Indian Minerals Yearbook 2018

(Part- II :Metals and Alloys)

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ALUMINIUM AND ALUMINA

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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1 Aluminium and Alumina

The aluminium industry in India is strategically well-placed and is one of the largest producers in the world with discernible growth plans and prospects for the future. India's rich bauxite mineral base renders a competitive edge to the industry as compared to its counterparts globally. The Indian aluminium industry scaled lofty notches since the establishment of the first manufacturing company, namely, Indian Aluminium Company (INDAL) in 1938. In 2004, all business activities of INDAL have been merged subsequently with Hindalco Industries Limited (Hindalco).

Four major primary producers, National Aluminium Co. Ltd, Hindalco Industries Ltd, Bharat Aluminium Co. Ltd and Vedanta Aluminium Ltd (VAL) are at the forefront in aluminium production. The primary producers have a strong presence in the sheet business and are enlarging their roles in the foil segment. The primary producers are also in the extrusion segment in which a large number of secondary manufacturers participate with fragmental capacities.

The overall total annual installed capacity of aluminium in the country has remained same at 41 lakh tonnes during both the year 2016-17 & 2017-18, respectively. The production of aluminium comes from the plants viz, NALCO, HINDALCO, BALCO, & VEDANTA whereas the MALCO plant remained non-operational during the year 2017-18. Producer-wise capacity of aluminium is given in Table-1.

The installed capacity of alumina plants in the country was 65.60 lakh tpy. However, the operational capacity was 62.75 lakh tpy and plant capacity of 2.85 lakh tpy remained non-operational (Table-2).

PRODUCTION

Aluminium

Aluminium production in 2017-18 at 3,401 thousand tonnes registered an increase of 17% as compared to that in the previous year. Seven plants reported production of aluminium during the year. Of these, one plant in Public Sector accounted for about 18% of the total production. The remaining 82% production was reported by the Private Sector (Tables - 3 & 4).

During the year 2017-18, all seven smelters reported higher production as compared to the previous year.

Table – 1: Installed Capacity of Aluminium, 2017-18 (By Producers)

(In '000 tonnes)

Producer	Plant	Annual capacity
Total		**4100**
Public Sector		
National Aluminium Co. Ltd	Angul (Odisha)	460
Private Sector		
Bharat Aluminium Co. Ltd	Korba (CG) - I 245	
	Korba (CG)- II 325	570
Hindalco Industries Ltd	Aditya (Odisha)- 360	
	Hirakud (Odisha)- 215	1280
	Mahan (M.P) - 360	
	Renukoot(U.P) - 345	
Madras Aluminium Co. Ltd	Mettur (Tamil Nadu)	40#
Vedanta Aluminium Ltd	Jharsuguda-I (Odisha) - 500	
	Jharsuguda-II (Odisha) - 1250	1750*

Source: *Information received from the companies/Annual Reports.*
 # MALCO has closed its smelter since December, 2008.

**Largest integrated smelter with 2.3 million tonnes per annum proposed capacity.*

Table – 2: Installed Capacity of Alumina, 2017-18 (By Producers)

(In '000 tonnes)

Producer	Plant	Annual capacity
Total		**6560**
Public Sector		
National Aluminium Co. Ltd	Damanjodi (Odisha)	2275
Private Sector		
Bharat Aluminium Co. Ltd	Korba (Chhattisgarh)	200#
Hindalco Industries Ltd	Renukoot - 700 (Uttar Pradesh)	
	Belagavi - 350 (Karnataka)	
(Jharkhand)	Muri - 450	3000
	Utkal Alumina - 1500 (Odisha)	
Madras Aluminium Co. Ltd	Mettur (Tamil Nadu)	85#
Vedanta Aluminium Co.Ltd	Lanjigarh (Odisha)	1000*

Source: *Information received from the companies/Annual Reports/Ministry of Mines Annual report.*
 # Plants remained non-operational during the year.
**Plans to enhance capacity of alumina refinery from 1 million to 6 million tonnes per annum.*

Alumina

The production of alumina at 6,119 thousand tonnes in 2017-18 increased marginally by about 1% as compared to that in the previous year. During the year 2017-18, except Hindalco (Muri & Renukoot) all other smelters reported higher production of Alumina as compared to that in the previous year. NALCO continued to be the leading producer of alumina accounting for 45% of the total production during the year under review (Tables-5 & 6).

Table – 3: Production of Aluminium 2015-16 to 2017-18 (P)

(Quantity in tonnes; Value in ` '000)

Year	Production	
	Quantity	Value
2015-16	2354949	268362923
2016-17	2896629	319857753
2017-18 (P)	3400618	430308076

Table – 4: Production of Aluminium 2016-17 and 2017-18 (P) (By Plants)

(In tonnes)

Producer	Plant	Production	
		2016-17	2017-18 (P)
National Aluminium Co. Ltd	Angul	386880	424949
Hindalco Industries Ltd	Aditya	363147	364591
	Hirakud	151901	161933
	Mahan	345542	355582
	Renukoot	405202	408929
Bharat Aluminium Co. Ltd	Korba	423308	568883
Vedanta Aluminium Co. Ltd	Jharsuguda	820649	1115751

Table – 5: Production of Alumina 2015-16 to 2017-18

(Quantity in tonnes; Value in `'000)

