

MINERAL-BASED INDUSTRIES



Indian Minerals Yearbook 2018

(Part- I : General Reviews)

57th Edition

MINERAL-BASED INDUSTRIES

(FINAL RELEASE)

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

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7 Mineral-based Industries

Minerals are vital raw materials for many basic industries and are major components for growth and industrial development. The management of mineral resources, hence, has to be closely integrated with the overall strategy for development and exploitation of minerals, which must be aimed at long-term national goals. In tune with the Economic Liberalisation Policy adopted in July 1991, the National Mineral Policy which was announced in March 1993 has opened the Mineral Sector for private entrepreneurs, both domestic and foreign. The changing global scenario necessitated revision in the National Mineral Policy which subsequently revised as, National Mineral Policy 2019, which aims to have more effective, meaningful and implementable policy that brings in further transparency, better regulation and enforcement, balanced social and economic growth as well as sustainable mining practices.

The National Mineral Exploration Policy (NMEP) approved by Govt. of India in June, 2016, primarily aims at accelerating the exploration activity in the country through enhanced participation of the private sector and will benefit the entire mineral sector across the country.

Capacity and production of important mineral-based products are detailed in Table-1.

FERROUS METALS

India is poised for brownfield expansion of existing steel plants, backward integration of re-rollers, forward integration of DRI or pig iron producers unfolding of a few greenfield projects. The National Steel Policy 2017 has projected a target of 300 million tonnes of domestic steel production by 2030. The total production of finished steel for sale during 2017-18 stood at 104.98 million tonnes.

In view of the long-term demand projection for steel, the Government adopted a two-pronged strategy for increasing steel production in the country through modernisation and expansion of existing Public Sector steel plants in the country and encouraging creation of new steel capacities in Private Sector.

Pig Iron

Pig iron is one of the basic raw materials required by the Foundry & Casting Industry for manufacturing various types of castings for the engineering section. The main sources of pig iron have traditionally been the integrated steel plants of SAIL besides steel plants of Tata Steel Ltd and Rashtriya Ispat Nigam Ltd. Domestic production of pig iron was low and is not in tandem with the demand. Efforts were, therefore, made to increase pig iron manufacturing facilities in the secondary sector. In 2017-18, about 9.40 million tonnes of pig iron was produced for sale in the country. Plant-wise capacity details as available in respect of major pig iron units are furnished in Table-2.

Sponge Iron

Commercial production of sponge iron in India commenced in 1980. Sponge Iron India Ltd was first to set-up a plant in 1980 at Palwancha district Khammam in Andhra Pradesh.

In the last few years, combined use of hot metal and sponge iron in electric arc furnace have been in practice for production of liquid steel. Consequently, production of sponge iron too went up, substantially. The installed capacity of sponge iron in 2017-18 was 49.62 million tonnes and the production was 30.51 million tonnes. Plant-wise details as available in respect of major sponge iron units are furnished in Table-3.

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Table – 1 : Capacity and Production of Important Mineral-based Products, 2016-17 and 2017-18

Mineral-based product	Unit of quantity	Annual Installed capacity	Production	
			2016-17	2017-18 (P)
Ferrous Metals				
Sponge iron	million tonnes	49.62	28.76	30.51
Crude/liquid steel	"	130.08	97.94	102.34
Ferro-alloys				
Ferrochrome/Charge-chrome	'000 tonnes	1690	944	944
Ferromanganese	"	3160	518	518
Silico manganese	"	-	301	311
Ferrosilicon	"	250	90	90
Ferro-Molybdenum	tonnes	-	1603	1205
Ferro-Titanium	"	-	291	281
Ferro-Vanadium	"	-	1329	1331
Ferro-Aluminium	"	-	4345	4422
Non-ferrous Metals				
Aluminium	million tonnes	4.10	2.9	3.4
Copper #	'000 tonnes	1001.5	787	830
Lead (primary)	"	201	142	168
Zinc Ingots	"	881	672	791
Silver	tonnes	600	460	557
Cement	million tonnes	532.16	279.97	297.71*
Fertilizers				
NP/ NPK Complex (including DAP)	lakh tonnes	125.27 ^s	122.57	128.92
SSP	"	110.36	42.96	39.05
Chemicals				
Aluminium fluoride	'000 tonnes	25.60	8.14	7.5
Caustic soda	"	3297	2594	2742
Calcium carbide	"	112	85.02	87.3
Soda ash	"	3086	2613	2989
Titanium dioxide pigment	"	82.50	58.46	57.82
Red phosphorus	"	1.68	0.77	0.89
Crude Throughputs in Refineries	"	247566	245362	251932

Figures rounded off

- Sources:** 1. Ministry of Steel, Annual Report, 2017-18 and JPC Bulletins.
2. Ministry of Commerce & Industry, Department of Industrial Policy & Promotion and Annual Report, 2017-18.
3. Ministry of Chemicals & Fertilizers, Department of Chemicals & Petrochemicals, Annual Report, 2017-18.
4. Ministry of Petroleum and Natural Gas, 2015-16 & 2016-17.
5. Cement Survey, 2017
6. Information received from individual plants in Organised Sector.
7. MSMP - March 2017
Production relates to copper cathodes (figures rounded off).
* Cement outlook, CMA India.
\$ Department of Fertilizer.

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Table – 2 : Location and Capacity of Principal Pig Iron Units

(In lakh tonnes)

Sl.No.	Unit	Location	Capacity
1.	Jayaswal NECO Industries Ltd	Raipur, Chhattisgarh	6.50
2.	Vedanta Ltd	Amona, Goa	7.42
3.	Usha Martin Industries	Jamshedpur, Jharkhand	6.00
4.	JSW Steel Ltd	Vijaynagar, Dolvi & Salem	180.00
5.	Steel Authority of India Ltd	Bhilai, Bokaro, Durgapur, Burnpur, Rourkela, Bhadravati	235.00
6.	Rashtriya Ispat Nigam Ltd	Visakhapatnam, Andhra Pradesh	65.00
7.	Monnet Ispat Ltd	Raigarh, Chhattisgarh	7.00
8.	MESCO Steel Ltd	Kalinganagar, Odisha	4.50
9.	Jai Balaji Industries Ltd	Durgapur, West Bengal	5.09
10.	JSPL	Raigarh, Chhattisgarh	20.00
11.	Neelaanchal Ispat Nigam Ltd	Kalinganagar, Odisha	11.00

Source: MCDR Returns (Form-O), Website of concerned company, Iron & Steel Review, JPC Bulletin and Ministry of Steel

Table – 3 : Capacities of Principal Sponge Iron (DRI) Plants

(In lakh tonnes)

Unit	Location	Capacity
Gas-based		
Essar Steel Ltd	Hazira, Gujarat	68.0
JSW Steel Ltd (Salav) (formerly Welspun Maxsteel Ltd)	Salav, Raigad, Maharashtra	9.00
JSW Steel (formerly Ispat Industries Ltd)	Geetapuram, Dolvi, Raigad, Maharashtra	16.00
Coal-based		
Alliance Integrated Metallics Ltd	Bemta, Raipur, Chhattisgarh	5.00
Godawari Power & Ispat Ltd	IGC Siltara, Raipur, Chhattisgarh	4.95
Ind Synergy Ltd	Kotmar, Raigarh, Chhattisgarh	3.00
Monnet Ispat Energy Ltd	Chandkhuri Marg, Hasaud, Raipur, Chhattisgarh	3.00
Monnet Ispat & Energy Ltd	Naharpalli, Raigarh, Chhattisgarh	5.00
Prakash Industries Ltd	Champa, Janjgir-Champa, Chhattisgarh	4.50
Rungta Mines Ltd	Karakola and Kamando, Sundergarh, Odisha	4.20
Rashmi Cement Ltd	Barbil, Kendujhar, Odisha	3.60
Tata Sponge Iron Ltd (Ipitata Sponge)	Joda, Kendujhar, Odisha	3.90
Visa Steels Ltd	KIC, Jajpur Road, Odisha	3.00

I.G.C.: Industrial Growth Centre

Source: Sponge Iron Manufacturers' Association (SIMA) and individual plants

Finished Steel/Saleable Steel

Some significant facts on Indian Steel Industry are as follows:

1. The National Steel Policy (NSP) was announced in 2017. The New steel policy, 2017 aspires to achieve 300 million tonnes of steel making capacity by 2030.
2. The total estimated value of exports of finished steel including CR sheets increased to 5.93 million tonnes in 2017-18 from 5.72 million tonnes in 2016-17 and the imports increased to 4.16 million tonnes in 2017-18 from 3.76 million tonnes in 2016-17.

Details about capacity and production of crude liquid steel & hot metal by main producers are furnished in Table-4.

Steel Companies in Public Sector

Steel Authority of India Ltd (SAIL)

SAIL is a Public Sector Company that operates five integrated steel plants at Bhilai in Chhattisgarh, Bokaro in Jharkhand, Durgapur & Burnpur in West Bengal and Rourkela in Odisha. SAIL has three special and alloy steel plants viz Alloy Steel Plant at Durgapur (West Bengal), Salem Steel Plant at Salem (Tamil Nadu) & Visvesvaraya Iron & Steel Plant at Bhadravati (Karnataka). Crude steel production from SAIL plants during the year 2017-18 was 15.02 million tonnes as against 14.49 million tonnes during the year 2016-17.

The modernisation & expansion of Bokaro Steel Plant (BSL), Durgapur Steel Plant (DSP), Rourkela Steel Plant (RPS), IISCO Steel Plant (ISP) and Salem Steel Plant has been completed. At IISCO Steel Plant, Burnpur, India's largest blast furnace (4,160 m³) has been installed.

SAIL is finalising its Vision-2025 document. The proposals for innovation are expected to steer the Company to increase its production capacity of Hot Metal to 50 MTPA, along with related/enabling business activities in line with growing demand for steel in the country. This will not only enhance SAIL's contribution to nation building but will also place SAIL amongst the top steel companies globally.

