan, 1A-Katol Road, Nagpur-440 013, Maharashtra.	Maharashtra	Bhandara

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**Table – 5 : Production of Manganese Ore, 2013-14 to 2015-16  
(By States)**

(Quantity in tonnes; Value in ₹'000)

State	2013-14		2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>2626291</b>	<b>15181757</b>	<b>2369481</b>	<b>13661799</b>	<b>2147629</b>	<b>8864926</b>
Andhra Pradesh <sup>#</sup>	334265	716420	253746	516842	185833	288176
Gujarat	-	-	15564	10179	38223	15687
Jharkhand	4779	20276	4448	20508	508	3274
Karnataka	144528	673035	206700	933894	145624	396853
Madhya Pradesh	796496	5157453	877994	5219983	763984	3428742
Maharashtra	666191	5222536	670238	5150230	614481	3102154
Odisha	663710	3339180	326106	1765655	388627	1603445
Rajasthan	5401	14442	7910	23501	3457	10350
Telangana <sup>#</sup>	10921	38415	6775	21007	6892	16245

<sup>#</sup> Figures mentioned against 2013-14 are of districts which are part of present Andhra Pradesh and Telangana.

**Table – 6 (A) : Gradewise Production of Manganese Ore, 2014-15  
(By Sectors/States/Districts)**

(Quantity in tonnes; Value in ₹'000)

State/ District	No. of mines	MnO <sub>2</sub>	Production By Grades: Mn Content				Total	
			above 46%	35%-46%	25%-35%	below 25%	Quantity	Value
<b>India</b>	<b>161(9)</b>	<b>20461</b>	<b>249050</b>	<b>479419</b>	<b>1174231</b>	<b>446320</b>	<b>2369481</b>	<b>13661799</b>
Public Sector	24	2189	204659	350696	570432	42557	1170533	8928788
Private Sector	137(9)	18272	44391	128723	603799	403763	1198948	4733011
<b>Andhra Pradesh</b>	<b>27</b>	<b>-</b>	<b>-</b>	<b>6320</b>	<b>148737</b>	<b>98689</b>	<b>253746</b>	<b>516842</b>
Vizianagaram	27	-	-	6320	148737	98689	253746	516842
<b>Goa*</b>	<b>5</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
South Goa*	5	-	-	-	-	-	-	-
<b>Gujarat*</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>15564</b>	<b>15564</b>	<b>10179</b>
Panchmahal*	1	-	-	-	-	-	-	-
Vadodara	1	-	-	-	-	15564	15564	10179
<b>Jharkhand</b>	<b>5(1)</b>	<b>94</b>	<b>-</b>	<b>47</b>	<b>3487</b>	<b>820</b>	<b>4448</b>	<b>20508</b>
Singbhum (West)	5(1)	94	-	47	3487	820	4448	20508
<b>Karnataka</b>	<b>14</b>	<b>-</b>	<b>-</b>	<b>7843</b>	<b>144672</b>	<b>54185</b>	<b>206700</b>	<b>933894</b>
Ballari	5	-	-	7843	134776	29749	172368	850823
Chitradurga	4	-	-	-	-	17600	17600	22779
Davanagere	2	-	-	-	9096	6016	15112	57864
Tumakuru	3	-	-	-	800	820	1620	2428
<b>Madhya Pradesh</b>	<b>44(5)</b>	<b>-</b>	<b>168870</b>	<b>103099</b>	<b>381358</b>	<b>224667</b>	<b>877994</b>	<b>5219983</b>
Balaghat	32	-	158247	94267	287039	59480	599033	4326437
Chhindwara	5	-	10623	8832	7878	12398	39731	300459
Jabalpur	6(5)	-	-	-	5	146422	146427	287622
Jhabua	1	-	-	-	86436	6367	92803	305465
<b>Maharashtra</b>	<b>22</b>	<b>2189</b>	<b>46860</b>	<b>283597</b>	<b>320424</b>	<b>17168</b>	<b>670238</b>	<b>5150230</b>
Bhandara	3	2189	17943	195997	209690	-	425819	3238139
Nagpur	19	-	28917	87600	110734	17168	244419	1912091
<b>Odisha</b>	<b>37(3)</b>	<b>18178</b>	<b>33320</b>	<b>78513</b>	<b>167643</b>	<b>28452</b>	<b>326106</b>	<b>1765655</b>
Kendujhar	19(3)	18178	33230	77280	152481	17368	298537	1580277
Sundargarh	18	-	90	1233	15162	11084	27569	185378
<b>Rajasthan</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>7910</b>	<b>-</b>	<b>7910</b>	<b>23501</b>
Banswara	1	-	-	-	7910	-	7910	23501
<b>Telangana</b>	<b>4</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>6775</b>	<b>6775</b>	<b>21007</b>
Adilabad	4	-	-	-	-	6775	6775	21007

Figures in parentheses indicate associated mines of iron ore, laterite and limestone.

\* Only labour reported.

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**Table – 6 (B) : Gradewise Production of Manganese Ore, 2015-16 (P)**  
(By Sectors/States/Districts)

(Quantity in tonnes; Value in ₹'000)

State/ District	No. of mines	Production By Grades: Mn Content					Total	
		MnO <sub>2</sub>	above 46%	35%-46%	25%-35%	below 25%	Quantity	Value
<b>India</b>	<b>145(9)</b>	<b>20161</b>	<b>275445</b>	<b>465659</b>	<b>993783</b>	<b>392581</b>	<b>2147629</b>	<b>8864926</b>
Public Sector	23	172	193164	337043	500747	51667	1082793	5540570
Private Sector	122(9)	19989	82281	128616	493036	340914	1064836	3324356
<b>Andhra Pradesh</b>	<b>23</b>	-	-	<b>10006</b>	<b>112331</b>	<b>63496</b>	<b>185833</b>	<b>288176</b>
Vizianagaram	23	-	-	10006	112331	63496	185833	288176
<b>Goa</b>	<b>5</b>	-	-	-	-	-	-	-
South Goa*	5	-	-	-	-	-	-	-
<b>Gujarat</b>	<b>2</b>	-	-	-	-	<b>38223</b>	<b>38223</b>	<b>15687</b>
Panchmahal*	1	-	-	-	-	37959	37959	15514
Vadodara	1	-	-	-	-	264	264	173
<b>Jharkhand</b>	<b>5</b>	-	-	-	<b>508</b>	-	<b>508</b>	<b>3274</b>
Singhbhum (West)	5	-	-	-	508	-	508	3274
<b>Karnataka</b>	<b>11(1)</b>	-	-	<b>4879</b>	<b>108028</b>	<b>32717</b>	<b>145624</b>	<b>396853</b>
Ballari	2(1)	-	-	4879	108028	26653	139560	387755
Chitradurga	4	-	-	-	-	4864	4864	6898
Davangere	2	-	-	-	-	250	250	375
Tumakuru	3	-	-	-	-	950	950	1825
<b>Madhya Pradesh</b>	<b>45(5)</b>	-	<b>200482</b>	<b>103098</b>	<b>286918</b>	<b>173486</b>	<b>763984</b>	<b>3428742</b>
Balaghat	33(1)	-	167682	91382	240284	40785	540133	2812089
Chhindwara	5	-	32800	11716	9044	6269	59829	340794
Jabalpur	6(4)	-	-	-	-	123075	123075	184150
Jhabua	1	-	-	-	37590	3357	40947	91709
<b>Maharashtra</b>	<b>17</b>	<b>172</b>	<b>27312</b>	<b>277417</b>	<b>286999</b>	<b>22581</b>	<b>614481</b>	<b>3102154</b>
Bhandara	2	172	7700	185182	187446	-	380500	1988229
Nagpur	15	-	19612	92235	99553	22581	233981	1113925
<b>Odisha</b>	<b>31(3)</b>	<b>19989</b>	<b>47651</b>	<b>70259</b>	<b>195542</b>	<b>55186</b>	<b>388627</b>	<b>1603445</b>
Kendujhar	18(2)	19462	47279	65196	146374	18256	296567	1259147
Sundergarh	13(1)	527	372	5063	49168	36930	92060	344298
<b>Rajasthan</b>	<b>1</b>	-	-	-	<b>3457</b>	-	<b>3457</b>	<b>10350</b>
Banswara	1	-	-	-	3457	-	3457	10350
<b>Telangana</b>	<b>5</b>	-	-	-	-	<b>6892</b>	<b>6892</b>	<b>16245</b>
Adilabad	5	-	-	-	-	6892	6892	16245

Figures in parentheses indicate associated mines of iron ore, laterite and limestone.