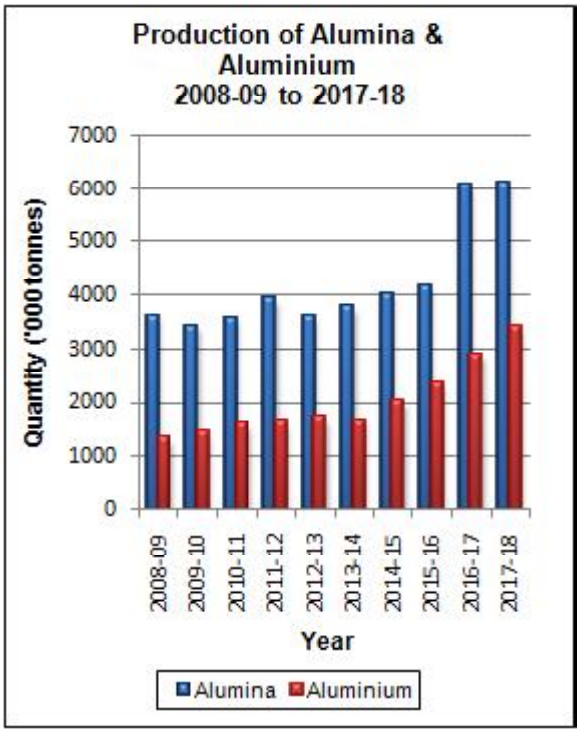
Year	Production	
	Quantity	Value
2015-16 *	4172293	73735844
2016-17	6075839	102008547
2017-18 (P)	6119449	119895282

*Excluding production of Utkal Alumina Ltd.

Table – 6: Production of Alumina 2016-17 and 2017-18 (P) (By Plants)

(In tonnes)

Producer	Plant	Production	
		2016-17	2017-18(P)
National Aluminium Co. Ltd	Damanjodi	2028400	2085000
Hindalco Industries Ltd	Belagavi	296800	317300
	Muri	333090	323717
	Renukoot	709992	684296
Vedanta Aluminium Co. Ltd	Lanjigarh	1207957	1209436
Utkal Alumina	Rayagada	1499600	1497700



INDUSTRY

Ten aluminium smelters having total installed capacity of 41.00 lakh tpy are operated by four companies viz. NALCO, BALCO, HINDALCO & VEDANTA. The actual production of aluminium comes from a plant capacity 40.60 lakh tpy as 0.40 lakh tpy capacity remained non-operational. Of these, NALCO is the only company in the Public Sector with installed capacity of 460,000 tpy. BALCO, earlier a Public Sector company, is now under Private Sector. The remaining Six smelters of Hindalco and VAL are in the Private Sector. The aluminium plants of NALCO and BALCO have their alumina-aluminium complexes at Damanjodi-Angul (Odisha), and Korba (Chhattisgarh), respectively.

NALCO is one of the largest integrated Bauxite-Alumina-Aluminium- Power Complex in the country. The Company has 460, 000 tpy Aluminium Smelter at Angul & 2,275,000 tpy Alumina Refinery located at Damanjodi in Koraput Odisha.

Hindalco Aluminium smelting operations are located at Renukoot (Uttar Pradesh), Aditya Aluminium (Odisha), Mahan Aluminium (Madhya Pradesh) and Hirakud (Odisha). Newly installed smelters at Aditya Aluminium and Mahan Aluminium are operating on state-of-the-art AP36 technology. The Hindalco's total primary aluminium (metal) capacity has enhanced to around 13,00,000 tpy from earlier capacity of 562, 000 tpy. This increase was primarily on account of production from Mahan and Aditya smelter commissioned during the year 2014-15. In addition to aluminium, Renukoot Integrated Aluminium Complex also produces semi-fabricated products viz. conductor redraw rods, sheet, extrusion, etc. The Alupuram (Kerala) smelter is closed but extrusion unit currently operates at a capacity of 8,000 tpy.

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) & Taloja (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 of entire range of Flat Rolled Products. Flat Rolled Products facilities at Hirakud (Odisha) and Mouda (Maharashtra) are being modernised to produce world class can body stock and Ultra Thin Gauge Foils, respectively. The Hirakud plant produce Flat Rolled Products (FRP), 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 205,000 tpy spread over at Renukoot (80,000 tpy), Belur (45,000 tpy), Taloja (50,000 tpy) and Mouda (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 Alupuram (Kerala) 8,000 tpy capacity.

Hindalco's foil unit located at Silvasa (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 Medak district (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.

The overall BALCO's smelter capacity augmented to 570,000 tpy with the commissioning of Korba-II smelter with 325,000 tpy capacity, with capabilities to produce ingots, wire-rods billets, bushbars and rolled products. The Korba-I plant with 245,000 tpy capacity show consistent

production during the year. The company operates two power plants for commercial power generation of which one is used to produce power for captive consumption, refining, smelting, fabrication, etc and another 1200 MW power plant is under construction. The ramp up of BALCO-II smelter was completed during the year 2018.

With the ramping up of the Jharsuguda- II smelter with capacity of 1.25 million tpy, the total smelter capacity of Vedanta in Odisha state enhanced to 1.75 million, from 50,000 tpy capacity. MALCO, a Vedanta Group Company has not reported production of alumina and aluminium in 2017-18. MALCO is under care and maintenance by Vedanta since May, 2017. It generates 100 MW power from 4 units of 25 MW each through power plants located at Mettur (Tamil Nadu), and is one of the largest private sector power suppliers in Tamil Nadu.