Rashtriya Ispat Nigam Ltd (RINL)

Visakhapatnam Steel Plant (VSP) of RINL is the first shore-based integrated steel plant located at Visakhapatnam in Andhra Pradesh. The Modernisation & up-gradation to 7.3 Mtpa is completed with the commissioning of additional Caster in SMS-2 in Dec'17. The revamp of Sinter Machine-2 is planned in 2018-19. The units are under advanced stage of stabilization & ramp up.

National Mineral Development Corporation (NMDC)

NMDC is setting up a 3.0 MTPA Greenfield Integrated Steel Plant at Nagarnar, Bastar District in Chhattisgarh. Construction work for the project is in progress and as on date around 90.59% of civil work, 79.01% structural erection, 60.36% equipment erection have been completed as on 31st Dec'17. The progress has picked up momentum since then in the last Quarter.

NMDC is in the process of expanding its business through forward integration in both Greenfield and Brownfield through following projects:

(a) 1.2 MTPA Pellet Plant at Donimalai in Karnataka

(b) 2.0 MTPA Pellet Plant at Nagarnar along with 2.0 MTPA Ore Processing Plant at Bacheli interconnected by a Slurry Pipeline System between Bacheli and Nagarnar in Chhattisgarh.

Major Steel Companies in Private Sector

Tata Steel Ltd (formerly TISCO)

The Company has been rechristened as Tata Steel Ltd (TSL). The Company has an integrated steel plant located at Jamshedpur, Jharkhand, with annual crude steel making capacity of 12.5 million tonnes and variety of finishing mills. TSL has produced 12.077 million tonnes of finished steel in 2017-18 as compared to 11.11 million tonnes in 2016-17. The production of crude steel in 2017-18 was 12.46 million tonnes as against 11.69 million tonnes in 2016-17.

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JSW Steel Ltd

JSW Steel Ltd's combined installed capacity of its plants at Karnataka, Tamil Nadu and Maharashtra was 18 million tpy crude steel with value added products constituting 1.8 million tpy spread across six locations; Toranagallu (Vijayanagar Works), Salem (Salem Works),

Vasind, Tarapur (downstream units), Dolvi and Kalmeshwar (Maharashtra). Vijayanagar Works existing operations produce flat and long steel products; Salem Works has its focus only in long products while the downstream units produce CR/galvanised, colour-coated, value-added flat products.

Table – 4 : Capacity and Production of Hot Metal and Crude/Liquid Steel, 2016-17 and 2017-18 (By Principal Producers)

(In '000 tonnes)

Unit	Annual installed capacity		Production			
	Hot metal	Crude/Liquid steel	Hot metal		Crude/Liquid steel	
			2016-17	2017-18	2016-17	2017-18
Public Sector						
Bokaro Steel Plant (Jharkhand)	4585	4360	3410	4046	3154	3694
Bhilai Steel Plant (Chhattisgarh)	4700	3925	5041	4280	4737	4072
Rourkela Steel Plant (Odisha)	2120	4400	3094	3320	2932	3220
Durgapur Steel Plant (West Bengal)	2088	1802	2318	2282	2042	2042
IISCO Steel Plant, Burnpur (West Bengal)	550	2500	1810	2055	1394	1801
Visvesvaraya Iron & Steel Plant (Karnataka)	205	118	54	–	39	–
Salem Steel Plant (Tamil Nadu)	–	180	–	–	108	97
Alloy Steel Plant, Durgapur (West Bengal)	–	234	–	–	88	96
Rashtriya Ispat Nigam Ltd (Andhra Pradesh)	3400	6300	4043	5132	3962	4731
Private Sector						
JSW Steel Ltd	–	15000	–	–	16505	17099
Tata Steel Ltd (Jharkhand)	–	12500	13059	13855	11688	12459
Essar Steel Ltd (Gujarat)	–	10000	–	–	5392	6082
Jindal Steel & Power Ltd (Chhattisgarh)	1670	8600	–	–	3445	4021
Others					42450	42924

Source: Ministry of Steel, Annual Report, 2018-19 and JPC Bulletin on Iron & Steel, April, 2018 and Annual Statistics, 2017-18, JPC

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The Company has enhanced the total capacity to 12 million tpy at Vijayanagar Works. JSW steel announced that steel making capacity at Dolvi Works would be increased from existing 5 MTPA to 10 MTPA. Salem works is India's largest special Steel plant with 1MTPA capacity and produces about 850 special grades of steel. The company capacity expansion roadmap and key projects are as below:

Plant	Targeted Capacity	Timeline
Vijayanagar Works	13 MTPA	Dec. 2019
Dolvi Works	10.7 MTPA	Dec.2020

Jindal Steel & Power Ltd (JSPL)

JSPL has manufacturing facilities for steel products in three locations: Raigarh in Chhattisgarh, Angul in Odisha and Patratu in Jharkhand. JSPL has set up a rail & universal beam plant. The sponge iron plant at Raigarh, Chhattisgarh has capacity of 1.37 million tpy. Facilities at Raigarh also include a Sinter plant of 2.84 MTPA and Steel melt shop of 3.25 MTPA.

JSPL has successfully completed Angul Greenfield project with installation of 6 MTPA integrated steel plant in Odisha along with successful commissioning of 4,554 m³ blast furnace and 1 MTPA coke oven along with 250 tonnes per heat BOF.

Performance of the BF/BOF & EAF/IF Industry is summarised below:

Basic Oxygen Furnace (BOF) : Presently, there are around 17 Basic Oxygen Furnace units with an installed capacity of 50.84 million tonnes, respectively.

Electric Arc Furnace (including corex & MBF/EOF) : Steel produced in the Electric Arc Furnace (including corex & MBF/EOF) is mostly by recycling of steel scrap using Electric Arc Furnace (EAF). Presently, there are more than 47 EAF based steel plants that are operational in the country with an aggregate working capacity of around 37.57 million tonnes per annum.

The recent developments in EAF technology, viz, to increase oxygen consumption, to reduce power consumption and to reduce tap time have led to increase in metal production. The development of thin slab casting has made EAF route more productive. This route enables slab strips rolling at lesser cost, facilitating production of cheaper strips/sheets than those that can be achieved through BF/BOF route.

FERRO-ALLOYS

The Indian Ferro alloy Industry was established during the second Five-year plan as an Ancillary Industry to cater to the growing needs of the domestic Steel Industry. As a deoxidant and alloying agent, Ferro-alloys are in demand for crude steel & alloy steel production.

Bulk ferro-alloys of high carbon category were produced by large-scale industries. The noble ferro-alloys are of low carbon category and include ferro-vanadium, ferro-tungsten, ferro-niobium, ferro-molybdenum and ferro-titanium. There are also a number of units under the Small-Scale Sector for the manufacture of ferro alloys, particularly ferro silicon, ferro chrome and ferro manganese.

India is the net exporter of ferro-alloys. About 25% to 30% production is usually exported. India is an established regular exporter of high carbon ferro manganese, silico manganese and high-

Table – 5 : Capacity of Ferro-alloys Industry

(In tonnes per annum)	
Ferro-alloys	Installed capacity
Total	5150000
Bulk Ferro-alloys : Total	5100000
Manganese alloys	3160000
Chrome alloys	1690000
Ferro silicon	250000
Noble Ferro-alloys : Total	50000^{e)}

Source: Indian Ferro-alloys Producers' Association (IFAPA), Mumbai

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carbon ferrochrome with an estimated export of 98% of total quantity. The capacity of ferro- alloys is furnished in Table-5. The details about ferro-alloys are discussed in the Review on Ferro-alloys in Vol.II of this publication (IMYB).

Bulk Ferro-alloys

Ferro-manganese and Silico-manganese

The country's total installed capacity for ferro manganese is around 42 lakh tonnes.

The total consumption for bulk ferro- alloys accounts for over 98 % of all ferro-alloys. Also about 80 % of total ferro-alloys production is used in steel making, while the balance is used for the manufacture of castings, super alloys, aerospace and other special applications.

The total production and estimated consumption of ferro manganese was 5,18,000 tonnes and 50,800 tonnes, respectively in the year 2017-18. The total production and estimated consumption of silico manganese was 3,11,326 tonnes and 1,22,600 tonnes, respectively in the year 2017-18.

Ferro chrome and Charge chrome

The total combined capacity of ferro chrome and charge chrome is around 16 lakh tpy. Stainless and Alloy-steel Industry are the chief consumers of ferro-chrome.

The total production of ferro chrome/charge chrome in 2017-18 was about 9,44,000 tonnes, which remains same as in 2016-17. Whereas, the consumption of ferro chrome/charge chrome in 2017-18 was reported at about 14,600 tonnes.

Noble Ferro alloys

Noble Ferro-alloys are one of the vital inputs required for producing special types of steel & alloy. The total capacity of noble ferro-alloys was 50,000 tpy ferro molybdenum, ferro vanadium, ferro tungsten, ferro titanium, ferro silico magnesium, ferro aluminium, ferro boron, etc. Mishra Dhatu Nigam (A Govt. of India Undertaking), with a capacity of 2,729 tpy produced different types of super-alloy, chiefly cobalt, molybdenum, titanium and tungsten-based super-alloys and products.

The production of various noble ferro-alloys is given in Table-6, as below:

Table – 6 : Production of Noble Ferro-alloys

Ferro-alloy	Quantity (in tonnes)
Ferro-molybdenum	1204.70
Ferro-titanium	280.88
Ferro-vanadium	1331.00
Ferro-aluminium	4422.57

Induction Furnace (IF)

Presently, in India, EAF based industries are yet to switch over to induction furnace route. An induction furnace is an electrical furnace in which heat is generated through electro-magnetic induction in an electrically conductive medium. Induction furnaces use steel melting scraps, sponge iron and pig iron/cast iron. On an average, the proportion of these items is 40% sponge iron + 10% cast iron or pig iron and the remaining is steel melting scraps. There are around 1126 nos. of ground induction furnaces with an aggregate working capacity of about 39.53 million tonnes.

