# Indian Minerals Yearbook 2016

**(Part-III : Mineral Reviews)**

## 55th Edition

# MANGANESE ORE

## (FINAL 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 ($Mn_2O_3.H_2O$, Mn about 62.4%); and (iv) braunite ($3Mn_2O_3$, $MnSiO_8$, Mn about 62% and $SiO_2$ about 10%).

Indian manganese ore deposits occur mainly as metamorphosed bedded sedimentary deposits associated with Gondite Series (Archaeans) of Madhya Pradesh (Balaghat, Chhindwara & Jhabua districts), Maharashtra (Bhandara & Nagpur districts), Gujarat (Panchmahal district), Odisha (Sundergarh district) and with Kodurite Series (Archaeans) 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.

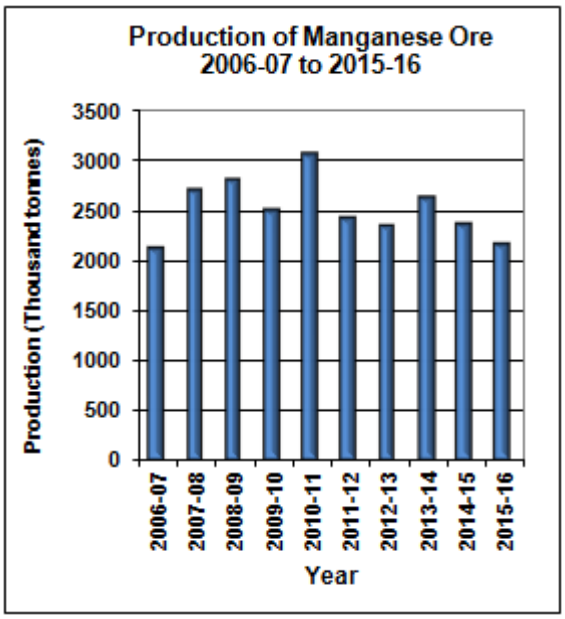
## PRODUCTION AND STOCKS

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.



## Table – 1 : Reserves/Resources of Manganese Ore as on 01.04.2015

### (By Grades/States)

(In '000 tonnes)

| State/Grade | Reserves | | | | Remaining Resources | | | | | | | | Total Resources |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Proved | Probable | | Total | Feasibility | Pre-feasibility | | Measured | Indicated | Inferred | Reconnsaissance | Total | |
| | STD111 | STD121 | STD122 | (A) | STD211 | STD221 | STD222 | STD331 | STD332 | STD333 | STD334 | (B) | (A+B) |
| **All India : Total** | **62982** | **19715** | **10778** | **93475** | **70742** | **44606** | **73823** | **18189** | **42803** | **135722** | **16513** | **402399** | **495874** |
| **By Grades** | | | | | | | | | | | | | |
| 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 |
| **By States** | | | | | | | | | | | | | |
| 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.*

## 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 | | |
| **GSI** | | | | | | | |
| **Odisha** | | | | | | | |
| 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. |
| **MOIL** | | | | | | | |
| **Madhya Pradesh** | | | | | | | |
| 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.)

Table-2 (Concld.)

| 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 in-situ 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. |
| **Maharashtra** | | | | | | | |
| Bhandara | Dongri-Buzurg Mine Teh. Tumsar | - | - | 01 | 300 | - | As on 01.04.2016, about 11.12 million tonnes in-situ 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.

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

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

(Contd.)

