

SILVER



Indian Minerals Yearbook 2016

(Part- II : Metals & Alloys)



55th Edition

SILVER

(ADVANCE RELEASE)

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

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15 Silver

Silver is soft and lustrous metal that is grouped in the category of noble metals. Its brilliant white colour, malleability and resistance to atmospheric oxidation has enhanced its value as a highly desired precious metal which is used in many industrial applications. Apart from its monetary and decorative uses, silver is known to have the highest electrical conductivity amongst all metals that enhances its potential in modern age applications, viz, for printed electric circuits, coating for electronic conductors and in alloys of gold & copper for electrical contacts. Its chloride and iodide are light-sensitive and hence used in photographic material. Silver is typically used (in paste form) on solar cells, this means the photovoltaics (PV) market has become one of the most important areas of silver demand. These two major uses have contributed to the increase in supply of scrap of silver contained products. Silver, which is the least expensive of the precious metals, is the whitest element and has the highest electrical and thermal conductivity of all the metals.

In India, there are no native silver deposits except the small and unique Bharak deposit in Rajasthan. It occurs generally with lead, zinc, copper (especially their sulphide ore) and gold ores and is extracted as a by-product from electrolysis or chemical methods. It was usually extracted by melting silver-bearing lead ore (ore containing argentiferous galena).

Silver is recovered as a co-product as well as a by-product in the country. Silver was recovered in the past as a co-product in gold refining at KGF Complex and Hutti Gold Mines in Karnataka, as a by-product in smelting and refining of lead, zinc and copper concentrates at Chanderiya and Debari smelters in Rajasthan, Tundoo and Moubandar (Ghatsila) smelters in Jharkhand and at Visakhapatnam smelter in Andhra Pradesh. The present production of silver comes from Chanderiya lead-zinc smelter of HZL and from gold refinery of HGML. In addition, Hindalco extracts silver as a by-product during smelting of imported copper concentrates at Dahej in Gujarat.

RESERVES/RESOURCES

As per the NMI database, based on UNFC system, the total reserves/resources of silver ore in the country as on 1.4.2015 has been estimated at about 511.95 million tonnes. Out of these, 150.44 million tonnes were placed under 'reserves' category and 361.51 million tonnes under the 'remaining resources' category.

The total reserves/resources of silver in the country as on 1.4.2015 in terms of metal were estimated at 29,982 tonnes, of which 7,172 tonnes are under 'reserves' and 22,810 tonnes are under the 'remaining resources'.

By States, Rajasthan accounted for about 87% reserves/resources in terms of ore, Jharkhand 5%, Andhra Pradesh 3% and Karnataka 2%. Madhya Pradesh, Uttarakhand, Odisha, Meghalaya, Sikkim, Tamil Nadu and Maharashtra together shared 3% ore reserves/remaining resources (Table- 1).

As per reserves & resources Summary of HZL 2015-16, grade of silver were 96 g/t under reserves category and 75 g/t under resources category.

PRODUCTION

Silver is recovered as a by-product from lead & zinc concentrates, copper slime and as a co-product of gold refining. During the year 2015-16, the production of silver at 4,26,443 kg increased by 30% as compared to the previous year. The production of silver from gold refining was 122 kg in 2015-16 as against 139 kg in 2014-15. One Private Sector and one Public Sector Undertaking reported production of silver during 2015-16 (Tables- 2 to 4). In addition, Hindalco Industries Ltd reported production of 74,820 kg and 64,735 kg silver from imported copper concentrates in 2014-15 and 2015-16 respectively. As per Annual Report of HZL 2015-16, silver refining capacity was 518 tonnes per annum. The annual total production of refined silver during the year 2015-16 was 459 tonnes under total refined metal. HZL also has facilities at Pantnagar, in the State of Uttarakhand for processing and refining of silver.

