Indian Minerals Yearbook 2022

(Part- II : Metals and Alloys)

61st Edition

LEAD & 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

March, 2024

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.

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

Zinc is the fourth most widely used metal across the globe, trailing only steel, aluminium and copper. 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. The Government of India has enacted Battery Management and Handling Rule (BMHR), 2002, in order to enable further increase in 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 2021-22 due to shut down of the operation of Edayar Zinc Limited (EZL).

RESERVES/RESOURCES

The total resreves/resources of lead and zinc ore as on 1.4.2020 as per NMI database based on UNFC system have been estimated at 766.49 million tonnes. of these, 103.27 million tonnes (13.47%) fall under 'Reserves' category while the balance 663.22 million tonnes (86.53%) are classified as 'Remaining Resources'.

The total/resources of ore containing + 10% Pb & Zn were estimated at 97.52 million tonnes (12.72%), ore containing 5 to 10% Pb & Zn were 280.05 million tonnes (36.53%) and ore containing less than 5% Pb & Zn were 388.90 million tonnes (50.73%).

The total metal content in total/ resources of lead is 12.86 million tonnes and that of zinc is 33.17 million tonnes and for lead & zinc metal is 0.14 million tonnes. In terms of reserves, 1.90 million tonnes of lead metal and 7.43 million tonnes of zinc metal have been estimated. Rajasthan is endowed with the largest reserves/resources of lead – zinc ore amounting to 684.65 million tonnes (89.32%), followed by Andhra Pradesh 22.69 million tonnes (2.96%), Madhya Pradesh 19.06 million tonnes (2.48%), Bihar 11.43 million tonnes (1.49%) and Maharashtra 9.27 million tonnes (1.20%). Resources are also established in Gujarat, Meghalaya, Odisha, Sikkim, Tamil Nadu, Uttarakhand and West Bengal (Table-1).

DEVELOPMENT

The Exploration & Development details, if any, are covered in the Review on Exploration & Development under "General Reviews".

Table – 1 : Reserves/Resources of Lead & Zinc Ore as on 1.4.2020 (P)
(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	**28791**	**63331**	**11153**	**103275**	**4627**	**23663**	**13784**	**51613**	**196911**	**368094**	**4530**	**663222**	**766497**
Lead metal	503.70	1188.47	208.02	1900.19	140.42	534.83	286.02	1117.33	2283.43	6607.77	-	10969.80	12869.99
Zinc metal	2356.56	4592.03	489.46	7438.05	448.15	1121.12	599.62	3540.38	5840.74	14080.66	101.65	25732.32	33170.37
Lead & Zinc metal	-	-	-	-	-	-	-	-	-	120.76	22.37	143.13	143.13
By Grades													
Ore with (+)10% Pb & Zn	14500	24600	-	39100	155	148	81	9900	3920	44225	-	58429	97529
Ore with 5—10 % Pb & Zn	13310	28600	8580	50490	3223	7991	10796	35987	52913	118658	-	229569	280059
Ore with (-)5% Pb & Zn	981	10131	2573	13685	1249	15524	2907	5726	140078	205211	4530	375225	388909
Lead metal	503.70	1188.47	208.02	1900.19	140.42	534.83	286.02	1117.33	2283.43	6607.77	-	10969.80	12869.99
Zinc metal	2356.56	4592.03	489.46	7438.05	448.15	1121.12	599.62	3540.38	5840.74	14080.66	101.65	25732.32	33170.37
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	-	38.75	38.75
Gujarat													
Ore	-	-	-	-	2013	2371	969	129	-	200	-	5682	5682
Lead metal	-	-	-	-	81.94	88.2	34.41	3.90	-	-	-	208.45	208.45
Zinc metal	-	-	-	-	111.73	111.44	37.13	1.10	-	-	-	261.40	261.40
Lead & Zinc metal	-	-	-	-	-	-	-	-	-	0.9	-	0.9	0.9
Madhya Pradesh													
Ore	-	-	-	-	129	117	-	1510	6396	7765	3150	19067	19067
Lead metal	-	-	-	-	-	-	-	26.12	5.13	5.04	-	36.29	36.29
Zinc metal	-	-	-	-	5.20	4.71	-	114.76	44.67	200.07	101.12	470.53	470.53
Maharashtra													
Ore	-	-	-	-	-	-	-	1967	6305	1000	-	9272	9272
Zinc metal	-	-	-	-	-	-	-	133.56	428.11	28	-	589.67	589.67

(Contd)

Table - 1 (Concld) (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	28791	63331	11153	103275	2485	19779	12632	43337	172985	328784	1380	581381	684656
Lead metal	503.70	1188.47	208.02	1900.19	58.48	405.41	245.68	917.50	1972.47	5832.19	-	9431.73	11331
Zinc metal	2356.56	4592.03	489.46	7438.05	331.22	992.09	559.35	3112.59	5052.47	13779.72	0.53	23827.97	31266.02
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 production of lead and zinc ore at 16.34 million tonnes in 2021-22 increased 5.7% as compared to that in the previous year.

The metal content of lead and zinc in the ore produced in 2021-22 works out to 210659 tonnes and 826020 tonnes respectively as against the corresponding figures of 274836 tonnes and 841947 tonnes in the previous year. During the year under review, 16.29 million tonnes of lead & zinc ore was treated as against 15.46 million tonnes in previous year.(Tables-2 & 3).

The production of lead concentrates in 2021-22 at 368040 tonnes decreased by 2.4% as compared to that in the previous year. Entire production of lead concentrate was reported from Rajasthan. (Tables-5 & 6).

The production of zinc concentrates increased from 1513996 tonnes in previous year to 1594087 tonnes in the 2021-22. Entire production of zinc concentrates was also reported from Rajasthan.(Tables - 7 & 8).

The entire output of lead & zinc ore and concentrates in both the years was reported by mines owned by Hindustan Zinc Ltd., a private sector unit.

Grade Analysis

All-India average metal content of ore treated during 2021-22 worked out to 7.08% (1.65% Pb and 5.43% Zn) as against 7.23% (1.78% Pb and 5.45% Zn) in previous year. The metal content of ore treated at Rampura Agucha mine in Bhilwara district of Rajasthan was the highest at 11.51% (1.47% Pb and 10.04% Zn). The lead concentrates produced in Rajasthan during 2021-22 was of grade 58.76% Pb as against 57.11% Pb in previous year. Metal content of zinc concentrates produced in Rajasthan worked out to 50.16% Zn in 2021-22 as against 50.07% Zn in the previous year.