Jindal Aluminium Ltd (JAL) established its factory for manufacture of aluminium extrusion in the year 1968 at Bengaluru. JAL has 11 aluminium extrusion presses with an installed capacity of 120,000 tpy. The company is the leader in aluminium extrusions, meeting country's about 30% demand. JAL has taken a step forward by diversifying into Aluminium rolled products. Jindal commissioned the state-of-the-art Aluminium sheet and foil manufacturing facility with installed capacity 40,000 tpy, at Dabaspet, Bengaluru, 35km from the existing extrusion plant. The information on installed capacity of Aluminium semis by different plants is given in Table-7.

Table – 7: Capacity for Aluminium Semis

(In tonnes)

Producer/product	Annual installed capacity
HINDALCO INDUSTRIES LTD.	
Rolled product	205000
Extruded products	31000
Conductor redraw rods	56400
Aluminium foils	40000
Aluminium wheels (No. of pieces)	-
NALCO	
Aluminium wire rods	100000
Aluminium billets	30000
Aluminium strips (smelter)	26000
Aluminium strips (RPU)	52000
Rolled products	45000
MALCO	
Rolled products	12000
Properzi rods	36000
Bus bars-	
Aluminium wire rods	32850
BALCO	
Extruded products	8000
Rolled products	72500
Properzi rods	111500
Foil product	600
Conductors	1200
Aluminium wire rods	43200
JINDAL ALUMINIUM LTD	
Extruded products	128000
Foil product	40000

Source: *Information received from individual plants/Annual Reports.*

DEVELOPMENT & EXPANSION

NALCO:-NALCO augmented alumina refinery capacity to 22.75 lakh tonnes per year from 21 lakh tonnes per year. The company is going forward to set up 5th stream in its existing Alumina refinery which shall add 10.0 lakh tonnes per year to its capacity. Sourcing of bauxite for 5th Stream expansion of alumina refinery has been envisaged from Pottangi Bauxite Mines. The surplus alumina that remains after internal consumption is exported and small portion sold to the domestic market. Upgradation of aluminium smelter capacity from 4.6 lakh tonnes to 5.67 lakh tonnes per year under current-amperage upgradation project is under progress.

NALCO plans to set up a 5 lakh tonnes per year smelter and 1050 MW power plant at Sundargarh district in Odisha. The company set up wind power plants of capacities 50.4 MW & 47.6 MW at Gandikota (Andhra Pradesh) & Jaisalmer (Rajasthan) and these are operational during the year. NALCO is in process of augmenting its wind power generation capacity from 198.40 MW to 223.90 MW by adding another wind farm of capacity 25.5 MW at Kayathar, Tamil Nadu. In the year 2016, 3rd wind power plants having capacity of 50MW was fully commissioned at Devikot site in Jaisalmer, Rajasthan. The erection activity of wind power plant with a capacity of 50.4 MW is underway at Jath site, Sangli in Maharashtra. Utkal D & E coal blocks (200 million tonnes) have been alloted to NALCO in the year 2016. NALCO has been granted mining lease over Gudam and KR Konda bauxite resources in Andhra Pradesh and Pottangi in Odisha. Term of reference for grant of mining lease of Pottangi Bauxite Mine was issued to NALCO from Government of Odisha in July, 2016. 10 lakh tonnes per year alumina refinery is being set up in Damanjodi, based on mineral available from Pottangi Bauxite Mine (Odisha). Based on bauxite resources, the company 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. The company plans to set up a 14 MW wind power project in mined out area of its working bauxite mines in Damanjodi area of Odisha.

HINDALCO:- HINDALCO's plans to expand alumina refinery capacity at Belagavi from 3.5 lakh tpy to 6.5 lakh tpy is on hold, awaiting government's approval relating to bauxite mines. Hindalco's three greenfield projects are well on their way towards full capacity utilisation.

Hindalco set up 3.60 lakh tpy aluminium smelter at Bargawan along with 900 MW captive power plant at Mahan in Madhya Pradesh, based on captive coal consumption from Sidhi district, Madhya Pradesh.

Utkal Alumina (Odisha), 1.5 million tpy alumina refining project along with 90 MW captive co-generation plant was completed during the year. Utkal alumina is sourcing bauxite from Baphlimali Bauxite Deposit in Odisha. Utkal alumina continues to be the most economical and an efficient alumina producer globally as it is working at maximum capacity producing 1.5 million tpy of alumina and providing strong support to Hindalco's smelting facilities, leading to better cost optimisation.

The other integrated aluminium project, namely, Aditya Alumina & Aluminium Project, alumina refinery at Koraput, 3.60 lakh tpy aluminium smelter at Lapanga, Odisha along with 900 MW captive power plant were commissioned during the year 2014-15. In addition, Hindalco operates two Hindalco Innovation Centers one at HIC -Alumina at Belagavi working on R&D of bauxite, alumina and specialty alumina products and another at Taloja, working in the area of aluminium fabricated products. In addition, Hindalco engages the Aditya Birla Group's corporate research and development centre, Aditya Birla Science and Technology Company Private Limited ("ABSTCPL"), for conducting R&D in select areas of work through chartered R&D projects. These are based on the domain expertise and R&D facilities available in ABSTCPL.

