

LEAD & ZINC



Indian Minerals Yearbook 2018

(Part- II : Metals & Alloys)

57th Edition

LEAD AND ZINC

(ADVANCE RELEASE)

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

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

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10 Lead & Zinc

Lead is a soft, heavy, toxic and highly malleable metal. It is bluish white when freshly cut, but tarnishes to dull grey when exposed. Both lead & zinc are found to occur together in ore along with other metals like silver and cadmium. Zinc is a silvery blue-grey metal with a relatively low melting and boiling point.

World wide largest single use of lead today is in the manufacture of lead-acid storage batteries about 74%, while the single largest use for zinc is in the Galvanising Industry about 50%.

The country has the self-sufficiency in respect of zinc. In contrast, there is short supply of lead vis-a-vis the demand in the country.

The ever increasing demand for lead especially from Lead Acid Battery Sector is met by the thriving market of lead scrap recycling. Government of India has enacted Battery Management and Handling Rule (BMHR), 2002, which will further increase the availability of scrap from the Organised Sector. It is estimated that 56% of refined lead produced worldwide is from recycled material. Producing lead through this route requires around one-third of the energy needed to extract it from its ores. Recovery of secondary zinc and lead is economically more attractive because of certain advantages. Besides, lower energy consumption, it also entails low capital cost, less environmental hazards and high metal contents.

HZL is the only producer of primary lead and primary zinc in 2017-18 due to shutdown of the operation of Edayar Zinc Limited (EZL). Edayar Zinc Limited (Formerly Binani Zinc Limited) produced zinc from imported concentrates. During the year 2017-18, EZL did not operate its plant and pursuant to repealing of Sick Industrial Companies (Special Provisions) Act, 1985, the reference made to Board of Industrial and Financial Reconstruction (BIFR) got abated.

RESERVES / RESOURCES

The total reserves/ resources of lead and zinc ore as on 1.4.2015 as per NMI data base based on UNFC system have been estimated at 749.46 million tonnes. Of these, 106.12 million tonnes (14.16%) fall under 'Reserves' category while balance 643.34 million tonnes (85.84%) are classified as 'Remaining Resources'.

The reserves/resources of ore containing + 10% Pb & Zn were estimated at 124.23 million tonnes (16.57%), ore containing 5 to 10% Pb & Zn were 329.88 million tonnes (44%) and ore containing less than 5% Pb & Zn were 295.35 million tonnes (39.41%).

The total metal content in reserves/ resources of lead is 13 million tonnes and that of zinc is 36.36 million tonnes and for lead & zinc metal is 0.14 million tonnes. In terms of reserves, 2.48 million tonnes of lead metal and 9.99 million tonnes of zinc metal have been estimated. Rajasthan is endowed with the largest reserves/ resources of lead-zinc ore amounting to 670.34 million tonnes (89.44%), followed by Andhra Pradesh 22.69 million tonnes (3.03%), Madhya Pradesh 14.84 million tonnes (1.98%), Bihar 11.43 million tonnes (1.52%) and Maharashtra 9.27 million tonnes (1.24%). Resources are also established in Gujarat, Meghalaya, Odisha, Sikkim, Tamil Nadu, Uttarakhand and West Bengal (Table-1).

EXPLORATION & DEVELOPMENT

The Exploration & Development details, if any, are shown in the review on Exploration & Development in "General Reviews".

Table – 1 : Reserves/Resources of Lead & Zinc Ore as on 1.4.2015
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining Resources							Total resources (A+B)	
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
		STD121	STD122			STD221	STD222						
All India													
Ore	31662	68687	5767	106116	5564	17411	31297	37055	192083	355403	4530	643343	749459
Lead metal	624.56	1666.02	191.76	2482.34	119.31	521.74	780.56	690.65	2171.43	6237.67	-	10521.36	13003.7
Zinc metal	2871.75	6728.14	399.63	9999.52	364.08	940.26	1362.05	1941.94	7931.06	13722.2	101.65	26363.24	36362.76
Lead & Zinc metal	-	-	-	-	-	-	-	-	-	120.76	22.37	143.13	143.13
By Grades													
Ore with (+)10%													
Pb & Zn	17597	36790	-	54387	155	148	81	-	24850	44605	-	69839	124226
Ore with 5-10 %													
Pb & Zn	14065	31897	5767	51729	5280	17146	31216	32449	29335	162730	-	278156	329885
Ore with (-)5%													
Pb & Zn	-	-	-	-	129	117	-	4606	137898	148068	4530	295348	295348
Lead metal	624.56	1666.02	191.76	2482.34	119.31	521.74	780.56	690.65	2171.43	6237.67	-	10521.36	13003.7
Zinc metal	2871.75	6728.14	399.63	9999.52	364.08	940.26	1362.05	1941.94	7931.06	13722.2	101.65	26363.24	36362.76
Lead & Zinc metal	-	-	-	-	-	-	-	-	-	120.76	22.37	143.13	143.13
By States													
Andhra Pradesh													
Ore	-	-	-	-	-	-	-	1000	4159	17530	-	22689	22689
Lead metal	-	-	-	-	-	-	-	28.70	119.53	688.65	-	836.88	836.88
Zinc metal	-	-	-	-	-	-	-	12.40	43.57	7.19	-	63.16	63.16
Bihar													
Ore	-	-	-	-	-	-	-	-	435	11000	-	11435	11435
Lead metal	-	-	-	-	-	-	-	-	-	24	-	24	24
Zinc metal	-	-	-	-	-	-	-	-	14.75	24.00	-	38.75	38.75
Gujarat													
Ore	-	-	-	-	2470	3010	1380	129	-	200	-	7189	7189
Lead metal	-	-	-	-	74.1	90.3	41.4	3.9	-	-	-	209.70	209.70
Zinc metal	-	-	-	-	123.5	150.5	69	1.1	-	-	-	344.10	344.10
Lead & Zinc metal	-	-	-	-	-	-	-	-	-	0.9	-	0.90	0.90
Madhya Pradesh													
Ore	-	-	-	-	129	117	-	1510	4006	5930	3150	14841	14841
Lead metal	-	-	-	-	-	-	-	26.12	5.13	5.04	-	36.29	36.29
Zinc metal	-	-	-	-	5.2	4.71	-	114.76	41.93	186.02	101.12	453.74	453.74
Maharashtra													
Ore	-	-	-	-	-	-	-	1967	6305	1000	-	9272	9272
Zinc metal	-	-	-	-	-	-	-	133.56	428.11	28	-	589.67	589.67
													(Contd.)

(Contd.)

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Table - 1 (Concl'd.) (In 000' tonnes)

Grade/State	Reserves				Remaining Resources							Total resources (A+B)	
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334		Total (B)
		STD121	STD122			STD221	STD222						
Meghalaya													
Ore	-	-	-	-	-	-	-	-	880	-	-	880	880
Lead metal	-	-	-	-	-	-	-	-	16.50	-	-	16.50	16.50
Zinc metal	-	-	-	-	-	-	-	-	14.00	-	-	14.00	14.00
Odisha													
Ore	-	-	-	-	-	961	119	-	-	670	-	1750	1750
Lead metal	-	-	-	-	-	34.32	4.25	-	-	38.39	-	76.96	76.96
Rajasthan													
Ore	31662	68687	5767	106116	2965	12888	29734	28779	170547	317929	1380	564221	670338
Lead metal	624.56	1666.02	191.76	2482.34	45.21	390.22	733.23	490.82	1860.47	5462.09	-	8982.04	11464.38
Zinc metal	2871.75	6728.14	399.63	9999.52	235.38	772.17	1289.91	1514.15	7145.53	13435.31	0.53	24392.98	34392.5
Lead & Zinc metal	-	-	-	-	-	-	-	-	-	119.86	22.37	142.23	142.23
Sikkim													
Ore	-	-	-	-	-	436	64	300	-	150	-	950	950
Lead metal	-	-	-	-	-	6.9	1.68	-	-	-	-	8.58	8.58
Zinc metal	-	-	-	-	-	12.88	3.14	3	-	1.05	-	20.07	20.07
Tamil Nadu													
Ore	-	-	-	-	-	-	-	200	590	-	-	790	790
Lead metal	-	-	-	-	-	-	-	2.26	5.48	-	-	7.74	7.74
Zinc metal	-	-	-	-	-	-	-	11.76	24.76	-	-	36.52	36.52
Uttarakhand													
Ore	-	-	-	-	-	-	-	3170	1790	660	-	5620	5620
Lead metal	-	-	-	-	-	-	-	138.85	34.25	9.50	-	182.60	182.60
Zinc metal	-	-	-	-	-	-	-	151.21	87.99	27.63	-	266.83	266.83
West Bengal													
Ore	-	-	-	-	-	-	-	-	3371	335	-	3706	3706
Lead metal	-	-	-	-	-	-	-	-	130.07	10.00	-	140.07	140.07
Zinc metal	-	-	-	-	-	-	-	-	130.42	13.00	-	143.42	143.42

Figures rounded off.