Stock

Mine-head closing stock of lead concentrates in 2021-22 was 30961 tonnes as against 2447 tonnes in previous year. (Table-9).

Mine-head closing stock of zinc concentrates in 2021-22 was 34023 tonnes as against 28926 tonnes in previous year. (Table-10).

Employment

The average daily labour employed in lead and zinc mines during the year under review was 12948 as against 8535 in previous year.

Lead and Zinc Metals

The production of primary lead during the year 2021-22 decreased to 191185 tonnes from 214399 tonnes during the previous year. The entire output of primary lead was contributed by Chanderia and Dariba smelters of Hindustan Zinc Ltd.

The production of zinc ingot metal at 775808 tonnes in 2021-22 increased by 8.4% 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, 2021-22

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

Table – 3 : Production of Lead and Zinc Ore, 2020-21 and 2021-22 (By State)

(In tonnes)

State	2020-21			2021-22 (P)		
	Ore Produced	Metal content		Ore Produced	Metal content	
		Lead (Pb)	Zinc (Zn)		Lead (Pb)	Zinc (Zn)
India	**15455342**	**274836**	**841947**	**16338461**	**210659**	826020
Rajasthan	15455342	274836	841947	16338461	210659	826020

(p) : Provisional

Table – 4 : Lead and Zinc Ore Treated, 2020-21 and 2021-22
(By State)

(In tonnes)

State	2020-2021			2021-22 (P)		
	Ore Treated	Metal content		Ore Treated	Metal content	
		Lead (Pb)	Zinc (Zn)		Lead (Pb)	Zinc (Zn)
India	**15458066**	**274704**	**842474**	**16292735**	**269196**	**883932**
Rajasthan	15458066	274704	842474	16292735	269169	883932

(p) : provisional

Table – 5 : Production of Lead Concentrates, 2019-20 to 2021-22
(By State)

(Quantity in tonnes; Value in ₹'000)

State	2019-20		2020-21		2021-22 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**351749**	**18260832**	**376923**	**18810483**	**368040**	**22366174**
Rajasthan	**351746**	**18260832**	**376923**	**18810483**	**368040**	**22366174**

(p): Provisional

Table – 6 : Production of Lead Concentrates, 2020-21 and 2021-22
(By Sector/State/Districts)

(Quantity in tonnes; Value in ₹'000)

State/District	2020-21				2021-22 (P)			
	No. of mines	Production			No. of mines	Production		
		Quantity	Pb%	Value		Quantity	Pb%	Value
India	**10**	**376923**	**57.11**	**18810483**	**10**	**368040**	**58.76**	**22366174**
Public Sector	**2**	**-**	**-**	**-**	**2**	**-**	**-**	-
Private Sector	8	376923	57.11	18810483	8	368040	58.76	22366174
Rajasthan	**10**	**376923**	**57.11**	**18810483**	**10**	**368040**	**58.76**	**22366174**
Ajmer*	1	-	-	-	1	-	-	-
Bhilwara	1	79537	56.97	3147436	1	81132	62.41	4138068
Rajsamand	3	194850	55.26	8802684	3	187584	55.86	10515327
Sirohi	1	-	-	-	1	-	-	-
Udaipur	4	102536	60.75	6860363	4	99324	61.25	7712779

**: 34RAJ01001 - Reported production of lead and zinc ore only and processing is done along with ore produced from Rampura Agucha mine at Bhilwara.*

34RAJ24001 reported employment but no production.

34RAJ27007 has not submitted Annual Returns for both years. Estimation is done from Monthly Returns. It has reported employment but no production.

Table – 7 : Production of Zinc Concentrates, 2019-20 to 2021-22
(By State)

(Quantity in tonnes; Value in ₹'000)

State	2019-20		2020-21		2021-2022 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**1446824**	**60438504**	**1513996**	**63127101**	**1594086**	**81815818**
Rajasthan	1446824	60438504	1513996	63127101	1594086	**81815818**

Table – 8 : Production of Zinc Concentrates, 2020-21 & 2021-22 (By Sector/State/Districts)

(Quantity in tonnes; Value in ₹'000)

State/District	2020-21				2021-22 (P)			
	No. of mines	Production			No. of mines	Production		
		Quantity	Zn%	Value		Quantity	Zn%	Value
India	**@**	**1513996**	**50.07**	**63127101**	**@**	**1594086**	**50.16**	**81815818**
Private Sector	@	1513996	50.07	63127101	@	**1594086**	**50.16**	81815818
Rajasthan	**@**	**1513996**	**50.07**	**63127101**	**@**	**1594086**	**50.16**	**81815818**
Bhilwara	@	943093	49.98	34787718	@	978250	50.38	45537513
Rajsamand	@	400197	49.47	16959450	@	426384	48.55	23118848
Sirohi	@	-	-	-	@	-	-	-
Udaipur	@	170706	52.00	11379933	@	189452	52.61	13159457

(p): provisional

**: 34RAJ01001 - Reported production of lead and zinc ore only and processing is done along with ore produced from Rampura Agucha mine at Bhilwara.*

Table – 9 : Mine-head Closing Stocks of Lead Concentrates, 2020-21 & 2021-22 (By State)

(In tonnes)

State	2020-21	2021- 22(P)
India	**2447**	**30960**
Rajasthan	2447	30961

(p): Provisional

Table – 10 : Mine-head Closing Stocks of Zinc Concentrates, 2020-21 & 2021-22 (By State)

(In tonnes)

State	2020-21	2021- 22(P)
India	**28926**	**34023**
Rajasthan	28926	34023

(p): Provisional

Table – 11 : Production of Lead Metal, 2019-20 to 2021-22

(Quantity in tonnes; Value in ₹'000)

Year	Lead Primary	
	Quantity	Value
2019-20	181365	29111241
2020-21	214399	34531700
2021-22 (P)	191185	34944601

Table – 12 : Production of Zinc Metal, 2019-20 to 2021-22

(Quantity in tonnes; Value in ₹'000)

Year	Zinc Ingots	
	Quantity	Value
2019-20	688282	137840297
2020-21	715445	147976396
2021-22 (P)	775808	202092083

(P): Provisional

Table – 13 : Production of Lead (Primary), 2020-21 and 2021-22 (By State/Plant)

(Quantity in tonnes; Value in ₹'000)