A joint venture agreement on bauxite mines was signed with Orissa Mining Corporation. Hindalco won 4 coal blocks viz Kathautia, Dumri, and Gare Palma IV/4 & Gare Palma IV/5 during the coal auction held during the previous year. Currently three captive mines viz. Gare Palma IV/4, Gare Palma IV/5 and Kathautia are fully operational. The captive mine at Dumri is in the process of obtaining necessary statutory clearances. The mining operation at Kathautia mines commenced in February, 2017. The company is also developing a coal mine for captive consumption jointly with Mahanadi Coalfields Ltd and Neyveli Lignite Corporation Ltd.

Hindalco's another greenfield project, viz Jharkhand Aluminium Project at Sonahatu, 55 km from Ranchi, entails setting up a 7.20 lakh tpy aluminium smelter with 1650 MW captive power plant. It is supported by 5 million tpy captive coal mine of Auranga Coalfields in Jharkhand with Tata Power.

VEDANTA:- Balco of Vedanta Group is undertaking programmes for modernisation and expansion. BALCO's operations include two bauxite mines, two power plants (of which one is used to produce power for captive consumption), refining, smelting, fabrication and also produce ingots, wire rods, billets, busbar, and rolled products . The total capacity of the Korba smelter is enhanced to 5.70 lakh tpy from 3.45 lakh tpy during the year. The production at Korba-I plant of BALCO with smelter capacity of 245,000 tpy is stable during the year and the new Korba-II smelter with 325,000 tpy with 84 pots commissioned during the year. Majority of the bauxite required for BALCO's smelter are acquired from its two captive mines in the state of Chhattisgarh. In addition, the construction of coal-based 1200 MW captive power plant is in progress and of two coal mines viz. Chotia & Gare Palma Blocks. **C**hotia a coal block has capacity of 17.7 million tonnes per annum. BALCO has an NABL accredited quality laboratory for raw materials & finished goods.

Vedanta Aluminium Ltd (VAL) has the largest integrated aluminium capacity in India (23.2 lakh tpy). VAL has 10 lakh tpy alumina refinery associated with 90 MW captive power plant at Lanjigarh in district Kalahandi, Odisha and 12. 50 lakh tpy & 5 lakh tpy capacity aluminium smelters and 1215 MW captive power plant at Jharsuguda (Odisha). The bauxite requirement for alumina refinery met from captive mines, domestic source and imports. The ramp up of Jharsuguda-II aluminium smelter continued during the year. The refinery currently has a debottlenecked capacity of 1.7-2.0 million tonnes per annum. Approval was received to expand to 4 million tonnes per annum**.** Vedanta have entered into a long term contract with Odisha Mining Corporation for supply of bauxite.

During the previous year, the company gained approvals to use the power generated from three units of the Jharsuguda power plant for captive use and received environmental clearance for expansion of Lanjigarh Alumina refinery capacity to 4 million tonnes per annum. Vedanta's two power plants were in the pre-commissioning phase during previous year, at BALCO and at Talwandi Sabo in Punjab. Both are now fully commissioned and have added nearly 2,500 MW of new capacity. The total generating capacity enhanced to 9,000 MW making Vedanta a larger power generator than many other power utilities.

Further, VAL entered into an agreement with the Orissa Mining Corporation (OMC) regarding the establishment of an alumina refinery, an aluminium smelter and associated captive plants in Lanjigarh and Jharsuguda, Odisha.

USES

Aluminium has widespread uses throughout the economy and is equally important to both the industrial and consumer sectors. On the industrial side, aluminium is heavily used in electrical power transmission, machinery & equipment and construction. Aluminium usage in automobiles is rising and is expected to increase internationally. Over the past five years considerable progress has been made in aluminium-intensive vehicle production.

Housing, in particular, make heavy use of the lightweight material as a substitute for steel and wood in doors, windows and sidings. Aluminium is also used in a variety of retail products including cans, packaging, air conditioners, furniture and automobile. In addition, India has pioneered the replacement of copper by aluminium in power transmission & distribution which has enhanced the demand for aluminium. There are nearly 600 cable and conductor manufacturing units in the country, having a total capacity of 400,000 tpy. The major end-use of aluminium is as rolled sheets, extrusions and foils. India Foils, Pennar Aluminium and Century Extrusions are the major players in the extrusion & foil market.

Foil is a very thin sheet of rolled aluminium supplied in its pure form or as alloys. The thickness of foil ranges from the thinnest currently produced at about 0.0065 mm to thickest 0.2 mm. Material thicker than 0.2 mm is defined as sheet or strip.

CONSUMPTION

The global primary aluminium demand in the year 2015 increased at around 4% to 56 million tonnes. The increase in consumption was primarily driven by China. China continued to be a major consumer of aluminium accounting for almost 51% of the global consumption. Elsewhere in Asia, consumption declined in Japan but was compensated by higher demand from India and the Middle East. In India, the power, packaging, transport, construction, machinery and equipment sectors are key demand drivers of aluminium. The domestic imports of aluminium products, including scrap, are growing significantly, which is a major concern for the domestic aluminium producers. In advanced economies, aluminium is increasingly replacing wood and steel in building sector. Aluminium cans and containers are used extensively, world over. Aluminium is also the ideal packaging material for pharmaceuticals and processed foods.

In India, aluminium was consumed mainly in the electrical sector (48%), followed by automobile and transport sector (15%), construction (13%), consumer durables (7%), machinery & equipment (7%), packaging (4%) and others (6%). In the electrical sector, aluminium usage is in overhead conductor, and power cable used in generation, transmission, and distribution of electricity. Aluminium is also used in switchboards, coil windings, capacitors, etc.