Electrolytic Manganese Dioxide (EMD)

EMD is consumed along with natural manganese dioxide for the manufacture of dry battery cells. There are two units, one owned by MOIL in Bhandara district of Maharashtra, having a capacity of 1,000 tpy and the other by the then Union Carbide Ltd (now Eveready Ltd) at Thane, Maharashtra, having a capacity of 2,500 tpy. MOIL has undertaken capacity expansion of the existing EMD plant to 2,000 tpy in view of the good demand for EMD in the domestic market. The production of EMD by MOIL was 875 tonnes in 2017-18 as against 731 tonnes in 2016-17. The Company has plans to set- up 10,000 tpy capacity electrolyte manganese metal (EMM) plant and 5,000 tpy capacity potassium permanganate plant to engender diversification and production of value-added products.

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NON-FERROUS METALS

Aluminium

There were four companies with a total installed capacity of 41.0 lakh tpy in operation. NALCO, the only Public Sector Company in aluminium & alumina segment has an installed capacity of 4.60 lakh tpy at Angul. BALCO has an installed capacity of 5.70 lakh tpy at Korba. The three companies with six plants in the Private Sector have a total capacity of 36.0 lakh tpy in operation. One unit at Korba of BALCO and a plant of MALCO have suspended operations.

The production of aluminium in 2017-18 was 3.40 million tonnes. The installed capacity and production of aluminium in 2016-17 and 2017-18 is enumerated in Table-7.

Alumina

The production of alumina was 4.61 million tonnes in 2017-18. The details of alumina producers in the country, their capacities and production are provided in Table-8.

Hindalco's Renukoot Integrated Smelter uses alumina produced in their plant for producing aluminium.

Table – 7 : Capacity and Production of Aluminium, 2016-17 and 2017-18

(In million tonnes)

Producer	Annual Capacity	Production	
		2016-17	2017-18 (P)
Total	4.06	2.9	3.4
Public Sector			
National Aluminium Co. Ltd (Angul)	0.46	0.39	0.42
Private Sector			
Bharat Aluminium Co. Ltd (Korba)	0.57	0.42	0.57
Hindalco Industries Ltd	1.28	1.27	1.29
Vedanta Aluminium Ltd (Jharsuguda)	1.75	0.82	1.12

Figures rounded off

Source: Information received from individual plants/Annual reports

MALCO Plant is closed, since December 2008, hence it is removed from the table.

Table – 8 : Capacity and Production of Alumina, 2016-17 and 2017-18

(In million tonnes)

Producer	Annual Capacity	Production	
		2016-17	2017-18 (P)
Total	6.47	4.58	4.61
Public Sector			
National Aluminium Co. Ltd (Damanjodi)	2.27	2.03	2.08
Private Sector			
Bharat Aluminium Co. Ltd	0.20	Nil	Nil
Hindalco Industries Ltd	3.00	1.34	1.32
Vedanta Aluminium Ltd (Lanjigarh)	1.00	1.21	1.21

Figures rounded off

Source: Information received from individual plants/Annual Reports.

Plants remained non-operational during the year.

MALCO Plant is closed, since December 2008, hence it is removed from the table.

National Aluminium Co. Ltd

The company has a 22.75 lakh tpa Alumina Refinery located at Damanjodi in Koraput distt of Odisha and 4.60 lakh tpa Aluminium Smelter & 1200 MW Captive Power Plant located at Angul, Odisha. The surplus alumina that remains after internal consumption sold to third parties in the export market and small portion sold to the domestic market. Upgradation of capacity of aluminium smelter from 4.6 lakh tonnes to 5.67 lakh tonnes per year under current-amperage upgradation project is under progress. The company also plans to develop a 42 lakh tpy bauxite mine and 14 lakh tpy alumina refinery complex in Andhra Pradesh. The company has port facilities at Visakhapatnam to export alumina at the rate of 1.4 million tpy.

Vedanta Limited

BALCO is a Private Sector Company with an integrated alumina/aluminium complex at Korba in Bilaspur district in Chhattisgarh. The Company has two captive bauxite mines, one at Mainpat and other at Kawardha. The total capacity of the Korba smelter has been enhanced to 5.70 lakh tpy from 3.45 lakh tpy. The production of Korba-I plant of BALCO with smelter capacity of 245,000 tpy is stable during the year and the ramp up of Korba-II smelter with 325,000 tpy was completed during the year 2018. The ramp up of BALCO-II smelter was completed during the year 2018. The company have the capacities to produce ingots, wire-rods billets, bushbars and rolled products. The company has 1.75 million tpy aluminum smelter and 3615 MW captive power plant supported by highly modern infrastructure at Jharsuguda, Odisha. The state-of-the art alumina refinery at Lanjigarh feeds the aluminium smelters at Jharsuguda and BALCO and forms a crucial link in the value chain. It is one of the world's largest, one-site integrated alumina refining complexes with a current capacity of 2 mtpa that can be ramped up to 6 mtpa.

Hindalco Industries Ltd

Hindalco Industries Ltd's total aluminium production capacity is around 1,282 thousand tonnes. Hindalco's plans to expand alumina refinery capacity at Belgavi from 3.5 lakh tpy to 6.5 lakh tpy are on hold, awaiting government approval related to bauxite mines.

Hindalco Aluminium smelting operations are located at Renukoot (Uttar Pradesh), Aditya Aluminium (Odisha), Mahan Aluminium (Madhya Pradesh) and Hirakud (Odisha). Aditya and Mahan Aluminium smelters are operating on state-of-the-art AP36 technology. In addition to aluminium, Renukoot (Uttar Pradesh), Intergrated Aluminium Complex also produces semi-fabricated products viz. conductor redraw rods, sheet, extrusion, etc. Hindalco's plants are equipped with sophisticated rolling mills and finishing equipment. The plants are located at Hirakud (Odisha), Belur (West Bengal), Mouda (Maharashtra), Renukoot (Uttar Pradesh) & Talaja (Maharashtra). Hindalco's finished products include, alumina, primary aluminium in the form of ingots, billets and wire rods, value added products such as rolled products, extrusion and foils. Hindalco is the largest manufacturer entire range of Flat Rolled Products. The Hirakud Flat Rolled Products (FRP), produce rolled products, extrusions products and wire rods. Hindalco has a conductor redraw capacity of 56,400 tpy at Renukoot plant and sheet rolling capacity of 2,05,000 tpy spread over at Renukoot (80,000 tpy), Belur (45,000 tpy), Talaja (50,000 tpy) and Mauda (30,000 tpy) plants. The company also has two plants for aluminium extrusion with capacity of 31,000 tpy (comprising units at Renukoot with 23,000 tpy capacity and Alupurum (Kerala) 8,000 tpy capacity).

Hindalco's foil unit located at Silvassa (Dadra & Nagar Haveli) has an installed capacity of 30,000 tpy and produces foils with thickness varying from 9 microns to 200 microns. Kollur plant in district Medak (Andhra Pradesh) has capacity of 4,000 tpy and produces an array of high-quality foils, from cigarette and blister foil to lidding foil in thicknesses from 50 to 7 microns.

Utkal Alumina (Odisha) with an installed capacity of 1.5 million tpy alumina refining, continues to be the most economical and efficient alumina producing plant globally. Utkal alumina is sourcing bauxite from Baphlimali Bauxite Deposit in Odisha. The company has set up 3.60 lakh tpy aluminium smelter at Bargawan. The other integrated aluminium project, namely, Aditya Alumina & Aluminium Project, alumina refinery at Koraput, 3.60 lakh tpy aluminium smelter was set-up at Lapanga, Odisha. A joint venture agreement on bauxite mines was signed with OMC.

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Another greenfield project, viz. Jharkhand Aluminium Project at Sonahatu, entails setting up a 7.20 lakh tpy aluminium smelter.

Recycling: Aluminium is recyclable without any loss of properties and consumes only 5% of the total energy requirement compared with primary metal production. At present, in the Organised Sector, only Hindalco operates 25,000 tpy capacity recycling plant at Taloja in Maharashtra.

Cadmium

Cadmium (99.95 min) is obtained as a by-product from zinc smelters of HZL at Debari, Visakhapatnam, Chanderiya and of BZL, Binanipuram. These together have an annual capacity of 913 tonnes. These by-products of cadmium are cast in the form of pencils weighing from 250 g to 500 g. In India, cadmium is consumed in industries like paint, glass and chemicals. Production of

cadmium is reported as 47 tonnes in 2017-18 as compared to 35 tonnes in the previous year.

Copper

The production of copper ore at 3.68 million tonnes in 2017-18 decreased by 4% as compared to that in the previous year. The metal content in the ore produced in 2017-18 works out to 33,359 tonnes as against 33,582 tonnes in 2016-17

Hindustan Copper Ltd produces copper metal from the ore produced at their captive mines. Sterlite Industries (India) Ltd and Hindalco Industries Ltd produce copper metal from imported copper concentrates. Details regarding capacity and production of copper are furnished in Table-9.

Production of refined copper (cathodes) in 2016-17 and 2017-18 was 788 thousand tonnes and 830 thousand tonnes, respectively.

Table – 9 : Capacity and Production of Copper

Producer	Annual capacity	Production*	
		2016-17	2017-18 (P)
Total	1001.5	788	830
Hindustan Copper Ltd**	51.5	7.5	13
Vedanta Ltd	400	403	403
Hindalco Industries Ltd	500	377	414
Jhagadia Copper Ltd (formerly SWIL)	50	-	-

Figures rounded off

* Relates to Copper cathodes.