Table-3 (Concld.)

| Name & address of Producer | Location of mine | |
|---|---|---|
| | State | District |
| Mangilal Rungta,<br>Rungta office,<br>Main Road, Barbil,<br>Dist. Kendujhar,<br>Odisha-758 035. | Odisha | Kendujhar |
| Orissa Manganese & Minerals Ltd,<br>Lansdowne Towers,<br>6th floor, 2/1A<br>Sarat Bose Road,<br>Kolkata-700 020.<br>West Bengal. | Odisha | Sundargarh |
| Krishnaping Alloys Pvt. Ltd,<br>579, Tharsa Road,<br>Kanhan-441 401<br>Madhya Pradesh. | Madhya Pradesh | Chhindwara |
| J.K. Minerals,<br>Main Road, Ward No. 15,<br>Balaghat-481 001<br>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,<br>24, Homi Mody Street, Fort,<br>Mumbai- 400 001,<br>Maharashtra. | Odisha | Kendujhar |
| Mangilal Rungta,<br>Rungta Office,<br>Main Road, Barbil-758 035,<br>Kendujhar, Odisha. | Odisha | Kendujhar |
| Orissa Manganese & Minerals Ltd,<br>Landsdowne Tower,<br>6th floor, 2/1A,<br>Sarat Bose Road,<br>Kolkata- 700 020,<br>West Bengal. | Odisha | Sundargarh |
| Rungta Mines Ltd,<br>8A, Express Tower,<br>42A, Shakespeare Sarani,<br>Kolkata-700 017,<br>West Bengal. | Odisha | Sundargarh |
| MOIL Ltd,<br>MOIL Bhavan,<br>1A-Katol Road,<br>Nagpur-440 013,<br>Maharashtra. | Maharashtra | Bhandara |

## 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 |
| **India** | **2626291** | **15181757** | **2369481** | **13661799** | **2147629** | **8864926** |
| Andhra Pradesh# | 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# | 10921 | 38415 | 6775 | 21007 | 6892 | 16245 |

*# 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 | $MnO_2$ | Production By Grades: Mn Content | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | | | above 46% | 35%-46% | 25%-35% | below 25% | Quantity | Value |
| **India** | **161(9)** | **20461** | **249050** | **479419** | **1174231** | **446320** | **2369481** | **13661799** |
| Public Sector | 24 | 2189 | 204659 | 350696 | 570432 | 42557 | 1170533 | 8928788 |
| Private Sector | 137(9) | 18272 | 44391 | 128723 | 603799 | 403763 | 1198948 | 4733011 |
| **Andhra Pradesh** | **27** | **-** | **-** | **6320** | **148737** | **98689** | **253746** | **516842** |
| Vizianagaram | 27 | - | - | 6320 | 148737 | 98689 | 253746 | 516842 |
| **Goa*** | **5** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |
| South Goa* | 5 | - | - | - | - | - | - | - |
| **Gujarat*** | **2** | **-** | **-** | **-** | **-** | **15564** | **15564** | **10179** |
| Panchmahal* | 1 | - | - | - | - | - | - | - |
| Vadodara | 1 | - | - | - | - | 15564 | 15564 | 10179 |
| **Jharkhand** | **5(1)** | **94** | **-** | **47** | **3487** | **820** | **4448** | **20508** |
| Singbhum (West) | 5(1) | 94 | - | 47 | 3487 | 820 | 4448 | 20508 |
| **Karnataka** | **14** | **-** | **-** | **7843** | **144672** | **54185** | **206700** | **933894** |
| Ballari | 5 | - | - | 7843 | 134776 | 29749 | 172368 | 850823 |
| Chitradurga | 4 | - | - | - | - | 17600 | 17600 | 22779 |
| Davanagere | 2 | - | - | - | 9096 | 6016 | 15112 | 57864 |
| Tumakuru | 3 | - | - | - | 800 | 820 | 1620 | 2428 |
| **Madhya Pradesh** | **44(5)** | **-** | **168870** | **103099** | **381358** | **224667** | **877994** | **5219983** |
| 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 |
| **Maharashtra** | **22** | **2189** | **46860** | **283597** | **320424** | **17168** | **670238** | **5150230** |
| Bhandara | 3 | 2189 | 17943 | 195997 | 209690 | - | 425819 | 3238139 |
| Nagpur | 19 | - | 28917 | 87600 | 110734 | 17168 | 244419 | 1912091 |
| **Odisha** | **37(3)** | **18178** | **33320** | **78513** | **167643** | **28452** | **326106** | **1765655** |
| Kendujhar | 19(3) | 18178 | 33230 | 77280 | 152481 | 17368 | 298537 | 1580277 |
| Sundargarh | 18 | - | 90 | 1233 | 15162 | 11084 | 27569 | 185378 |
| **Rajasthan** | **1** | **-** | **-** | **-** | **7910** | **-** | **7910** | **23501** |
| Banswara | 1 | - | - | - | 7910 | - | 7910 | 23501 |
| **Telangana** | **4** | **-** | **-** | **-** | **-** | **6775** | **6775** | **21007** |
| Adilabad | 4 | - | - | - | - | 6775 | 6775 | 21007 |