PRODUCTION & STOCKS

Lead & Zinc Ores and Concentrates

The entire output of lead & zinc ore and concentrates in 2016-17 and 2017-18 was reported by mines owned by Hindustan Zinc Ltd, a private sector company (Tables- 2 to 8).

The production of lead and zinc ore at 12.61 million tonnes in 2017-18 increased by 6% as compared to that in the previous year (Tables-2 & 3). The metal content of lead and zinc in the ore produced in 2017-18 works out to 2,27,248 tonnes and 8,31,938 tonnes respectively .

During the year 2017-18, 13.23 million tonnes of lead & zinc ore was treated as against 10.84 million tonnes in 2016-17 (Table-4).

The production of lead concentrates in 2017-18 at 3,06,399 tonnes increased by 14% as compared to the previous year. Entire production of lead concentrates was reported from Rajasthan (Tables - 5 & 6).

The production of zinc concentrates increased from 14,84,244 tonnes in 2016-17 to 15,39,655 tonnes in 2017-18. The entire production of zinc concentrates was reported from Rajasthan (Tables - 7 & 8).

Grade Analysis

All India average metal content of ore treated during 2017-18 worked out to be 8.33% (1.77% Pb and 6.56% Zn) as against 9.47% (1.82% Pb and 7.65% Zn) in 2016-17. The metal content of ore treated at Rampura Agucha mine in Bhilwara district Rajasthan was the highest at 11.86% (1.52% Pb and 10.34% Zn). The lead concentrates produced during 2017-18 were of grade 56.73% Pb as against 56.28% Pb in 2016-17. Metal content of zinc concentrates produced worked out to 50.18% Zn in 2017-18 as against 50.92% Zn in the previous year.

Stock

Mine-head closing stocks of lead concentrates in 2017-18 were 32,555 tonnes as against 7,917 tonnes in 2016-17. The entire quantity of the stocks at the end of the year was held in Rajasthan (Table-9).

Mine-head closing stocks of zinc concentrates in 2017-18 were 24,834 tonnes as against 66,595 tonnes in 2016-17. The entire quantity of the stocks was held in Rajasthan (Table-10).

Employment

The average daily labour employed in lead and zinc mines during the year 2017-18 under review was 8,391 as against 7,337 in 2016-17.

Lead and Zinc Metals

The production of primary lead during 2017-18 increased to 1,68,245 tonnes from 1,42,231 tonnes during the previous year. The entire output of primary lead was from Chanderiya and Dariba smelters of Hindustan Zinc Ltd.

The production of zinc ingot metal at 7,91,461 tonnes in 2017-18 increased by 18% as compared to that in the previous year. Hindustan Zinc Ltd, contributed 100% of the total output. (Tables - 11 to 14).

Table - 2 : Producers of Lead & Zinc Ore, Concentrates & Metals, 2017-18

Name and address of the producer	Location	
	State	District
Hindustan Zinc Ltd,	Rajasthan	Ajmer
Yashad Bhavan,		Bhilwara
Udaipur - 313 004,		Rajsamand
Rajasthan.		Udaipur

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**Table – 3 : Production of Lead and Zinc Ore, 2016-17 and 2017-18
(By State)**

(In tonnes)

State	2016-17			2017-18		
	Ore Produced	Metal content		Ore Produced	Metal content	
		Lead (Pb)	Zinc (Zn)		Lead (Pb)	Zinc (Zn)
India	11881238	213436	888666	12613866	227248	831938
Rajasthan	11881238	213436	888666	12613866	227248	831938

**Table – 4 : Lead and Zinc Ore Treated, 2016-17 and 2017-18
(By State)**

(In tonnes)

State	2016-17			2017-18		
	Ore Treated	Metal content		Ore Treated	Metal content	
		Pb	Zn		Pb	Zn
India	10836827	196767	828750	13232379	233753	868024
Rajasthan	10836827	196767	828750	13232379	233753	868024

**Table – 5 : Production of Lead Concentrates, 2015-16 to 2017-18
(By State)**

(Quantity in tonnes; Value in ₹'000)

State	2015-16		2016-17		2017-18	
	Quantity	Value	Quantity	Value	Quantity	Value
India	261857	7885122	268047	9669267	306399	11429378
Rajasthan	261857	7885122	268047	9669267	306399	11429378

**Table – 6 : Production of Lead Concentrates, 2016-17 and 2017-18
(By Sector/State/Districts)**

(Quantity in tonnes; Value in ₹'000)

State/District	2016-17				2017-18			
	No. of mines	Production			No. of mines	Production		
		Quantity	Pb%	Value		Quantity	Pb%	Value
India	8	268047	56.28	9669267	8	306399	56.73	11429378
Private Sector	8	268047	56.28	9669267	8	306399	56.73	11429378
Rajasthan	8	268047	56.28	9669267	8	306399	56.73	11429378
Ajmer*	1	-	-	-	1	-	-	-
Bhilwara	1	102068	59.33	3294063	1	91412	57.41	2920824
Rajsamand	2	116939	53.17	4278705	2	164327	55.39	5901582
Udaipur	4	49040	57.36	2096499	4	50651	59.89	2606972

*: Reported production of lead and zinc ore only and processing is done along with ore produced from Rampura Agucha mine at Bhilwara.

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**Table – 7 : Production of Zinc Concentrates, 2015-16 to 2017-18
(By State)**

(Quantity in tonnes; Value in ₹'000)

State	2015-16		2016-17		2017-18	
	Quantity	Value	Quantity	Value	Quantity	Value
India	1473811	34943088	1484244	43385599	1539655	49799283
Rajasthan	1473811	34943088	1484244	43385599	1539655	49799283

**Table – 8 : Production of Zinc Concentrates, 2016-17 & 2017-18
(By Sector/State/Districts)**

(Quantity in tonnes; Value in ₹'000)

State/District	No. of mines	2016-17			No. of mines	2017-18		
		Production				Production		
		Quantity	Zn%	Value		Quantity	Zn%	Value
India	@	1484244	50.92	43385599	@	1539655	50.18	49799283
Private Sector	@	1484244	50.92	43385599	@	1539655	50.18	49799283
Rajasthan	@	1484244	50.92	43385599	@	1539655	50.18	49799283
Bhilwara	@	1129276	50.74	30741266	@	1064141	50.11	32475626
Rajsamand	@	290993	50.21	9907697	@	402884	49.56	13616705
Udaipur	@	63975	57.43	2736636	@	72630	54.53	3706952

@ Associated mines with lead concentrates.

**Table – 9 : Mine-head Closing Stocks
of Lead Concentrates,
2016-17 & 2017-18
(By State)**

(In tonnes)

State	2016-17	2017-18 (P)
India	7917	32555
Rajasthan	7917	32555

**Table – 11 : Production of Lead Metal,
2015-16 to 2017-18**

(Quantity in tonnes; Value in ₹'000)

Year	Lead Primary	
	Quantity	Value
2015-16	145257	20363511
2016-17	142231	23270410
2017-18 (P)	168245	28487471

**Table – 10 : Mine-head Closing Stocks
of Zinc Concentrates,
2016-17 & 2017-18
(By State)**

(In tonnes)

State	2016-17	2017-18 (P)
India	66595	24834
Rajasthan	66595	24834

**Table – 12 : Production of Zinc Metal,
2015-16 to 2017-18**

(Quantity in tonnes; Value in ₹'000)

Year	Zinc Ingots	
	Quantity	Value
2015-16	758944	108928344
2016-17	672010	128211275
2017-18 (P)	791461	169157981

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**Table – 13 : Production of Lead (Primary), 2016-17 and 2017-18
(By State/Plant)**

(Quantity in tonnes; Value in ₹'000)

State	Plant	2016-17		2017-18	
		Quantity	Value	Quantity	Value
India		142231	23270410	168245	28487471
Rajasthan	HZL Chanderiya/ Dariba	142231	23270410	168245	28487471

**Table – 14 : Production of Zinc (Ingots), 2016-17 and 2017-18
(By States/Plants)**

(Quantity in tonnes; Value in ₹'000)

State	Plant	2016-17		2017-18	
		Quantity	Value	Quantity	Value
India		672010	128211275	791461	169157981
Rajasthan	HZL Chanderiya/ Debari/Dariba	672010	128211275	791461	169157981

MINING & MILLING

HZL is the only integrated lead and zinc producer in the country. Its operation can be classified into mining and smelting. At present, HZL's eight mines and all mining operations are located in Rajasthan. Eight mines are Rampura-Agucha mine (Bhilwara district), Kayad mine (Ajmer district), Rajpura-Dariba mine, Sindesar-Khurd mine (both in Rajsamand district) and Zawar group of mines (4 mines in Udaipur district), Rajasthan. In 2017-18, at Rampura-Agucha Mine, the opencast operations has been completed and the mine is fully turned into underground mine of lead and zinc, with an annual production capacity of 5.0 million tonnes of lead zinc ore. Sindesar-Khurd mine is the highly mechanised and largest ore producing underground mine with annual production capacity of 4.50 million tonnes. The other six mines viz, Rajpura-Dariba, Zawar group of mines (Mochia, Ballaria, Zawarmala and Baroi) and Kayad mine are underground mines with an annual production capacity of 0.9 million tonnes, 4.0 million tonnes and 1.2 million tonne of lead & zinc ore, respectively (Table-15).

