

## **Indian Minerals Yearbook 2021**

(Part-II: Metals & Alloys)

60<sup>th</sup> Edition

### SILVER

(ADVANCE RELEASE)

GOVERNMENT OF INDIA MINISTRY OF MINES INDIAN BUREAU OF MINES

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February, 2023

Cilver is soft and lustrous metal that is grouped **O** in the category of noble metals. Its brilliant white colour, malleability and resistance to atmospheric oxidation have 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. It 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 among 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 and 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 byproduct 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 1.4.2020 has been estimated at about 568.64 million tonnes. Out of these, 170.44 million tonnes were placed under 'Reserves' category and 398.20 million tonnes under the 'Remaining Resources' category.

The total reserves/resources of silver in the country as on 1.4.2020 in terms of metal content was estimated at 30,267 tonnes, of which 7707 tonnes are under 'Reserves' and 22,560 tonnes are under the 'Remaining Resources'. By States, Rajasthan accounted for about 86% reserves/resources in terms of ore, Karnataka & Jharkhand 4% each, Andhra Pradesh 3% and 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 2020-21, grade of silver was 61 gram/tonne under Total Reserves category, 63 gram/tonne under measured and indicated Resources category and 66 gram/ tonne under inferred Resources categories.

#### PRODUCTION

Silver is recovered as a by-product from lead & zinc concentrates, copper slime and as a coproduct of gold refining. As per Annual Report of HZL 2020-21, silver refining capacity is 800 tonnes per annum. HZL is also currently operating a plant for processing and refining of zinc, lead and silver at SIDCUL, Pantnagar, Uttarakhand since 2011. This facility does not add to the overall smelting capacity.

			R	Reserves					Remainir	Remaining Resources				Ę
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Total         61604192         67971000         40870828         1707.07         172.2         824.44         663.67         3881.88         4575.73         1244           ddesh         2155.3         4981.73         570.04         7707.07         172.2         824.44         663.67         3881.88         4575.73         1244           ddesh         0         0         0         0         0         0         0         0         0         124.146         1455.73         1244         125.13         1244         125.13         1244         1245.73         1244         1245.73         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         1244         1245.13         124         124         124         124         124         124         124         124         124         124         124		111/110	I			117016	STD221	STD222	1000110	700010	cccute	+ccU16	(a)	(A <sup>+</sup> B)
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	Metal	0	0	0	0	0	0	0	0	19.8	0	0	19.8	19.8
d15h a	Odisha													
Ore 0 0 0 0 0 0 960500 119000 0 0 670	Ore	0	0	0	0	0	960500	119000	0	0	670000	0	1749500	1749500
Metal         0         0         0         0         0         27.34         3.4         0         0         3	Metal	0	0	0	0	0	27.34	3.4	0	0	34.17	0	64.91	64.91
														(contd.)

Table – 1 : Reserves/Resources of Silver as on 1.4.2020 (P) (Bv Grades/States)

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State (Cundo		R	Reserves					Remainin	Remaining Resources				LotoL
State Olauc	Proved STD111		Probable	Total (A)	Feasibility STD211		Pre-feasibility	Measured STD331	ed Indicated STD332	d Inferred STD333	Reconnaissance STD334	e Total (B)	Resources (A+B)
		STD121	21 STD122	22		STD221	STD222						
Rajasthan													
Ore	44124192	63331000 40870828		148326020 $2330000$	2330000	17049200	$17049200 \ 36712218 \ 39420000$		64730000	64730000 182142579	0 3.	42383997	342383997 490710017
Metal	2150.87	4980.73	570.04	7701.64	172.2	781.85	531.62	3720.28	4384.86	12349.76	0	21940.57 29642.21	29642.21
Sikkim													
Ore	0	0	0	0	0	435843	63780	300000	0	150000	0	949623	949623
Metal	0	0	0	0	0	15.25	0.04	27.6	0	13.8	0	56.69	56.69
Tamil Nadu													
Ore	0	0	0	0	0	0	0	0	330000	460000	0	790000	790000
Metal	0	0	0	0	0	0	0	0	15.87	26.68	0	42.55	42.55
Uttarakhand													
Ore	0	0	0	0	0	0	0	1600000	1400000	390000	0	3390000	3390000
Metal	0	0	0	0	0	0	0	134	4.2	0.39	0	138.59	138.59
Figures rounded off													