** Metal capacity. However, the cathode capacity of HCL is 49,500 tonnes.

Hindustan Copper Ltd

Hindustan Copper Ltd is a Mini Ratna Government of India Enterprise under the administrative control of the Ministry of Mines. Copper is produced at two smelters of HCL at Indian Copper Complex (ICC), Ghatsila, East Singhbhum district in Jharkhand and Khetri Copper Complex (KCC), Khetrinagar, district Jhunjhunu, Rajasthan. The aggregate capacity of the two smelters for copper cathode production is 51,500 tpy. Refinery at ICC also has a Wire Bar Casting Plant with a capacity of 8,400 tpy and a Brass Rolling Mill that manufactures brass sheets by using copper produced at ICC. The aggregate installed capacity of wire bars is 39,400 tpy and wire rod capacity is 60,000 tpy at HCL. It also has a precious metal recovery plant

for the recovery of gold, silver, selenium, tellurium and nickel sulphate and copper sulphate at Ghatsila. The company inaugurated the first facility to produce nickel at ICC, Ghatsila in August, 2016. The capacity of the plant is 50 tonnes per annum. The plant is currently being scaled up to a production capacity of 5 tonnes per month of nickel cathodes.

The capacity of Khetri Copper Complex (KCC) smelter is 31,000 tpy. However, HCL has shut down the Khetri smelting refining plant due to economic reasons. KCC has a concentrator plant at Khetri in Jhunjhunu district, Rajasthan, having a capacity of 2.02 million tpy. KCC & ICC Ghatsila, Jharkhand with 1.55 million tpy each and Malanjkhand, Madhya Pradesh with two million tpy capacity also operates a sulphuric acid plant.

Continuous Cast Copper Wire Rods Project, (TCP)

Taloja, Maharashtra: This project has a capacity of 60,000 tpy continuous cast copper wire rods (CCWR). The plant is based on the Southwire SCR-2000 technology of the USA, which uses natural gas as fuel and imported copper cathodes.

Vedanta Ltd (Sterlite copper)

It is India's largest Mining Company with interests and operations in iron ore, aluminium, copper, zinc, lead & power. The smelter and refinery of Sterlite Industries (India) Ltd are located at Thoothukudi in coastal belt of Tamil Nadu and Silvassa, Dadra & Nagar Haveli and has a total installed capacity of 4 lakh tpy each. The unit is based on 'ISASMELT' technology from MIM, Australia, using imported concentrates. A Cathode Refinery of 2,05,000 tpy capacity and 90,000 tpy Copper Rod Plant have been built at Thoothukudi with a view to undertaking export operations from the nearby port. The 1,80,000 tpy copper cathode refinery of Sterlite is located in Chinchpada at Silvassa in the Union Territory of Dadra & Nagar Haveli which predominantly caters to the domestic market and also has a 1,50,000 tpy rod mill. The copper anodes at Sterlite are refined into cathodes at Silvassa for domestic markets, while anodes are refined to cathodes at Thoothukudi itself for exports. The technology for refineries and Continuous Cast Copper Rod Plant is of MIM, Australia and Continuous Properzi, Italy, respectively. The imported copper concentrates for smelters are obtained from captive mines in Australia through long-term contracts with producers in Chile and Indonesia, as also through spot purchases. The Company is the largest producer of Continuous Cast Copper Rods (CCR) in India. The CCR plants have total annual capacity of 2,68,000 tpy. The Company has sulphuric acid plant of 1.3 million tpy and phosphoric acid plant of 2,30,000 tpy.

Hindalco Industries Ltd (Birla Copper)

The Company's copper smelters located at Dahej, Lakhigam, district Bharuch, Gujarat has an installed capacity of 5,00,000 tpy. The copper operation consists of producing copper through smelting, refining copper from imported copper concentrates and converting refined copper cathode into continuous cast rod. It is now one of the world's largest smelter at a single location. It is based on Outokumpu Technology. The Company also produces continuous cast copper rods (CCR) with an annual capacity of 97,200 tonnes. In the process

of extraction of copper metal, by-products are recovered and include sulphuric acid (1.67 million tpy), phosphoric acid (1,80,000 tpy), di-ammonium phosphate (DAP) & complex fertilizers (4,00,000 tpy), gold (15 tpy) and silver (150 tpy). The entire requirement of copper concentrates is met through imports.

Gujarat Copper Project (formerly Jhagadia Copper Ltd)

It is located at Jhagadia in Bharuch district, Gujarat. HCL has acquired the assets of Jhagadia Copper Ltd (renamed as GCP). It is a scrap-based electrolytic smelter that produces cathodes with a capacity of 50,000 tpy and additional 20,000 tpy of copper anodes. The plant was in technical collaboration with Outokumpu Technology (formerly Boliden Contech AB), Sweden. The precious metals like gold, silver, platinum, palladium, etc. are also recovered as part of anode slime during the refinery process. The refinery is based on ISA-Technology from Mount ISA Mines Ltd, Australia.

Lead

The total installed capacity of primary lead smelting was 2,01,000 tpy. Primary lead was produced entirely by HZL at lead-zinc smelter at Chanderiya, district Chittorgarh, and Rajpura-Dariba Plant, district Udaipur, Rajasthan.

There are a number of secondary producing units in the Organised and Unorganised Sector.

Zinc

HZL is the major producer of Zinc. The smelting capacity of HZL for zinc is distributed between three smelters at Debari (88,000 tpy), Chanderiya (5,35,000 tpy) and Dariba (2,20,000 tpy). Edayar Zinc Ltd's plant at Binanipuram, Kerala has a capacity of 38,000 tpy. Thus, the smelting capacity for zinc in the country is 8,81,000 tpy.

The primary product of Debari and Vizag smelters is high-grade zinc, while cadmium is recovered as by-product. Chanderiya smelter complex with a total capacity of 5,35,000 tpy of zinc is the world's largest single location zinc smelting complex. Besides lead and zinc, HZL also produces silver as by-products at its Pant Nagar plant in Uttarakhand state. The annual installed capacities of silver as by-products are 600 tonnes. The data on total capacity and production of primary lead and zinc ingots in 2016-17 and 2017-18 are furnished in Table-10.

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Table – 10 : Capacity and Production of Primary Lead and Zinc Ingots

(In tonnes)

Producer	Lead capacity (tpy)	Production		Zinc capacity (tpy)	Production	
		2016-17	2017-18 (P)		2016-17	2017-18 (P)
Hindustan Zinc Ltd	201000	142231	168245	843000	672010	791461
Edayar Zinc Ltd (formerly Binani Zinc Ltd)	-	-	-	38000	-	-
Total	201000	142231	168245	881000	672010	791461

ABRASIVES

Natural abrasives, which include calcite, emery, diamond, zircon, corundum, novaculite, pumice, etc. are generally sold as dressed stones. Synthetic abrasives include borazon, ceramic, dry ice, glass powder, silica carbide, etc. Commercial abrasives are manufactured in many shapes as bonded or coated abrasives including belt discs, wheels, sheets, blocks, rods & loose grains. A large number of units exist in the Unorganised Sector. However, important producers of coated abrasives were: Grindwell Norton Ltd, Mora, Uran, district Raigad, Maharashtra; Flexoplast Abrasives (India) Ltd, Aurangabad, Maharashtra; Associated Abrasives Ltd, Nashik, Maharashtra; Carborundum Universal Ltd, Chennai, Tamil Nadu; Cutfast Abrasives Tools Pvt. Ltd, Chennai, Tamil Nadu; and John Oakey and Mohan Ltd, Ghaziabad, Uttar Pradesh. Important producers of bonded abrasives (grinding wheels) are Associated Abrasives Ltd, Nashik, Maharashtra; Carborundum Universal Ltd, Chennai, Tamil Nadu; Cutfast Abrasives Tools Pvt. Ltd, Chennai, Tamil Nadu and K.L. Thirani & Company Ltd, Kolkata, West Bengal.

Silicon Carbide (SiC)

Silicon Carbide (SiC) is a synthetic material most commonly produced by the so called Archean process in electrical resistance furnaces. SiC does not occur naturally except in some types of pre-solar meteorites, along with diamonds. SiC can be produced either in black colour or green colour depending on the raw material. SiC products have applications in metallurgical refractories, abrasives, slurry wire sawing, and for technical ceramics.

Major producers of silicon carbide are: Grindwell Norton Ltd, Renigunta, Telangana and at Bengaluru, Karnataka; Indian Metals & Carbide Ltd, Therubali, Odisha; Carborundum Universal Ltd, Tiruvottiyur, district Chennai, Tamil Nadu, and Speedfam (India) Pvt. Ltd, Navi Mumbai, Maharashtra.

CEMENT

The Cement Industry which is one of the key infrastructure industries recorded exponential growth pattern in successive years since the introduction of partial decontrol in 1982, total decontrol in 1989 and post delicensing of the Industry and Policy Reforms initiated in 1991.

MINERAL-BASED INDUSTRIES

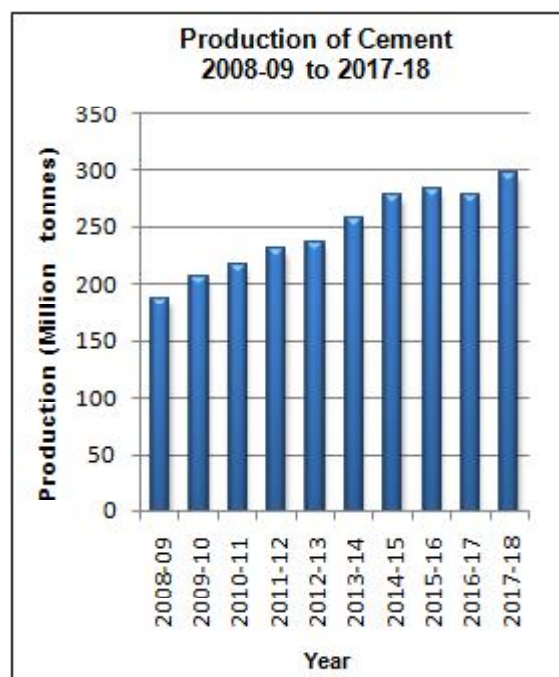
As per Cement Survey 2017, the total annual installed capacity of cement in 2017 was around 502 million tonnes. Most of these capacities are modern and based on the energy efficient dry process technology. The number of plants and capacity are more in the southern region (Andhra Pradesh, Tamil Nadu, Karnataka and Telangana) of the country. The total production of cement (all kinds) in 2017-18 was about 297.71 million tonnes.