State	Plant	2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value
India		**214399**	**34531700**	**191185**	**34944601**
Rajasthan	HZL Chanderiya/ Dariba	214399	34531700	191185	34944601

Table – 14 : Production of Zinc (Ingots), 2020-21 and 2021-22 (By State/Plant)

(Quantity in tonnes; Value in ₹'000)

State	Plant	2020-21		2021-22 (P)	
		Quantity	Value	Quantity	Value
India		**715445**	**147976396**	**775808**	**202092083**
Rajasthan	HZL Chanderiya/ Debari/Dariba	715445	147976396	775808	202092083

(p): Provisional

MINING & MILLING

HZL is the only integrated lead and zinc metal producer in the country. Its operations can be classified into mining and smelting. At present, HZL's eight mines and all mining operations are located in Rajasthan. The 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 i.e. Mochia, Balaria, Zawarmala and Baroi), Rajasthan. All the mines of HZL undertake underground mining operations. Rampura Agucha mine was completely turned to underground mine with an annual production capacity of 4.51 million tonnes of lead & zinc ore. Sindesar Khurd mine is highly mechanised and the largest ore producing underground mine with annual production capacity of 5.23 million tonnes. The other six mines viz, Rajpura Dariba, Zawar group of mines (Mochia, Balaria, Zawarmala and Baroi) and Kayad mine are underground mines with an annual production capacity of 1.08 million tonnes, 4.41 million tonnes and 0.94 million tonnes of lead & zinc ore respectively (Table-15).

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 commissioned in the year 1966. Zawar group of mines, one of the oldest mines is 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 passed through a flotation process to produce concentrate. In 2021-22, the Zawar group of mines produced 4.41 million tonnes ore.

Table – 15 : Ore Production Capacity of HZL Mines

Mine	Ore	Capacity (million tpy)
Total		**16.33**
Zawar Mines, Distt Udaipur, Rajasthan.	Zinc-lead	4.41
Rajpura Dariba, Distt Rajsamand, Rajasthan.	Zinc-lead	1.25
Sindesar Khurd Mine, Distt Rajsamand, Rajasthan.	Zinc-lead	5.23
Rampura Agucha, Distt Bhilwara, Rajasthan.	Zinc-lead	4.51
Kayad Distt Ajmer Rajasthan.	Zinc-lead	0.93

Source : *HZL Annual Report 2021-22*

The Rajpura Dariba mine is an underground lead & zinc mine where mining operations began in 1983. It is located at 75 kilometers north-east of Udaipur, Rajasthan. Mining is carried out by using Blasthole stoping method with hydraulic filling. Mined out stopes are backfilled with cement tailings. During the year 2021-22, Rajpura Dariba Mine produced 1.2 million tonnes ore. 2% Pb feed-grade. Presently, the mine is accessed via decline and two shafts. As RDM ore body also allows for multiple production centres, the mine is poised to produce at the capacity of 2 million tonnes per annum of ore in future with new level of mechanisation & automation. Mine has achieved highest truck filling hours and exploration

drilling resulting in its readiness for expansion.

Rampura Agucha mine is located at 230 km north of Udaipur in Bhilwara district, Rajasthan and it was commissioned in 1991. It has high zinc-lead reserve grades averaging 15.4%. In 2021-2022, the production of ore was carried out by underground mining at 4.5 million tonnes. Until 2017-18 the production of ore from the mine was by surface mining and the mine has been fully transformed into an underground mine. Two ventilation shafts (North and South) each with diameter of 7.5 m and 450 m depth are in operation. The main hoisting shaft of 7.5 m diameter has been sunk and furnished to its final depth of 950 m and winders, skip loading & surface conveyors have been installed, while off-shaft development activities to commision underground crushing and conveying system are under progress. Paste-Fill plant has been established in the mine area. Underhand stoping method has been adopted which will use mine tailings to fill stopes after ore extraction.

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 5.35% with its silver-rich lead-zinc deposit. The mine lies on the same geological belt as the Rajpura Dariba mine. During the year 2021-22, Sindesar Khurd mine produced 5.2 million tonnes ore.

Kayad mine is a newly developed underground mine near Ajmer, Rajasthan. It was commissioned in 2014 having small but high-grade ore at 5.23% Pb & Zn ore deposit. In Kayad mine, 21 tonnes capacity of LHD and 65 tonnes capacity of LPDT are used to produce 1.2 million tonnes of ore per annum. The mine has access through a single decline from surface portal to the top of the orebody and split in two declines 75 meters below surface.

Longitudinal Long-Hole Open Stoping method is used for the steeper and thinner portion of ore body and Transverse Long-Hole Open Stoping method for flatty dipping and thick portion of the ore body. In the year 2021-22, the Kayad mine produced 0.93 million tonnes ore. 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 90,000 tonnes and 1,20,000 tonnes per annum of lead metal, respectively. Thus, the smelting capacity for lead (primary) in the country presently is 2,10,000 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 (5,85,000 tonnes) and Dariba (2,40,000 tonnes). Edayar Zinc Ltd's plant at Binanipuram (Aluva), Kerala, has capacity of 38,000 tonnes per annum. Thus, the smelting capacity for zinc in the country is 9,51,000 tonnes per annum. EZL produced zinc from imported concentrates but since the Company has been declared as sick unit, it did not operate its plant. Besides lead & zinc capacities, HZL has capacities to produce 800 tonnes per annum of silver. HZL is India's largest manufacturer of sulphuric acid which is by-product of its smelting operations. In 2019-20, HZL produced 1.24 million tonnes of sulphuric acid, as compared to 1.28 million tonnes in the previous year.

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. The company entered into a One Time Settlement (OTS) with the Lenders and payments are being made under the sanctioned OTS. Due to Covid-19 and consequent lockdown, Company sought extension of time for payment under the settlement. Settlement with the statutory authorities and Government agencies is underway. The Company is hopeful that Lenders, Creditors and Authorities will take a measured stand to safeguard interest of all stakeholders.