**Table – 15 : Ore Production Capacity of
HZL Mines**

Mine	Ore	Capacity (million tpy)
Total		15.60
Zawar Mines, Distt. Udaipur, Rajasthan.	Zinc-lead	4.00
Rajpura-Dariba, Distt. Rajsamand, Rajasthan.	Zinc-lead	0.90
Sindesar-Khurd Mine, Distt. Rajsamand, Rajasthan.	Zinc-lead	4.50
Rampura-Agucha, Distt. Bhilwara, Rajasthan.	Zinc-lead	5.00
Kayad Distt. Ajmer Rajasthan.	Zinc-lead	1.20

Source : HZL Annual Report 2017-18

Zawar group of mines is a cluster of four underground mines viz. Mochia, Balaria, Zawarmala and Baroi mines and one beneficiation plant for all mines. Zawar group of mines one of the oldest mine and located about 40 km south of Udaipur. Lead-Zinc ore of the mines is divided into stope blocks which are drilled and blasted using sub-level open stoping mining method. Loading and transportation are done using combination of LHDs, LPDTs, LOCO and shaft hoisting to surface. The ore is further crushed and then undergoes a flotation process to produce concentrate. In 2017-18, the Zawar group of mines produced 2.17 million tonnes ore at 2.5% Zn and 2% Pb feed grade. During the year 2017-18, Mochia and Baroi declines were connected to production level enhancing hauling capacity. Mochia - Balaria portal & North Baroi were developed as new entry locations.

The Rajpura-Dariba mine of HZL is an underground mine commissioned in 1983. It is located at 75 kilometers north-east of Udaipur, Rajasthan. Mining is carried out by using the Vertical Crater Retreat method and Blast hole stoping method. Mined out stopes are backfilled with cement tailings. During the year 2017-18, Rajpura- Dariba Mine produced 0.89 million tonnes ore at 4.8% Zn and 1.1% Pb feed grade. In 2017-18, the development of decline was completed such as all parts of the mine is accessible through decline. Rock Breaker was installed in underground crusher to improve fragmentation for higher metal recoveries during beneficiation. A monitoring system was installed to improve load carrying capacity of trucks. At different levels in underground raise boring was done to improve ventilation system.

Rampura-Agucha mine is located at 230 km north of Udaipur in Bhilwara district, Rajasthan and it was commissioned in 1991. It is high zinc-lead reserve grades averaging 15.7%. In 2017-18, the production of ore carried out from both surface mining and underground mining. The year 2017-18 is the last year for the mine to produce ore from surface mining and the mine is fully transformed from surface mining to underground mining. The underground mine project includes a production shaft of 955 meters depth and 7.5 m diameter at hauling capacity of 3.75 million tonnes

per annum, two declines from surface, two ventilation shafts and a paste fill plant. The underground mine development achieved 20 km in the year 2017-18. In the year 2017-18, the mine produced 3.8 million tonnes of ore which is 30% of total ore production of HZL as against 40% last year at 11.4% Zn and 1.6% Pb feed grade. The main production shaft is expected to commence commercial production by 2019.

Sindesar-Khurd mine is located at 6 km NNE of Rajpura-Dariba mine and 82 km north east of Udaipur. It is an underground mine, commissioned in 2006. The average reserve grade of Sindesar-Khurd Mine is 7% with its silver rich lead-zinc deposit. The mine lies on the same geological belt as the Rajpura- Dariba mine. Access to the mine is presently through declines (North and South), while ore hauling is planed to start through shaft in the year 2019. During the year 2017-18, Sindesar- Khurd mine produced 4.5 million tones ore at 3.9% Zn and 2.1% Pb grade. It produces high silver content ore at 113 gm/tonne. The mine is set to reach the enhanced targeted capacity of 4.5 million tonnes. The mine consists of multiple standalone deposits or auxiliary lenses, which gives three standalone production centres at present. The production is carried out from the main lode which has an annual capacity of 2.5 million tonnes & two auxiliary lens SKA2 and SKA6, are functioning at 1.5 million tonnes capacity. The development of the main production shaft of 1050 m depth, and 7.5 m diameter having 3.75 million tonnes hauling capacity is under progress. In 2017-18, the SKA6 section of the mine has been fully converted to wi-fi. In Sindesar - Khurd mine 21 tonnes capacity Load Haul Dump (LHD) machines and 65 tonnes capacity Low Profile Dump Truck (LPDT) machines are working for ore transportation.

Kayad mine is newly developed underground mine near Ajmer, Rajasthan. It is commissioned in 2013 having small but high grade ore at 6.4% Pb & Zn ore deposit. The mine has access through decline for ore and waste transportation. During the year 2017-18, Kayad mine has received environmental clearance to increase ore production from one million tonnes to 1.2 million tonnes per annum. Longitudinal Long Hole Open Stopping method is

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Table – 16 : Company-wise Capacity and Production of Primary Lead and Zinc

(In tonnes)

Company	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	-	-	-	38000	-	-
Total	201000	142231	168245	881000	672010	791461

used for the steeper and thinner portion of ore body and Transverse Long Hole Open Stopping method for flatty dipping and thick portion of the ore body. In the year 2017-18, the mine produced 1.2 million tonnes ore as compared to one million tonnes in the previous year at average feed grade of 8.7 % Zn and 1.2% Pb. The ore from Kayad mine is treated at Rampura Agucha's beneficiation plant.

SMELTING

Primary lead was produced entirely by HZL which operated smelter at Chanderiya and Dariba having capacity of 85,000 tonnes and 1,16,000 tonnes per annum of lead metal, respectively. Thus, the smelting capacity for lead (primary) in the country presently is 2,01,000 tonnes per annum. Company wise smelting capacity of lead and zinc smelters is furnished in Table - 16.

The smelting capacity of HZL for zinc is distributed between three smelters at Debari (88,000 tonnes), Chanderiya (5,35,000 tonnes) and Dariba (2,20,000 tonnes). Edayar Zinc Ltd's plant at Binanipuram (Aluva), Kerala with capacity of 38,000 tonnes per annum. Thus, the smelting capacity for zinc in the country is 8,81,000 tonnes per annum. EZL produced zinc from imported concentrates but since the company declared as sick unit, it did not operate its plant. Besides lead & zinc capacities, HZL has capacities to produce 600 tonnes per annum of silver. HZL is an India's largest manufacturer of sulphuric acid which is by-product of its smelting operations. In 2017-18, HZL produced 1.40 million tonnes of sulphuric acid, as compared to 1.18 million tonnes in the previous year.

The Registrar of Companies issued a fresh certificate to change in name from "Binani Zinc Limited" to "Edayar Zinc Limited" with effect from 6th October 2015. Edayar Zinc Ltd (EZL) has been incurring huge fixed costs due to shutdown of the plant from April 2014 onwards, except for a brief period of 59 days when the plant operated. In the year 2017-18, the Edayar Zinc Limited did not operate its plant and pursuant to the repealing of Sick Industrial Companies (Special Provisions) Act, 1985 (SICA), the reference made to Board of Industrial and Financial Reconstruction (BIFR) got abated.