\* Only labour reported.

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**Table – 7 : Production of Manganese Ore, 2014-15 and 2015-16  
(By Frequency Groups)**

(Quantity in tonnes)

Production Group	No. of mines		Production		Percentage in total Production		Cumulative %	
	2014-15	2015-16 (P)	2014-15	2015-16 (P)	2014-15	2015-16 (P)	2014-15	2015-16 (P)
<b>Total</b>	<b>161(9)</b>	<b>145(9)</b>	<b>2369481</b>	<b>2147629</b>	<b>100.00</b>	<b>100.00</b>	-	-
Up to 1000	87(3)	82(2)	12586	14293	0.53	0.67	0.53	0.6
1001 - 5000	27(2)	23(2)	70078	65032	2.96	3.03	3.49	3.70
5001 - 10000	10(1)	9(1)	70005	63466	2.95	2.96	6.44	6.66
10001 - 20000	13(1)	8(1)	200494	118085	8.46	5.50	14.90	12.16
20001 - 30000	7(1)	4(1)	182998	112004	7.72	5.21	22.62	17.37
30001 - 40000	2	3(1)	77565	140050	3.27	6.52	25.89	23.89
40001 - 50000	1(1)	3	90517	128126	3.82	5.96	29.71	29.56
50001 and above	14	13(1)	1665238	1506573	70.29	70.15	100.00	100.00

Figures in parentheses indicate associated mines of iron ore, laterite and limestone.

**Table – 8 (A) : Mine-head Closing Stocks of Manganese Ore, 2014-15  
(By States and Grades)**

(In tonnes)

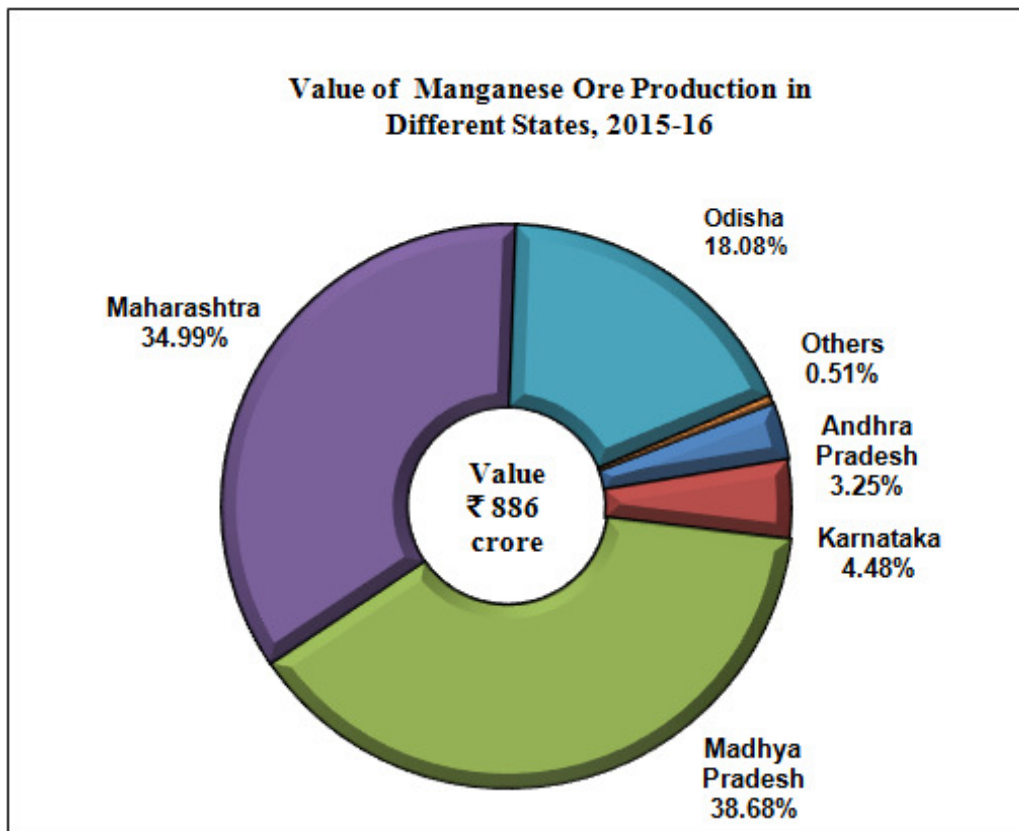
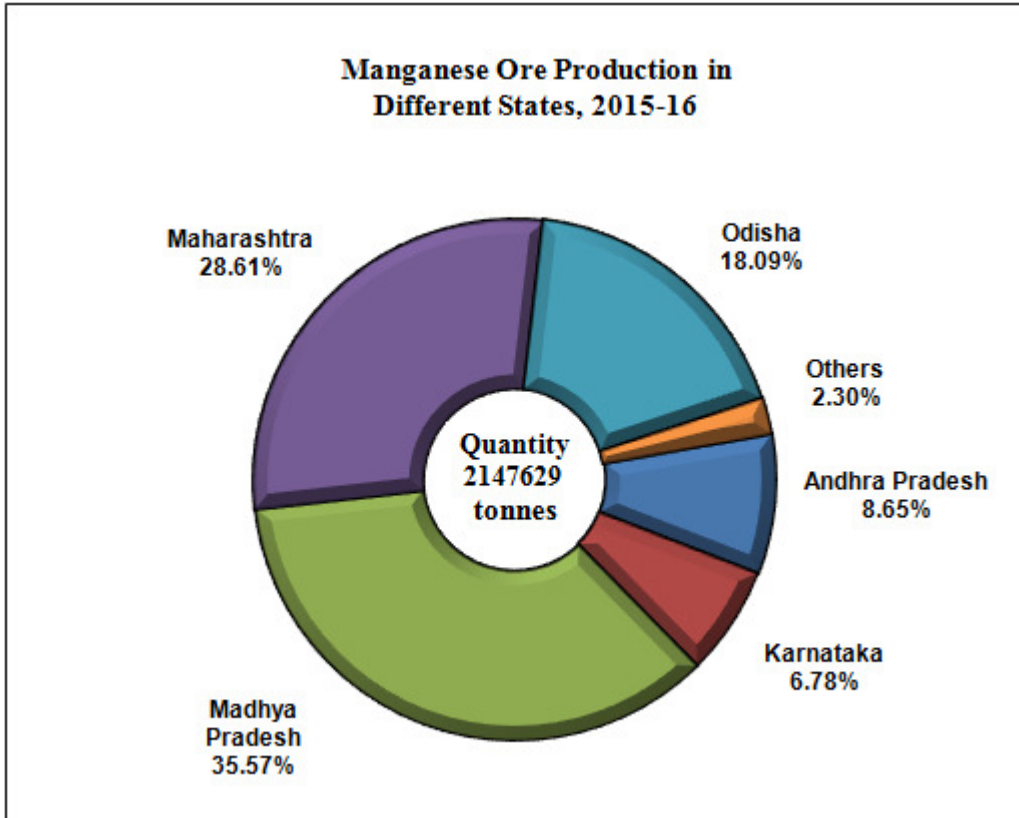
State	Grades : Mn content					Total
	MnO <sub>2</sub>	above 46%	35% - 46%	25% - 35%	below 25%	
<b>India</b>	<b>9479</b>	<b>49901</b>	<b>159470</b>	<b>457422</b>	<b>438089</b>	<b>1114361</b>
Andhra Pradesh	-	-	20	39856	16976	56852
Goa	-	-	-	100	-	100
Jharkhand	-	24	22	5111	168	5325
Karnataka	-	-	4459	70562	133485	208506
Madhya Pradesh	-	32118	25711	62802	178307	298938
Maharashtra	3387	13175	63510	62305	16192	158569
Odisha	6092	4584	65748	215327	91404	383155
Rajasthan	-	-	-	1345	-	1345
Telangana	-	-	-	14	1557	1571