15-4

During the year 2020-21, the production of silver at 705,796 kg increased by 16% as compared to the previous year. The production of silver from gold refining was 120 kg in 2020-21 as against 187 kg in 2019-20. One Private Sector and one Public Sector undertaking reported production of silver during 2020-21 (Tables- 2 to 4).

In addition, Hindalco Industries Limited reported production of 40582 kg and 63,040 kg silver from imported copper concentrates in 2020-21 and 2019-20 respectively.

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

#### Table – 2 : Principal Producers of Silver, 2020-21

#### Table – 3 : Production of Silver\*, 2018-19 to 2020-21 (By States)

(Quantity in kg; Value in ₹'000)

<b>G</b> + - +	2018	-19	2019	-20	2020-	21 (P)
State	Qty	Value	Qty	Value	Qty	Value
India	679386	25824756	609340	25616104	705796	42664424
Karnataka	214	7785	187	8066	120	7244
Rajasthan	679172	25816971	609153	25608038	705676	42657180

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

#### Table – 4 : Production of Silver\*, 2019-20 and 2020-21 (By Sectors/States/Districts)

(Qty in kg; Value in ₹'000)

State/District	20	19-20	2020	-21 (P)
	Qty	Value	Qty	Value
India	609340	25616104	705796	42664424
Public sector	187	8066	120	7244
Private sector	609153	25608038	705676	42657180
Karnataka/Raichur	187	8066	120	7244
Rajasthan/Chittorgarh	609153	25608038	705676	42657180

\* 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 Chanderiya, lead-zinc smelters of HZL.

*iii)* Excludes by-product recovery of 40,582 kg and 63,040 kg silver from imported copper concentrates in 2020-21 and 2019-20, respectively.

#### 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 World Silver Survey 2021 report, Global silver recycling edged higher last year, by 7% to 5,665 tonnes (182.1Moz). Every key segment of scrap supply rose except photography, which suffered further structural losses. Industrial scrap benefited from growth in ethylene oxide (EO) change-outs and electrical supplies. It was also observed that, higher silver prices contributed to a rise in jewellery and silverware scrap supply especially from India.

#### WORLD REVIEW

The total reserves of silver in metal content is estimated at 5,30,000 tonnes. Peru (22%), Australia (17% each), Poland (13%), Russia (8%), China (8%), Mexico (7%), Chile & USA (5% each) and Bolivia (4%) are the major countries having silver reserves (Table-5).

Mexico, Peru, China, Poland, Russia, Australia, Chile, Bolivia and Kazakhstan are the main producers of silver. The total world mine production of silver in metal content was reported at 24,563 tonnes during the year 2020 which decreased by 14% as compared to 28,353 tonnes in the preceding year. Mexico was the leading producer with 22% share in the total production followed by Peru (11%), China (13%), Chile (6%), Poland (6%), Russia & Australia (5% each) and USA & Kazakhstan (4% each). World mine production of silver is furnished in Table- 6.

To provide a generalised view of the

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

	(In tonnes <sup>1</sup> of silver content)
Country	Reserves
World: Total (rounded off	) 530000
Argentina	NA
Australia	<sup>10</sup> 90000
Bolivia	22000
Chile	26000
China	41000
Kazakhstan	NA
Mexico	37000
Peru	120000
Poland	67000
Russia	45000
USA	26000
Other countries	57000

Source: USGS Mineral Commodity Summaries, 2022.