The Cement Industry produces a variety of cement such as Ordinary Portland Cement (OPC) Portland Pozzolana Cement (PPC), Portland Blast Furnace Slag Cement (PBFC), Oil Well Cement, White Cement, etc. to suit a host of applications.

ASBESTOS-CEMENT PRODUCTS

The installed capacity of asbestos-cement pressure pipes in the Organised Sector was about 1,49,640 tpy. Production capacity of asbestos cement sheets was not available. By virtue of the high tensile strength and bonding properties with cement, it is used in the manufacture of fibre cement products.

Industries that deal with asbestos-cement products include Everest Building Products Ltd which has units located at Kymore in Madhya Pradesh and at Podanur in Tamil Nadu. Similarly, Hyderabad Industries Ltd has three plants at Sanatnagar, Ranga Reddy district in Andhra Pradesh, Jasidih in Jharkhand and Ballabgarh in Haryana; Ramco Industries Ltd has three plants at Arakkonam, district Vellore, Tamil Nadu, Karur in district Dharwad, Karnataka and Maksi in district Shajapur, Madhya Pradesh; Southern Asbestos Cement Ltd has two plants at Karur in district Dharwad, Karnataka and Arakkonam, district Vellore in Tamil Nadu; Shree Pipes Ltd Hamirgarh, district Bhilwara, Rajasthan; Malabar Building Products Ltd, Malakunnathukavu, district Thrissur, Kerala; Konark Cement and



Asbestos Industries Ltd at Bhubaneswar in Odisha; Shri Digvijay Cement Co. Ltd, Digvijaynagar, Ahmedabad in Gujarat; Uttar Pradesh Asbestos Ltd, Mohanlalganj, district Lucknow, Uttar Pradesh; Assam Asbestos Ltd, Bonda, Narangi, district Guwahati, Assam; Utkal Asbestos Ltd, Dhenkanal in Odisha and Visaka Asbestos, Pattencheru (Medak) in Andhra Pradesh.

Besides, Swastik Industries, Pune in Maharashtra; Kalani Asbestos, a Division of Kalani Industries Pvt. Ltd, Pitampur, district Dhar in Madhya Pradesh; Tamil Nadu Asbestos (Pipes), a unit of Tamil Nadu Cement Corp. Ltd, Mayanur, district Tiruchirapalli in Tamil Nadu and Ganga Asbestos Cement Ltd, Raebareli in Uttar Pradesh produced only asbestos pressure pipes. The present status of all these asbestos cement units is not available with Indian Bureau of Mines.

REFRACTORY INDUSTRY

Refractory Units fall under Medium and Small-Scale Sectors. Steel Industry is the biggest group of customers of this Industry, which consumes about 70% of total refractory production, followed by 12% in Cement, 5-6% in non-ferrous, 3% in Glass and balance in other industries. There are more than 100 refractory producers in India, out of which around 14 major, 33 medium sized and rest are relatively smaller in respect of production. The estimated annual installed capacity of all types of refractory was 2,015 thousand tonnes and the production in 2017-18 of all types of refractories was 1,107 thousand tonnes as compared to 1,136 thousand tonnes in 2016-17. Bharat Refractories Ltd (BRL), a Govt. of India Undertaking, has four units that are engaged in the manufacture & supply of various kinds of refractories not only to the integrated steel plants but also to smaller steel plants. The Salem Refractory Unit of Burn Standard Co. Ltd (BSCL) became a wholly owned subsidiary of SAIL w.e.f. December 16th 2011. The Unit has now been named as SAIL Refractory Co. Ltd (SRCL).

With the modernisation and renovation of steel plants, the requirements for various types of refractories have undergone revolutionary changes. The stress is now on for more sophisticated products like precast monolithics. The domestic Refractory Industry, taking cue of this change, has acquired the technical know-how for production of sophisticated refractories, such as, magnesia carbon bricks, new generation sliding-gate plate refractories, for ladles, gunning materials and castables. Manufacture of carbon bonded silicon carbide crucible and clay graphite foundry products is continuously done with constant upgradation for production of improved products. The use of these special refractories has brought down the consumption of refractories per tonne of steel production. However, the customers are benefited by way of improved performance, lower shut down time

and savings on energy. The specific consumption of refractories at present in integrated steel plants varies from 8 to 10 kg/tonne of crude steel as compared to 6-8 kg/tonne of crude steel in advanced countries.

The price and supply of imported raw materials are subjected to international demand and supply situation and most of the refractory makers are completely dependent on imported raw materials, especially for making high-end products (Table-11).

Table – 11: Refractory Production in India, 2016-17 and 2017-18

Item	Production (In tonnes)	
	2016-17	2017-18
Total	1135668	1107159
Fireclay Bricks & Shapes	229195	224937
High Alumina Bricks & Shapes	224115	215444
Silica Bricks & Shapes	45860	45990
Basic Bricks & Shapes	190020	189689
Monolithics/ Castables/ Pre-cast Blocks	324651	317419
Othres	63636	52950

Source: IRMA journal Vol.XXXXXI No.3

CERAMIC & GLASS INDUSTRY

Ceramic Industry

Ceramic Industry in India is about 100 years old. India ranks 8th in world in terms of production of ceramics production, which is around 2.5 % of global output (as per Morbi Ceramic association). As per ICCTAS, The 750 million sq metres of ceramic tiles were estimated to be produced as against the global production of about 11,913 million sq m. The main product segments are the Wall tile, Floor tile, Vitrified tile and Industrial tile segments. The market shares (in value terms) are 20%, 23% 50%, and 7% respectively for Wall, Floor, Vitrified, and Industrial tiles. Ceramic products are made from clay and felspar and are manufactured in Large and Small-scale Sectors with wide

variations in type, range, quality and standard. Ceramic items have properties, such as glassy smooth finish, high thermal shock resistance, poor thermal and electrical conductivity, high abrasion resistance, acid resistance and weather resistance. During the last two decades, there has been a phenomenal growth in the field of ceramics to meet specific demands of industry, such as, high alumina ceramics, cutting tools and other structural ceramics. The state-of-the-art technology of international standards are adopted for production of high quality, ceramic goods in the country. The major industries include Kajaria Ceramics, Somani Ceramics, Asian Granite India, Orient Ceramics & Industries, Nitco, Regency Ceramics, Euro Ceramics, Bell Ceramics, etc. The per capita consumption of ceramic tiles in the country was about 0.50 sq m which is comparatively lower as compared to 2.6 sq m in China and 5-6 sq m in Europe. Ceramics Technological Institute (CTI), Bengaluru, a National Level Institute for R&D in BHEL, offers the much-needed technical support for product development by enabling the Indian Ceramic Industry to adopt a modernised technology for development of new and advanced ceramics. Areas of research are nano-technology, separation technology, microwave processing, etc.

Ceramic Tiles

Following the development and growth of the Building Industry, ceramic glazed tiles producing industries too flourished considerably during the last decade. There were 14 units in the National Sector, which accounted for 40% of production of ceramic tiles. Besides, there are about 200 units in Regional Sector, which accounted for 60% of production of Ceramic Tiles. The domestic Ceramic Tile Industry has been growing at about 15% per annum. Indian tiles are competitive in the international market and are chiefly exported to East and West Asian

countries. In India, both traditional methods of manufacturing (tunnel) as well as the latest single fast firing methods are in vogue in manufacturing of ceramic tiles.

Sanitarywares

Sanitarywares are ceramic products used for sanitation purposes, like wash basins. The basic raw materials for sanitaryware are felspar, ball clay, kaolin and quartz. There were 7 units with installed capacity of 143 thousand tpy in the Organised Sector, while around 210 plants with a capacity of 53,000 tpy exist in the Small-scale Sector. Some units have either been closed or merged with the other existing ones. This Industry has been reporting a growth rate of about 10% per annum. The major manufacturers of sanitaryware include Hindustan Sanitaryware Industries Ltd, Parryware Roca Bathroom Products, Cera Sanitaryware, Neycer India, Kohler India, Toto, RAK Ceramics India, Duravit Sanitaryware Pvt. Ltd, Golf Ceramics, etc.

Potterywares

Potterywares include crockery and tableware and its manufacturers are a part of an age old Handicraft Industry in the country. Produced both in the Large-scale and the Small-scale Sectors, there were 16 units in the Organised Sector with a total installed capacity of about 43,000 tpy, while in the Small-scale Sector, there were over 1,400 plants with a capacity of 3 lakh tpy. Out of these, over 600 units are located in Uttar Pradesh.

Glass Industry

The Glass Industry includes manufacturing unit that makes glass products, such as, glass containers and hollow-wares, tablewares, flat glass (including float, sheet, figured, wired and safety, mirror glass), speciality glass (such as electronics, optics, lighting, ophthalmic lenses) vacuum flasks, refills, laboratory glasswares, fibre glass, kitchen

MINERAL-BASED INDUSTRIES

glassware, glass bangles, etc. Principal raw materials used in the manufacture of glass are silica sand, soda ash, calcite, dolomite, etc.

Glass Industry comes under the category of delicensed industry and manufacturing units are spread all over India. The large-scale producers are located mostly at Mumbai, Kolkata, Bengaluru, Hyderabad and in Gujarat and are equipped mostly with modern melting furnace technology. The Medium and Small-scale Industries, on the other hand, include Cottage Industries that still use outdated technology for production of glass products. The share of Organised Sector in the Glass Industry is dominant at about 55% whereas, the Unorganised sector accounts for about 45%. There is considerable scope in demand for glass fibre products, particularly due to growth in petrochemical sector, solar products, Packaging Industry and allied products. Glass Industry in India remained in the form of Cottage Industry till the beginning of 20th century. First glass plant in India was set-up in August 1908 by freedom fighter & Bharat Ratna Lokmanya Bal Gangadhar Tilak at Talegaon in the state of Maharashtra. Glass Industry in India has made a steady progress since then, particularly after independence. Firozabad, known as glass city of India, continues to be a place of master craftsmen and entrepreneurs, where traditional processes are still used for production of a wide variety of glass items. About, 70% of the total glass production in the Unorganised Sector in the country is contributed by Firozabad glass industry.