**Table – 8 (B) : Mine-head Closing Stocks of Manganese Ore, 2015-16 (P)  
(By States and Grades)**

(In tonnes)

State	Grades : Mn content					Total
	MnO <sub>2</sub>	above 46%	35% - 46%	25%-35%	below 25%	
<b>India</b>	<b>8198</b>	<b>52450</b>	<b>125973</b>	<b>556607</b>	<b>576782</b>	<b>1320010</b>
Andhra Pradesh	-	-	126	55258	17973	73357
Goa	-	-	-	100	-	100
Jharkhand	-	23	15	4544	1007	5589
Karnataka	-	-	5367	66238	153150	224755
Madhya Pradesh	-	44141	12296	115492	283823	455752
Maharashtra	1404	2804	34511	106069	18624	163412
Odisha	6794	5482	73658	208195	97807	391936
Rajasthan	-	-	-	697	-	697
Telangana	-	-	-	14	4398	4412

MANGANESE ORE



## MINING, PROCESSING, MARKETING & TRANSPORT

Manganese ore mining in the country is carried out by opencast as well as by underground methods. Of the 145 mines, 8 are underground (3 in Madhya Pradesh and 5 in Maharashtra). Seven underground mines were operated by MOIL Ltd, a Public Sector company, and one by M/s J.K. Minerals, Balaghat (Madhya Pradesh), a private company. All the underground mines are mechanised or semi-mechanised and adopt cut and fill method of stoping. In Kandri mine, hydraulic sand stowing has been introduced in place of manual filling system. This system is faster, cheaper and requires less manpower. Conventional timber supports are replaced by cable bolting pre-mining support to increase safety and productivity. In Balaghat underground mechanised mine, overhand flat back cut and fill method with rock bolting support and sand stowing is being practised to fill up the voids with a level interval of 30 m and size of stope block as 30 m x 30 m to 60 m x 30 m. Side Dump Loaders (SDL) of 0.66 cu m bucket capacity were also deployed in underground levels for mechanised loading of run of mine (r.o.m.) in stopes. Tyre mounted Rocker shovel was also introduced in Balaghat mine for mechanised loading of ore from ore drive at stripping area. Deepening of vertical shaft up to 435m was completed in Balaghat, up to 169 m in chikla mine, upto 245 m in Kandri mine and up to 160 m in mansar mine of MOIL. Sinking of vertical shafts is in progress at Mansar and Ukwa mines.

The open-pits are usually worked manually by benching method, using portable compressors, jackhammers and dumper trucks. Tirodi mine of MOIL is worked by opencast mechanised method. Height of the benches in overburden is kept at 7.5 m and that in the ore at 6 m. Drills of 100 mm dia. with 0.9 to 1.7 m<sup>3</sup> capacity of shovels and 20-25 tonnes dumpers are used for production, loading & transport.

The workings vary from shallow depth in

lateritoid-type deposits in Odisha, Karnataka and Goa to deep operations in deposits of a more regular nature found in Madhya Pradesh, Maharashtra and Andhra Pradesh. Bulldozers are used where the overburden is soft. In a few cases, tramways are laid up to the working face and loaded tubs are pushed manually to the dumping ground. In Odisha, Goa and Karnataka, ore is worked by loosening the ground either with crowbars or by blastings. After picking up manganese ore, the waste is removed to the dumping ground. Mining of bedded ore in Madhya Pradesh and Maharashtra is generally carried out by drilling and blasting.

Hand sorting and visual grading are adopted widely to upgrade the ore. Scrubber is also used for washing the ore at some mines. Manual as well as mechanised jigging is done in a few mines.

MOIL has set up an integrated manganese ore beneficiation plant at Dongri Buzurg mine in Bhandara district, Maharashtra, with 4 lakh tonnes annual capacity to process r.o.m. The plant is equipped with handling, crushing, wet screening, drying and magnetic separation facilities in one complex. MOIL has installed a manganese ore beneficiation plant of 5,00,000 tonnes per annum capacity at Balaghat mine in order to conserve mineral and profitably utilise the low/medium grade ore. The plant facilities include crushing, wet screening, classification and jigging operations.

The plant upgrades the low/medium grade fines into high grade and the value addition is around 3-4 times, in case of low grade fines. The company is planning to set up a sintering plant for agglomeration of these fines. After agglomeration, these fines will be utilised in ferro-alloys production.

Most of the producers market manganese ore directly to the industrial units. In a few cases, especially in case of supplies of special type of ore or a semi-processed product, middlemen are found to be involved in marketing. Ore from mines

## MANGANESE ORE

is usually sold to the domestic consumers, either at the rail-head or ex-plant. In the cases of Integrated Iron & Steel and Ferro-manganese Industry, the units draw their supplies largely from captive mines. However, special ore types for specific purposes are obtained from other producers. In case of ore meant for exports, producers other than MOIL Ltd supply it to MMTTC, the canalising agency, either at rail-head or at the port. MOIL Ltd did not export manganese ore in the year 2015-16.

Transport of manganese ore from mines to rail-head is generally done by trucks from where it is transported to ports by rail wagons. From the mine of MOIL in Balaghat district, Madhya Pradesh, the ore is transported by aerial ropeways to the loading bins at the rail-heads. Battery loco was introduced for underground transport of r.o.m. tub from ore pass chute to skip bunker. In Goa, ore, in bulk is carried by road-cum-river routes up to Mormugao harbour and in a few cases by rail where the mines are close to the railways. The ore loading at river-head into barges is carried out mechanically.

## ENVIRONMENTAL PROTECTION

MOIL carried out mass afforestation work and planted 4,000 saplings during 2015-16 to maintain the ecological balance at area closer to the mines. The cumulative plantation till date is about 18.50 lakh saplings. The Company has also set up 2 wind energy farms of 4.8 MW and 15.2 MW capacity. R&D work was taken up by MOIL for reclamation of old mined out areas and to ascertain the impact of manganese mining on ecology, including air and water pollution. At Gumgaon mine, a sericulture project has been established as a part of socio-economic programme, while on waste debris dumps, a forest has been developed.