As per Technology Vision Document 2035, the per capita consumption of aluminium in India is among the lowest in the world with only 2.2 kg as compared to world average roughly of 8 kg with 22-25 kg in developed nations.

Alumina is produced from bauxite. About one tonne of alumina is produced from 3 to 3.5 tonnes of bauxite and about one tonne of aluminium is produced from about two tonnes of alumina.

RESEARCH & DEVELOPMENT

The Hindalco collaborated with institutes such as the Indian Institute of Technology (IIT), National Metallurgical Laboratory (NML), Institute of Minerals and Materials Technology (IMMT), and Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC) among others, for generating values from wastes such as bauxite residue, fly ash, copper slag, phosphogypsum, aluminium dross and spent pot liner, etc. Hindalco operates two Hindalco Innovation Centres (HIC), (i) HIC-Alumina at Belagavi working on R&D of bauxite ore, alumina refining and speciality alumina, hydrate products; as well as waste management; and (ii) HIC-SemiFab located at Taloja, near Mumbai, working in the area of tribology, energy & environment management and aluminium fabricated products and new applications.

NALCO is exploring to set up world class, State-of-the-Art research and development centre in the field of bauxite, alumina, aluminium, downstream products, power, waste utilisation, and allied areas. Some of the in-house R&D activities carried out by NALCO are as follows:- (i) 150 m^3 per batch Effluent Water Treatment Plant Emrion Nano Technology of Eesavyasa Technology Pvt Ltd, first of its kind is running successfully, meeting the environments norm stipulated by OSPCB at Smelter Plant (ii) Performance Guarantee (PG) test of the Emrion plant has been completed successfully (iii) Filtration trials of Red mud carried out in pilot setups with M/s. Unitop Multitech India Pvt Ltd and M/s. FL Smith to establish the efficiency of pressure filtration for Red mud filtration. The data generated will be used for plant scale implementation (iv) R&D has developed a process for improvement of oxidation behavior of anode which has been successfully implemented in the Smelter plant (v) Extraction of Alumina from Partially Lateritized Khondalite (PLK) at laboratory scale has been completed and the basic flow sheet for the process has been developed by CSIRO, Australia. (vi) NALCO & IIT, Bhubaneswar have jointly developed a process for "Synthesis, Characterisation and Development of Red Mud-Fly ash based Geopolymer concrete" which has a potential for application in civil activities.

The completed Research & Development projects by JNARDDC, Nagpur is as given below- (i) Setting up of mini-pilot plant for red mud based light weight foamed bricks for NALCO (ii) Analysis of impurities (Fe, Si, Ca, etc.) in alumina and aluminate liquor using hand-held spectrometer (iii) Upgradation & utilisation of laterite of east and west coast deposits (iv) Study on scale formation in precipitation tank based on the operating parameter to optimise the uptime of tanks at Alumina Refinery plant (v) Development of ceramic proppant form PLK and fly ash at laboratory scale (vi) Development of a

process for detoxification of SPL 1st cut for recovery of mineral values (Carbon, Soda, etc.) and (vii) Detailed study on melt generation and suggest solutions for reduction in melt loss.

RECYCLING

In India, though aluminium industry is over six decades old, the recycling sector with modern State-of-the-Art technology is still in its nascent stage.

Aluminium is 100% recyclable and there is no loss of properties or quality during the recycling process. Products of aluminium such as UBC (Used Beverages Can), aluminium foils, plates and automotive components can be easily recycled, thereby, saving energy and reducing greenhouse emissions. Aluminium recycling process is less capital intensive than primary metal production as the process requires only 5% of energy, between 13-15 thousand units of power for producing one tonne of aluminium through primary route. Recycling of aluminium saves about 6 kg of bauxite/kg and 14 kWh of electrical energy /kg of primary aluminium. Besides, it keeps the emission levels of greenhouse gases as low as 5% from the actual emission experienced during primary production. Further, recycling facilitates reduced stress on the use of bauxite and thereby preserving about six lakh tonnes of bauxite resources every year.

India's metal recycling rate is about 25%. All the activity related to aluminium scrap recovery are limited to the unorganised sectors, catering mostly to the utensil and casting industries. The proportion of recycled aluminium has been increasing over the years. It is expected that in the years to come, it will reach a figure of about 35-40% of total aluminium consumption. Currently, there is only one recycling unit of Hindalco in organised sector at Taloja with 25,000 tonnes annual capacity. Although the plant at Taloja was facing challenges due to less availability of scrap, the production from the unit has improved and the plant is now operating at 80% of the rated capacity as against earlier capacity of 60%.

Most recycling units in India operate on outdated, or primitive technology which leads to high levels of pollution and energy consumption. This is an area that needs to be addressed by the Indian Aluminium Industry. Due recognition of recycling could encourage users of aluminium particularly in transport, housing, packaging and durable sectors to broaden the organised markets for the scrap generated. In September, 2018 the Gujarat Govt. has signed a MoU with Hindalco industries Ltd for setting up of 300, 000 tonnes per annuam aluminium recycling plant at Gujarat.

WORLD REVIEW

World production of alumina was 127 million tonnes in 2017. China continued to be leading producer with a share of about 55% which is followed by Australia (16%), Brazil (9%) and India (4%). World production of aluminium was 60 million tonnes in 2017. China continued to be the leading producer with a share of about 54% which is followed by Russia & India (6% each), Canada (5%) and UAE (4%) (Tables 8 & 9).