The production of of Glass sheet, Glass Bangles, Glassware and Fiber Glass was 87,383.36 tonnes, 1,13,554.55 tonnes, ` 36.60 crore and ` 3424.66 crore respectively, in 2017-18.

The per capita consumption of glass in India is about 1.1 kg, which is on the lower side when compared to 15 kg in China. Indian Glass market is estimated to increase at a CAGR of 15%

in future. Most of the glass demand in India comes from container glass which accounts for 50% of country's glass consumption by value. The market share of Indian Glass Industry consists of architectural (45%), automotive (15%), value added glass (15%), mirrors (10%) & furniture segment (15%).

Glass Containers and Hollow-wares

About 43 units in the Organised Sector are engaged in the manufacture of glass containers and hollow-wares, with an installed capacity of around 9305 tonnes per day. Glass containers are ideal packaging medium, but are increasingly being replaced by other packaging materials like plastic, PET, aluminium and tetrapack. The per capita consumption of container glass in India is 1.8 kg as compared to 27.5 kg in USA & 9 kg in China. The major producers include Hindustan National Glass & Industries, Piramal Glass, Haldy Glass Gujarat, La Opala RG, Mohan Meakin, Gujarat Glass, Associated Glass Industries (AGI), etc.

Laboratory Glasswares

There were six units in this Sector which manufacture neutral glass tubing, laboratory glasswares and chemical process equipment. The installed capacity of neutral glass tubing was 46,600 tpy. The data on production are not available. The demand for neutral glass tubing has not picked up due to sizeable switch over from glass items to plastic items.

Flat Glass

Silica sand, dolomite, limestone are some of the mineral ingredients used in the manufacture of flat glass. The term flat glass includes float glass, sheet glass or plate glass, figured and wired glass. These are further processed into mirror, toughened glass, laminated glass, double glazing, etched glass, glass doors, etc. The total capacity of Flat Glass Industry

MINERAL-BASED INDUSTRIES

in India is about 5,473 tonnes per day, out of which the installed capacity of major producers was 5,235 tonnes per day (i.e. 96% of total installed capacity). Hindustan National Glass and Industries Ltd, (HNG) has a new plant being set-up at Naidupeta in Andhra Pradesh and is undertaking expansion of capacity at its Nashik (Maharashtra) plant to 4,395 tonnes per day. The major consumers of flat glass are Architectural (80%) and Automotive (15%). The per capita consumption of flat glass in India is 0.88 kg as against 12 kg in China, 9 kg in Thailand, 13 kg in Malaysia and 4 kg in Indonesia. There has been growing acceptability of the Indian flat glass products in the global market.

Vacuum Flasks and Refills

There were eight units in the Organised Sector that manufacture vacuum flasks and refills, with an installed capacity of 36 million numbers per annum.

Fibre Glass (Glass-reinforced plastic)

Silica sand, limestone, kaolin, fluorspar, dolomite, etc. are some of the important minerals used in manufacturing fibre glass. Fibre glass is highly capital and technology-intensive Industry. Fibre glass is lighter than aluminium but stronger than steel. Moreover, being an inorganic material, it does not pose any health hazard. There are five units with production capacity of 55,000 tpy, while the production hovered around 39 thousand tonnes. Presently, India exports about 80% of its glass fibre production.

GRANITE INDUSTRY

Major production of granite in raw as well as processed form is generally from Andhra Pradesh, Rajasthan, Karnataka, Tamil Nadu and Gujarat. Granite is used in monuments, building slabs, tiles, surface plates, etc. Over 160 varieties of granite

with exotic colours/shades have been identified as products that could be exported after processing.

Granite is a minor mineral as defined under Section 3(e) of MMDR Act, 1957, and as per Section 15 of MMDR Act, 1957, all powers to make rules and grant of Mineral Concessions for minor minerals have been entrusted with concerned State Government. Granite Conservation and Development Rules, 1999 were notified separately on 1.6.1999 for ensuring systematic/scientific exploitation and conservation of granite resources of the country. The deposits are dispersed widely in all parts of the country. Major production of granite in raw as well as in processed form is generally from Andhra Pradesh, Rajasthan, Karnataka, Tamil Nadu and Gujarat.

Granite is a Non-scheduled Industry and the processing of granite is a phenomenon that was started in 1930s. The mining and processing techniques of granite adopted in the country have improved over the years. Looking at its export potential, the Government of India has been encouraging setting up of 100% EOU in this Sector to promote export of value-added granite products. The production of granite from five states (Rajasthan, Telangana, Andhra Pradesh, Gujarat and Karnataka) was arrived at 6.79 cu.m and 6.11 cu.m during the year 2016-17 and 2017-18 respectively. Exports of granite are freely allowed. The total granite export during 2017-18 was 6.09 million tonnes as against 6.52 million tonnes in 2016-17.

CHEMICALS

Caustic Soda (Sodium hydroxide)

Caustic soda is a basic inorganic chemical prepared by electrolysis of salt brine and is

used in the manufacture of pulp and paper, viscose rayon, textile, vanaspati & other chemicals and in aluminium extraction. A significant quantity of caustic soda is used in the manufacture of other inorganic chemicals and dyestuffs, in metallurgical operations and in petroleum refining. The production of caustic soda was 27.42 lakh tonnes against the total installed capacity of 32.97 lakh tonnes in 2017-18. The major Indian producers are Gujarat Alkalies & Chemicals, Grasim Industries, DCM Shriram Consolidated, DCW, Reliance Industries, Aditya Birla Chemicals (India), etc. NALCO and GACL have plans to set-up a proposed caustic soda plant of 2.7 lakh tonnes per annum capacity at Dahej in Gujarat as joint venture with Gujarat Alkali and Chemicals Ltd (GACL).

Soda Ash

Soda ash is an important chemical used widely as a raw material in the manufacture of glass and glassware, sodium silicate, textile, paper & pulp, in Metallurgical Industries, desalination plants and in the preparation of a host of chemicals. Soda ash is an essential ingredient in the manufacture of detergent, soap, sodium salts and dyes. The major soda ash producers are Tata Chemicals, Gujarat Heavy Chemicals Ltd, Nirma, Saurashtra Chemicals, DCW, etc. The manufacture of soda ash in India started in 1932 at Dhrangadhra in Gujarat with installed capacity of 50 tpd.

RSPL Jamnagar Greenfield Soda Ash Plant, Gujarat is a project that involves construction of a greenfield soda ash plant with a production capacity of 5,00,000 tonnes of light soda ash per year at village Kuranga in Dwarka, district Jamnagar.

The installed capacity of soda ash was 30.86 lakh tonnes. The production of soda ash during the year 2017-18 was 29.89 lakh tonnes.

Calcium Carbide

Calcium carbide is used in the manufacture of flammable acetylene gas for rubber, synthetic and plastic industry. It is used as a raw material for

manufacturing various rubber goods. It is self-reinforcing filler. It is also used for cutting & welding of metals besides its use in manufacturing various chemical substances.

The installed capacity of calcium carbide was 1.12 lakh mtpa. The production of calcium carbide during the year 2017-18 was 0.87 lakh tonnes.

Synthetic Cryolite (Na₃AlF₆)

Navin Fluorine Industries, Bhestan, Gujarat, is an important producer of synthetic cryolite. Other producers are Tanfac Industries Ltd, Cuddalore, Tamil Nadu; (Aditya Birla Group) and Adarsh Chemicals and Fertilizers Ltd, Udhna, Gujarat. GMDC, Gujarat has 500 tpd fluorite beneficiation plant at village Kadipani that produces 96% CaF₂ acid-grade & 90% CaF₂ metallurgical grade concentrate. The acid-grade finds use in aluminium fluoride, synthetic rutile & fluorine chemicals.

Aluminium Fluoride

The important units that produce aluminium fluoride include Navin Fluorine Industries, Maya Rasayan Ltd, Mumbai, Tanfac Industries Ltd, SPIC and Aegis Chemical Industries Ltd. The installed capacity of aluminium fluoride was about 25,600 tpy. The production of aluminium fluoride during the year 2017-18 was 7,510 tonnes.

Titanium Dioxide

Four plants that reported an installed capacity of 248 thousand tpy produce synthetic rutile, while other four plants with total installed capacity of about 79,800 tpy produce titanium dioxide pigment. IREL has not reported synthetic rutile production in recent years.

Sulphuric Acid

There were 140 (130 sulphur based and 10 smelter gas based) units with an annual capacity of more than 12 million tonnes that manufacture sulphuric acid in the Organised Sector based on sulphur as a raw material. In addition, sulphuric acid is also recovered at HCL, Hindalco & Sterlite and at HZL & BZL during lead-zinc smelting.

Phosphoric Acid

Important units that produce phosphoric acid of various grades, such as, pharma-grade, food-grade, technical-grade, analytical reagent grade, etc. include Gujarat State Fertilizer Company, Vadodara, Gujarat; Fertilizers and Chemicals Travancore Ltd (FACT), Udyogmandal, Kochi, Kerala; Sterlite Industries India Ltd (Vedanta); HCL, Khetri, Rajasthan; HZL, Udaipur, Rajasthan; Southern Petrochemical Industries Corp. Ltd, Thoothukudi, Tamil Nadu; EID Parry (India) Ltd, Ennore, Tamil Nadu; Star Chemical Ltd, Mumbai, Maharashtra; Ballarpur Industries Ltd, Karwar, Karnataka; Hindalco Industries Ltd, Dahej, Gujarat; and Paradeep Phosphates Ltd, Paradeep, Odisha. The important uses of phosphoric acid are in the manufacture of phosphatic fertilizers, agricultural feed, waxes, polishes, soaps & detergents, and in waste water treatment, tea-leaf processing, sugar refining, as well as anodising & stabilising agent.