Chandrapur Ferro Alloys Plant of SAIL (formerly Maharashtra Electros melt Ltd) has continuously taken steps towards gainful utilisation of high MnO slag in silico-manganese production, lumpy silico-manganese slag as rail ballast and for road construction as a step towards solid waste management.

Manganism - a health condition attributed to manganese poisoning - has been reported to be detected in case of five persons working with BHP Billiton's Metalloys, a manganese alloy plant in South Africa. Manganism shows symptoms similar to Parkinson's disease and psychotic behaviour but conditions of development of the disease are not properly understood.

## USES & SPECIFICATIONS

Classification of manganese ore, ferruginous manganese ore, siliceous manganese ore, dioxide manganese ore, and manganiferous iron ore is laid down by BIS vide specification no. IS: 11895-2006 (Reaffirmed 2008). Manganese ore is an important material in iron and steel metallurgy, where it is used both in the ore form as such and as ferro-manganese. Manganese improves strength, toughness, hardness and workability of steel, acts as a deoxidiser and desulphuriser and also helps in getting ingots free from blowholes. About 90 to 95% world production of manganese ore is used in metallurgy of iron and steel. Manganese has no satisfactory substitute in its major applications. The specifications of manganese ore by different industries are detailed below:

In Iron and Steel Industry, the BIS:11281-2005 (Reaffirmed 2008) specification is laid down for manganese ore. However, specifications based on the user industry indicate that normally manganese ore containing 28 to 35% Mn is used. Ore size generally varies from 10 to 40 mm. For other constituents general stipulations are Fe: 16 to 22%, SiO<sub>2</sub>: 2 to 8%, Al<sub>2</sub>O<sub>3</sub>: 5 to 8% and P: 0.3% maximum.

For manganese ore used in Ferro-manganese Industry, besides manganese content, other important considerations are high manganese to iron ratio and a very low content of deleterious phosphorus. Specifications of manganese ore for ferro-manganese are prescribed by the Bureau of Indian Standards vide IS: 4763-2006, (Second Revision, Reaffirmed 2010). BIS has also laid down the specifications of manganese ore sinters for blending for ferro-manganese production vide IS:12596-1989 (Reaffirmed 2009). User's specifications of manganese ore for Ferro-manganese/Silico-manganese industries are furnished in Table- 9.

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**Table – 9 : User's Specifications of Manganese Ore in Different Ferro-manganese/Silico-manganese Units**

Name and location of plant	Specifications of ore consumed
<b>Andhra Pradesh</b> Ferro-Alloys Corp. Ltd, Shreeram Nagar, Dist. Vizianagram.	Mn: 70-75% C: 6-8%
Nav Bharat Ferro-Alloys Ltd, Paloncha, Khammam.	Mn: 28-50%, P: 0.1-0.3%, SiO <sub>2</sub> : 8-30% Fe :5-8%
<b>Chhattisgarh</b> Sarda Energy & Minerals Ltd Raipur.	Mn: 28-30% (Low P) Mn: 37-40% , 42-44% , 46% (High P)
Monnet Ispat & Energy Ltd, Raipur	Mn: 28-46% Fe : 5-16% SiO <sub>2</sub> : 6-34% S & P: 0.05-0.28% Size: 0-100% (lumps & fines)
<b>Hira Power &amp; Steel Ltd, Raipur</b> i) Jain Carbides & Chemicals Ltd, Raipur (Unit-I). ii) Jain Carbides & Chemicals Ltd, Raipur (Unit-II).	Mn: 32-35% Mn: 32-35%
<b>Karnataka</b> S. R. Chemicals & Ferro Alloys, Belgaum. Thermit Alloys Ltd, Shivamogga.	Mn: 38-40%, Fe: 18-23% Mn: 48-54%
<b>Kerala</b> INDSIL Hydro Power and Manganese Ltd, Pallatheri Palakkad.	Fe-Mn ratio 1:3 to 5% (50%) 1:5 to 8% (50%) P: 0.05% max. Al <sub>2</sub> O <sub>3</sub> : 3 to 5% max.
<b>Madhya Pradesh</b> MOIL, Ferro-manganese Plant, Bharveli, Dist. Balaghat.	Mn: 46-48%
<b>Maharashtra</b> Chandrapur Ferro Alloys Ltd, (Formerly Maharashtra Electro-Smelt Ltd) Chandrapur.	Mn: 38-46%, Fe: 6-17% SiO <sub>2</sub> +Al <sub>2</sub> O <sub>3</sub> : 10-16% P: 0.5-0.25% max. +100 mm, 10% max. +10-100 mm, 80-85% min. +5-10 mm, 10% max.
Nagpur Power & Industries Ltd, Nagpur.	Mn: 42-46%, Fe: 7-8%, SiO <sub>2</sub> : 3.6%,  Al <sub>2</sub> O <sub>3</sub> : 6-7%, P: 0.10-0.12% Size: 5-25 mm
Natural Sugar & Allied Ind. Ltd, Sai Nagar Ranjani, Dist. Osmanabad	Size: 10-80 mm
<b>Odisha</b> Tata Steel Ltd, Joda, Kendujhar.	Mn: 43%, min. (for FeMn) 36% min. (for SiMn), Size: 10-75 mm (for FeMn & SiMn)
	<b>Captive Mn Ore</b> <b>Size (mm)</b> Below 35%            (10-75) + 5% 35% to 46%        (10-75) + 5% 46% to 49%        (10-75) + 5% Dioxide + 49%      (10-75) + 5%
	<b>MOIL, Mn Ore</b> Below 35%            (10-75) + 5% Imported Mn 46 to 49%            (10-75) + 5%
<b>Tamil Nadu</b> Silcal Metallurgical Ltd, Ramanuja Nagar, Coimbatore.	Mn: 35-40% & above Size: 35 mm
<b>West Bengal</b> Cosmic Ferro Alloys Ltd, Bankura.	Size: 75 mm

## MANGANESE ORE

Manganese dioxide is used for manufacturing dry cell batteries in which it functions as a depolariser of hydrogen. For use in dry cell battery, BIS has prescribed Specification No. IS:11153-1996 (First Revision, Reaffirmed 2010) for manganese dioxide. Suitability of ore depends not only on manganese dioxide content but also on its crystallographic structure. Ore having predominant gamma structure is required. The ore must have high manganese dioxide and low iron content, a certain degree of porosity and moderate hardness. It should be free from metallic compounds such as copper, nickel, cobalt, arsenic, lead and antimony, which are electronegative to zinc (container). The user industry specifications are MnO<sub>2</sub> 70% (min.), Fe 6% (max.), moisture 4% (max.), Cu 0.02% (max.) and Ni 0.02% (max.). The size requirement lays down that 90% material should pass through 300 mesh and 100% through 100 mesh. User industry specifications for electrolytic manganese dioxide (EMD) used in dry cell battery are MnO<sub>2</sub> 90% (min.), Fe (as oxide) 0.05% (max.), moisture 4% (max.), Pb 0.15% (max.) and pH 4.5 to 5.6. The size requirements are same as those for manganese dioxide ore.