**Table – 1 : Reserves/Resources of Silver as on 1.4.2015
(By Grades/States)**

(In tonnes)

State/Grade	Reserves			Remaining resources					Total resources (A+B)				
	Proved STD111	Probable STD121 STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221 STD222	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334	Total (B)		
All India : Total													
Ore	69277075	8413000	72753828	150443903	-	1484543	46726460	29632000	65056000	218611729	-	361510732	511954635
Metal	4309.78	220.77	2641.39	7171.94	-	42.85	259.62	2037.99	3236.39	17230.19	2.84	22809.88	29981.82
By state													
Andhra Pradesh													
Ore	-	-	-	-	-	-	16950000	-	-	-	-	16950000	16950000
Metal	-	-	-	-	-	-	128.13	-	-	-	-	128.13	128.13
Jharkhand													
Ore	-	-	-	-	-	-	-	-	23840000	-	-	23840000	23840000
Metal	-	-	-	-	-	-	-	-	5.22	-	-	5.22	5.22
Karnataka													
Ore	10620000	1730000	-	12350000	-	-	69462	-	-	314150	-	383612	12733612
Metal	2.71	0.24	-	2.95	-	-	0.48	-	-	2.92	-	3.40	6.35
Madhya Pradesh													
Ore	-	-	-	-	-	-	-	2096000	1120000	-	-	3216000	3216000
Metal	-	-	-	-	-	-	-	150.61	9.25	-	-	159.86	159.86
Maharashtra													
Ore	-	-	-	-	-	-	-	-	235000	-	-	235000	235000
Metal	-	-	-	-	-	-	-	-	0.23	-	-	0.23	0.23
Meghalaya													
Ore	-	-	-	-	-	-	-	880000	-	-	-	880000	880000
Metal	-	-	-	-	-	-	-	19.80	-	-	-	19.80	19.80

(Contd.)

Table - 1 (Concl.d.)

State/Grade	Reserves				Remaining resources				Total resources (A+B)			
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Inferred STD333		Reconnaissance STD334		
		STD121	STD122			STD221	STD222					
Odisha												
Ore	-	-	-	-	-	960500	119000	-	670000	-	1749500	
Metal	-	-	-	-	-	27.34	3.40	-	34.17	-	64.91	
Rajasthan												
Ore	58657075	6683000	72753828	138093903	-	88200	29524218	27732000	60350000	191432579	-	309126997
Metal	4307.07	220.53	2641.39	7168.99	-	0.26	127.57	1876.39	3045.91	17137.53	2.84	22190.50
Sikkim												
Ore	-	-	-	-	-	435843	63780	300000	-	150000	-	949623
Metal	-	-	-	-	-	15.25	0.04	27.60	-	13.80	-	56.69
Tamil Nadu												
Ore	-	-	-	-	-	-	-	-	330000	460000	-	790000
Metal	-	-	-	-	-	-	-	-	15.87	26.68	-	42.55
Uttarakhand												
Ore	-	-	-	-	-	-	-	1600000	1400000	390000	-	3390000
Metal	-	-	-	-	-	-	-	134.00	4.20	0.39	-	138.59

Figures rounded off.

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Table – 2 : Principal Producers of Silver, 2015-16

Name and address of the producer Plant	Name of State	Location of the plant	
		District	
Hindustan Zinc Ltd , Yashad Bhavan, Udaipur- 313 004 Rajasthan.	Chandera	Rajasthan	Chittorgarh
The Hutti Gold Mines Co. Ltd , Hutti, Distt.-Raichur, 584 115 Karnataka	Hutti	Karnataka	Raichur

**Table – 3 : Production of Silver*, 2013-14 to 2015-16
(By States)**

(Quantity in kg; Value in ₹'000)

State	2013-14		2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	349774	15778713	327647	11947028	426443	15212365
Karnataka	154	6569	139	5103	122	4039
Rajasthan	349620	15772144	327508	11941925	426321	15208326

*: Excludes by-product recovery of silver by Hindalco Industries Ltd at Dahej, Gujarat from imported copper concentrates.

**Table – 4 : Production of Silver*, 2014-15 and 2015-16
(By Sectors/States/Districts)**

(Qty in kg; Value in ₹'000)

State/District	2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value
India	327647	11947028	426443	15212365
Public sector	139	5103	122	4039
Private sector	327508	11941925	426321	15208326
Karnataka/Raichur	139	5103	122	4039
Rajasthan/Chittorgarh	327508	11941925	426321	15208326

* Silver as a by-product:

i) In Karnataka, it is recovered at Raichur while refining of gold at Hutti and Uti gold mines.

ii) In Rajasthan, it is recovered at Chandera, lead-zinc smelters of HZL.

iii) Excludes by-product recovery of 74,820 kg and 64,735 kg silver from imported copper concentrates in 2014-15 and 2015-16, respectively.