Ferro-phosphorus (FeP)

Ferro-phosphorus is obtained as a by-product during steel manufacturing, during the production of yellow phosphorus or is smelt by phosphate rock & ferro-rock in blast furnace. It is used as an ingredient in high strength low-alloy steel, foundry products, as de-oxidiser in Metallurgy Industry & as a brake liner with 23% min. phosphorus and 1% max. carbon. Ferro-phosphorus is also used as a drying agent and as an additive in metallic paints.

Red Phosphorus

Star Chemicals Ltd, Mumbai and United Phosphorus Ltd, Gujarat are the leading manufacturers and suppliers of red phosphorus in the country. It is mainly consumed in the Match Industry for making strike plate of match box. Besides, in Agriculture Industry, it is used as fumigant and in the making of pesticides. Red phosphorus finds application in the manufacture of phosphoric acid, semi-conductors and also as flame retardant for polymers. It is also used in pharmaceuticals for synthesis of drugs. The installed capacity of red phosphorus was 1.68 thousand tpy. The production of red phosphorus during the year 2017-18 was 0.89 thousand tpy.

Borax

Borax is used as a component of glass, ingredient in enamel glazes, pottery & ceramics. The main manufacturers of borax is Borax Morarji Ltd with an installed capacity of 24,000 tpy at Dahej, GIDC in the state of Gujarat. The plant uses imported crude sodium borate concentrates (rasorite) and crude calcium borate (colemanite) as these are not produced indigenously. National Peroxide Ltd, Kalyan, Maharashtra, has 1,200 tpy combined installed capacity that produces other boron compounds, namely, sodium perborate-tetrahydrate and monohydrate. Indo-Borax & Chemical Ltd also operates borax and boric acid plants at Pithampur, Madhya Pradesh. The capacity of the plant, however, is not available. As a thumb rule, for one tonne production of boric acid, about 2 tonnes of boro-gypsum is produced. However, boro-gypsum does not have ready market for its disposal.

Besides the above listed chemicals, activated bleaching earth, fluorochemicals, alumina ferric and sodium silicofluoride were the other mineral-based products.

CHEMICAL FERTILIZERS

In India, the Agricultural Sector plays a vital role in the economic development of the country as securing food for 1.2 billion plus population is a mammoth task. To maximise agricultural output, it is imperative that better agricultural methods, and greater, but judicious use of fertilizers be put to effect. The application of fertilizers has been known well over a hundred years, but the use of chemical fertilizer started in the beginning of this century. The first phosphate fertilizer plant in India went on stream in 1906. Since then, the Phosphatic Fertilizer Industry has grown considerably, but, the growth has not been able to keep pace with the ever increasing demand.

Presently, there are around 170 fertilizer plants operating in India. They comprise of 31 units manufacturing urea, 19 DAP & Complex fertilizers, 109 SSP and 10 ammonium sulphate and 1 ammonium chloride in India.

MINERAL-BASED INDUSTRIES

As per Fertilizer Association of India, the total installed capacity of P_2O_5 almost stood at 7.31 million tonnes. The major raw materials for Single Super Phosphate (SSP) are rock phosphate and sulphur. Besides containing 14%-16% phosphorous, Single Super Phosphate (SSP) also contains 11%-12% sulphur and 16%-21% calcium. This provides an advantage in the form of improving agricultural productivity since large areas in the country are deficient in sulphur and calcium.

Different types of straight and complex fertilizers are manufactured from rock phosphate such as SSP, DAP, nitrophosphate, urea ammonium phosphate. In the year 2017-18, the consumption of straight fertilizer and complex fertilizer contributed about 8% and 92% of total P_2O_5 in the country. However, the trend is towards the production of complex fertilizers having the total P_2O_5 in water soluble form along with other nutrients.

In the absence of commercially exploitable resources of potash in the country, the entire demand of potassic fertilizers is met through imports. The capacity and production of different types of fertilizers are provided in Table-12.

The principal list of Fertilizer Plants is furnished in Table-13.

Types of fertilizers produced in India are detailed below:

A) Straight Nitrogenous Fertilizers:

- 1) Ammonium Sulphate (AS)
- 2) Calcium Ammonium Nitrate (CAN)
- 3) Ammonium Chloride
- 4) Urea

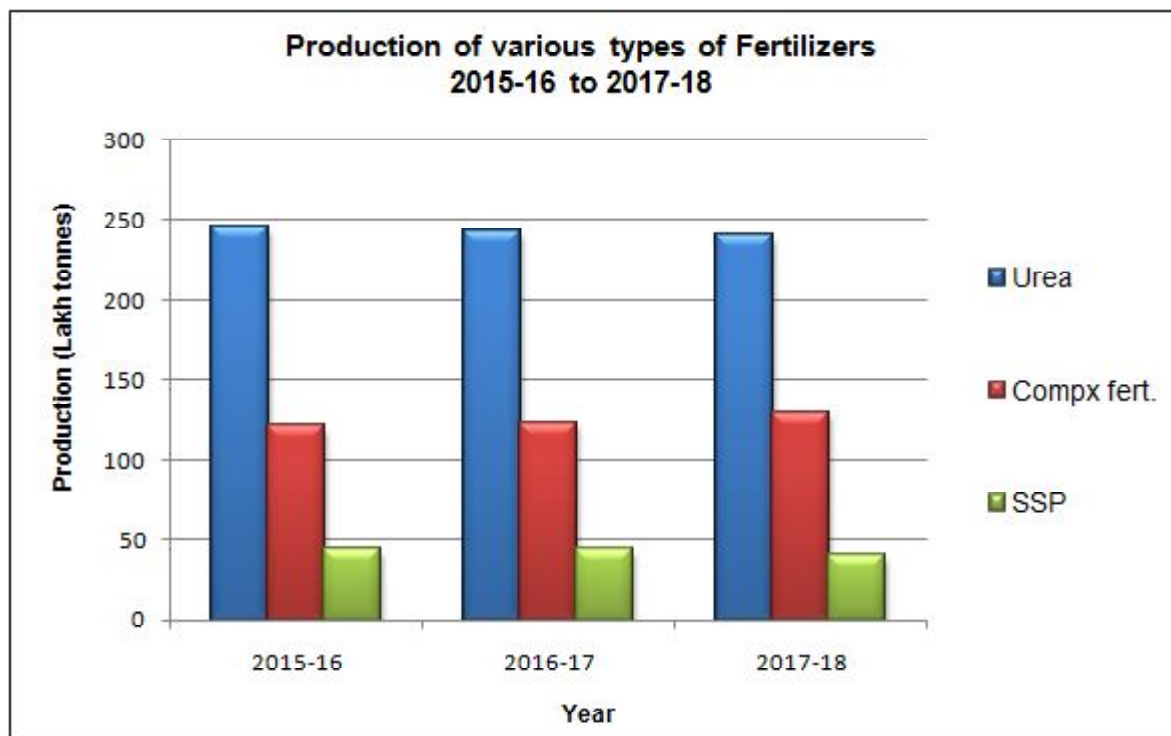
B) Straight Phosphatic Fertilizers:

- 1) Single Super Phosphate (SSP)
- 2) Triple Super Phosphate (TSP)

C) NP/NPK Complex Fertilizers:

- 1) Urea Ammonium Phosphate
 - 2) Ammonium Phosphate Sulphate
 - 3) Diammonium Phosphate (DAP)
 - 4) Mono Ammonium Phosphate (MAP)
 - 5) Nitro Phosphate
 - 6) Nitro Phosphate with Potash
 - 7) NP/NPK
-

Source: Department of Fertilizers.



MINERAL-BASED INDUSTRIES

Table – 12 : Installed Capacity and Production of Various Types of Fertilizers

(In lakh tonnes)

Products	No. of Units	Production	
		2016-17	2017-18 (P)
Urea	31	242.00	240.03
NP/ NPK complex (incl. DAP)	19	122.57	128.93
Ammonium Sulphate	10	6.32	6.89
SSP	109	42.97	39.06
Ammonium Chloride	1	0.41	0.43

Source: Fertilizer's Statistics, Fertilizer Association of India 2017-18

Table – 13 : Principal Fertilizer Plants

Sl. No.	Plant	Location
Public Sector		
1.	National Fertilizer Ltd	Nangal-II and Bhatinda (Punjab), Panipat (Haryana), Vijaipur, Vijaipur Expansion (Madhya Pradesh)
2.	Brahmaputra Valley Fertilizer Corp. Ltd	Namrup- II and III (Assam)
3.	Fertilizers & Chemicals Travancore Ltd	Udyogmandal and Cochin-II (Kerala)
4.	Rashtriya Chemicals & Fertilizers Ltd	Trombay and Trombay IV, V and Thal (Maharashtra)
5.	Madras Fertilizers Ltd	Chennai (Tamil Nadu)
6.	Steel Authority of India Ltd	Rourkela (Odisha)
7.	Hindustan Fertilizer Corp. Ltd	Khetrinagar (Rajasthan)
Private Sector Large Units		
8.	Gujarat State Fertilizers Co. Ltd	Vadodara and Sikka I & II (Gujarat)
9.	Shriram Fertilizers & Chemicals	Kota (Rajasthan)
10.	DIL (Duncan Industries Ltd)	Kanpur (Uttar Pradesh)
11.	Zuari Agro Chemicals Ltd	Zuari Nagar (Goa)
12.	Coromandal Fertilizers Ltd	Visakhapatnam and Kakinada (Andhra Pradesh), Ennore (Tamil Nadu)
13.	Mangalore Chemicals & Fertilizers Ltd	Mangaluru (Karnataka)
14.	Gujarat Narmada Valley Fertilizers Company Ltd	Bharuch (Gujarat)
15.	Southern Petrochemicals Industrial Corp.	Thoothukudi (Tamil Nadu)
16.	Tata Chemicals Ltd	Haldia (West Bengal), Babrala (Uttar Pradesh)
17.	Punjab National Fertilizers and Chemicals Ltd	Nangal (Punjab)
18.	Deepak Fertilizers & Petrochemicals Corporation	Taloja (Maharashtra)
19.	Tuticorin Alkali	Thoothukudi (Tamil Nadu)
20.	Indo-Gulf Fertilizers & Chemicals Corp. Ltd	Jagdishpur (Uttar Pradesh)
21.	Nagarjuna Fertilizers & Chemicals Ltd	Kakinada I & II (Andhra Pradesh)
22.	Godavari Fertilizers & Chemicals Ltd	Kakinada (Andhra Pradesh)
23.	Hin. Ind. Ltd	Dahej (Gujarat)
24.	Chambal Fertilizers & Chemicals Ltd	Gadepan I & II (Rajasthan)
25.	KSF Ltd	Shahjahanpur (Uttar Pradesh)
26.	Paradeep Phosphates Ltd	Paradeep (Odisha)
Co-operative Sector		
27.	Indian Farmers' Fertilizers Co-operative Ltd	Kalol and Kandla (Gujarat), Aonla I & II, Phulpur I & II (Uttar Pradesh), Paradeep (Odisha)
28.	Krishak Bharti Co-operative Ltd	Hazira (Gujarat)