In chemical industry, generally high-grade material is used for potassium permanganate. Ore containing MnO<sub>2</sub> 80% (min.), SiO<sub>2</sub> 5% (max.), Fe<sub>2</sub>O<sub>3</sub> 5% (max.) and 200 to 250 mesh ore size is used. In glass industry, ore analysing MnO<sub>2</sub> 80% (preferably 86% min.), Fe<sub>2</sub>O<sub>3</sub> 5% (preferably 0.75% max.), SiO<sub>2</sub> 2.8% (max.), Al<sub>2</sub>O<sub>3</sub> 1.1% (max.), BaO 1.3% (max.), CaO 0.4% (max.) and MgO 0.4% (max.) is consumed.

Requirement of manganese dioxide for Explosive and Pyrotechnic industries as laid down in IS : 5713-1981 (First Revision, Reaffirmed 2011) by BIS is as follows: MnO<sub>2</sub> 80% by mass (min.), moisture 1% (max.), matter soluble in water

0.2% (max.) and water soluble chlorides (as NaCl) 0.05% (max.). There are three types of material with above composition which show variation in their particle size: Type A, Type B and Type C. Particle size (max.) is 600 micron for Type A, 150 micron for Type B and 74 micron for Type C ore. In addition, grit content should be 1% (max.) for Type A ore. For Match Industry, the MnO<sub>2</sub> content shall be 50% (min.).

Pyrolusite is used generally to impart glaze to the pottery and to make coloured bricks. It also finds use as driers for oils, varnishes and paints. Manganese sulphide is used in the manufacture of salts and in calico printing. Manganese chloride is used in cotton textile as a bronze dye. Manganese salts are used in photography and in leather and matchbox industries.

## CONSUMPTION

The consumption of manganese ore in all industries was about 3.54 million tonnes in 2015-16 as against 4.44 million tonnes in 2014-15. Ferro-alloys industries accounted for about 83% consumption followed by Iron & Steel (16%). The remaining (1%) was shared by Battery, Chemical, Zinc Smelter, Alloy Steel and Glass industries (Table- 10).

The consumption of ferro-manganese in 2015-16 increased slightly to 131 thousand tonnes from 122 thousand tonnes in the previous year. Iron & steel industry was the bulk consumer of ferro-manganese accounting for about 92% consumption in 2015-16. The remaining 8% was consumed in alloy steel, foundry and electrode industries. Consumption of silico-manganese which was 225.8 thousand tonnes in 2014-15 increased to 258.2 thousand tonnes in 2015-16 (Tables- 11 & 12).

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**Table – 10 : Estimated Consumption of Manganese Ore<sup>1/</sup>\*, 2013-14 to 2015-16  
(By Industries)**

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
<b>All Industries</b>	<b>4184000</b>	<b>4439300</b>	<b>3544015</b>
Ferro-alloys	3904300 <sup>(e)</sup>	3904300 <sup>(e)</sup>	2944715
Iron & steel	262000	517300	581500
Battery <sup>2/</sup>	14600	14600	14600
Others: (Alloy steel, chemical, zinc smelter & electrode )	3100	3100	3200

*Figures rounded off.**\* Includes actual reported consumption and/or estimates made wherever required; Paucity of data has posed restriction to the data coverage on consumption.**<sup>1/</sup> Data does not include consumption of SSI units manufacturing ferro-manganese, data for which are not available.***Table – 11 : Consumption\* of Ferro-manganese, 2013-14 to 2015-16  
(By Industries)**

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
<b>All Industries</b>	<b>124800</b>	<b>122400</b>	<b>131000</b>
Alloy steel	6400	5800	9100
Electrode	1300	1000	1200
Foundry	500	500	500
Iron & steel	116600	115100	120200

*Figures rounded off.**\* Includes actual reported consumption and/or estimates made wherever required; Paucity of data has posed restriction to the data coverage on consumption.***Table – 12 : Consumption\* of Silico-manganese, 2013-14 to 2015-16  
(By Industries)**

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
<b>All Industries</b>	<b>219600</b>	<b>225800</b>	<b>258100</b>
Alloy steel	2000	2300	10400
Electrode	100	100	100
Foundry	100	100	100
Iron & steel	217400	223300	247500

*Figures rounded off.**\* Includes actual reported consumption and/or estimates wherever required; Paucity of data has posed restriction to the data.*

## INDUSTRY

Manganese alloys are the largest produced ferro-alloys in the world with a share of about 41% of the global production of ferro-alloys. For production of one tonne of ferro-manganese, about 2.6 tonnes of manganese ore, 0.5 tonne of reductant and 3 MWh of electricity inputs are required. As per Indian Ferro Alloys Producers' Association (IFAPA), the total installed capacity of manganese alloys including ferro-manganese/silico-manganese in the country was estimated to be around 3.16 million tonnes per annum.

MOIL had set up a High Intensity Magnetic Separation Plant and 1,000 tpy Electrolytic Manganese Dioxide (EMD) Plant at Dongri Buzurg mine. The plant is under expansion to 1,500 tpy capacity. In 2015-16, about 612 tonnes of EMD was produced as against 950 tonnes in 2014-15. Ferro-manganese plant of 10,000 tonnes per annum capacity has been set up at Bharveli, Balaghat. In 2015-16, 6,519 tonnes of ferro-manganese was produced as compared to 10,045 tonnes in the previous year.

### Ferro-manganese

The total production of various types of manganese alloys (high carbon ferro-manganese, medium carbon ferro-manganese and low carbon ferro-manganese) was about 4.72 lakh tonnes in 2015-16 (up to February 2016), as per Monthly Statistics of Mineral Production (February, 2016). It is to be noted that the data coverage is partial and does not reflect the actual production.

### Silico-manganese

Silico-manganese is a combination of 60-70% Mn, 10-20% silica and about 20% carbon. As per Monthly Statistics of Mineral Production (March, 2016), production of silico-manganese was reported at 2,69,920 tonnes in 2015-16 from 2,49,691 tonnes in 2014-15. It is to be noted that the data coverage is partial and does not reflect the actual production. MOIL was considering setting up ferro-manganese and silico-manganese plants through joint venture companies with RINL and SAIL, namely, 31,000 tpy ferro-manganese and 75,000 tpy silico-manganese plants at Nandini near

Bhilai, Chhattisgarh and a 20,000 tpy ferro-manganese and 37,000 tpy silico-manganese plants at Bobbili, Vizianagaram district, Andhra Pradesh with RINL. These projects are not viable at present especially on account of the present power tariffs of the State Electricity Boards. activities in respect of both these joint venture companies have been put on hold.

The major factor driving the production of manganese alloys is high production growth of low nickel austenitic stainless steel. India is emerging as the largest producer of this steel where manganese is added substituting the expensive nickel.

### Iron & Steel

Iron & Steel Industry was the second major consumer of manganese ore wherein manganese ore is used directly as a blast furnace feed. Details on consumption, specifications and source of supply of manganese ore to major iron & steel plants in the country in 2014-15 and 2015-16 are furnished in Table-13.

### Dry Battery

Consumption of manganese dioxide ore in Dry Battery Industry was 14,600 tonnes in 2015-16, [excluding Electrolytic Manganese Dioxide EMD)]. The demand was met through imports, supported by indigenous production of manganese dioxide and EMD.

Dry battery Industry also consumes EMD along with natural manganese dioxide ore. The only one plant of 1,000 tpy capacity producing EMD is owned by MOIL and is located in Bhandara district.

## SUBSTITUTES

Cost and technology militate substitution in major applications. However, for economic reasons, there is only limited substitution in minor applications in Chemical and Battery industries. The Steel Industry has, however, made great strides in economising the use of manganese, largely through changes in steel-making techniques.