Chanderiya 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. Chanderiya lead-zinc smelting complex comprises one zinc Pyro-metallurgical smelter having production capacity of 1,05,000 tonnes zinc, one lead Pyrometallurgical smelter having production capacity

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

(In tonnes)

Company	Lead capacity tpy	Production		Zinc capacity tpy	Production	
		2019-20	2020-21 (P)		2019-20	2020-21 (P)
Hindustan Zinc Ltd	210000	214399	191185	913000	715445	775808
Edayar Zinc Ltd	-	-	-	38000	-	-
Total	**210000**	**214399**	**191185**	**951000**	**715445**	**775808**

of 90,000 tonnes lead and one Hydro-metallurgical zinc smelter having production capacity of 4,80,000 tonnes zinc. It employs Roast-Leach Electro-winning 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 2019-20, Chanderia lead-zinc smelter produced 4,25,780 tonnes of zinc and 94,916 tonnes of lead as compared to 4,24,803 tonnes of zinc and 85,916 tonnes of lead in the previous year.

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 for enhancing zinc output.

Zinc Smelter Debari was commissioned in the year 1968 with an initial production capacity of 92,000 tonnes per annum of zinc. The present capacity has now reached 88,000 tonnes per annum of zinc. It is located at about 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 & 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 2019-20, Zinc Smelter Debari produced 62,817 tonnes of zinc as compared to 67,968 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 2,40,000 tonnes per annum while lead smelter was commissioned in July, 2011 and has a capacity of 1,20,000 tonnes 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 & 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 2019-20, the smelter produced 2,00,689 tonnes of zinc and 86,454 tonnes of lead metal as compared to 2,03,512 tonnes of zinc and 1,11,922 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. In 2019-20, Dariba Smelting Complex produced 4,26,623 tonnes of sulphuric acid as compared to that of 4,77,217 tonnes in the previous year.

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 per cent 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), SO_2, NOX 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 the 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 a few Chinese and Korean Zinc Plants.

Hindustan Zinc Limited runs a 25 MLD STP in Udaipur for treating municipal sewage. The enhancement of capacity of STP to 45 MLD and establishment of another STP of 15 MLD capacity is in progress. 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 flotation & ore retreatment technology to increase ore-to-metal ratio which is aimed at reducing waste and increasing 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 SOX. 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 $\mu g/m^3$ while the permissible limit for SOX is 50 $\mu g/m^3$.

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. 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 the total lead production in India. More than 80% of lead consumed in the country goes for manufacturing of lead batteries.

The Government of India enacted Battery Waste Management Rules, 2020 and issued Gazette Notification No. S.O. 770 (E) dated 20th Feb. 2020 to organise the recycling of lead acid batteries and to make available raw material to the lead reproducers. The said Rules are in supersession of the Batteries

(Management and Handling) Rules, 2001, published vide number S.O.1035(E) dated 16th May 2001. At present, 672 units are registered as lead recycling units with CPCB for processing used lead batteries with the production capacity of 3.53 million tonnes per annum in India. CPCB has also developed online web-based application "Batteries (Importer) Registration Management" for registration /renewal of registration for import of new lead acid batteries.

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 & extruded products, alloys, cable sheathing and other industries.

The apparent consumption of lead during the year 2020-21 and 2021-22 was calculated on the basis of production of lead (primary) and imports & exports of refined lead (unwrought). The apparent consumption thus arrived at was 179135 tonnes in 2020-21 and 83012 tonnes in 2021-22 (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	2020-21	2021-22
Total Production Lead (Primary)	214399	191185
Total Imports*	89777	51810
Total Exports*	125041	159983
Apparent Consumption (Primary)	179135	83012

** 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 2020-21 and 2021-22 was calculated on the basis of production of zinc, import & export of zinc (not alloyed). The apparent consumption, thus arrived at was 519008 tonnes in 2020-21 and 594809 tonnes in 2021-22 (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	2020-21	2021-22
Total Production Zinc	715445	775808
Total Imports*	84980	86667
Total Exports*	281417	267666
Apparent Consumption	519008	594809

**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 of these metals 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

Lead

The world's reserves of lead were estimated at 90 million tonnes in terms of lead content. Australia possesses 41% of the world's reserves followed by China (20%), Peru (7%), Mexico & USA (6% each) and Russia (5%). (Table- 19).

Zinc

The world's reserves of zinc were estimated at 250 million tonnes of zinc content. Australia accounts for 27% of world's zinc reserves, followed by China (18%), Russia (9%), Kazakhstan (5%), USA (4%), etc. (Table-20).

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

(In '000 tonnes of lead content)

Country	Reserves
World: Total (rounded off)	**90000**
Australia[(a)]	[8]37000
Bolivia	1600
China	18000
India*	2500
Kazakhstan	2000
Mexico	5600
Peru	6400
Russia	4000
Sweden	1100
Tajikistan	NA
Turkey	860
USA	5000
Other countries	5900

Source: *USGS, Mineral Commodity Summaries, 2022.*
(a) For Australia, Joint Ore Reserve Committee-compliant reserves were about 12 million tonnes.
** India's total reserve/ resources of lead & zinc as per National Mineral Inventory based on UNFC as on 01.04.2020 are 766.49 million tonnes.*

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

(In '000 tonnes of zinc content)

Country	Reserves
World: Total (rounded off)	**250000**
Australia[(a)]	[11]69000
Bolivia	4800
Canada	5400
China	44000
India*	9400
Kazakhstan	12000
Mexico	1900
Peru	1900
Russia	22000
Sweden	3700
USA	9000
Other countries	34000

Source: *USGS, Mineral Commodity Summaries, 2022.*
(a) For Australia, Joint Ore Reserve Committee-compliant reserves were about 25 million tonnes.
** India's total reserves/ resources of lead & zinc as per National Mineral Inventory based on UNFC as on 01.04.2020 are 766.49 million tonnes.*

PRODUCTION

Lead

World mine production of lead in terms of metal content was about 4.60 million tonnes in the year 2021 which is 1.2% more as compared to 4.54 million tonnes in the previous year. China is foremost amongst producing countries with about 2.00 million tonnes (33%) followed by Australia (8%), USA & Mexico (4.66% & 4.43%), and Peru (4.30%). (Table-21).

Zinc

World mine production of zinc ore was at 13.50 million tonnes in terms of zinc content in the year 2021 which was slightly increased by 1.01% from 11.53 million tonnes in the year 2020. China is at top position with 4.73 million tonnes (35%) followed by Peru (11.34%), Maxico , USA & India (5% each) & Bolivia (4%), Kazakhsthan (2%), etc. (Table- 22).