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

** Only labour reported.*

## 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 | |
|---|---|---|---|---|---|---|---|---|
| | | $MnO_2$ | above 46% | 35%-46% | 25%-35% | below 25% | Quantity | Value |
| **India** | **145(9)** | **20161** | **275445** | **465659** | **993783** | **392581** | **2147629** | **8864926** |
| Public Sector | 23 | 172 | 193164 | 337043 | 500747 | 51667 | 1082793 | 5540570 |
| Private Sector | 122(9) | 19989 | 82281 | 128616 | 493036 | 340914 | 1064836 | 3324356 |
| **Andhra Pradesh** | **23** | **-** | **-** | **10006** | **112331** | **63496** | **185833** | **288176** |
| Vizianagaram | 23 | - | - | 10006 | 112331 | 63496 | 185833 | 288176 |
| **Goa** | **5** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |
| South Goa* | 5 | - | - | - | - | - | - | - |
| **Gujarat** | **2** | **-** | **-** | **-** | **-** | **38223** | **38223** | **15687** |
| Panchmahal* | 1 | - | - | - | - | 37959 | 37959 | 15514 |
| Vadodara | 1 | - | - | - | - | 264 | 264 | 173 |
| **Jharkhand** | **5** | **-** | **-** | **-** | **508** | **-** | **508** | **3274** |
| Singhbhum (West) | 5 | - | - | - | 508 | - | 508 | 3274 |
| **Karnataka** | **11(1)** | **-** | **-** | **4879** | **108028** | **32717** | **145624** | **396853** |
| Ballari | 2(1) | - | - | 4879 | 108028 | 26653 | 139560 | 387755 |
| Chitradurga | 4 | - | - | - | - | 4864 | 4864 | 6898 |
| Davangere | 2 | - | - | - | - | 250 | 250 | 375 |
| Tumakuru | 3 | - | - | - | - | 950 | 950 | 1825 |
| **Madhya Pradesh** | **45(5)** | **-** | **200482** | **103098** | **286918** | **173486** | **763984** | **3428742** |
| 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 |
| **Maharashtra** | **17** | **172** | **27312** | **277417** | **286999** | **22581** | **614481** | **3102154** |
| Bhandara | 2 | 172 | 7700 | 185182 | 187446 | - | 380500 | 1988229 |
| Nagpur | 15 | - | 19612 | 92235 | 99553 | 22581 | 233981 | 1113925 |
| **Odisha** | **31(3)** | **19989** | **47651** | **70259** | **195542** | **55186** | **388627** | **1603445** |
| Kendujhar | 18(2) | 19462 | 47279 | 65196 | 146374 | 18256 | 296567 | 1259147 |
| Sundergarh | 13(1) | 527 | 372 | 5063 | 49168 | 36930 | 92060 | 344298 |
| **Rajasthan** | **1** | **-** | **-** | **-** | **3457** | **-** | **3457** | **10350** |
| Banswara | 1 | - | - | - | 3457 | - | 3457 | 10350 |
| **Telangana** | **5** | **-** | **-** | **-** | **-** | **6892** | **6892** | **16245** |
| Adilabad | 5 | - | - | - | - | 6892 | 6892 | 16245 |

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

** Only labour reported.*

## 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) |
| **Total** | **161(9)** | **145(9)** | **2369481** | **2147629** | **100.00** | **100.00** | **-** | **-** |
| 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)