To give a generalised view of the development in various countries the country-wise description sourced from latest available publication of Mineral Year Book 'USGS-2016 is furnished below:-

Australia

A power failure took place at the 358,000 tpy smelter in Portland, Victoria. Prior to the power failure, the smelter had been producing at 85% of its capacity but was producing at less than 30% of its capacity after the power failure. Alcoa restarted the shutdown capacity, but said the ramp-up of the smelter would take about 6 months.

Behrain

Aluminium Bahrain B.S.C. (Alba) signed a contract with international Bechtel Co. ltd. to construct and engineer a sixth potline that would have a capacity of 540,000 tpy. Alba began to upgrade two of its potlines to improve efficiency and increase capacity to 1.05 Mtpy from 970,000 tpy. Alba completed an upgrade of one of its casthouses to increase production of value-added products.

Brazil

Primary aluminium production increased to 793,000 tpy, slightly more than that in 2015. Decreased power prices during the first half of the year encouraged smelters to restart some capacity that was shut down when power prices increased in 2013. However, at the end of 2016, power prices were rising again leading to decline in aluminium consumption for the third year in

Table – 8: World Production of Alumina (By Principal Countries)

(In '000 tonnes of Al_2O_3 content)

Country	2015	2016	2017
World: Total (rounded off)	**116300**	**118400**	**126500**
Australia	20097	20681	20486
Brazil	10452	10886	11014
Canada	1561	1566	1564
China	58978	60906	69017
Germany[e]	1000	1000	1000
India*	4172	4576	4674
Ireland, Republic of	1898	1898	1880
Jamaica	1865	1865	1782
Kazakhstan	1448	1746	1771
Russia	2593	2682	2822
Spain	1 633	1579	1588
USA	4234	2360	1500[e]
Ukraine	1481	1510	1676
Other countries	4853	5149	5726

Source: *World Mineral Production, 2013-2017.*
** During 2015-16, 2016-17 and 2017-18 India's production of alumina was 4,172, 6,075and about 6,119 thousand tonnes, respectively.*

Table – 9: World Production of Aluminium (Primary) (By Principal Countries)

(In '000 tonnes)

Country	2015	2016	2017
World: Total (rounded off)	**57900**	**59600**	**60100**
Australia	1646	1635	1487
Bahrain	961	971	981
Brazil	772	793	802
Canada	2880	3209	3212
China	31518	32698	32273
Iceland	725	700	760
India*	2355	2897	3401
Norway	1224	1247	1253
Russia	3529	3561	3584
Saudi Arabia	839	871	916
South Africa	695	701	716
USA	1587	818	741
UAE	2397	2471	2500
Other countries	6738	7053	7480

Source: *World Mineral Production, 2013-2017, British Geologicaal Survey.*
** During 2015-16, 2016-17 and 2017-18 India's production of aluminium was 2,355, 2,897 and 3,401 thousand tonnes, respectively.*

a row as a result of decreased demand by Brazil's automobile and construction sectors. However, consumption got stabilised during the second half of the year. With increased production and decreased consumption, exports of aluminium in the first 11 months of 2016 increased by 9% compared with those in the same period of 2015. The Government extended the elimination of a 6% tariff on unwrought primary aluminium imports through August 2017. In 2014, the tariff was eliminated as shutdowns of primary smelting capacity forced manufacturers to rely on imports.

Canada

Rio Tinto completed ramping up production at the 420,000 tpy smelter in Kitimat, British Columbia, in March. An expansion and modernisation project, which increased capacity to 420,000 tpy from 280,000 tpy, was completed and started production in June 2015.

China

Primary aluminium production in 2016 was 31.9 million tonnes, slightly more than that in 2015. Aluminum production generally increased throughout the year; production in January was 2.59 million tonnes, and in December production was 2.89 million tonnes. Smelters were restarted in September and October in Gansu, Guizhou, Ningxia, Shanxi, and Sichuan Provinces. New capacity was started in Shandong Province and Guangxi Zhuang, Inner Mongolia, and Xinjiang Uyghur Autonomous Regions. In October, more than 34 million tonnes of capacity was operational, up from 30.4 million tonnes in January. The Government ordered local authorities to strictly control expansion of primary aluminium smelting capacity in December. Provincial and municipal governments were prohibited from giving approval, allocating land, or granting environmental permits for new smelting capacity. Banks were also prohibited from financing new smelting capacity. However, expansion projects with a combined capacity of 2.7 million tonnes were already under construction. Total smelting capacity at end of year 2016 was estimated to be 43.2 million tonnes, 11% more than that at end of year 2015. Capacity increases were focused in Qinghai, Shandong, and Shanxi Provinces and Guangxi Zhuang, Inner Mongolia, and Xinjiang Uyghur Autonomous Regions. Aluminium consumption in China was estimated to be

32.7 million tonnes, 8% more than the amount consumed during 2015. Chiping Xinfa Group Ltd started production in the first quarter of the year at its 1 million tonnes smelter in Shandong Province that was completed in 2015. By May, the production rate was 200,000 tpy and was at 500,000 tpy in July with the ramp-up the expected to be completed by the year end. East Hope Group Ltd was expanding the capacity of its smelter in Xinjiang to 1.2 million tonnes from 800,000 tpy. Completion of the expansion was expected by year end, and capacity already completed was producing at a rate of 900,000 tpy in July. Yinhai Aluminum Ltd. was expanding capacity of its 250,000 tpy smelter in Laibin, Guangxi Zhuang Autonomous Region, to 500,000 tpy.