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

(In '000 tonnes of metal content)

Country	2019	2020	2021
World: Total (rounded off)	**4818746**	**4543981**	**4600000**
China	2006000	1970000	2000000
Australia	500985	494271	487563
USA	266000	297000	286000
Mexico	372106	260390	272200
Peru	308116	241548	264124
Russia	207900*	200000	200000
India*[(c)]	202964(c)	217787	182500
Turkey	71500*	81500	93700
Bolivia	88002	64679	92767
Iran	72500*	70000	70000
Other countries	740815	645825	472218

Source: *BGS, World Mineral Production, 2017-21*

** India's production of primary lead in 2018-19, 2019-20 and 2020-21 was 202 thousand 217 thousand tonnes and 182 thousand tonnes respectively.*
(c) Year ended 31st March following that stated
(d) Metal content of ore
(e):Estimated

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

(In '000 tonnes of metal content)

Country	2019	2020	2021
World:Total(rounded off)	**12483251**	**11530291**	**13500000**
China	3700000*	3200000	4737000
Peru	1404382	1334570	1532043
Mexico	859194	688461	742900
USA	753000	718000	740000
India*[(b)]	723412(b)	756998	735000
Bolivia	527521	358411	499257
Kazakhstan	321900	335400	326900
Canada	323019	371491	310158
Russia	275400*	280000	280000
Sweden	247657	234811	246316
Other countries	2258102	2172050	1719193

Source : *BGS, World Mineral Production, 2017-21*

** India's production of primary zinc in 2018-19, 2019-20 and 2020-21 was 723 thousand tonnes, 756 thousand tonnes and 735 thousand tonnes respectively.*

(b) Year ended 31st March following that stated

(e): Estimated

Lead

As per USGS Minerals Yearbook, world refined lead production (including secondary production) was 11.40 million tonnes in which secondary lead production was 6.6 million tonnes in the year 2018. Secondary lead production represented about 58% of total refined lead production worldwide in 2018 which was 55% in 2017. The global production of refined lead in the year 2018 is the same as that of the previous year. China is the largest producer of refined lead with 4.91 million tonnes in the year 2018 and contributed 43 % of world refined lead production followed by USA (10%), Republic of Korea (7%), India (5%), Mexico (4%), etc.

World consumption of refined lead was 11.87 million tonnes in the year 2018 (including secondary lead) which is 1.2% more than that of the previous year. China is the largest refined lead consuming country with 4.9 million tonnes consumption during the year 2018 which was 42% of world refined lead consumption followed by European countries (17%), USA (14%), Republic of Korea & India (5% each), etc. After falling by 3.9% in 2020, International Lead & Zinc Study Group (ILZSG) forecasted the global demand for refined lead metal to rise by 5.5% to 12.39 million tonnes in this year and by 1.7% to 12.61 million tonnes in 2022.

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', 2016 & 2017 is furnished as below.

Australia

In 2016, lead mine production in Australia decreased by 31% as a result of the closure of Glencore plc's (Switzerland) Black Star Mine, which had a lead production capacity of 75,000 t/yr and was a part of the Mount Isa mining complex. Black Star was placed on care-and-maintenance status in November 2016 owing to reserve depletion.

China

In 2016, China continued to be the leading global producer and consumer of lead and the leading producer of lead-acid batteries. China produced 4.67 Mt of refined lead, essentially unchanged from that in 2015 and accounting for about 42% of global refined lead. China's secondary lead production was about 28% of total secondary world refined lead production in 2016, slightly less than that in 2015. China's refined lead production consisted of 64% primary and 36% secondary lead production. In 2016, two lead refineries opened a 40,000 t/yr secondary smelter owned by Yunnan Xiangyun Feilong Nonferrous Metal Co. Ltd in China and Aqua Metal's 30,000 t/yr secondary plant in the United States (International Lead and Zinc Study Group, 2017). Lead in concentrate production in 2016 was estimated to be about 2.34 Mt, unchanged from that in 2015. According to the ILZSG, consumption of lead in China decreased slightly to 4.64 Mt in 2016 from 4.71 Mt in 2015.

USA

In 2017, domestic mine production of recoverable lead was 3,02,000 tonnes, 10% less than that in 2016. There were 9 lead producing mines operating in the United States in 2017. Alaska and Missouri accounted for most of the US mine output of lead. Lead was also mined in Idaho and Washington. Domestic mine production data were collected by the U.S. Geological Survey (USGS) from a voluntary survey of lode mines. Eight lead-producing mines responded to the survey in 2017, accounting for about 90% of US production.

According to the ILZSG, global consumption of refined lead in 2017 was 11.7 Mt, 5% more than that in 2016. The leading refined-lead-consuming countries in 2017 were China (42%), USA (15%), India (5%), Republic of Korea (5%) and Germany (3%).

Zinc

As per USGS Minerals Yearbook, world refined zinc production was 13.7 million tonnes in the year 2019 which increased by 3% from that of the previous year.

China was the largest producer of refined zinc with 6.16 million tonnes in the year 2019 which contributed 45% of world refined zinc production followed by Republic of Korea (7%), Canada & India (5% each), Japan (4%), Australia (3%), etc.

The world consumption of refined zinc was 13.69 million tonnes in the year 2018 which is 2% less than the previous year. China was the largest refined zinc consuming country with 6.52 million tonnes in 2018 which accounted for 48% of world consumption followed by European countries (18%), USA (6%), India (5%) and Republic of Korea (4%), etc.

ILZSG forecasts that world demand for refined zinc metal will rise by 6.2% to 14.09 million tonnes in 2021 and will further increase by 2.3% to 14.41 million tonnes in 2022.

A summary of generalised view of the development in various countries in respect of zinc, which include country-wise description sourced from latest available publication of Minerals Yearbook of 'USGS', 2017 is furnished as below.

Australia

Zinc mine production in Australia decreased by 5% in 2017 as compared with that of 2016 mainly as result of several mine closures. Three mines opened in Australia in 2017 and therefore it is expected that production would increase in 2018. During the second quarter of 2017, Auctus Minerals Pty. Ltd, restarted production at 20,000 tonnes per annum Mungana zinc mine in Northern Queensland. In September, 2017, Red River Resources Ltd restarted production at 21,000 tonnes per year from Thalang zinc-copper-lead mine in Queensland. The mine was placed on care-and-maintenance status in 2012 and reopened after the processing plant was refurbished. Minerals and Metals Group opened Dugald River zinc mine in Northe western Queensland and commercial production was expected to commence in 2018 at 1,70,000 tonnes per year.