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TRADING EXCHANGE

The three leading commodities exchanges, where a prospective investor can trade in silver are:

1. National Multi Commodity Exchange (NMCE)
2. National Commodity & Derivatives Exchange (NCDEX)
3. Multi Commodity Exchange (MCX)

RECYCLING

Recycling, a significant factor in the supply of many of the metals used in our society, provides environmental benefits, such as, energy saving, reduced emission associated with energy saving etc. Photographic wastes, spent catalysts and electronic scrap are the major sources of materials for silver recycling. Other recyclable silver-bearing materials include dental alloys, jewellery and silverware. Cell phones have become one of the major sources for recycled silver recovery. As per USGS Report entitled "Recycled Cell Phones—A Treasure Trove of Valuable Metals", references on data offered by the Falconbridge Ltd, indicate that one tonne of obsolete cellphones (exclusive of batteries) contains an average 3.14 kg of silver metal.

As per the data of World Silver Survey 2017, silver scrap supply remains steady at 85 tonnes (2.7 Moz) in 2016 as compared to the previous year. Scrap from retail consumers was mainly in the form of old jewellery. Recycling of silver from these uses is an important part of its supply.

As per annual Silver Focus Report 2017, global silver recycling was effectively unchanged during 2016-17, at 5,023 tonnes (161.5 Moz). The largest source of silver scrap, which is the Industrial Sector, posted a 1% rise, benefitting from slightly higher ethylene oxide recycling. This was joined by a 4% gain for jewellery, the result of growth in East Asia and the Middle East. However, these were offset by losses elsewhere. Photographic recycling posted a further structural decline and the largest year to year fall at 7%. By contrast, silverware fell by 3%, in large part due to the weak response from western countries's scrap to higher prices.

WORLD REVIEW

The total reserves of silver in metal content are estimated at 5,70,000 tonnes. Peru (21%), Australia (16%), Poland (15%), Chile (14%), China

(7%) and Mexico (6%) are the major countries having silver reserves (Table- 5).

Mexico, Peru, China, Australia, Russia, Bolivia and Poland are the main producers of silver. The global primary as well as by-product mine output slightly increased to 27,511 tonnes of metal content in 2015 from 27,203 tonnes in the previous year. World mine production of silver is furnished in Table- 6.

Australia

Production in Australia decreased by 26% to 1,374 tonnes in 2015 from 1,847 tonnes in 2014. The decrease was the result of lower average ore grades which is in tandem and in accord with plans to cease operation at Cannington in 2015.

Argentina

Silver production increased by 19% to 1,079 tonnes in 2015 from 905 tonnes in 2014 owing to production increases at most of the major silver mines and to the startup of Goldcorp Inc.'s Cerro Negro Mine. Processing of ore at Cerro Negro commenced in July and began ramping up to full capacity of 4,000 tonnes per day of ore. Significant increases in silver production took place at Pan American Silver Corp.'s Manantial Espejo Mine and Troy Resources Ltd's Casposo Mine.

Chile

Silver production decreased by 4% to 1,504 tonnes in 2015 from 1,572 tonnes in 2014.

FOREIGN TRADE

Exports

There were no exports of silver ores and concentrate during 2015-16. Exports of metal silver in 2015-16 increased drastically to 24 tonnes from 5 tonnes in the preceding year. Exports were mainly to USA (58%) and UAE & Canada (8% each). Exports of silver-clad base metals was drastically decreased to 291 kg during 2015-16 from 22,375 kg reported in 2014-15. Exports of Semi-Manufactured silver were at 24 tonnes during the year 2015-16 as compared to one tonne of the previous year and exports of silver powder was negligible during the year 2015-16 (Tables-7 to 11).

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**Table – 5 : World Reserves of Silver
(By Principal Countries)**

(In tonnes of silver content)

Country	Reserves
World: Total (rounded)	570000
Australia	89000
Bolivia	22000
Chile	77000
China	39000
Mexico	37000
Peru	120000
Poland	85000
USA	25000
Russia	20000
Other countries	57000