1:One tonne (1,000 kilograms)=32,150.7 troy ounces, a: For Australia, Joint Ore Reserves Committee-compliant reserve were 25,000 tonnes.

development in various countries the country-wise description sourced from the latest available publication of 'USGS' 2018 Minerals Yearbook, 'Silver [Advance Release]' is furnished below.

#### Argentina

In 2018, silver production in Argentina increased by 3% to 1,024 t from 2017 owing to increased production from Yamana Gold Inc.'s Cerro Moro Mine, which produced 128 t of silver after beginning commercial production on June 26. SSR Mining Inc.'s Puna operations decreased by 39% to 117 t of silver in 2018 from 192 t produced in the previous year.

#### Australia

In 2018, silver production in Australia increased by 12% to 1,254 t from 1,120 t (revised) in 2017. South32 Ltd.'s Cannington silver mine produced 416 t of silver in 2018, an 11% increase from 2017 production of 375 t. MMG Australia Ltd.'s Rosebery Mine produced 91 t, a 24% increase from 73 t in 2017, and the Dugald River Mine began operations in 2018, producing 28 t. BHP Group Ltd.'s Olympic Dam Mine produced 30 t, a 39% increase from 21 t in 2017.

		(In Kilograms	of metal conten
Country	2018	2019	2020
World:Total	28006638	28353780	24563120
Mexico	7243245	7485602	5605000
China	3421355	3443128	3377810
Peru	4160162	3860306	2723876
Chile	1370237	1309321	1575794
poland	1471000	1455000	1423000
Russia	1400100	1407000	1380000
Australia	1254480	1325089	1337344
Kazakhstan	969347	1022068	1035181
USA	934000	977000	986000
Bolivia	1191024	1153110	929909
Other countries	4591688	4916156	4189206

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

**Source:** BGS World Mineral Production, 2016-20. (a):- Smelter and/or refinery production.

c:- Years ended 31 March following that stated.

#### Bolivia

Silver production in Bolivia in 2018 was 1,191 t, essentially unchanged compared with 1,196 t (revised) in 2017. During 2018, the San Bartolomé Mine produced an estimated 136 t of silver. In February 2018, Coeur and its subsidiaries completed the sale of Empress Minera Manquiri, S.A. (the operator of the San Bartolomé Mine) to Ag-Mining Investments, AB Production of silver at the San Vincente Mine was 110 t in 2018, a slight decrease compared with 112 t in 2017.

#### Canada

Most of the silver in Canada was produced as a co-product or by-product of other metals in 35 mines. Silver production in Canada was 353 t in 2018, a 4% decrease from 366 t (revised) in 2017. This decrease was attributed to a decrease in production at Teck's Trail operation, Vale S.A.'s Sudbury operations, Glencore ple's Kidd Creek Mine, and Agnico Eagle Mines Ltd's LaRonde operations. Teck's Trail operation had a fire in its silver refinery, reducing refined silver production by 311 t (47%) from 2017. Vale's Sudbury operations produced less silver owing to reduced throughput. Glencore's Kidd Creek and Agnico Eagle's LaRonde operations had lower ore grades in 2018.

#### China

Silver production in China was 3,574 t in 2018, a slight increase from that in 2017. About 90% of the silver produced in the country was produced as a by-product of copper, lead, and zinc mining, and about 9% was from primary silver mines. In 2017, increased attention to environmental protection by the Government led to decreased lead and zinc production, resulting in a decrease in silver production. In 2018, some mines met the new Government requirements and increased silver production.

#### Mexico

In 2018, Mexico was the leading producer of silver in the world with production of 6,049 t, a slight decrease from the 6,109 t in 2017. At Minera Fresnillo plc's Herradura Mine, higher grades of ores, improved recovery rates, and the ramp up of the San Julian operations increased silver production. Minera Frisco, S.A.B de C.V.'s production decreased by 240 t (8%), owing to a decrease in throughput with the cessation of operations at the Porvenir and San Felipe open pit mines.