Canada

Zinc mine production in Canada was 3,44,000 tonnes in 2017, 7% more than that in 2016. Production increased in 2017 owing mostly to an increase in zinc production at Trevali Mining Corp.'s Caribou Mine. In October 2017, Coeur Mining Inc. acquired the Silvertip silver-zinc-lead mine in British Columbia and production was expected to commence in the first quarter of 2018. Zinc smelter production in Canada was at 6,08,000 tonnes in 2017, 12% less than that in 2016. Smelter production decreased mainly as a result of the nine month strike at Noranda Income Fund's zinc refinery in Salaberry-de-Valleyfield, Quebec. During the strike, the facility operated at a partial production level, although the reduced rate was not disclosed.

China

Zinc mine production in China decreased by 8% in 2017 from that of 2016 to 4.4 million tonnes. According to Beijing Antaike Information Development Co. Ltd, decreased production was attributed to the closure of mines owing to increased environmental protection measures, lower than expected production from new mines and a decrease in ore grades. As a result of the decrease in mine production, China's net imports of zinc in concentrate increased by 22% in 2017 to about 2.4 million tonnes. About 60% of China's zinc concentrate imports (gross weight) were sourced from Australia, Peru and Russia.

Zinc metal production in China decreased slightly in 2017 from that of 2016 to 6.14 million tonnes. Despite the slight production decrease, two smelters of 1,00,000 tonnes per year capacity opened in China, i.e., Hualian Zinc and Indium Co.'s Hulian zinc smelter in Yunnan Province and Huili Lead and Zinc Co.'s Huili zinc smelter in Sichuan Province. Antaike attributed the decrease in zinc smelter production to refinery maintenance, a shortage of zinc concentrates and stricter environmental regulations.

China's net imports of refined zinc increased by 67% in 2017 to about 0.66 million tonnes. Increased imports were attributed to the tight domestic supply. About 66% of China's refined zinc imports were sourced from Australia, Kazakhstan and Spain.

China's zinc consumption increased in 2017 from that of 2016. ILZSG reported a 4% increase in zinc consumption in 2017 as against 9% increase in 2016.

Cuba

In 2017, construction was completed on the Castellanos lead and zinc mine near Santa Lucia, Pinar del Rio. This was the first new mining project in Cuba in more than 20 years. The mine, operated by Empresa Minera del Caribe, was expected to commence commercial production during the first half of 2018. Trafigura reported that the mine was expected to ramp up throughout the year and produce 1,00,000 tonnes of zinc concentrate when it reached full capacity.

Peru

Zinc mine production in Peru increased by 10% in 2017 from that of 2016 as a result of increased production at the Antamina copper-zinc mine and the opening of two mines. Zinc production nearly doubled at Antamina in 2017 to 3,72,100 tonnes, primarily as a result of increased processing of copper-zinc ores and significantly higher zinc grades and recoveries. Copper and zinc production at Antamina can vary significantly from year to year, owing to the geology of the deposit and the proportion of copper to copper-zinc ore produced.

In 2017, a new mine and a capacity expansion opened in Peru. In January, Compania de Minas Buenaventura S.A.A. commisioned the 10,000 tonnes per year Tambomayo Mine near Chilcaymarca, Arequipa. In May 2017, Shougang Group Co. Ltd added 30,000 tonnes per year of capacity by reprocessing the tailings at the Marcona Mine near San Juan de Marcona. The Company also planned to produce copper and iron.

Thailand

Zinc mine production ceased in Thailand in 2017 after closure of Padaeng Industry Public Co. Ltd's Mae Sod Mine in 2016. The mine closed owing to the depletion of reserves and ceased operations by the end of 2017. In 2017, zinc metal production decreased by 73% from that of 2016. Padaeng Industry's smelter in Tak Province processed the remaining zinc concentrate from Mae Sod in 2017 and operations at the plant ceased in the second quarter of 2017. The refinery had a production capacity of 1,05,000 tonnes per year.

FOREIGN TRADE

Lead

Exports

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

Exports of lead ores and concentrates which were 9 tonnes in 20-201 increaed to 12 tonnes in 2021-22. Bangladesh is the sole country which imports lead ores & concentrates from India.

Exports of lead & alloys including scrap increased by 30% to 229864 tonnes during 2021-22 as compared to 176601 tonnes in the preceding year. Similarly, export of lead and alloys also increased by 30% to 229727 tonnes in 2021-22 as compared to 176569 tonnes in the previous year. Exports of refined lead unwrought also increased by 28% to 159983 tonnes in 2021-22 as compared to 125041 tonnes in the previous year. (Tables- 23 to 29).

Imports

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

Imports of lead ores & concentrates decreased to 5325 tonnes in 2021-22 as compared to 5473 tonnes in 2020-21. Imports were mainly from UAE (38%), Argentina (27%), Morocco (7%) and Taiwan (6%). The total imports of lead & alloys including scrap decreased marginally by 10% in 2021-22 with 314954 tonnes as compared to 348747 tonnes during 2020-21, of the total imports of lead and alloys including scrap. Imports of lead and alloys during 2021-22 were 225448 tonnes as compared to 245841 tonnes in 2020-21. (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 increased to 1762 tonnes in 2021-22 as against 399 tonnes in

the previous year. Korea is the main export destination of zinc ores & concentrates and accounted for 49% of all the exports of zinc ores & concentrates followed by China (38%).

Exports of zinc & alloys including scrap during 2021-22 were 283204 tonnes as against 300018 tonnes in the preceding year. Almost entire exports during 2021-22 were of zinc & alloys while those of scraps were nominal. UAE (18%), Taiwan (16%), Singapore (13%), Thailand (8%), Indonesia (7%) and Korea (6%) were the main export destinations for zinc alloys & scrap. Exports of zinc (scrap) were at 4 tonnes in 2021-22 as compared to 82 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.

Imports of zinc ores & concentrates during 2021-22 were at 720 tonnes as against 804 tonnes import during the previous year. Imports were mainly from UAE (45%), Imports of zinc & alloys during 2021-22 were at 148376 tonnes as compared to 139769 tonnes in 2020-21. Imports of zinc (scrap) were 79048 tonnes during 2021-22 as compared to 49428 tonnes in 2020-21. Imports of zinc or spelter were at 119157 tonnes in 2021-22 as compared to 118333 tonnes during the previous year. The major suppliers of zinc & alloys including scrap during 2020-21 were Republic of Korea (43%), Japan (9%), USA and UAE (6% both) (Tables- 41 to 45).