France

Constellium completed a 100,000 tpy automobile sheet line at its rolling mill in Neuf-Brisach in October.

Germany

In May, Norsk Hydro ASA (Norway) commissioned a 50,000 tpy secondary smelter at its Neuss facility to recycle UBCs. In June, Norsk Hydro announced that it had signed a power-supply contract with Axpo Trading AG (Switzerland) that would provide 150 megawatts (MW) of generating capacity from 2021 to 2025 to its 235,000 tpy primary smelter and rolling mill at Neuss. The contract supplemented a previous contract signed in 2015 that would provide 100 MW of generating capacity from 2018 to 2025. Norsk Hydro started trial production of its rolling mill in Grevenbroich during the third quarter. The capacity of the rolling mill was increased to 200,000 tpy from 50,000 tpy, and output would supply automobile manufacturers. Trimet Aluminium SE's Voerde smelter reached full production capacity of 95,000 tpy in June. Trimet acquired the Voerde smelter in 2014 and had been increasing production gradually.

Greece

Aluminium of Greece signed a power-supply contract with Public Power Corp. of Greece for its 182,000 tpy smelter. The contracted price was retroactive to 2014 and will last through 2020. Aluminium of Greece also started a modernisation project to increase productivity and reduce energy costs of the smelter.

Hungary

Alumetal Group S.A. (Poland) completed the construction of a secondary aluminium smelter in Komarom. The 60,000 tpy smelter started production in September and would supply casting alloys to consumers in the automotive parts industry located in Hungary and southern Europe.

Indonesia

Inalum was expanding capacity of its smelter to 300,000 tpy from 250,000 tpy. Completion of the project was expected by year end 2017. Further expansion to 400,000 tpy by year end 2019 was planned.

Italy

Alcoa began to dismantle its 150,000 tpy Portovesme smelter in 2016. The company, which had been trying to find a buyer for Portovesme since 2011, idled the smelter in November 2012 after being unable to secure a power-supply contract at a competitive price.

Malaysia

Press Metal Berhad's Samalaju smelter completed the rampup of new capacity. The expansion doubled the capacity of the smelter to 640,000 tpy from 320,000 tpy. The rampup of new capacity and the restart of capacity that was temporarily shut down after a fire in May 2015 accounted for the 55% increase in total production in Malaysia in 2016 compared with that in 2015.

Norway

In February, Norsk Hydro temporarily shut down about 20,000 tpy of capacity at the 190,000 tpy Ardal smelter, citing a power failure related to adverse weather. The affected capacity was restarted by mid-year. Norsk Hydro started construction of a 75,000 tpy pilot plant in Karmoy to test more efficient smelting processes. The Karmoy pilot plant would be completed in the second half of 2017. Norsk Hydro signed a power-supply contract with Nordic Wind Power Da to replace the contract with the state-owned hydropower company, Statkraft, when it expires in 2020. Under the new contract, Nordic Wind Power will provide between 0.6 and 1.0 tera watt hours of power from 2020 through 2039.

Romania

Alro S.A. (A subsidiary of Vimetco N.V.) was expanding its secondary production capacity adjacent to its primary smelter in Slatina. The expansion would increase Alro's secondary aluminium capacity to 90,000 tpy from 30,000 tpy and was part of an investment to increase energy efficiency at the Alro's facilities.

Russia

United Company RuSal Plc continued trial production at the 147,000-tpy Boguchansky smelter, which was completed in 2015. The smelter would be powered by the 3,000-mW Boguchanskaya hydroelectric powerplant on the angara River (united Company RuSal Plc, 2016).

FOREIGN TRADE

Exports

Exports of alumina decreased considerably by 10% to 13.61lakh tonnes in 2017-18, from 15.09 lakh tonnes in the previous year. Exports were mainly from UAE (52%), Egypt (16%), Iran (11%), China (10%) and Malaysia (5%). Exports of aluminium and alloys including scrap increased by 30 % to 20.10 lakh tonnes from 15.47 lakh tonnes. Exports in 2017-18 were mainly to Malaysia & Korea, Rep. of (18% each), USA (12%),Turkey (6%) and Italy (5%) (Tables-10 to 12).

Imports

Imports of alumina increased drastically by 58% to 22.24 lakh tonnes from 14.03 lakh tonnes in the previous year. Imports were mainly from Australia (68%), Vietnam (22%), China (3%) and USA & Brazil (2% each). In India, as per Union Budget 2016, the import duty on aluminium was increased to 7.5% from 5%.

Imports of aluminium & alloys and scrap increased by 12% to 19.58 lakh tonnes in 2017-18, from17.51 lakh tonnes in the previous year. The imports were mainly from China (12%), UAE,UK & Malaysia (9 % each), Saudi Arabia (8%), Australia (6%), USA (5%), and Korea, Rep. of & Bahrain (3% each) (Tables- 13 to 15).