#### Peru

In 2018, Peru was the second-leading producer of silver in the world with a production of 4,160 t, a 3% decrease from that in 2017. The leading silver producer was Compañía de Minas Buenaventura S.A.A. with production from the following mines-Uchucchacua (480 t), Cerro Verde (142 t), Tambomayo (122 t), El Brocal (121 t), Julcani (77 t), Yancocha (33 t), Tantahuatay (25 t), Mallay (16 t), Orcopampa (10 t), and La Zanja (7 t). Of the 1,030 t of silver produced by Buenaventura mines, 836 t was attributed to the company because of the partial ownership of El Brocal (61.43%), La Zanja (53.06%), Yanacocha (43.65%), Tantahuatay (40.10%), and Cerro Verde (19.58%). Silver production at Uchucchachua decreased by 10% to 480 t in 2018 from 535 t in 2017 because of reduced ore grades and two temporary shutdowns, one in August and one in December.

Imports

#### Russia

In 2018, Russia was estimated to have produced 2,040 t of silver compared with 2,030 t (revised) in 2017. Silver production as a byproduct in gold mines in Russia increased by 392 t (32%). However, this increase was offset by a 50-t decrease in production at Polymetal International plc's Dukat and Lunnoune silver mines, which had lower ore grades in 2018.

#### FOREIGN TRADE

#### Exports

Exports of silver increased manyfold to 615 tonnes in 2020-21 as compared to 30 tonnes in the preceding year. Exports were mainly to UK (78%), USA (11%), Canada (5%). Exports of silver-clad base metals also increased to 6,026 kg during 2020-21 from 3,898 kg in 2019-20. Exports of Semi-manufactured silver increased manyfold to 569 tonnes in 2020-21 as compared to 30 tonnes in the preceding year. Exports of silverunwrought were 45 tonnes during the year 2020-21. Similarly, exports of silver powder were too negligible in both the years (Tables-7 to 11).

# Imports of silver decreased drastically by 72% to 1,484 tonnes in 2020-21 as compared to 5,421 tonnes in the preceding year. Imports were mainly from the Hong Kong (42%), UK (14%), Russia (9%), and Austria (8%).

Imports of silver-clad base metals also decreased to 500 kg in 2020-21 as against 574 kg in the previous year. Imports were mainly from Italy (60%) and Thailand (24%).

Imports of semi-manufactured silver were at 1195 tonnes during the year 2020-21 as compared to 589 tonnes in the previous year. Besides, imports of silver unwrought were at 279 tonnes during the year 2020-21 as compared to 4,833 tonnes in previous year. Imports were mainly from Hong Kong (48%), Thailand (20%). In 2020-21, imports of silver powder increased to 10 tonnes in 2020-21 from 5 tonnes reported in the previous year (Tables-12 to 16).

C t	2019	9-20 (R)	20	20-21 (P)
Country	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	30	680127	615	33934966
UK	2	14485	479	29198348
Canada	2	35347	34	1820793
Australia	++	3577	18	1107200
U S A	12	234275	66	987913
UAE	2	139441	6	451871
Germany	5	68652	5	90279
Turkey	1	19438	1	49527
Sweden	++	5034	2	32397
Italy	1	17128	1	28768
Spain	++	1145	1	25758
Other countries	5	141605	2	142112

Table – 7 : Exports of Silver (By Countries)

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

Constant	2019-	20 (R)	20	20-21 (P)
Country	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	3898	12268	6026	23892
Sri Lanka	3500	9730	5269	18053
Saudi Arabia	396	2356	730	5245
Germany	-	-	18	472
USA	-	-	5	103
Australia	-	-	4	15
Mauritius	-	-	++	3
Singapore	-	-	++	1
UK	2	182	-	-

#### Table -9: Exports of Silver: Semi-manufactured

(By Countries)

Constant	20	019-20 (R)	20	020-21 (P)
Country	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	30	674513	569	33851111
U K	2	14485	479	29198154
Canada	2	35347	34	1820793
Australia	++	3565	18	1107194
USA	12	230635	20	906204
UAE	2	139441	6	451853
Germany	5	68127	5	90279
Turkey	1	19438	1	49527
Sweden	++	5034	2	32397
Italy	1	16908	1	28768
Spain	++	1145	1	25720
Other countries	5	140388	2	140222