Chandaria Lead-zinc smelting complex is located at 110 km North of Udaipur in Chittorgarh district, Rajasthan. It was commissioned in 1991 with an initial production capacity of 70,000 tonnes per annum. Chandaria Lead-zinc smelting complex comprises one lead-zinc pyrometallurgical smelter having production capacity of 1,05,000 tonnes zinc and 35,000 tonnes lead, one Ausmelt lead smelter having production capacity of 50,000 tonnes and two Hydro metallurgical zinc smelters namely Hydro-I & Hydro-II having production capacity of 2,15,000 tonnes zinc each. It employs Roast Leach Electro-Wining technology in its Hydro metallurgical smelters, Imperial Smelting process in lead-zinc smelter and Top submerged Lance Technology (Designed by M/s Ausmelt Ltd, Australia) coupled with Cansolv Technology for its lead smelter. In the year 2017-18, Chandaria Lead-Zinc smelter produced 4,97,049 tonnes of zinc and 72,450 tonnes of lead as compared to 4,35,664 tonnes of zinc and 46,474 tonnes of lead

in previous year. A new project of 1,60,000 million tonne of Zinc Residue Fuming Project will commence by 2019. Zinc fuming is a process that recovers valuable metals from zinc residue and will help in higher recovery of zinc, lead and silver. At the Hydro plant, Hydro-2 cell house was upgraded from 192 kA to 200 kA enhancing zinc output.

Zinc Smelter Debari was commissioned in the year 1968 with an initial production capacity of 18,000 tonnes per annum of zinc and now it reached to 88,000 tonnes per annum of zinc. It is located at 13 km north of Udaipur, Rajasthan. Zinc smelter Debari employs Roast leach Electro-Winning Technology at its Hydro metallurgical zinc smelter. The plant has three roasting facilities, leaching and purification section, electrolysis, melting and casting sections. It produced surplus calcine, an intermediate product, which is supplied to the rest of the Hydro metallurgical zinc smelter. In the year 2017-18, zinc smelter Debari produced 76,979 tonnes of zinc as compared to 46,442 tonnes of zinc in the previous year.

Dariba smelting complex is located at 75 km north-east of Udaipur near to Rajpura-Dariba Mine and 7 km from Sindesar Khurd mine in Rajsamand district, Rajasthan. The zinc smelter at Dariba was commissioned in March 2010 and has a capacity of 220,000 tonnes per annum while lead smelter was commissioned in July, 2011 with a capacity of 1,16,000 tonnes lead per annum. Dariba smelting complex employs Roast Leach Electro-winning technology at its hydro metallurgical zinc smelter. The plant has two roasting facilities, a leaching and purification section and a cell house. The lead smelter employs SKS bottom blowing technology. The plant consists of SKS furnace – bottom blowing, blast furnace, electric arc furnace & fuming furnace and electro-refining. Fuming furnace is also installed to produce zinc-oxide from blast furnace slag. In the year 2017-18, the smelter produced 2,17,433 tonnes of zinc and 95,797 tonnes of lead metal as compared to 1,89,882 tonnes of zinc and 92,535 tonnes of lead metal in the previous year. Dariba Smelting Complex lead plant steam was utilised in Dariba Smelting Complex Captive Power Plant (CPP) for reducing the auxiliary steam consumption.

The product range of HZL constitutes two grades, namely, Special High Grade (SHG) zinc containing 99.995% Zn (min.) and Prime Western (PW) containing 98.65% Zn (min.). Both these products are available in the form of slabs weighing 25 kg, SHG Jumbo weighing 1,000 kg and PW Jumbo weighing 600 kg. Lead is available as HZL Grade containing 99.99% Pb (min.) in the form of slab weighing 24 kg. In October 2016, a new zinc alloy value added product, HZDA or Hindustan Zinc Die-cast Alloy was added to the Company's portfolio from Chanderiya Lead-Zinc Smelter.

POLLUTION CONTROL & ENVIRONMENTAL MANAGEMENT EFFORTS

The standard for Emission or Discharge of Environment Pollutant from lead & zinc smelting is prescribed in Schedule-I of the Environment (Protection) Rules, 1986. The standards for Particulate Matter Emission in concentrator for lead & zinc smelter is 150 mg per normal cubic metre and the standard for emission of oxides of sulphur in smelter & convertor is that off-gases must be utilised for sulphuric acid manufacture. The limit of sulphur dioxide emission from stock shall not exceed 4 kg per tonne of concentrate (one hundred percent acid produced).

At underground mines, the tailings generated after beneficiation is utilised to backfill the underground mined stopes and the remaining tailings is stored in tailing dam at various mines location. During the process of recovery of metal at smelters, waste is generated. The waste contains toxic element i.e. waste water effluent sludge, smelter slag leach residues, suspended particulate matter (SPM), SO₂, NO_x and toxic metal fumes which are harmful at low exposure generated during the production of lead & zinc metal.

Smelting and mining operations of HZL are working on zero discharge principle and company is committed for efficient utilisation of waste generated at its mines and smelter. The Company has adopted Fumer technology to reduce jarosite generation, which is known to be successful in few Chinese and Korean Zinc Plants.

LEAD & ZINC

During the year 2017-18, the environment expenses of HZL was ₹59 crore. Hindustan Zinc Limited runs a 20 MLD STP in Udaipur, which treated effluent of 6,215,000 Kilolitres during the year 2017-18 and recovered about 5,731,650 kilolitres of water. This STP is a unique PPP initiative of the Company and is counted among the best functioning STPs in the country.

HZL is using internal waste for paste filling of stopes in mines. Remote operations and autonomous fleet in mines keep people away from risk. Some other initiatives in pipeline include ventilation on-demand in mines to reduce energy consumption and use of advance floatation & ore retreatment technology to increase ore-to-metal ratio will reduce waste and increase output.

The sewage treatment plants at Debari and Chanderiya smelters were operated continuously and the recovered water was reutilised in the smelter and for plantation in the colony. Over the years, the company has been voluntarily filing Carbon Disclosure Project (CDP) responses as a proactive step towards reporting carbon footprint emissions.

HZL has entered into a charter on Corporate Responsibility for Environmental Protection (CREP) with MoEF, Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) for achieving a quantum jump in its environmental performance in the coming years.

Many of the secondary lead producing units have operated in the unorganised sector and they create major pollution by emission of lead vapour and SO_x . The small scale units generally do not control process parameters such as smelting temperature, charge to fuel ratio, leakages in the body, etc. As per the National Ambient Air Quality standards, the permissible concentration of lead in ambient air is $0.50 \mu\text{g}/\text{m}^3$ while the permissible limit for SO_x is $50 \mu\text{g}/\text{m}^3$.

RECYCLING OF LEAD & ZINC Lead

The storage battery scrap is the main source of secondary lead production. Lead is one of the

highest recycled metals. Lead is very easy to recycle. It can be re-melted any number of times, and provided enough processes to remove impurities are performed, the final product (termed secondary lead) is indistinguishable from primary lead produced from ore. The amount of lead recycled is about 75% of total lead production in India. More than 80% of lead consumed in the country goes for manufacturing of lead batteries.

Government of India has enacted Battery Management and Handling Rules (BMHR), 2002 to organise the recycling of lead acid batteries and to make available raw material to the lead reproducers. In 2010, the Ministry of Environment and Forest also issued amendments making battery dealers and importers of new lead batteries to register with the respective state regularity bodies and to file periodic returns every six months on collection of used lead batteries. In September, 2010, Central Pollution Control Board also shifted the registration scheme for lead recycling, as a decentralisation move to the state regulatory boards. In 2010, 355 eco-friendly lead recycling units had registered with CPCB for processing used lead batteries which is now more than 550 units in India.

Lead when used as metal in batteries, cable sheathing and sheathing for containing radiation is fully recyclable and it does not lose its properties. There is indeed a thriving industry that recycles lead in the country. However, due to the health risk involved in lead recycling the Central Pollution Control Board issues licences to the lead-reprocessors to ensure adherence to environmental norms.

Zinc

The largest consumer of zinc is the Galvanising Industry. The zinc once used for galvanising as well as for brass making is not recoverable. Hence, the quantum of zinc recycling is comparatively small as compared to lead recycling. The secondary zinc was recovered from pure zinc scrap in the form of sheet cutting, zinc roofings, old zinc anodes and alloys containing zinc as a major constituent.

CONSUMPTION

Consumption of lead and zinc in various industries is not available readily. However, it is known that lead and zinc are consumed in the form of metals as well as in the form of compounds and oxides.

Lead

The Battery Industry consumes about 80% of lead and remaining 20% is consumed in pigments & compounds, rolled and extruded products, alloys, cable sheathing and other industries.

The apparent consumption of lead during the year 2016-17 and 2017-18 was calculated on the basis of production of lead (primary) and imports & exports of refined lead (unwrought). The apparent consumption thus arrived at was 1,75,599 tonnes in 2016-17 and 1,63,435 tonnes in 2017-18 (Table-17). In addition to this, it is understood that large quantities of recycled lead were also consumed in certain other industries.