*Source: Mineral Commodity Summaries, 2017.***Imports**

Imports of silver were 7,428 tonnes in 2015-16 against 7,708 tonnes in the previous year. Imports were mainly from the UK (31%), Switzerland (13%), China & Russia (10% each), Korea, Rep. of (7%), USA (5%) and Germany, Hong Kong & Australia (3% each). Imports of silver-clad base metals were 189 kg in 2015-16 as against 2,774 kg in the previous year. Korea, Rep. of (79%) and Germany (21%) were the major importers. Imports of Semi-Manufactured silver were 502 tonnes during the year 2015-16 as compared to 402 tonnes in the previous year. Besides, imports of Silver unwrought were 6,784 tonnes during the year 2015-16 as compared to 7,306 tonnes in previous year. UK (32%) and Switzerland (13%) were the major importers. Imports of silver powder in 2015-16 increased drastically to 142 tonnes from negligible quantities reported in the previous year. UK (37%), Korea, Rep. of (25%), Switzerland (24%) and China (7%) were the major importers (Tables-12 to 16).

**Table – 6 : Mine Production of Silver
(By Principal Countries)**

(In tonnes of metal content)

Country	2013	2014	2015
World: Total	25989	27203	27511
Argentina	774	905	1079
Australia	1840	1847	1374
Bolivia	1287	1345	1306
Brazil	22	25	25 ^e
Canada	640	495	380
Chile	1174	1572	1504
China	3670	3499	3393
Guatemala	281	858	863
Kazakhstan	964	989	1309
Mexico	5821	5766	5592
Peru	3674	3778	4102
Poland	1161	1384	1407
Russia*	1412	1334	1571
USA	1037	1184	1100 ^e
Other countries	2230	2221	2506

Source: World Mineral Production, 2011-2015.

* Smelted and/or refinery production.

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**Table – 7 : Exports of Silver
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	5	346251	24	481460
USA	1	48440	14	191372
UAE	2	139482	2	112351
Mexico	++	18	1	28650
Canada	++	39	2	23381
UK	++	13945	++	14105
Philippines	-	-	1	10765
Turkey	++	2743	++	8814
South Africa	-	-	1	8752
Iran	++	6018	++	8201
Sweden	-	-	1	7596
Other countries	2	135566	2	67473

**Table – 8 : Exports of Silver-clad Base Metals
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity (kg)	Value (₹'000)	Quantity (kg)	Value (₹'000)
All Countries	22375	264220	291	2514
USA	10491	130912	190	2267
Sri Lanka	120	434	100	231
Cyprus	-	-	1	16
Canada	2000	35066	-	-
Chinese taipei/Taiwan	373	3194	-	-
Brazil	132	1880	-	-
Argentina	170	1221	-	-
Bahrain	47	976	-	-
Australia	15	50	-	-
Bangladesh	1	28	-	-
Other countries	9026	90459	-	-

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**Table – 9 : Exports of Silver:Semi-Manufactured
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	1	89597	24	461663
USA	1	45270	14	185000
UAE	++	56	2	111297
Mexico	++	18	1	28650
Canada	++	39	2	23381
Philippines	-	-	1	10765
Turkey	++	2743	++	8814
South Africa	-	-	1	8752
Iran	++	6018	++	8201
Sweden	-	-	1	7596
Finland	++	12429	++	7285
Other countries	++	23024	2	61922

**Table – 10 : Exports of Silver:Unwrought
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	++	17848	++	19778
UK	++	13905	++	10473
USA	++	3170	++	6372
UAE	-	-	++	1054
Germany	-	-	++	508
Hong Kong	++	201	++	507
Belgium	-	-	++	400
Dominican Rep.	-	-	++	286
Malaysia	-	-	++	96
Saudi Arabia	-	-	++	81
Sri Lanka	++	203	-	-
Other countries	++	369	++	1

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**Table – 11 : Exports of Silver:Powder
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value
	(t)	(₹'000)	(t)	(₹'000)
All Countries	4	238806	++	19
Sri Lanka	-	-	++	10
Singapore	-	-	++	8
Tanzania	-	-	++	1
UAE	2	139426	-	-
Belgium	2	99340	-	-
UK	++	40	-	-

**Table – 12 : Imports of Silver
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity	Value	Quantity	Value
	(t)	(₹'000)	(t)	(₹'000)
All Countries	7708	276863750	7428	244357984
UK	1472	50461466	2336	75325344
Switzerland	444	15208675	967	31502018
China	1820	69243611	775	25124810
Russia	850	30581026	713	22665591
Korea, Rep. of	623	22734128	533	17373285
USA	70	2053472	352	11352603
Germany	742	25772844	258	8246166
Hong Kong	538	20071243	252	8221064
Australia	5	173746	243	7898376
Canada	25	858372	205	6657264
Other countries	1119	39705167	794	29991463