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	176569	25841849	229727	40523557
Korea, Rep. of	69336	9803170	135896	23625355
Thailand	17440	2645595	21942	3962844
Vietnam Soc Rep	16591	2430259	29794	5514652
Taiwan	14250	2031656	3448	625827
Bangladesh Pr	13326	1988441	5069	883128
U A E	11540	1819996	11838	2130948
Belgium	1051	206061	1966	483627
Singapore	6202	851671	3052	593726
Oman	4584	692525	3726	691397
Japan	3066	520185	2525	474486
Other countries	19183	2852290	10471	1537567

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**9**	**21076**	**12**	**1595**
Bangladesh	9	700	12	1290
Sri Lanka	++	176	++	45
Canada	++	110	++	--
Iraq	++	59	--	62
South Africa	++	24	++	--
U S A	++	7	--	

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**176601**	**25845466**	**229864**	**40542449**
Korea, Rep. of	69336	9803170	135896	23625355
Thailand	25498	3821467	17440	2645595
Vietnam Soc Rep	16591	2430259	29794	5514652
Taiwan	14250	2031656	3448	625827
Bangladesh Pr	13326	1988441	5069	883128
UAE	11540	1820001	11972	2148902
Singapore	6202	851671	3052	593726
Oman	4584	692525	3726	691397
Japan	3066	520185	2525	474486
Belgium	1051	206061	1966	483627
Other Countries	19215	2855902	10474	1538505

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**32**	**3617**	**137**	**18892**
U K	27	2491	--	--
Nepal	4	913	1	248
Uganda	++	118	++	3
Bhutan	1	90	++	18
U A E	++	5	134	17954
Mozambique	—	—	++	1
Canada	—	—	2	305
Ghana	—	—	2	305
Tanzania Rep	—	—	++	1
USA	—	—	++	35

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**125041**	**17711659**	**159983**	**27714832**
Korea, Rep. of	57095	8010251	104708	17751098
Indonesia	694	90670	744	131394
Vietnam Soc Rep	11555	1646508	23767	4399066
Thailand	10384	1480455	13981	2393953
Taiwan	14249	2031320	3053	557525
Singapore	6032	810675	2206	436927
Bangladesh Pr	4725	692814	1964	335052
UAE	4206	627828	4468	760493
Belgium	307	61573	1251	254676
Qatar	1550	235663	2017	357877
Other countries	14244	2023902	1824	336771

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	31878	5105512	41844	8169395
Korea, Rep. of	9163	1348577	21879	4183917
Thailand	6923	1141304	7425	1451694
Oman	3615	548344	3028	570970
U A E	2982	521682	2472	494075
Vietnam Soc Rep	3220	512255	2995	577459
Bangladesh Pr	2517	390239	825	148031
Japan	1174	225339	802	168319
Indonesia	903	145148	450	87156
Belgium	744	144470	641	205721
Sri Lanka dsr	50	9817	476	107887
Other countries	587	118337	851	174166

Figures rounded off

Table – 29 : Exports of Lead (Pig Lead) (By Countries)

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	—	—	++	205
Nepal	—	—	++	25
Oman	—	—	++	180

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	5473	146234	5325	255224
Turkey	1574	1107	122	7575
U A E	2196	101447	2033	90006
Morocco	276	19963	354	22289
Sudan	316	12421	194	7637
Argentina	212	8710	1418	61012
Ghana	322	7141	215	8111
Jordan	101	4385	138	6358
Taiwan	--	--	312	18580
tanzania Rep	--	--	141	16407
Cameroon	--	--	147	6441
Other countries	476	24803	251	10808

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**348747**	**49923441**	**314954**	**45882809**
Korea, Rep.of	68876	10913957	64132	10047758
U S A	31192	4246560	29942	4125992
U A E	27657	3884470	27109	3952987
Australia	15330	2215733	24631	3597602
Malaysia	32955	4673445	20411	2925282
Vietnam	23196	3299440	20436	2915131
U K	31520	4232373	17340	2414745
Singapore	8587	1271828	15612	2312748
Japan	5468	830031	7483	1165366
Philippines	7562	1082965	6485	930088
Other countries	96399	13272639	81373	11495110

Figures rounded off

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

Country	2020-21 (R)		2021-2022 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**245841**	**36498550**	**225448**	**40056256**
Korea Rep.	64132	10047758	58025	11416895
U A E	25190	3689200	35893	6319169
Senegal	4023	536116	8272	1234691
Vietnam Soc Rep	20436	2915131	5208	906636
Malaysia	19727	2835078	17302	2982150
Sri Lanka Dsr	3951	567711	7006	1178659
Singapore	14944	2222329	14401	2524294
Philippines	6295	904353	11541	1993641
Tanzania Rep	5471	768310	9954	1674550
Mozambique	5333	725802	5379	838124
Other countries	76339	11286762	52467	8987447

Figures rounded off

Table – 33 : Imports of Lead and Waste &Scrap (By Countries)

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**69113**	**9384259**	**78125**	**12913604**
USA	29111	4008027	25957	4763985
UK	14957	2034671	15650	2579214
Australia	3333	443539	3510	609271
Qatar	961	105500	8150	992953
U A E	1919	263787	2092	366884
Canada	1758	232161	1856	323476
Spain	1707	226882	2301	376473
Belgium	1807	212306	2237	334530
Kuwait	752	106532	2136	330950
Netherlands	1113	139473	2513	392704
Other countries	11695	1611381	11723	1843164

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**3091**	**446955**	**3168**	**548109**
UAE	2393	347242	2151	385190
South Africa	384	55459	91	15699
Nepal	169	23913	151	22032
Turkey	94	12990	—	—
Oman	51	7351	—	—
Nigeria	—	—	425	72583
Korea Rp	—	—	350	52605

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**76619**	**10883029**	**92646**	**15812725**
U Arab Emts	13370	1925738	22752	3976487
Philippines	4781	687182	9802	1703083
Tanzania Rep	4635	647258	8977	1509429
Singapore	6375	923452	5956	1068009
Senegal	2604	347763	6021	973265
Mozambique	4075	553340	5379	838124
Vietnam Soc Rep	17825	2549515	3808	666120
Malaysia	3036	433410	2983	514619
Thailand	1428	202084	2822	492213
Zambia	771	109855	2596	453592
Other countries	17719	2503432	21550	3617784