Table – 17 : Apparent Consumption of Lead (Based on Production of Lead (Primary), and Imports & Exports of Refined Lead, Unwrought)

(In tonnes)		
Item	2016-17	2017-18
Total Production Lead (Primary)	142231	168245
Total Imports*	110749	119919
Total Exports*	77381	124729
Apparent Consumption (Primary)	175599	163435

* DGCI & S, Kolkata.

Zinc

Owing to its corrosion resistance in varied types of environment, zinc is used for protecting steel by way of galvanising. The Galvanising Industry alone consumes about 57% of zinc, followed by coatings (16%), die-casting alloys (14%), oxides & chemicals (7%) and extruded products (6%). The apparent consumption of zinc during the year 2016-17 and 2017-18 was

calculated on the basis of production of zinc, import & export of zinc (not alloyed). The apparent consumption, thus arrived at was 6,48,481 tonnes in 2016-17 and 6,50,755 tonnes in 2017-18 (Table-18). The data on trade of zinc (not-alloyed) was taken from DGCI&S (HS Code 79011100). In addition to this, some quantities of recycled zinc are also consumed in certain other industries.

Table – 18 : Apparent Consumption of Zinc (Based on Production of Zinc (Ingots) and Imports & Exports of Zinc (not alloyed)

(In tonnes)		
Item	2016-17	2017-18
Total Production Zinc	672010	791461
Total Imports*	179403	117322
Total Exports*	202932	258028
Apparent Consumption	648481	650755

*DGCI&S, Kolkata.

SUBSTITUTES & TECHNICAL POSSIBILITIES

Lead

Battery replacements include batteries of nickel-zinc, zinc lithium chloride, sulphide or nickel lithium hydride. The large-scale commercial use of any of these four possible substitutes was so far precluded by cost and operating problems. Polyethylene and other materials work as substitute in some cable applications.

In construction applications, in place of galvanised sheets, copper and aluminium are alternatives. In corrosive chemical environment, stainless steel, titanium, plastics and cements are substitutes. Tin, glass, plastics and aluminium are alternatives in tubes and containers; iron & steel or bismuth in shots for ammunition; and tin in solder. In Electronic Industry, there has been a move towards lead-free solders with varying compositions of tin, bismuth, silver and copper.

Environmental concerns for lead are limiting the uses, particularly in gasoline, where its use as an anti-knocking agent was phased out by the introduction of catalytic converters. Storage

batteries for industrial load levelling, mains power management and electric vehicles have growing markets. The continued search for weight reduction is reducing the amount of lead per battery, and battery lives are being extended. Possible new developments include the use of lead as an anti-oxidant in asphalt, as a shielding material in nuclear waste, in protection of buildings against radon gases and as a sound buffer. Environmental legislation will inhibit the growth of new uses and possibly eliminate lead from many existing uses. The Organisation for Economic Cooperation & Development (OECD) is actively examining possible restrictions on uses of lead. New techniques to recover lead from concentrates and from scrap are being developed and are bound to become more important in future. Recycling of lead and zinc through environmentally safe processes needs to be encouraged as the growing use of lead and zinc in railway electrification as well as in road transport vehicles have created shortage in the country.

Zinc

Aluminium, magnesium and plastic compete in some die-casting applications. Ceramic and plastic coatings, electroplated cadmium & aluminium and special steel compete in some galvanising applications. Aluminium, magnesium and titanium can replace zinc in chemicals and pigments. Zirconium is an alternative in ceramic and enamel applications. New alloys, e.g. superplastic alloys of zinc and aluminium could be developed. Many elements are substitutes for zinc in chemical, electronic and pigment uses.

WORLD REVIEW

RESERVES

Lead

The world's reserves of lead were estimated at 83 million tonnes in terms of lead content. Australia possesses 29% of the world's reserves followed by China (22%), Russia (8%), Peru, Mexico & Turkey (7% each) and USA (6%), etc. (Table- 19).

**Table – 19 : World Reserves of Lead
(By Principal Countries)**

(In '000 tonnes of lead content)

Country	Reserves
World: Total (rounded off)	83000
Australia ^(a)	24000
Bolivia	1600
China	18000
India*	2500
Kazakhstan	2000
Mexico	5600
Peru	6000
Russia	6400
Sweden	1100
USA	5000
Turkey	6100
Other countries	5000

*Source: Mineral Commodity Summaries, 2019, USGS.
(a) For Australia, Joint Ore Reserve Committee-compliant reserves were about 12 million tonnes.*

** India's total reserve/ resources USGS of lead & zinc as per National Mineral Inventory based on UNFC as on 01.04.2015 are 749.46 million tonnes.*

**Table – 20 : World Reserves of Zinc
(By Principal Countries)**

(In '000 tonnes of zinc content)

Country	Reserves
World: Total (rounded off)	230000
Australia ^(a)	64000
Bolivia	4800
Canada	3000
China	44000
India*	10000
Kazakhstan	13000
Mexico	20000
Peru	21000
Sweden	1400
USA	1100
Other countries	33000

*Source: Mineral Commodity Summaries, 2019, USGS.
(a) For Australia, Joint Ore Reserve Committee-compliant reserves were about 24 million tonnes.*

** India's total reserves/ resources of lead & zinc as per National Mineral Inventory based on UNFC as on 01.04.2015 are 749.46 million tonnes*

Zinc

The world's reserves of zinc were estimated at 230 million tonnes. Australia accounts for 28% of world's zinc reserves, followed by China (19%), Peru & Mexico (9% each), Kazakhstan (6%), USA (5%), India (4%), etc. (Table-20).

PRODUCTION

Lead

World mine production of lead ore was about 4.9 million tonnes in terms of lead content in the year 2017 which is about 2% more than the previous year. China is the leading producing country with 2.3 million tonnes (47%) followed by Australia (9%), USA and Peru (6% each), Mexico (5%), Russia & India (4% each), etc. (Table-21).

Zinc

World mine production of zinc ore was at 12.50 million tonnes in terms of zinc content in the year 2017. China is at top position with 4.3 million tonnes thus contributed 34% followed by Peru (12%), Australia (7%), India & USA (6% each), Mexico (5%), Kazakhstan & Canada (3% each), etc. (Table- 22).

**Table – 21 : World Mine Production of Lead
(By Principal Countries)**

(In '000 tonnes of metal content)			
Country	2015	2016	2017
World Total (rounded off)	5000	4800	4800
Argentina	30	28	28
Australia	653	441	459
Bolivia	75	90	112
China	2335	2337	2300
India*(d)	144	151	173
Iran	44	47	48
Ireland	31	20	17
Kazakhstan	41	71	112
Korea, Dem. P.R. of °	33	39	34
Macedonia	38	31	40
Mexico	264	242	243
Morocco	32	30	38
Peru	316	314	307
Poland	69	63	74
Russia	180	195	202
South Africa	35	39	48
Sweden	79	76	71
Tajikistan°	31	47	51
Turkey	33	29	30
USA	367	335	302
Other countries	170	174	211

Source: World Mineral Production, 2013-17, BGS.

* India's production of primary lead in 2014-15, 2015-16 and 2016-17 was 127 thousand tonnes, 145 thousand tonnes and 142 thousand tonnes respectively.

(d) Year ended 31st March following that stated.

**Table – 22 : World Mine Production of Zinc
(By Principal Countries)**

(In '000 tonnes of metal content)			
Country	2015	2016	2017
World Total (rounded off)	13400	12600	12500
Australia	1610	884	841
Bolivia	442	487	504
Canada	290	301	344
China	4749	4711	4300°
India*(d)	741	756	784
Ireland	236	148	131
Kazakhstan	384	366	375
Mexico	787	662	671
Peru	1421	1337	1473
USA	825	805	730°
Other countries	1915	2143	2347

Source : World Mineral Production, 2013-17, BGS

*India's production of primary zinc in 2014-15, 2015-16 and 2016-17 was 733 thousand tonnes, 759 thousand tonnes and 672 thousand tonnes respectively.

(d) Year ended 31st March following that stated.

Lead

As per World Metal Statistics, 2018, report, world refined lead production (includes secondary production) was 11.22 million tonnes in which secondary lead production was 6.27 million tonnes in the year 2017. Secondary lead production represented about 56% of total refined lead production worldwide in 2017 which is similar in 2016. The global production of refined lead in the year 2017 increased by 0.4% than previous year. China is the largest producer of refined lead with 4.71 million tonnes in the year 2017 and contributed 42 % of world refined lead production followed by USA (9%), Korea Rep. of (7%), India (5%), Germany, United Kingdom & Mexico (3% each), etc.