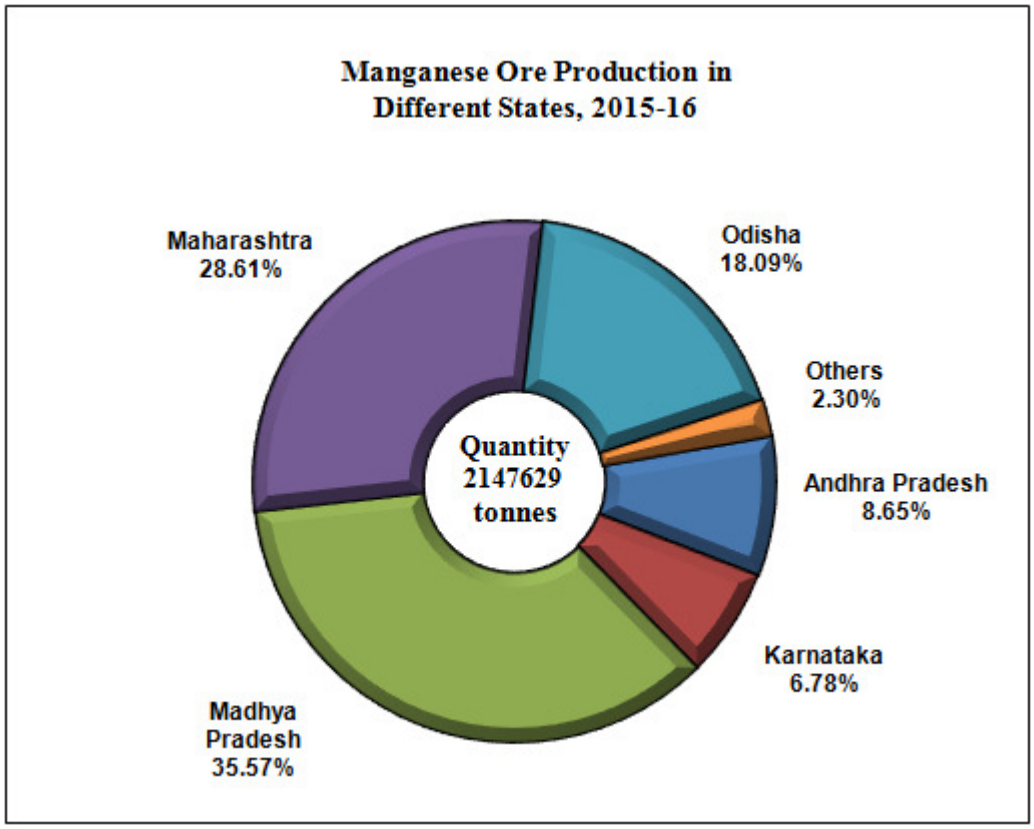
(In tonnes)