MANGANESE ORE

**Table – 13 : Consumption, Specifications and Source of Supply of Manganese Ore in Different Iron and Steel Plants, 2014-15 and 2015-16**

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2014-15	2015-16 (P)	2014-15	2015-16 (P)		
Bhilai Steel Plant, Bhilai Nagar, Durg Chhattisgarh.	Hot metal 5072258	Hot metal 5317127	25656 4995	NA 6735	Size: 25 to 85 mm Mn: 30% min. SiO <sub>2</sub> : 30% max. Al <sub>2</sub> O <sub>3</sub> : 5% max. P: 0.3% max.	MOIL/ Ramtek Goberwahi, Gua Mines SAIL, RMD
Bokaro Steel Plant, Bokaro, Jharkhand.	Hot metal 4253271	Hot metal 3700004	NA	NA	Mn: 30% max. SiO <sub>2</sub> +Al <sub>2</sub> O <sub>3</sub> : 20.5% max. -10 mm -15% max. +40 mm -10% max.	-
Durgapur Steel Plant, Durgapur, West Bengal.	Hot metal 2296707	Hot metal 2170498	NA	NA	Mn: 30% min. Fe: 15-28% SiO <sub>2</sub> : 3.3% max. Al <sub>2</sub> O <sub>3</sub> : 7.5% max.	-
Rourkela Steel Plant, Rourkela, Odisha.	Hot metal 2538322	Hot metal 2591417	NA	NA	-	-
IISCO Steel Plant, Burnpur, Dist. Burdwan, West Bengal- 713 325.	Hot metal 219641	Hot metal 566244	NA	NA -	Mn (dry) 30% (min.) -10 mm - 10.0% max. +40 mm - 15% max.	-
Visvesvaraya Iron and Steel Ltd, Bhadravati, Shivamogga, Karnataka.	Hot metal 20986	Hot metal 67603	NA	NA	-	-
KIOCL Ltd, Pellet Plant, Mangaluru, Dakshina Kannada, Karnataka.	Hot metal NA	Hot metal NA	NA	NA	Fe: 25-50% min. MnO <sub>2</sub> : 44% min. SiO <sub>2</sub> +Al <sub>2</sub> O <sub>3</sub> : 12% max.	Milan Minerals, Karnataka
Visakhapatnam Steel Plant, Visakhapatnam, Andhra Pradesh.	NA	NA	11400	NA	Mn: 28%, (min.) Fe: 16% SiO <sub>2</sub> : 25% max. Size: 10-60 mm (BF) (-) 10 mm (SP)	Garividi, Andhra Pradesh
IDCOL, Kalinga Iron Works Ltd, Barbil, Kendujhar, Odisha.	Hot metal 7793	Hot metal -	338 68	68 -	Size: 10-40 mm	From own/ local mines
Gordan Steel India Ltd, Jaonbulapadu, Anantapur, Andhra Pradesh.	Hot metal 30427	Hot metal 30427(e)	728	2292	Mn 28-35% Mn	-
Tata Steel Ltd, Jamshedpur, Jharkhand.	Hot metal 9898502	Hot metal 10162917	NA	NA	NA	-

(Contd.)

MANGANESE ORE

Table - 13 (Contd.)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2014-15	2015-16 (P)	2014-15	2015-16 (P)		
Kirloskar Ferrous Industries Ltd, Berinahalli, 583 234, Koppal, Karnataka.	Pig iron 277026	Pig iron 324053	6721	7163	Mn: 28% min. Fe: 20% min. SiO <sub>2</sub> : 8% max. Alkalies: 1% max. Size: 10 to 40 mm 90% min. under & over size: 5% max. each	SMIORE, Adarsha Mining Co., Omkaramma
LANCO Industries Ltd, Chittoor, Andhra Pradesh.	Pig iron+ (molten metal) 198036	Pig iron+ (molten metal) 198036(e)	NA	NA	NA	NA
Visa Steel Ltd, Kalinganagar, Jajpur, Odisha.	Hot metal NA	Hot metal NA	302	NA	below 35% Mn Mines	Siljoda
Sunflag Iron & Steel Co. Ltd, Bhandara, Maharashtra.	Hot metal 208224	Hot metal 208224(e)	NA	NA	-	-
Jaiswal Neco Industries Ltd, Siltara, Raipur, Chhattisgarh.	Hot metal 548753	Hot metal 524575	2170	1871	Mn:26-28% Size:10-60 mm	-
Jaiswal Neco Industries Ltd, Bellari, Karnataka.	Hot metal 8492000	Hot metal 9029390	-	-	NA	NA
Tata Metalliks Ltd, Kharagpur, Medinipur, West Bengal.	Hot metal 302999	Hot metal 292575	7048	10502	NA	NA
JSW Steel Ltd, Salem, Tamil Nadu- 636 453.	Hot metal 860000	Hot metal 914000	- 14	- -	NA	NA
JSW Steel Ltd, Vidyanagari, Bellari, Karnataka.	Hot metal 9029390	Hot metal 9683092	-	-	NA	NA
Rashmi Metaliks Ltd, Gokulpur, West Midnapur, West Bengal.	Hot metal 163911	Hot metal 136832	1494	852	NA	NA
Sona Alloys P. Ltd, Lonad, Pune, Maharashtra.	Hot metal 250000	Hot metal 250000(e)	NA -	3640 -	NA -	NA -
Aparant Iron & Steel Pvt.Ltd, Goa.	Pig Iron 20237	Pig Iron 20237(e)	1380	334	NA	NA
Uttam Galva Metallics Ltd, Bhugaon- 442001, Wardha, Maharashtra.	Hot metal 487	487(e)	30	118	NA	NA

## MANGANESE ORE

Table - 13 (Concl'd.)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2014-15	2015-16 (P)	2014-15	2015-16 (P)		
Vedanta Ltd, Navelim Amona, Marcela, Goa.	620984	665869	348	16	-	-
Neelachal Ispat Nigam Ltd, Kalinga Nagar, Duburi, Jajpur, Odisha.	602680	616570	NA	NA	-	-
Suraj Products Ltd Barpali, Rajgangpur, Sundargarh, Odisha.	12151	13689	594	1139	-	-

### TECHNICAL POSSIBILITIES

The deep-sea nodules can be a potential resource of manganese in the next decades to come. There is a trend towards using lower grades of ores in ferro-manganese production. New steel-making practices and techniques are reducing the amount of manganese consumed in the process. However, counterbalancing this to some extent is a trend towards higher manganese specifications for modern steels.

### TRADE POLICY

#### Export Policy

The Foreign Trade Policy, 2015-20 and the policy on export puts restrictions on exports of manganese ore as follows:

HS Code	Item description	Policy	Nature of restriction
2602 0000	Manganese ores excluding the following: Lumpy/blended manganese ore with more than 46% Mn	State Trading Enterprise	Exports through (a) MMTC (b) MOIL for manganese ore produced in MOIL mines
2602 0010	Lumpy/blended manganese ore with more than 46% Mn	Restricted	Export permitted under licence

#### Import Policy

Imports of manganese ore and concentrates including ferruginous manganese ores and concentrates containing 20% or more manganese (calculated on dry weight basis), agglomerated manganese ore sinters, etc. are freely allowed.