World consumption of refined lead was 11.61 million tonnes in the year 2017 (including secondary lead) which is 2.7% more than the previous year. China is the largest refined lead consuming country with 4.8 million tonnes consumption during the year 2017 which was 41.3% of world refined lead consumption followed by USA (14%), Korea, Rep.of & India (5% each), Germany (4%), and Italy (2%), etc. International Lead & Zinc Study Group (ILZSG) anticipates that global demand for refined metal will rise to 11.87 million tonnes in 2019. This will mainly be a

consequence of increase in consumption in India, Japan and Korea Rep. of that are expected to more than offset a reduction in China of 1.1%.

A generalised view of the development in various countries along with the country-wise description sourced from latest available publication of Minerals Yearbook of 'USGS', 2015 furnished as below.

Australia

In 2015, lead mine production in Australia decreased by about 10% as a result of reduced production at Ivern Inc.'s (Canada) Paroo Station Mine (85,000-t/yr production capacity) in Western Australia. In January 2015, the mine was placed on care-and-maintenance status owing to market conditions, primarily due to the decline in lead prices. In 2014, the mine produced 80,900 tonnes of lead in concentrates.

Canada

Trevali Mining Corp. announced the commissioning of the mill at its Caribou Zinc Mine in northern New Brunswick following the start of underground mining operations earlier in the year. The company expected that the mill could process 3,000 t/d of ore and produce about 14,000 t/y of lead in concentrate at full capacity.

China

In 2015, China continued to be the leading global producer and consumer of lead and the leading producer of lead-acid batteries, although declines were reported for each compared with those in 2014. Refined lead production in 2015 decreased by 7% to 4.40 million tonnes from 4.74 million tonnes in 2014, the second consecutive annual decrease. The decline in primary refined lead production was attributed to less available production capacity in 2015 following plant shutdowns for maintenance or environmental reasons. The decline in secondary production was partially attributed to the reduction of a value-

added tax rebate to 30% from 50% in July 2015 that increased the tax burden on secondary lead producers and resulted in some producers cutting back production during the second half of 2015. Lead in concentrate production in 2015 was about 2.40 million tonnes, a 17% decrease from the 2.90 million tonnes produced in 2014 and an 18% decrease from production in 2013. The decrease in mine production was attributed to price-induced production cutbacks and an increase in environmental regulations for mines by Provincial government.

According to the ILZSG, consumption of lead in China decreased by 6% to 4.41 million tonnes in 2015 from 4.71 million tonnes in 2014. The decline in domestic lead consumption was attributed to a slowdown in sales of electric bikes in 2015, as was the case in 2014, which accounted for about 30% of annual lead consumption.

Zinc

World refined zinc production was 13.8 million tonnes in the year 2017 and is 0.7% increase than the previous year.

China was the largest producer of refined zinc with 6.22 million tonnes in the year 2017 which contributed 45% of world refined zinc production followed by Korea Rep. of (8%), India (6%), Canada, Japan & Spain (4% each), Australia (3%), Peru & Kazakhstan (2% each), etc.

The world consumption of refined zinc was 14.23 million tonnes in the year 2017 which is 3% increase than the previous year. China was the largest refined zinc consuming country with 6.96 million tonnes in the year 2017 which accounted for 49% of world followed by USA (6%), India & Korea, Rep. of (5% each), Germany & Japan (3% each), etc.

ILZSG forecasts that world demand of refined zinc metal is expected to increase by 0.6% to 13.77

million tonnes in 2019. Zinc demand is forecasted due to zinc consumption will be rise by 0.7% in Europe, 1% in USA, 0.6% in China. Zinc consumption is also expected to rise in India and Mexico and to remain stable in Japan & Korea Rep. of.

To give a generalised view of the development in various countries, the country-wise description is sourced from latest available publication of Minerals Yearbook of 'USGS', 2016 is furnished below.

Australia

Zinc mine production in Australia decreased by 44% in 2016 as compared with the previous year mainly as result of several mine closures. Glencore moved the Mount Isa Mine's Black Star open pit zinc mines to a maintenance phase after mining out the existing reserves. Consolidated Tin Mines also closed its Mount Garnet mine until additional funding could be secured.

Canada

Zinc mine production in Canada was 322,000 tonnes in 2016, 16% more than that in 2015. Production increased in 2016 owing mostly to increase in zinc production at Glencore's Kid Creek mine and Matagami mill and also to record production at Caribou Mine of Trevali Mining Corporation. This increased production offset the closure of Yukon Zinc Corporation's Wolverine Mine and Nyrstar's Myra Falls Mine.

China

Zinc mine production in China increased slightly in 2016 from that of 2015 to 4.8 million tonnes and took place predominantly in the Nei Mongol Autonomous Region and Hunan & Yunnan Provinces, where combined production accounted for more than one-half of China's zinc in concentrate production in 2016. According to Beijing Antaika Information Development Co. Ltd (Antaika), increase in zinc prices and decrease in smelter treatment charges resulted in considerable

mine profit which stimulated an increase in output. As a result of the increase in mine production, the imports of zinc in concentrate decreased by 38% in 2016 to about 2 million tonnes. About 50% of China's zinc concentrate imports (gross weight) were sourced from Australia and Peru.

Zinc metal production increased slightly to 6.3 million tonnes in 2016 as compare to 6.1 million tonnes in 2015. Zinc smelters in China were reported to have operated at stable production rates in 2016. Hunan, Shaanxi, and Yunnan were the three leading zinc-metal-producing Provinces in China and accounted for slightly over one-half of the country's zinc metal production in 2016. Domestic smelter production capacity in China remained unchanged in 2016 compared with increase in 2015.

China's zinc consumption increased in 2016 from that of 2015 coinciding with higher utilization rate in the country's automotive, construction and galvanizing sectors. ILZSG reported a 9% increase in zinc consumption in 2016 compared with slight decrease in 2015.

Finland

Zinc mine production in Finland increased significantly in 2016 owing to the ramp-up and first full year of production at Terrafame Ltd.'s mine located in Sotkamo. The mine produced 22,600 tonnes of zinc during its first full year. Zinc smelter production decreased by 5% in 2016 owing to disruptions in production, including fire in the cell house, and lower recovery levels at Boliden's Kokkola smelter.

Honduras

Zinc mine production decreased by 37% in Honduras in 2016. The Nyrstar NV sold the El Mochito mine, the only zinc mine in Honduras to Ascendant Resources Inc., Canada. The new owner agreed to sell 100% production of the zinc concentrate to Nyrstar for a period of 10 years. Ascendant announced plans to implement optimization programs focused on increase in mine production.

Ireland

Zinc mine production in Ireland decreased by 37% in 2016 from that of 2015 to 149,000 tonnes of contained zinc mostly as a result of the closure of Vedanta's Lisheen Mine due to reserve depletion. Mining activities and concentrate production at Lisheen stopped in late 2015. Boliden's Tara Mine was the only zinc producing mine in Ireland in 2016.

Peru

Zinc mine production in Peru decreased by 6% in 2016 from that of 2015 mostly as a result of decreased production at the Antamina copper-zinc mine and suspensions of production at Glencore's Iscaycruz Mine and Volcan's Cerro do Pasco mining unit. Zinc production decreased by 12% at Antamina in 2016 to 195,000 tonnes primarily as a result of decrease in copper-zinc ore processed. In 2018 to 2020, zinc production at Antamina was projected to increase as mining was expected to take place in an area of higher zinc ore grades resulting in an increased proportion of copper-zinc ore mined. Copper and zinc production at Antamina can vary significantly from year to year due to the geology of the deposit and the proportion of copper to copper-zinc ore produced. In 2015 Glencore announced plans to reduce its zinc mine production by 500,000 tonnes per year in response to low lead and zinc prices. The suspension of Iscaycruz mine was included in this reduction and the mine remained suspended throughout 2016. Operations at Volcan's Cerro do Pasco mining unit were temporarily suspended from November 2015 to November 2016.

Spain

Zinc mine production increased by an estimated 53% in 2016 compared with that in 2015 mostly as a result of increased production in Aguas Tenidas Mine. The mine located in Valdelamusa, had a zinc production capacity of 58,000 tonnes per annum for the majority of 2016. The company completed work to double zinc capacity to 116,000 tonnes per annum in the fourth quarter of 2016.

FOREIGN TRADE**Lead****Exports**

Exports of lead from the country are in the form of ore & concentrates, lead and alloys & scrap, lead waste & scrap, lead unrefined, refined lead unwrought, pig lead, lead & alloys worked and others.

Exports of lead ores and concentrates were negligible in 2017-18 as compared to only one tonne in 2016-17.