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**89777**	**13415047**	**51810**	**9125700**
Korea Rep.	44988	6773388	30934	5622611
Australia	15764	2302577	296	46630
Nepal	1267	181274	2151	346125
U A E	4216	615859	6534	1129796
Malaysia	3707	541480	1007	176683
Tanzania Rep	376	57158	651	113331
U K	2378	370189	3891	641994
Sri Lanka Dsr	2225	318846	3753	628072
Russia	1770	278778	670	99153
Germany	252	38045	663	111068
Other countries	12834	1937453	1260	210237

Figures rounded off

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

Country	2020-2021 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**399**	**20716**	**1762**	**46757**
Cuba	150	17276	100	10689
China P Rp	249	3440	672	20337
Netherland	—	—	100	12367
Korea Rp	—	—	890	3342
U S A	—	—	++	22

Figures rounded off

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

Country	2020-21 (R)		2020-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**300018**	**55103971**	**283204**	**74950497**
Malaysia	95207	15880500	12973	3366333
Singapore	72651	13296034	36877	8862815
Taiwan	30349	5684418	47569	12427104
Korea Rep.	19462	3619387	19179	4888152
Thailand	14109	2832734	27597	7319273
UAE	13401	2594864	51188	14027340
Nepal	12622	2457205	12622	3106318
Vietnam Soc Rep	3361	703327	10064	2648860
Indonesia	7749	1469272	20096	5456259
Saudi Arab	2710	528251	10914	3166543
Other countries	28397	6037979	34125	9681500

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**299936**	**55094321**	**283200**	**74949996**
Malaysia	95207	15880500	12973	3366333
Singapore	72651	13296034	36877	8862815
Taiwan	30349	5684418	47569	12427104
Korea Rep.	19462	3619387	19179	4888152
Thailand	14109	2832734	27597	7319270
U A E	13401	2594864	51185	14027005
Nepal	12618	2456700	12621	3106157
Saudi Arab	2710	528251	10914	3166543
Indonesia	7749	1469272	20096	5456259
Vietnam Soc Rep	3361	703327	10064	2648860
Other countries	28319	6028834	34125	9681498

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**82**	**9650**	**4**	**501**
Hong Kong	52	6206	—	—
China P Rp	26	2939	—	—
Nepal	4	505	1	161
U Arab Emts	—	—	3	335
Thailand	—	—	++	3
Bhutan	—	—	++	1
Guinea	—	—	++	1

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	804	9530	720	24772
Belgium	804	9513	—	—
U S A	++	17	++	56
Ethiopia	—	—	240	5031
U Arab Emts	—	—	328	14212
Zambia	—	—	128	3052
Mexico	—	—	24	2421

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**189197**	**34313169**	**227424**	**50722547**
Korea, Rep. of	88877	16988711	98412	24171382
Japan	31867	6297778	20835	5064363
USA	9544	1472753	13596	2669794
UAE	9788	1463781	13237	2574177
Australia	3936	772291	4916	1033054
Italy	3999	693321	4411	976911
Malaysia	3341	539389	4481	891737
Singapore	1143	166615	4003	891239
Netherlands	3048	465791	7639	1402450
Germany	2637	437731	7419	1504532
Other countries	31017	5015008	48475	9542908

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**139769**	**27338160**	**148376**	**36587059**
Korea Rep.	88866	16987074	98410	24171001
Japan	31643	6267634	20672	5037439
Australia	3848	760630	4853	1022524
U Arab Emts	3411	602970	5839	1375424
China P Rp	909	419540	1151	616750
Switzerland	1879	385274	3520	870334
Singapore	71	12684	2400	612586
Uzbekistan	203	31304	1292	328964
Belgium	816	191588	990	296032
Myanmar	998	189027	1117	285415
Other countries	7125	1490435	8132	1970590

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**118333**	**22644454**	**119157**	**28626796**
Korea Rp	73744	13989990	78076	18913268
Japan	31372	6189217	20190	4911919
Australia	3844	759038	3878	780989
U Arab Emts	2325	433102	4449	1086595
Switzerland	1829	374946	3519	865724
Myanmar	998	189027	1117	285415
Singapore	—	—	2172	555179
Kenya	672	107305	772	156582
Uzbekistan	203	31304	1292	328964
Congo P Rep	—	—	843	230194
Other countries	3346	570525	2849	511967

Figures rounded off

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

Country	2020-21 (R)		2021-2022 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**49428**	**6975009**	**79048**	**14135488**
USA	8453	1243249	12743	2457975
UAE	6377	860811	7398	1198753
Italy	3393	493975	3907	760398
Saudi Arabia	3269	470225	3959	695111
Netherland	2808	426371	7116	1288768
Malaysia	2503	364714	3804	705340
Germany	2397	346003	7246	1424661
Indonesia	1996	261024	4177	671929
U K	1782	243296	2617	459968
Thailand	703	95115	3263	409948
Other countries	15747	2170226	22818	4062637

Figures rounded off

FUTURE OUTLOOK

International Lead & Zinc Study Group (ILZSG) forecasted the global demand for refined lead metal to rise by 1.7% to 12.61 million tonnes in 2022. ILZSG also forecasted that world demand for refined zinc metal would rise by 6.2% to 14.09 million tonnes in 2021 and would further increase by 2.3% to 14.41 million tonnes in 2022. These projections would be due to a number of new projects and expansions in existing capacity in India, Kazakhstan, Mexico and Portugal.

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

As per Ministry of Mines report on"'National Non-Ferrous Metal Scrap Recycling Framework, 2020", Lead finds its use in storage batteries, also dubbed lead acid batteries. India is likely to witness a substantial growth in the demand for lead batteries given that several sectors, including automotive, telecommunication, railways and defence, are set to expand in the years ahead. As a battery ingredient, lead is increasingly used in inverters, UPS and similar energy storage devices. The Indian market for lead acid batteries is currently estimated at US$7 billion, driven by the Automotive Sector, which consumes ~60% of lead acid batteries.The demand of Lead has been increasing with a CAGR of 3.8%, while there has been a consistent level of imports over last 5 years.

In case of zinc, the demand has increased at CAGR 1.89% in last five years. The production, however has declined and has a negative, -1.3% CAGR. Dependence on imports has grown over the years at the rate of CAGR 2.10%. To meet the demand domestically in view of low production trend and higher imports, recycling can be a good alternative.

As every major national plan sees continuous rise in the power generation capacity of the country, the demand for galvanised transmission tower is also expected to increase by about 4 to 5% along with increasing necessity of erection of mobile towers for which higher investment in infrastructure would have to met. Railways will also lead in the use of galvanised steel.