### WORLD REVIEW

The total world reserve of manganese ore is approximately 690 million tonnes of metal content which is unevenly distributed (Table-14). Reserves are located in South Africa (29%), Ukraine (20%), Brazil (17%), Australia (13%) and India (8%). Only a small fraction of global manganese reserves is clearly economic. This fact continues to support interest in deep-sea manganese nodules, which constitute an enormous untapped resource. Most nodules are found in areas of deep-sea floor at water depths of 5 to 7 km. The Pacific Ocean alone is estimated to contain about 2.5 billion tonnes nodules containing about 25% Mn, making them similar in abundance to low-grade land-based deposits. Most major steel-making nations lack manganese resources. North America had less than 1% world reserves. Besides, United States have lean grade reserves and potentially high extraction cost. This situation has created an active global trade in manganese ore and manganese alloys.

World production of manganese ore in 2015 was estimated to be around 53.2 million tonnes as compared to 54.5 million tonnes in 2014. South Africa was the leading producer contributing about 30% followed by China (28%), Australia (12%), Gabon (8%), India (4%) and Kazakhstan (3%) (Table-15). The production of manganese ore is linked with the production of steel. The Steel Industry consumes it in the form of ore and manganese alloys.

## FOREIGN TRADE

### Exports

Exports of manganese ore decreased drastically to about 444 tonnes in 2015-16 from 11 thousand tonnes in 2014-15. Out of the total exports in 2015-16, 93 tonnes of manganese ore having +46% Mn were exported. There were no exports of ore having 30 to 35% Mn. Exports of manganese ore (others) were 351 tonnes. More than 78% of exports were to Netherlands and 21% exports to Nepal. Exports of manganese oxide (total) increased to 21,850 tonnes in 2015-16, as against 16,449 tonnes in the previous year. Manganese oxide exports in 2015-16 comprised manganese dioxide 2,679 tonnes and other than manganese oxides 19,171 tonnes. Exports were mainly to Russia (10%), Spain (8%), Indonesia and Germany (6% each) Canada and Vietnam (5% each). In 2015-16, exports of manganese and alloys (including waste & scrap) increased to 190 tonnes as compared to 134 tonnes in the previous year. Exports of manganese & alloys (wrought/un-wrought) in 2015-16 were at 180 tonnes as compared to 114 tonnes in the previous year (Tables- 16 to 23).

### Imports

Imports of manganese ore decreased to about 2.22 million tonnes in 2015-16 from 3.17 million tonnes in 2014-15. South Africa (50%), Australia (24%) and Gabon (20%) were the main suppliers of manganese ore in 2015-16. Out of the manganese ore (total) imported, manganese ore having +46% Mn contributed 5,88,896 tonnes, manganese ore having 35 to 46% Mn were 13,85,986 tonnes, manganese ore having 30 to 35 % Mn were 1,99,508 tonnes and manganese ore (others) were 15,112 tonnes. In 2015-16, imports of manganese dioxide were 8,225 tonnes. Imports were mainly from China (82%), Indonesia (13%) and South Africa (3%). Imports of manganese oxide and other than manganese dioxides were 4,966 tonnes. During 2015-16, imports of manganese & alloys (including waste and scrap) were 29,045 tonnes, out of which manganese & alloys (unwrought) comprised 20,839 tonnes. Imports of manganese & alloys NES were 195 tonnes mostly from China (76%) and Spain (16%) (Tables- 25 to 35).

**Table – 14 : World Reserves of Manganese Ore (By Principal Countries)**

(In '000 tonnes of metal content)

Country	Reserves
<b>World: Total (rounded)</b>	<b>690000</b>
Australia	91000
Brazil	116000
China	43000
Gabon	22000
Ghana	12000
India*	52000
Kazakhstan	5000
Mexico	5000
South Africa	200000
Ukraine	140000
Other countries	Small

*Source: Mineral Commodity Summaries, 2017.*

\* India's total resources of manganese ore as on 1.4.2015 are estimated at 496 million tonnes.

**Table – 15 : World Production of Manganese Ore (By Principal Countries)**

(In '000 tonnes)

Country	2013	2014	2015
<b>World: Total</b>	<b>53023</b>	<b>54469</b>	<b>53193</b>
Australia	7426	7587	6281
Brazil	2833	2723	2700
China <sup>(e)</sup>	15000	15000	15000
Gabon	4091	4000 <sup>e</sup>	4000 <sup>e</sup>
Ghana	1998	1531	1563
India*	2626	2369	2148
Kazakhstan	2852	2609	1626
Malaysia	1125	835	502
South Africa <sup>e</sup>	10952	13857	15979
Ukraine	1525	1526	1525 <sup>e</sup>
Other countries	2595	2432	1869

*Source: World Mineral Production, 2011-2015.*

\* India's production of manganese ore in 2013-14, 2014-15 and 2015-16 was 2.63 million tonnes 2.37 million tonnes and 2.15 million tonnes, respectively.

**Table – 16 : Exports of Manganese Ore : Total (By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>11026</b>	<b>65399</b>	<b>444</b>	<b>18946</b>
Netherlands	25	1310	346	18526
Nepal	-	-	93	191
Saudi Arabia	-	-	1	103
Malaysia	-	-	3	69
Bhutan	-	-	1	55
Brunei	1	1	++	1
Pakistan	11000	64088	-	-
Other countries	-	-	++	1

MANGANESE ORE

**Table – 17 : Exports of Manganese Ore  
(46% or more Mn)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	-	-	<b>93</b>	<b>317</b>
Nepal	-	-	91	159
Saudi Arabia	-	-	1	103
Bhutan	-	-	1	55

**Table – 18 : Exports of Manganese Ore (Others)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>11026</b>	<b>65399</b>	<b>351</b>	<b>18629</b>
Netherlands	25	1310	346	18526
Malaysia	-	-	3	69
Nepal	-	-	2	32
Brunei	1	1	++	1
Pakistan	11000	64088	-	-
Other countries	-	-	++	1

**Table – 19 : Exports of Manganese Oxide : Total  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>16449</b>	<b>642153</b>	<b>21850</b>	<b>805057</b>
Russia	1043	39165	2259	78763
Spain	1553	60873	1797	64164
Canada	953	44006	1083	49068
Indonesia	641	27211	1281	47733
Germany	1181	44705	1303	45972
Vietnam	606	25605	1104	41516
Thailand	868	29999	1073	34893
Turkey	550	22574	855	31672
Australia	659	27547	810	30629
Belgium	700	27843	850	29749
Other countries	7695	292625	9435	350898

**Table – 20 : Exports of Manganese Dioxide  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>3261</b>	<b>105170</b>	<b>2679</b>	<b>91517</b>
Iran	750	28413	700	20635
Saudi Arabia	88	3396	120	8496
Poland	150	8413	123	6760
Kenya	154	5535	179	6736
Italy	37	2031	125	4943
Bangladesh	352	9042	174	4358
Netherlands	25	1355	75	3668
Thailand	243	4105	248	3657
Malaysia	105	5483	74	3369
Sri Lanka	113	2523	131	3072
Other countries	1244	34874	730	25823

**Table – 21 : Exports of Manganese Oxide  
(Other than Manganese Dioxide)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>13188</b>	<b>537072</b>	<b>19171</b>	<b>713740</b>
Russia	1043	39165	2235	78161
Spain	1508	57652	1771	62190
Canada	929	43070	1083	49068
Indonesia	640	27183	1281	47733
Germany	1181	44705	1303	45918
Vietnam	605	25566	1029	39995
Turkey	550	22574	853	31589
Thailand	625	25894	825	31236
Australia	659	27547	810	30629
Belgium	675	26666	800	27253
Other countries	4773	197050	7181	269968