Exports of lead and alloys including scrap increased to 1,59,543 tonnes during 2017-18 as compared to 1,08,065 in the preceding year. Export of lead and alloys increased to 1,59,530 tonnes in 2017-18 as compared to 1,08,064 tonnes in the previous year. Export of refined lead, unwrought also increased to 1,24,729 tonnes in 2017-18 as compared to 77,381 tonnes in the previous year. In 2017-18, USA with 35% followed by Rep. of Korea (26%) and Bangladesh (8%) were the major export destinations for refined lead, unwrought (Tables- 23 to 29).

Imports

Imports of lead in India are in the form of lead ores & concentrates, lead & alloys including scrap, lead & alloys unwrought, pig lead, antimonial lead worked, lead and alloys (bars, rods, plates, etc.).

Imports of lead ores & concentrates decreased drastically by 64% to 2,220 tonnes in 2017-18 as compared to 6,217 tonnes in 2016-17. Imports were mainly from Turkey (15%) and UAE & Saudi Arabia (14% each). Total imports of lead & alloys and scrap during 2017-18 were at 3,51,648 tonnes as compared to 3,04,913 tonnes during 2016-17, out of which imports of lead and alloys during 2017-18 were 2,53,352 tonnes as compared to 2,38,262 tonnes in 2016-17.

Imports comprised mainly of lead and alloys and the rest was scrap (28%). The major suppliers during 2017-18 were Korea, Rep. of (18%) Australia (14%), UAE & Vietnam (9% each) and Malaysia, UK and USA (7% each) (Tables- 30 to 36).

Zinc

Exports

Exports of zinc are in the form of ores & concentrates, zinc & alloys including scrap and zinc & alloys in the form of bars, rods & plates.

Exports of zinc ores & concentrates decreased drastically by 98% to 1,206 tonnes in 2017-18 as against 53,912 tonnes in the previous year. China is the solely export destination of zinc ores & concentrates accounted by almost all the export of zinc ores and concentrates.

Exports of zinc & alloys and scrap during 2017-18 were 2,86,979 tonnes as against 2,28,025 tonnes in the preceding year. Almost entire exports during 2017-18 were of zinc & alloys while those of scraps were nominal. China (30%), Korea, Rep. of (17%), Malaysia (13%) and Chinese Taipei/Taiwan (6%) were the main export destinations for zinc alloys & scrap. Exports of zinc (scrap) were only at 216 tonnes in 2017-18 as compared to 48 tonnes in the preceding year (Tables- 37 to 40).

Imports

Imports of zinc in the country are in the form of zinc ores & concentrates, zinc & alloys including scrap, zinc or spelter and zinc & alloys in the forms of bars, rods, plates, mazak, etc.

There were no imports of zinc ores & concentrates during 2017-18 as against 1771 tonnes during the previous year. Imports of zinc and alloys during 2017-18 were at 1,91,601 tonnes as compared to 2,41,074 tonnes in 2016-17. Imports of zinc (scrap) were 81,171 tonnes during 2017-18 as compared to 69,746 tonnes in 2016-17. Imports of zinc or spelter were at 1,56,012 tonnes in 2017-18 as compared to 2,09,779 tonnes during the previous year. The major suppliers of zinc & alloys during 2017-18 were Korea, Rep. of (69%), UAE (10%), Australia (4%) and Iran (2%) etc. (Tables- 41 to 45).

**Table – 23 : Exports of Lead and Alloys
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	108064	15867389	159530	25570818
Korea, Rep. of	18263	2661217	44663	7119499
USA	48758	6875963	44043	6856285
Bangladesh	2307	329951	13700	2167879
Vietnam	4415	661474	11765	1957571
Chinese Taipei/Taiwan	10531	1668120	9548	1571596
Thailand	2888	441525	8801	1369996
UAE	8650	1414622	8006	1306687
Philippines	403	52579	5292	836516
Indonesia	964	137966	2585	428623
Oman	948	136039	2243	415061
Other countries	9937	1487933	8884	1541105

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**Table – 24 : Exports of Lead Ores & Concentrates
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1	33	++	52
South Africa	-	-	++	23
USA	-	-	++	17
Australia	-	-	++	12
Bangladesh	1	33	-	-

**Table – 25: Exports of Lead & Alloys Including scrap
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	108065	15868134	159543	25572181
Korea, Rep. of	18263	2661217	44663	7119499
USA	48758	6875963	44043	6856285
Bangladesh	2307	329951	13700	2167879
Vietnam	4415	661474	11765	1957571
Chinese Taipei/Taiwan	10531	1668120	9548	1571596
Thailand	2888	441525	8801	1369996
UAE	8650	1414622	8017	1307718
Philippines	403	52579	5292	836516
Indonesia	964	137966	2585	428623
Oman	948	136039	2243	415061
Other countries	9938	1488678	8886	1541437

**Table – 26 : Exports of Lead and Waste & Scrap
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1	745	13	1363
UAE	-	-	11	1031
Nepal	1	728	2	217
Uganda	-	-	++	80
Yemen Republic	-	-	++	34
Kenya	++	14	++	1
Gabon	++	3	-	-

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**Table – 27 : Exports of Refined Lead Unwrought
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	77381	11165711	124729	19653387
USA	45072	6361197	43998	6841549
Korea, Rep. of	7848	1139225	31850	5001337
Bangladesh	796	115578	10521	1357297
Vietnam	3666	539006	9843	1639068
Chinese Taipei/Taiwan	10531	1668120	9544	1570829
Thailand	2269	333958	7097	1078655
Philippines	403	52579	5292	836516
UAE	2888	415742	3079	474747
Sri Lanka	++	46	542	86807
Iran	-	-	483	75249
Other countries	3908	540260	2480	391333

**Table – 28 : Exports of Lead & Alloys Unwrought, NES
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	17181	2736278	20654	3581916
Korea, Rep. of	6836	1010733	9831	1639325
UAE	3387	637646	2096	389835
Oman	765	110056	2050	382587
Thailand	503	89202	1586	268985
Bangladesh	854	121882	1280	209925
Indonesia	316	43798	1181	202451
Japan	862	118617	635	109696
Saudi Arabia	1247	176561	557	86113
Vietnam	396	64025	427	75362
Pakistan	151	23261	248	51040
Other countries	1864	340497	763	166597

**Table – 29 : Exports of Lead (Scrap)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1	745	13	1363
UAE	-	-	11	1031
Nepal	1	728	2	217
Uganda	-	-	++	80
Yemen Republic	-	-	++	34
Kenya	++	14	++	1
Gabon	++	3	-	-

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**Table – 30 : Imports of Lead Ores & Conc.
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	6217	318697	2220	149369
UAE	581	44017	315	34419
Saudi Arabia	260	9436	312	21517
Turkey	4181	210212	334	19708
Yemen Republic	343	10190	258	14928
Sudan	145	4661	191	14044
Morocco	137	10786	150	12490
Estonia	107	4218	248	11259
Ethiopia	-	-	130	8009
South Africa	214	12459	97	6612
Jordan	172	8720	160	5062
Other countries	77	3998	25	1321

**Table – 31 : Imports of Lead and Alloys Including Scrap : Total
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	304913	40065602	351648	52503753
Korea, Rep. of	62022	9183868	62194	10584499
Australia	46376	6380614	47894	7780336
Vietnam	22558	2792268	30680	4683430
UAE	36122	4168035	30870	4310529
Malaysia	18494	2438437	24819	3826480
UK	18974	2525194	24059	3445105
USA	18280	2123195	23774	3408962
Bangladesh	14160	2084860	12206	1990675
Burundi	-	-	5043	836165
Sri Lanka	4142	535216	5116	791879
Other countries	63785	7833915	84993	10845693

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**Table – 32 : Imports of Lead & Alloys
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	238262	32861867	253352	40639649
Korea, Rep. of	62022	9183868	62194	10584499
Australia	44451	6148603	44999	7379222
Vietnam	22558	2792268	30680	4683430
Malaysia	17990	2376612	23938	3726404
UAE	20767	2791193	22121	3428944
Bangladesh	14160	2084860	12206	1990675
Burundi	-	-	5043	836165
Sri Lanka	4142	535216	5116	791879
Myanmar	2650	366590	5087	789115
UK	8114	1142162	4916	766280
Other countries	41408	5440495	37052	5663036