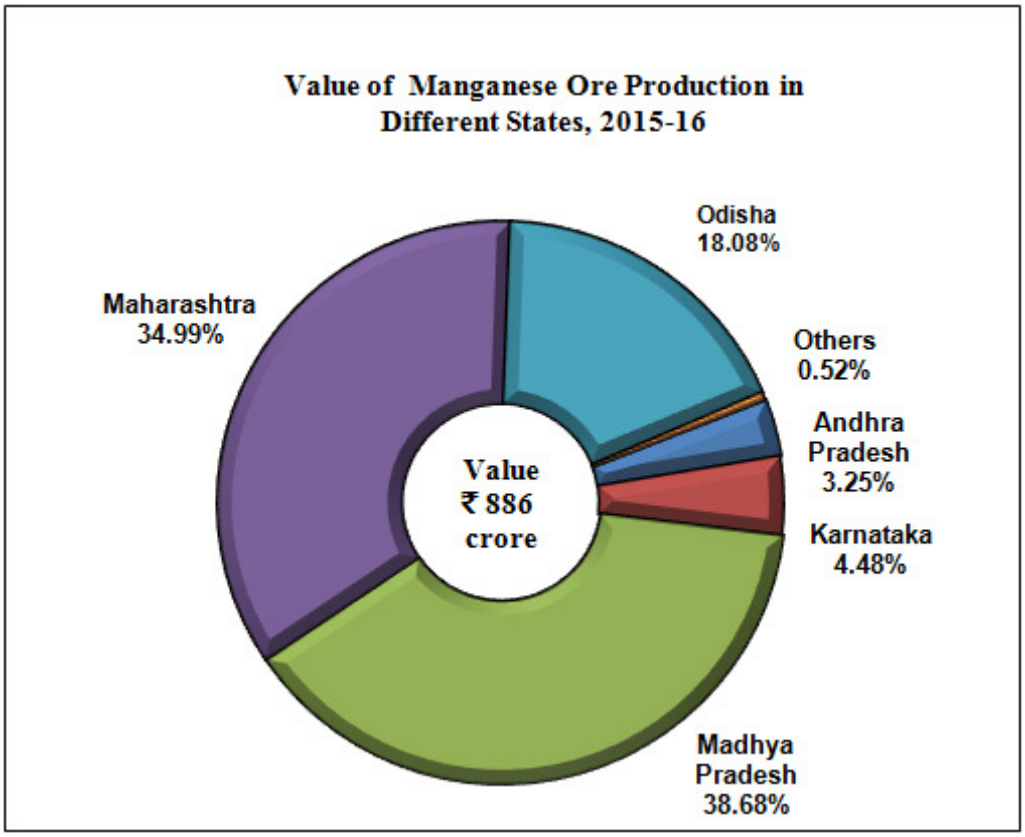
| State | Grades : Mn content | | | | | |
|---|---|---|---|---|---|---|
| | $MnO_2$ | above 46% | 35% - 46% | 25% - 35% | below 25% | Total |
| **India** | **9479** | **49901** | **159470** | **457422** | **438089** | **1114361** |
| Andhra Pradesh | - | - | 20 | 39856 | 16976 | 56852 |
| Goa | - | - | - | 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 | | | | | |
|---|---|---|---|---|---|---|
| | $MnO_2$ | above 46% | 35% - 46% | 25%-35% | below 25% | Total |
| **India** | **8198** | **52450** | **125973** | **556607** | **576782** | **1320010** |
| 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 Production in Different States, 2015-16
Maharashtra 28.61%
Odisha 18.09%
Others 2.30%
Andhra Pradesh 8.65%
Karnataka 6.78%
Madhya Pradesh 35.57%
Quantity 2147629 tonnes


Value of Manganese Ore Production in Different States, 2015-16
Odisha 18.08%
Maharashtra 34.99%
Others 0.52%
Andhra Pradesh 3.25%
Karnataka 4.48%
Madhya Pradesh 38.68%
Value ₹ 886 crore

# 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 435 m was completed in Balaghat, up to 169 m in chikla mine, up to 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 $m^3$ 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

is usually sold to the domestic consumers, either at the rail-head or ex-plant. In the cases of Integrated Iron & Steel and Ferromanganese 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 MMTC, 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 Electrosmelt 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%, $SiO_2$: 2 to 8%, $Al_2O_3$: 5 to 8% and P: 0.3% maximum.

For manganese ore used in Ferromanganese 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 ferromanganese 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 ferromanganese production vide IS:12596-1989 (Reaffirmed 2009). User's specifications of manganese ore for Ferromanganese/Silico-manganese industries are furnished in Table- 9.