Paper & Paper Board Industry

The Indian Paper Industry accounts for about 4% of the world's total production of paper. There are around 850 units which are manufacturing pulp, paper, paper board and newsprint with an installed capacity of nearly 27 million tonnes out of which 4.71 million tonnes are lying idle. The Indian Paper Industry is in a fragmented structure, consisting of small, medium and large paper mills having capacity ranging from 5 to 1650 tonnes per day. These units use wood and agro residues as well as recovered paper as raw material. The production share of these units is around 18%, 9% and 73% respectively. The production of paper and paper board was about 19 million tonnes in the year 2017-18 as compared to 16.91 million tonnes in the previous year. During the year 2017-18, 2.13 million tonnes of paper and paper board was imported and about 1.34 million tonnes of paper and paper board was exported. Domestic paper and paper board segment produces all the main varieties of paper viz. writing and printing paper (35%), packaging grade paper (54%), newsprint (7%), other and speciality paper (<4%). The newsprint sector in the country is governed by the Newsprint Control Order (NCO), 2004. At present, there are 124 mills registered under the Schedule to the NCO. However, only 62 are producing newsprint, making the operating installed capacity 1.59 million tonnes per annum, which accounts for 63% of total capacity. At present total installed capacity of news print is 2.50 million tonnes. Further, 59 mills have discontinued or closed their operations. The domestic production of newsprint was 1.37 million tonnes in 2017-18. Nearly half of the newsprint demand in the country is met by imports. Around 1.43 million tonnes of newsprint was imported in 2017-18. The per capita consumption of paper in India is 14.5 kg, which is far behind the global average of 53 kg in 2018. As a thumb rule, in Paper Industry, cost of energy is nearly 25% of cost of production. Hence, energy management is an important aspect in this Sector. Minerals like china clay, limestone, talc, salt, sulphur, etc. besides coal as fuel are used for purposes such as filler, coating & surface sizing, etc., in this Industry and also play vital role in quality control.

PAINT & ALLIED PRODUCTS INDUSTRY

The Paint & Allied Products Industry comprises paints, enamels, varnishes, pigments, synthetic resins, printing inks, etc. Approximately, 65% of the production is contributed by the Organised Sector. The per capita consumption of paint in India is around 4 kg.

The Indian Paint Industry will grow at the rate of 12-13% annually. India is self-sufficient in the production of paints. Barytes, bentonite, calcite, china clay, mica powder, rutile, talc/steatite/soapstone, ochre, silica & dolomite powder are some of the important minerals consumed in Paint Industry.

The production of Paints of all kinds and Printing Ink during 2016-17 was 4,81,034 tonnes and 1,21,930 tonnes, respectively. During the year 2017-18 (April, 2017 to October, 2017), the production of these products has been 1,21,930 tonnes and 1,18,359 tonnes, respectively.

PETROLEUM REFINERIES

There were 23 refineries operating in the country (20 in Public/Joint Sector and 3 in Private Sector). India has emerged as second largest refiner in Asia after China.

Installed capacity and crude throughputs of refineries are provided in Table-14.

The total refining capacity in the country as on 01.04.2018 is around 247.566 million tpy. The total crude throughput increased to 252 million tonnes in 2017-18 from 245 million tonnes in 2016-17. Production of petroleum products from crude oil was 254.40 million tonnes in 2017-18 as against 243.55 million tonnes in 2016-17. Import of petroleum crude was 220 million tonnes in 2017-18 as against 214 million tonne in 2016-17. During 2017-18, crude oil production in the country was at 35.68 million tonnes, while the natural gas production was at 32.65 billion cubic metres (BCM).

India has a near self-sufficiency in the Refinery Sector. The details of capacity expansion and development are reflected in the Review on Petroleum and Natural Gas in Vol-III, IMYB.

MINERAL-BASED INDUSTRIES

Table – 14 : Installed Capacity and Crude Throughputs in Refineries

(In '000 tonnes)

Refinery	Annual installed capacity (as on 01.04.2018)	Refinery Crude throughput		
		2015-16	2016-17	2017-18 (P)
Total	247566	232865	245362	251935
Public/Joint Sector	142066	127087	137388	145234
IOCL, Guwahati, Assam	1000	904	864	1024
IOCL, Barauni, Bihar	6000	6545	6526	5819
IOCL, Koyali, Gujarat	13700	13820	13994	13811
IOCL, Haldia, West Bengal	7500	7776	7689	7655
IOCL, Mathura, Uttar Pradesh	8000	8860	9230	9240
IOCL, Digboi, Assam	650	562	533	666
IOCL, Bongaigaon, Assam	2350	2442	2486	2402
IOCL, Panipat, Haryana	15000	15282	15638	15654
IOCL, Paradip, Odisha	15000	1817	8230	12730
BPCL, Mumbai, Maharashtra	12000	13371	13541	14054
BPCL (formerly KRL), Kochi, Kerala	15500	10712	11820	14095
HPCL, Mumbai, Maharashtra	7500	8013	8510	8641
HPCL, Vizag, Andhra Pradesh	8300	9220	9335	9635
CPCL, Manali, Tamil Nadu	10500	9100	9725	10289
CPCL, Nagapattinam, Tamil Nadu	1000	544	531	500
MRPL, Mangaluru, Karnataka	15000	15532	15965	16130
NRL, Numaligarh, Assam	3000	2520	2683	2809
ONGC, Tatipaka, Andhra Pradesh	66	67	86	80
Joint Venture	17300	17116	16882	15538
Bharat Oman Refineries Ltd, Bina	6000	6402	6360	6708
HPCL, Bhatinda	11300	10713	10521	8830
Private Sector	88200	88662	91093	91163
RPL, Jamnagar, Gujarat	33000	32428	32823	33153
RPL (SEZ), Jamnagar, Gujarat	35200	37133	37351	37317
Nyara Energy Ltd., Vadinar, Gujarat	20000	19101	20919	20693

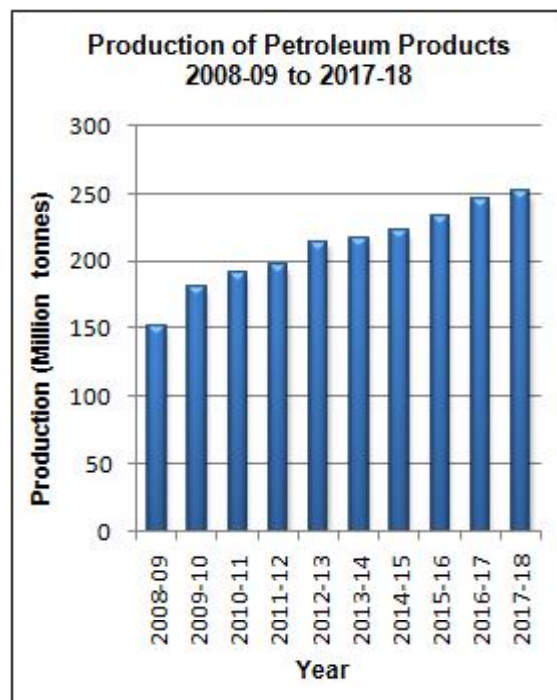
Source: Ministry of Petroleum and Natural Gas, Annual Report, 2018-19

FOUNDRY

The Indian Foundry Sub-sector is the key feeder to the Engineering Industry. Foundry Industry, on the advice of National Manufacturing Competitiveness Council (NMCC), New Delhi under Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, has prepared draft vision document 2020 in which it is envisaged that there must be doubling of production with enhanced energy efficiency, technological modernisation and greenfield expansion to realise achieving the vision.

Indian Foundry Industry is the third largest in the world. This industry is now well established in the country and is spread across a wide spectrum consisting of large, medium, small and tiny sector.

Typically, each foundry cluster is known to cater to specific end-use markets. The Coimbatore cluster is famous for pump-sets castings; Kolhapur and Belgaum cluster for automotive castings; Rajkot cluster for diesel engine castings and Butala-Jalandhar cluster mainly for machine parts and agricultural implements. Advanced countries like USA, Japan, Germany are unlikely to add much capacity due to stringent pollution control norms there. India can thus have a dominant presence in this field and can become an important casting supplier to the world.



Although intermediate mineral-based products like pig iron, scrap of metals and ferro-alloys, etc. are main inputs for foundry, minerals like bentonite, coke, coal, fireclay, fluorite, iron ore, limestone, silica sand, zircon flour, etc. are also being consumed by the Foundry Industry.

The production of cast iron castings in 2016-17 and 2017-18 was 1119.19 thousand tonnes and 555.61, respectively.