Table – 10: Exports of Alumina
(By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**1509464**	**30030430**	**1361382**	**32961495**
UAE	556880	10623135	703993	16435288
Egypt	220946	4218504	214306	4815744
Iran	215360	4364919	154747	4371196
China	267186	5118543	141526	3232628
Malaysia	151953	2953535	61460	1336946
Qatar	++	1	30602	767333
Korea, Rep. of	6655	227063	14682	510330
Chinese Taipei/Taiwan	8206	313491	14209	495892
USA	4908	221271	7526	287401
Thailand	4831	183656	6142	208937
Other countries	72539	1806312	12189	499800

Table – 11: Exports of Aluminium and Alloys Incl. Scrap (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**1546990**	**216150533**	**2010162**	**307872663**
Malaysia	155566	18028339	361598	49980259
Korea, Rep. of	423496	49788762	368118	49273696
USA	125268	23460931	249118	43867625
Turkey	55838	6792464	116416	16425872
Italy	88158	10854597	91670	12719280
Bangladesh	45247	6026563	67386	10739181
Mexico	89478	11001725	73808	10270285
Spain	37065	4761211	66028	9669885
Japan	38429	4571298	66546	9170360
Chinese Taipei/Taiwan	47987	5639013	41070	5715495
Other countries	440458	75225630	508404	90040724

Table – 12: Exports of Aluminium (By Items)

Item	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All items	**1546990**	**216150533**	**2010162**	**307872663**
Aluminium & Alloys : Unwrought	1223846	143869283	1668660	228742070
Aluminium Alloys Unwrought	124740	15884500	290061	41980441
Aluminium Ingots	1093651	127289001	1370375	185604182
Aluminium Unwrought Nes	5455	695782	8224	1157447
Aluminium & Alloys : Worked	148452	25620097	161968	29773337
Aluminium & Alloys :Worked (Bars,Rods,Plates)	85378	12940658	103138	17002182
Aluminium & Alloys :Worked (Bars,Rods,Profiles)	43062	9208649	40490	9327033
Aluminium Worked (Bars,Rods,Profiles Etc)	20012	3470790	18340	3444122
Aluminium & Alloys, Worked, Nes	166890	45497562	171193	48040364
Aluminium & Scrap	4173	383166	4853	525498
Aluminium Powders & Flakes	3629	780425	3488	791394

Table – 13: Imports of Alumina (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**1403569**	**33417506**	**2224196**	**60483411**
Australia	1051908	22110083	1513984	38401968
Vietnam	222186	4277979	493077	12744335
China	60390	2726012	68773	3423962
USA	1621	473550	33799	1378628
Brazil	95	7431	45221	1055740
Netherlands	29903	1430761	24316	1054990
Germany	9845	860843	15024	990715
France	7857	287316	10500	399682
Canada	4632	480880	3570	367617
Bahrain	7468	264934	7597	247245
Other countries	7664	497717	8335	418529

Table – 14: Imports of Aluminium Alloys Incl. Scrap (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**1750582**	**233259468**	**1957740**	**291548386**
China	230656	44390014	238223	48672745
UAE	196896	23677540	181869	25792975
Malaysia	134211	17292071	176380	25725805
UK	145020	16435126	179215	22544652
Saudi Arabia	125139	13605945	148505	19053035
USA	76683	9538609	107564	14401509
Korea, Rep. of	40488	8903536	63725	14327799
Australia	95595	10603870	109866	13708563
Bahrain	56236	7139317	65922	9710379
Germany	41471	8057882	43086	8754607
Other countries	608187	73615558	643385	88856317

Table – 15: Imports of Aluminium (By Items)

Item	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All items	**1750582**	**233259468**	**1957740**	**291548386**
Aluminium & Alloys:Unwrought	422355	52606221	360844	51924875
Aluminium Alloys Unwrought	57467	7341645	47670	7850732
Aluminium Ingots	354355	43896334	304769	42875320
Aluminium Unwrought Nes	10533	1368242	8405	1198823
Aluminium & Alloys:Worked	349777	67192137	399951	80541698
Aluminium & Alloys:Worked (Bars,Rods,Plates)	96345	19554426	139919	27416760
Aluminium & Alloys:Worked (Bars,Rods,Profiles)	199338	38498352	198661	42027852
Aluminium Worked(Bars,Rods,Profiles Etc)	54094	9139359	61371	11097086
Aluminium &Alloys,Worked,Nes	44822	18980428	72630	26783334
Aluminium & Scrap	931279	94049706	1121435	131753050
Aluminium Powders & Flakes	2349	430976	2880	545429

FUTURE OUTLOOK

As per the industry sources, the primary aluminium demand in India is expected to reach 6 million tonnes by 2025, which equates 4.1 kg of per capita aluminium consumption, whereas at present per capita aluminium consumption in India is around 2.5 kg which is much below the global average of 11kg. Thus, Indian market offers a huge potential for demand growth of Aluminium Industry. To reach the global average of 11 kg per capita, India will require an additional annual consumption of 16 million tonnes, thus, making it the second largest consumer in the world

Aluminium contributes to nearly 2% of manufacturing GDP and with projected consumption growth, the share (% of manufacturing GDP) may go higher.

Aluminium consumption may likely to increase due to government's key flagship programs like Make in India, National Capital Goods Policy, Development of 100 smart cities and government's commitment to reach a 100 GW solar capacity by 2022 from 20 GW today.

Aluminium has forward linkages with key sectors like aviation, defense, auto, electricity, construction, packaging, machinery, marine etc. and backward linkages with mining, chemical industry, power, machinery. By speeding up investment in sectors with high backward and forward multipliers, the industrialisation process can be speeded up accelerating economic growth.