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

| Name and location of plant | Specifications of ore consumed |
|---|---|
| **Andhra Pradesh** | |
| Ferro-Alloys Corp. Ltd,<br>Shreeram Nagar, Dist. Vizianagram. | Mn: 70-75%<br>C: 6-8% |
| Nav Bharat Ferro-Alloys Ltd,<br>Paloncha, Khammam. | Mn: 28-50%, P: 0.1-0.3%, $SiO_2$: 8-30%<br>Fe :5-8% |
| **Chhattisgarh** | |
| Sarda Energy & Minerals Ltd<br>Raipur. | Mn: 28-30% (Low P)<br>Mn: 37-40%, 42-44%,<br>46% (High P) |
| Monnet Ispat & Energy Ltd,<br>Raipur | Mn: 28-46%<br>Fe : 5-16%<br>$SiO_2$: 6-34%<br>S & P: 0.05-0.28%<br>Size: 0-100% (lumps & fines) |
| **Hira Power & Steel Ltd, Raipur** | |
| i) Jain Carbides & Chemicals Ltd, Raipur (Unit-I). | Mn: 32-35% |
| ii) Jain Carbides & Chemicals Ltd, Raipur (Unit-II). | Mn: 32-35% |
| **Karnataka** | |
| S. R. Chemicals & Ferro Alloys, Belgaum.<br>Thermit Alloys Ltd, Shivamogga. | Mn: 38-40%, Fe: 18-23%<br>Mn: 48-54% |
| **Kerala** | |
| INDSIL Hydro Power and<br>Manganese Ltd,<br>Pallatheri<br>Palakkad. | Fe-Mn ratio 1:3 to<br>5% (50%) 1:5 to<br>8% (50%)<br>P: 0.05% max.<br>$Al_2O_3$: 3 to 5% max. |
| **Madhya Pradesh** | |
| MOIL, Ferro-manganese Plant,<br>Bharveli, Dist. Balaghat. | Mn: 46-48% |
| **Maharashtra** | |
| Chandrapur Ferro Alloys Ltd,<br>(Formerly Maharashtra Electro-Smelt Ltd)<br>Chandrapur. | Mn: 38-46%,<br>Fe: 6-17%<br>$SiO_2$+$Al_2O_3$: 10-16%<br>P: 0.5-0.25% max.<br>+100 mm, 10% max.<br>+10-100 mm, 80-85% min.<br>+5-10 mm, 10% max. |
| Nagpur Power & Industries Ltd,<br>Nagpur. | Mn: 42-46%,<br>Fe: 7-8%,<br>$SiO_2$: 3.6%,<br>$Al_2O_3$: 6-7%,<br>P: 0.10-0.12%<br>Size: 5-25 mm |
| Natural Sugar & Allied Ind. Ltd,<br>Sai Nagar Ranjani, Dist. Osmanabad | Size: 10-80 mm |
| **Odisha** | |
| Tata Steel Ltd, Joda,<br>Kendujhar. | Mn: 43%, min. (for FeMn)<br>36% min. (for SiMn),<br>Size: 10-75 mm<br>(for FeMn & SiMn) |
| | **Captive Mn Ore** **Size (mm)**<br>Below 35% (10-75) + 5%<br>35% to 46% (10-75) + 5%<br>46% to 49% (10-75) + 5%<br>Dioxide + 49% (10-75) + 5%<br>**MOIL, Mn Ore**<br>Below 35% (10-75) + 5%<br>Imported Mn<br>46 to 49% (10-75) + 5% |
| **Tamil Nadu** | |
| Silcal Metallurgical Ltd,<br>Ramanuja Nagar, Coimbatore. | Mn: 35-40% & above<br>Size: 35 mm |
| **West Bengal** | |
| Cosmic Ferro Alloys Ltd, Bankura. | Size: 75 mm |

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 $MnO_2$ 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 $MnO_2$ 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 $MnO_2$ 80% (min.), $SiO_2$ 5% (max.), $Fe_2O_3$ 5% (max.) and 200 to 250 mesh ore size is used. In glass industry, ore analysing $MnO_2$ 80% (preferably 86% min.), $Fe_2O_3$ 5% (preferably 0.75% max.), $SiO_2$ 2.8% (max.), $Al_2O_3$ 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: $MnO_2$ 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 microns for Type A, 150 microns for Type B and 74 microns for Type C ore. In addition, grit content should be 1% (max.) for Type A ore. For Match Industry, the $MnO_2$ 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. Ferroalloys 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 ferromanganese 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).