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**Table – 22 : Exports of Manganese & Alloys  
(Incl. Waste & Scrap)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>134</b>	<b>110433</b>	<b>190</b>	<b>150383</b>
France	-	-	40	35411
China	-	-	23	20238
Korea, Rep. of	33	48329	10	14554
Slovenia	8	11206	9	11708
Chinese Taipei/ Taiwan	7	11416	6	9843
Malaysia	5	5074	36	9831
Korea Dem. P. Rep.	-	-	6	9134
Italy	4	6005	4	7298
Brazil	8	3563	4	6329
Romania	2	4378	2	3644
Other countries	67	20462	50	22393

**Table – 23 : Exports of Manganese & Alloys :  
(Wrought/Unwrought)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>114</b>	<b>107093</b>	<b>180</b>	<b>148371</b>
France	-	-	40	35411
China	++	931	23	20238
Korea, Rep. of	33	48329	10	14554
Slovenia	8	11206	9	11708
Chinese Taipei/ Taiwan	7	11385	6	9843
Malaysia	5	4881	34	9417
Korea Dem. P. Rep.	-	-	6	9134
Italy	4	6005	4	7224
Brazil	3	2450	4	6329
Romania	2	4378	2	3644
Other countries	52	17528	42	20869

**Table – 24 : Imports of Manganese Ore : Total  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>3173158</b>	<b>34669120</b>	<b>2216864</b>	<b>17413687</b>
South Africa	2043506	19932204	1118790	8102080
Australia	748671	9900465	535431	4760456
Gabon	263274	3314330	447388	3620290
Ivory Coast/ Cote d' Ivoire	75124	931846	48200	380360
Malaysia	14710	92041	54410	253989
Singapore	6350	233138	5170	189483
France	-	-	4554	52598
Peru	929	15768	1177	18481
Colombia	480	7958	320	14953
Indonesia	-	-	438	7295
Other countries	20114	241370	986	13702

**Table – 25 : Imports of Manganese Ore  
(46% or more Mn)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>892093</b>	<b>11730476</b>	<b>588896</b>	<b>5376549</b>
Australia	595815	8212297	422527	3884653
South Africa	216394	2222393	119430	882415
Gabon	55164	779168	39315	373706
Singapore	6350	233138	5170	189483
Peru	929	15768	1177	18481
Colombia	180	7958	320	14953
UAE	-	-	349	5410
Tanzania Rep.	-	-	377	4250
Zambia	2853	47818	136	2244
Nigeria	28	378	75	587
Other countries	14380	211558	20	367

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**Table – 26: Imports of Manganese Ore  
(35% or more but below 46% Mn)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>2090849</b>	<b>21380159</b>	<b>1385986</b>	<b>10479876</b>
South Africa	1697148	16606003	973510	7049910
Gabon	191444	2394448	248147	2137984
Australia	126965	1489494	108147	848682
Ivory Coast/ Cote d' Ivoire	64199	774199	46238	362731
France	-	-	4554	52598
Malaysia	-	-	5363	27682
Nigeria	353	4362	27	289
Morocco	4727	52651	-	-
Turkey	4315	37719	-	-
Senegal	577	7234	-	-
Other countries	1121	14049	-	-

**Table – 27 : Imports of Manganese Ore  
(30% or more but below 35%)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>170570</b>	<b>1426501</b>	<b>199508</b>	<b>1358838</b>
Gabon	16666	140714	159926	1108600
South Africa	125329	1063871	25850	169754
Malaysia	-	-	7013	35734
Australia	25891	198674	4757	27121
Ivory Coast/ Cote d' Ivoire	-	-	1962	17629
Morocco	2094	19824	-	-
Georgia	590	3418	-	-
Other countries	-	-	-	-

**Table – 28 : Imports of Manganese Ore (Others)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>1</b>	<b>2373</b>	<b>15112</b>	<b>78204</b>
Malaysia	-	-	14672	70354
Indonesia	-	-	438	7295
Kazakhstan	-	-	1	549
Germany	-	-	1	6
South Africa	++	2367	-	-
Ivory Coast/ Cote d' Ivoire	1	6	-	-
Other countries	-	-	-	-

**Table – 29 : Imports of Manganese Dioxide  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>7847</b>	<b>651539</b>	<b>8225</b>	<b>743183</b>
China	5760	528860	6731	661884
Belgium	53	11957	162	29589
Indonesia	1244	30868	1090	20199
South Africa	760	71196	232	18886
Japan	1	770	6	9256
USA	24	6262	1	2067
Germany	5	1524	3	1234
UK	++	102	++	60
Canada	-	-	++	6
Singapore	-	-	++	2

**Table – 30 : Imports of Manganese Oxide  
(Other than Manganese Dioxide)  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>4653</b>	<b>275496</b>	<b>4966</b>	<b>218769</b>
Belgium	810	122591	740	102647
South Africa	2011	45900	3122	72581
Indonesia	1328	33549	950	20547
China	415	61960	56	8962
USA	49	5766	82	8949
Germany	9	2846	14	4462
Japan	-	-	++	468
Australia	-	-	2	88
UK	5	784	++	65
Canada	-	1364	-	-
Other countries	26	736	-	-

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**Table –31: Imports of Manganese & Alloys  
(Incl. Waste & Scrap)  
By Countries**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>30932</b>	<b>4232257</b>	<b>29045</b>	<b>3606506</b>
China	30197	4019763	28565	3364240
France	135	131602	213	160162
USA	11	13500	66	48130
South Africa	506	36438	153	10656
Germany	20	3176	12	9412
Spain	-	-	31	8669
Sweden	18	16230	5	4436
UK	20	9808	++	449
Switzerland	-	-	++	238
Japan	-	-	++	82
Other countries	25	1740	++	32

**Table – 32 : Imports of Manganese & Alloys Unwrought  
By Countries**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>20226</b>	<b>2806722</b>	<b>20839</b>	<b>2539220</b>
China	19534	2602832	20406	2319401
France	135	131602	209	156566
USA	10	12740	66	48115
South Africa	464	29484	153	10656
Sweden	18	16201	4	3445
Germany	20	3169	1	926
Japan	-	-	++	82
Singapore	-	-	++	29
UK	20	9594	-	-
UAE	5	667	-	-
Other countries	20	433	-	-

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**Table – 33: Imports of Manganese : Wrought  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>9634</b>	<b>1281601</b>	<b>8011</b>	<b>1024855</b>
China	9592	1274647	8011	1024855
South Africa	42	6954	-	-

**Table – 34: Imports of Manganese & Alloys, NES  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>1072</b>	<b>143934</b>	<b>195</b>	<b>42461</b>
China	1071	142284	148	19985
Spain	-	-	31	8669
Germany	++	7	11	8486
France	-	-	4	3596
Sweden	++	29	1	991
UK	++	214	++	449
Switzerland	-	-	++	238
USA	1	760	++	45
Belgium	-	-	++	2
Italy	++	622	-	-
Other countries	++	18	-	-

## FUTURE OUTLOOK

India's per capita steel consumption is about 60 kg as against the world's per capita consumption of 214 kg. This difference in the per capita consumption of steel in itself reflects opportunities that are bound to occur for Steel Industry which in turn would positively impact the demand for manganese ore. Production of crude steel is the single most important factor that influences the demand for manganese ore. Steel Industry accounts for approximately 90% of the

world demand for manganese. Carbon steel is the principal market accounting for 65 to 70% manganese consumption.

India has set a capacity target of 300 million tonnes of steel by 2030. The demand for manganese ore is expected to commensurately raised to about 10 million tonnes per year in the coming years.