**Table – 33 : Imports of Lead (Scrap)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	66651	7203735	98296	11864104
USA	18096	2091814	23369	3329435
UK	10860	1383032	19143	2678825
UAE	15355	1376842	8749	881585
Kuwait	3081	310354	6619	623860
Australia	1925	232011	2895	401114
Netherlands	1420	164013	2044	280049
Germany	2487	296679	1942	274615
Yemen Republic	-	-	3422	273507
Ghana	1301	97941	2923	266437
South Africa	629	70501	1817	238804
Other countries	11497	1180548	25373	2615873

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**Table – 34 : Imports of Lead: Pig Lead
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	6367	817080	5827	903644
UAE	4464	589638	3601	555647
Nigeria	292	35012	482	76865
Jordan	50	5939	350	55444
Bangladesh	40	5708	300	50159
Sri Lanka	-	-	300	45888
Azerbaijan	144	21437	147	21207
Tanzania Republic	-	-	124	20263
Saudi Arabia	577	66201	109	16277
Zambia	-	-	104	14396
South Africa	-	-	64	11973
Other countries	800	93145	246	35525

**Table – 35 : Imports of Lead Unrefined, NES
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	44516	5930455	46846	7169219
Bangladesh	14120	2079152	11816	1925398
Vietnam	8286	1052777	7262	1111762
UAE	5601	726211	6644	1009502
Malaysia	5768	753274	4240	637934
Saudi Arabia	3450	400346	2607	364140
Sri Lanka	1250	163230	2150	330572
Nigeria	542	63651	2127	310250
Yemen Republic	885	108110	1658	246912
Jordan	655	80776	1425	207700
Thailand	250	35367	1235	185345
Other countries	3709	467561	5682	839804

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**Table – 36 : Imports of Refined Lead Unwrought
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	110749	15347116	119919	19414429
Korea, Rep. of	42977	6151751	46101	7597705
Australia	38713	5310761	38073	6235946
Malaysia	4923	650490	9588	1501117
Burundi	-	-	4534	755004
UAE	5343	692371	4580	706901
Mayanmar	1500	226805	4337	677265
UK	7507	1054019	3979	626474
Thailand	2494	332662	1638	254207
Nepal	468	54325	1060	150594
Sri Lanka	850	110144	800	130693
Other countries	5974	763788	5229	778523

**Table – 37 : Exports of Zinc Ores & Concentrates
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	53912	3990176	1206	31460
China	11913	832091	1206	31457
Canada	++	1	++	2
Germany	-	-	++	1
USA	++	7	-	-
Korea, Rep. of	31423	2368367	-	-
Japan	10576	789709	-	-
UK	++	1	-	-

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**Table – 38 : Exports of Zinc & Alloys Including Scrap : Total
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	228025	40967513	286979	61679962
China	16026	3120056	85433	18614786
Korea, Rep. of	36493	6273618	48030	10441309
Malaysia	51837	9616658	36960	7802485
Chinese Taipei/Taiwan	23945	4242039	17732	3655423
UAE	10504	1908432	14677	3101596
Nepal	6412	1084457	13116	2757024
USA	7149	1305983	13203	2704558
Bangladesh	8827	1603549	7477	1637161
Indonesia	8701	1493227	7533	1589593
Kenya	7947	1337397	7153	1545548
Other countries	50184	8982097	35665	7830479

**Table – 39 : Exports of Zinc & Alloys
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	227977	40960486	286763	61654611
China	16026	3120056	85433	18614786
Korea, Rep. of	36493	6273618	48030	10441309
Malaysia	51837	9616658	36960	7802485
Chinese Taipei/Taiwan	23945	4242039	17732	3655423
UAE	10479	1904773	14591	3092829
Nepal	6411	1084152	13115	2756813
USA	7147	1305729	13202	2704343
Bangladesh	8827	1603549	7477	1637161
Indonesia	8701	1493227	7533	1589593
Kenya	7947	1337397	7153	1545548
Other countries	50164	8979288	35537	7814321

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**Table – 40 : Exports of Zinc (Scrap)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	48	7027	216	25351
Singapore	20	2778	103	13347
UAE	25	3659	86	8767
Belgium	-	-	25	2809
USA	2	254	1	215
Nepal	1	305	1	211
Bhutan	-	-	++	1
Israel	-	-	++	1
Mauritius	++	2	-	-
UK	++	29	-	-

**Table – 41 : Imports of Zinc Ores & Conc.
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1771	86640	-	-
Turkey	1394	61466	-	-
Spain	257	16166	-	-
Japan	45	2931	-	-
USA	26	2285	-	-
Korea, Rep. of	24	2263	-	-
Morocco	10	847	-	-
UAE	15	682	-	-

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**Table – 42 : Imports of Zinc and Alloys Including Scrap
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	310820	47056547	272772	53324306
Korea, Rep. of	140545	22582330	131777	27859994
UAE	26679	4016369	28151	5186256
USA	13397	1787029	13071	2287998
Australia	9783	1509822	10108	2035373
Netherlands	2233	317288	6492	1108166
Italy	4946	667198	6409	1083912
Saudi Arabia	5748	748472	5940	970671
Spain	13160	1930510	4451	855442
Malaysia	13257	1869154	4223	760973
Thailand	7065	937538	4128	673361
Other countries	74007	10690837	58022	10502160

**Table – 43 : Imports of Zinc & Alloys
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	241074	38274764	191601	40230229
Korea, Rep. of	139607	22468887	131363	27795720
UAE	21055	3278855	19923	3835178
Australia	9339	1452553	7828	1667236
Iran	1521	233261	3489	662456
Spain	11832	1766206	2985	619332
Kazakhstan	6471	1047358	2955	591836
Netherlands	1095	161939	2372	448927
China	1882	553966	893	430310
USA	4465	663421	2101	428373
Uzbekistan	850	126854	1877	415205
Other countries	42957	6521464	15815	3335656

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**Table – 44 : Imports of Zinc or Spelter
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	209779	32501012	156012	32189028
Korea, Rep. of	119826	19071978	105661	22271181
UAE	20501	3203752	19356	3741345
Australia	6974	1056348	5304	1125320
Iran	1521	233261	3489	662456
Spain	11795	1761243	2967	615883
Kazakhstan	6471	1047358	2955	591836
Netherlands	1093	159968	2346	443784
Uzbekistan	850	126854	1877	415205
myanmar	603	116191	1821	397218
Unspecified	2678	388578	1719	324787
Other countries	37467	5335481	8517	1600013

**Table – 45 : Imports of Zinc (Scrap)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	69746	8781783	81171	13094077
USA	8932	1123608	10970	1859625
UAE	5624	737514	8228	1351078
Italy	4888	599913	6168	955661
Saudi Arabia	5316	693280	5777	942959
Netherlands	1138	155349	4120	659239
Mexico	3212	394713	3241	518030
Thailand	4032	495986	3262	514099
Germany	1798	239715	2877	458016
Malaysia	2646	337855	2708	436823
Indonesia	1559	204488	2240	371205
Other countries	30601	3799362	31580	5027342

FUTURE OUTLOOK

ILZSG forecasts that world lead metal production is expected to increase by 2.5% to 11.94 million tonnes in 2019 due to expected increase in China and India. The consumption of refined lead metal is expected to increase by 1.2% to 11.87 million tonnes in 2019 due to increase in consumption in India, Japan and Korea Rep. of. ILZSG also forecast that world zinc mine production will rise by 6.2% to 13.48 million tonnes in 2019. This will be driven mainly by an expected 29.4% rise in Australia, 3.3% increase China, expand in South Africa, as a result of higher output at Vedanta's Gamsberg mine and in Canada, Cuba, India and Namibia. World demand for refined zinc metal is forecasted to rise by 0.6% to 13.77 million tonnes in 2019. Demand is forecast to continue to growing demand in China and India, to remain stable in Japan, South Korea and to fall in Thailand.

HZL has ambitious plans to expand in mining extraction & production of zinc, depending on the country's need while in lead, the recycling sector is likely to emerge as the major sector in future.

As every major national plan sees continuous rise in the power generation capacity of the country, the demand for galvanised transmission tower also increases by about 4-5% along with increasing necessity of erection of mobile towers, higher investment in the infrastructure, Railways will also lead to increase the use of galvanised steel. Over the past decade, zinc consumption in India has trebled, the CAGR from 2001 to 2009 being 10%. CARE Research predicts zinc demand to grow at the rate of 8 to 9% in the current decade (2010-20). The domestic demand of zinc metal is expected to reach 09 lakh tonnes by 2020.

Lead metal will remain in demand for the electric vehicles in view of pressure on petrol fuel driven automobiles. Increased volume of transportation prompted by higher industrialisation is going to keep lead in demand. The Government thrust upon Automobile Industries to produce battery running vehicles is likely to encourage investment in battery vehicles and this would raise huge demand for lead metal in the future.