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**Table – 13 : Imports of Silver-clad Base Metals
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity (kg)	Value (₹'000)	Quantity (kg)	Value (₹'000)
All Countries	2774	28253	189	1185
Germany	30	521	39	940
Korea, Rep. of	-	-	150	245
USA	1135	12531	-	-
Italy	345	7652	-	-
France	1183	5455	-	-
Spain	5	962	-	-
Brazil	9	700	-	-
UK	35	262	-	-
Guatemala	12	127	-	-
Hong Kong	20	43	-	-
Other countries	-	-	-	-

**Table – 14 : Imports of Silver Semi-Manufactured
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	402	13865841	502	15596904
Korea, Rep. of	109	3874574	153	4980433
UK	14	523711	81	2619538
China	53	2021911	54	1777202
USA	25	506270	51	1298605
Switzerland	3	91962	33	1050492
Sweden	65	2171553	28	927334
Australia	++	6	20	673233
South Africa	5	174092	15	459534
Italy	19	334971	26	417385
Russia	14	531426	12	362720
Other countries	95	3635365	29	1030428

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**Table – 15 : Imports of Silver :Unwrought
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	7306	262988879	6784	224242895
UK	1458	49937727	2202	71057608
Switzerland	441	15116713	900	29361135
China	1767	67215582	711	23024854
Russia	836	30049600	701	22302871
Korea, Rep. of	514	18859554	345	11218404
USA	45	1546883	300	10021484
Germany	740	25685766	257	8206831
Hong Kong	502	18701103	250	8161443
Australia	5	173740	223	7225143
Canada	25	858372	205	6656620
Other countries	973	34843839	690	27006512

**Table – 16 : Imports of Silver :Powder
(By Countries)**

Country	2014-15		2015-16 (P)	
	Quantity (t)	Value (₹'000)	Quantity (t)	Value (₹'000)
All Countries	++	9030	142	4518185
UK	++	28	53	1648198
Korea, Rep. of	-	-	35	1174448
Switzerland	-	-	34	1090391
China	++	6118	10	322754
Turkey	-	-	5	145814
UAE	-	-	3	77293
USA	++	319	1	32514
Singapore	-	-	1	15393
Germany	++	1831	++	5225
Israel	-	-	++	2821
Other countries	++	734	++	3334

FUTURE OUTLOOK

Silver has the dual usefulness of being a precious metal as well as an industrial metal. World over, silver is primarily traded for its industrial applications, however, Indian silver imports are largely consumed for jewellery and silverware. India is among the top 5 silver consumers in the world. About 60% of silver consumption in India is from the rural population who view it as a solid saving commodity. India does not produce silver in a significant scale and most of the silver has to be imported. Moreover, silver demand has been on the rise in major growing economies including India during the past few years. New industries, such as, medicine, manufacturing etc. are sealing up their demand for silver, and this may soon translate to higher levels of imports.

As per annual Silver Focus Report 2017, global silver demand in photographic applications is likely to drop and is expected to touch 1,155 tonnes (37.1 Moz) during 2017-18. Digital technology and its applications would indeed be the primary cause for this fall.

As per annual Silver Focus Report 2017, India is aiming to double its installation of new capacity from 4.5 GW during 2016-17 to around 10 GW during

2017-18. In the year 2017-18, India in all probabilities would overtake Japan as the world's third largest photovoltaic (PV) market as there are plans to raise capacity steadily to a target of 100 GW by 2022.

On the other side, industrial demand for silver in India may remain unchanged and would be in consistant with 1,015 tonnes (35.8 Moz) as in 2015-16. This trend is likely to continue into the near future. The key areas of industrial demand are electrical and electronics and brazing alloys. The government's aggressive effort to boost infrastructure that include expanding the power network, with a target to complete electrification of villages in the next 4-5 years would be the most potent driving force that would influence the industrial demand for silver.

However, the counter narrative is that notwithstanding the Government's initiative for infrastructural boost, the benefits for industrial demand would be only to modest levels as the high inventory levels of semi-fabricated products across the supply chain would offset any demand escalation of silver. Housing projects (driven by a new government initiative) is another potential demand escalator for electrical equipment which would in turn influence the demand for silver.