**Table – 10 : Estimated Consumption of Manganese Ore[1/*], 2013-14 to 2015-16 (By Industries)**

(In tonnes)

| Industry | 2013-14 | 2014-15 (R) | 2015-16 (P) |
|---|---|---|---|
| **All Industries** | **4184000** | **4439300** | **3544015** |
| Ferroalloys | 3904300[(e)] | 3904300[(e)] | 2944715 |
| Iron & steel | 262000 | 517300 | 581500 |
| Battery | 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.*

*1/ Data does not include consumption of SSI units manufacturing ferromanganese, data for which are not available.*

**Table – 11 : Consumption* of Ferromanganese, 2013-14 to 2015-16 (By Industries)**

(In tonnes)

| Industry | 2013-14 | 2014-15 (R) | 2015-16 (P) |
|---|---|---|---|
| **All Industries** | **124800** | **122400** | **131000** |
| 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) |
|---|---|---|---|
| **All Industries** | **219600** | **225800** | **258100** |
| 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 ferroalloys in the world with a share of about 41% of the global production of ferroalloys. For production of one tonne of ferromanganese, 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 ferromanganese/ 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. Ferromanganese 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.

## Ferromanganese

The total production of various types of manganese alloys (high carbon ferromanganese, medium carbon ferromanganese and low carbon ferromanganese) 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 ferromanganese and silico-manganese plants through joint venture companies with RINL and SAIL, namely, 31,000 tpy ferromanganese 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 Elctricity 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 1,00 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.

**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<br>5072258 | Hot metal<br>5317127 | 25656<br>4995 | NA<br>6735 | Size: 25 to 85 mm<br>Mn: 30% min.<br>$SiO_2$: 30% max.<br>$Al_2O_3$: 5% max.<br>P: 0.3% max. | MOIL/ Ramtek<br>Goberwahi, Gua Mines SAIL, RMD |
| Bokaro Steel Plant, Bokaro, Jharkhand. | Hot metal<br>4253271 | Hot metal<br>3700004 | NA | NA | Mn: 30% max.<br>$SiO_2+Al_2O_3$ : 20.5% max.<br>-10 mm -15% max.<br>+40 mm -10% max. | - |
| Durgapur Steel Plant, Durgapur, West Bengal. | Hot metal<br>2296707 | Hot metal<br>2170498 | NA | NA | Mn: 30% min.<br>Fe: 15-28%<br>$SiO_2$: 3.3% max.<br>$Al_2O_3$: 7.5% max. | - |
| Rourkela Steel Plant, Rourkela, Odisha. | Hot metal<br>2538322 | Hot metal<br>2591417 | NA | NA | - | - |
| IISCO Steel Plant, Burnpur, Dist. Burdwan, West Bengal- 713 325. | Hot metal<br>219641 | Hot metal<br>566244 | NA | NA<br>- | Mn (dry) 30% (min.)<br>-10 mm - 10.0% max.<br>+40 mm - 15% max. | - |
| Visvesvaraya Iron and Steel Ltd, Bhadravati, Shivamogga, Karnataka. | Hot metal<br>20986 | Hot metal<br>67603 | NA | NA | - | - |
| KIOCL Ltd, Pellet Plant, Mangaluru, Dakshina Kannada, Karnataka. | Hot metal<br>NA | Hot metal<br>NA | NA | NA | Fe: 25-50% min.<br>$MnO_2$: 44% min.<br>$SiO_2+Al_2O_3$ : 12% max. | Milan Minerals, Karnataka |
| Visakhapatnam Steel Plant, Visakhapatnam, Andhra Pradesh. | NA | NA | 11400 | NA | Mn: 28%, (min.)<br>Fe: 16%<br>$SiO_2$: 25% max.<br>Size: 10-60 mm (BF)<br>(-) 10 mm (SP) | Garividi, Andhra Pradesh |
| IDCOL, Kalinga Iron Works Ltd, Barbil, Kendujhar, Odisha. | Hot metal<br>7793 | Hot metal<br>- | 338<br>68 | 68<br>- | Size: 10-40 mm | From own/ local mines |
| Gordan Steel India Ltd, Jaonbulapadu, Anantapur, Andhra Pradesh. | Hot metal<br>30427 | Hot metal<br>30427(e) | 728 | 2292 | Mn 28-35% Mn | - |
| Tata Steel Ltd, Jamshedpur, Jharkhand. | Hot metal<br>9898502 | Hot metal<br>10162917 | NA | NA | NA | - |