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

Country	2019	-20 (R)	2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	++	2425	45	13671
USA	++	913	45	13353
UK	-	-	++	194
New Zealand	++	60	++	72
Seychelles	-	-	++	21
Nepal	++	475	++	9
Hong Kong	-	-	++	9
Australia	++	12	++	6
UAE	-	-	++	4
Oman	-	-	++	3
Germany	++	421	-	-

Country	20	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)	
All Countries	++	3189	1	70184	
U S A	++	2727	1	68356	
Singapore	-	-	++	1546	
Bangladesh	-	-	++	112	
Israel	-	-	++	65	
Spain	-	-	++	38	
Japan	-	-	++	31	
Jordan	-	-	++	19	
UAE	-	-	++	14	
Kenya	-	-	++	3	
Oman	++	174	-	-	
Other countries	++	288	-	-	

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

Figures rounded off

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

Country	20	2019-20 (R)		2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)	
All Countries	5421	191617874	1484	59602766	
Hong Kong	1802	63498460	630	25251729	
UK	961	34223525	213	8572283	
Russia	344	12831977	140	5599051	
Austria	143	5197187	124	4815459	
China	89	3223864	86	3882315	
Singapore	125	4615101	43	1986814	
Thailand	180	6097693	55	1901035	
Italy	60	1666311	46	1766814	
Netherlands	170	6163839	40	1526491	
USA	387	13721712	37	1364430	
Other countries	1160	40378205	70	2936345	

Country	2019	9-20 (R)	2020-21 (P)	
	Qty (kg)	Value (₹'000)	Qty (kg)	Value (₹'000)
All Countries	574	5565	500	7518
Italy	-	-	300	3939
Thailand	-	-	120	2252
Germany	-	-	19	516
U S A	74	3905	10	356
Malaysia	-	-	5	314
Japan	-	-	46	141
Brazil	500	1660	-	-

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

Figures rounded off

#### Table – 14 : Imports of Silver: Semi-manufactured (By Countries)

Country	20	019-20 (R)	2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	583	21357953	1195	48096027
Hong Kong	199	7626895	494	20179854
UK	119	4897864	213	8571878
Russia	60	2436350	140	5595929
Australia	-	-	124	4815459
China	28	1021051	86	3876130
Netherlands	20	652719	40	1526491
U S A	36	899845	27	864966
Korea Rep. of	1	21608	21	733851
Italy	37	799975	27	652430
Germany	1	49489	10	533408
Other countries	82	2952157	13	745631

#### Table – 15 : Imports of Silver: Unwrought

#### (By Countries)

Country	20	19-20 (R)	2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	4833	170217267	279	11350070
Hong Kong	1603	55871135	136	5071875
Thailand	180	6097577	55	1900014
Singapore	74	2972773	30	1457232
Italy	23	866007	19	1111913
Switzerland	353	12235280	20	694251
USA	350	12818559	8	481223
Germany	53	1898434	7	424407
UAE	4	165308	3	153326
Peru	2	68072	1	46555
China	61	2202714	++	6185
Other countries	2130	75021408	++	3089

Figures rounded off

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

Country	2019	9-20 (R)	2020-21 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	5	42654	10	156669
Brazil	++	19197	2	79950
Singapore	4	12818	6	32848
Germany	++	6372	++	20037
USA	1	3308	2	18241
Russia	-	-	++	3122
Italy	++	329	++	2471
Hong Kong	++	430	-	-
UK	++	101	-	-
China	++	99	-	-

#### **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 views 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 scaling up their demand for silver, and this may soon translate to higher levels of imports.

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 damand for silver.

This will be a great opportunity for India to build silver powder producing facilities themselves in order to facilitate the projected growth in domestic solar generating power capacity.