(Contd.)

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. $SiO_2$ : 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 | -<br>14 | -<br>- | 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<br>- | 3640<br>- | NA<br>- | NA<br>- |
| 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 |

Table - 13 (Concld.)

| 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 ferromanganese production. New steel-making practices and techniques are reducing the amount of manganese consumed in the process. However, counter balancing 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 dioxides 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 |
|---|---|
| **World: Total (rounded)** | **690000** |
| 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 |
|---|---|---|---|
| **World:Total** | **53023** | **54469** | **53193** |
| Australia | 7426 | 7587 | 6281 |
| Brazil | 2833 | 2723 | 2700 |
| China(e) | 15000 | 15000 | 15000 |
| Gabon | 4091 | 4000e | 4000e |
| Ghana | 1998 | 1531 | 1563 |
| India* | 2626 | 2369 | 2148 |
| Kazakhstan | 2852 | 2609 | 1626 |
| Malaysia | 1125 | 835 | 502 |
| South Africae | 10952 | 13857 | 15979 |
| Ukraine | 1525 | 1526 | 1525e |
| 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) |
| **All Countries** | **11026** | **65399** | **444** | **18946** |
| 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 |

**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) |
| **All Countries** | **-** | **-** | **93** | **317** |
| 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) |
| **All Countries** | **11026** | **65399** | **351** | **18629** |
| 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) |
| **All Countries** | **16449** | **642153** | **21850** | **805057** |
| 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) |
| **All Countries** | **3261** | **105170** | **2679** | **91517** |
| 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) |
| **All Countries** | **13188** | **537072** | **19171** | **713740** |
| 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 |

**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) |
| **All Countries** | **134** | **110433** | **190** | **150383** |
| 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) |
| **All Countries** | **114** | **107093** | **180** | **148371** |
| France | - | - | 40 | 35411 |
| China | ++ | 931 | 23 | 20238 |
| Korea, Rep. of | 33 | 48329 | 10 | 14554 |
| Slovenia | 8 | 112069 | 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) |
| **All Countries** | **3173158** | **34669120** | **2216864** | **17413687** |
| 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) |
| **All Countries** | **892093** | **11730476** | **588896** | **5376549** |
| 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 |

**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) |
| **All Countries** | **2090849** | **21380159** | **1385986** | **10479876** |
| 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) |
| **All Countries** | **170570** | **1426501** | **199508** | **1358838** |
| 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) |
| **All Countries** | **1** | **2373** | **15112** | **78204** |
| 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) |
| **All Countries** | **7847** | **651539** | **8225** | **743183** |
| 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) |
| **All Countries** | **4653** | **275496** | **4966** | **218769** |
| 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 | - | - |

## 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) |
| **All Countries** | **30932** | **4232257** | **29045** | **3606506** |
| 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) |
| **All Countries** | **20226** | **2806722** | **20839** | **2539220** |
| 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 | - | - |

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

| Country | 2014-15 | | 2015-16 (P) | |
|---|---|---|---|---|
| | Qty (t) | Value (₹'000) | Qty (t) | Value (₹'000) |
| **All Countries** | **9634** | **1281601** | **8011** | **1024855** |
| 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) |
| **All Countries** | **1072** | **143934** | **195** | **42461** |
| 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.