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(Part- II : Metals & Alloys)

59th Edition

COBALT

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

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4 Cobalt

Cobalt is an important ferromagnetic strategic alloying metal having irreplaceable industrial applications. It is a chemical element with the symbol Co and atomic no. 27. Cobalt is associated mostly with copper, nickel and arsenic ores. Cobalt is extracted as a by-product of copper, nickel, zinc or precious metals. Lateritic/limonitic nickel ore usually is found to contain 0.08-0.15% Co along with 1.5-4% Ni in many parts of the world.

RESERVES/RESOURCES

Occurrences of cobalt are reported from Singhbhum district, Jharkhand; Kendujhar and Jajpur districts, Odisha; Jhunjhunu district, Rajasthan; Tuensang district, Nagaland; and Jhabua & Hoshangabad districts, Madhya Pradesh. Cobalt occurring with nickeliferous limonite/laterite in Sukinda area, Jajpur district, Odisha and copper slags produced by HCL are two possible sources of cobalt. The seabed multimetal nodules which contain 0.3% Co (Av) along with other minerals are the other sources of cobalt.

As per NMI data based on UNFC system, reserves/resources of cobalt in terms of ore as on 1.4.2015 have been estimated at 44.91 million tonnes of which about 69%, i.e., 30.91 million tonnes are estimated in Odisha. The remaining 31% resources are in Jharkhand (9 million tonnes) and Nagaland (5 million tonnes). The Reserves/Resources of cobalt as per UNFC system are furnished below in Table-1.

EXPLORATION & DEVELOPMENT

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

USES

Major use of cobalt is in metallurgical applications, in Special alloy/Superalloy Industry, in magnets and cutting tools industries. Cobalt is used as precursors (cobalt compounds) for cathodes in rechargeable batteries. Largest demand for cobalt has been from the Rechargeable Battery Industry. It was initially used in NiCd and NiMH cells, however, post the invention of the Lithium-ion battery, there was phenomenal growth in cobalt consumption in the Battery Sector (CRU). Cobalt-based superalloys normally contain 45% or more cobalt, while nickel and iron-based superalloys contain 8 to 20% cobalt. Cobalt oxide is used in chemical applications, such as, catalyst, dyes & pigments, paint driers/adhesives and glass & ceramics. Cobalt catalyst, mostly cobalt acetate is used in the manufacture of Terephthalic acid (TPA) and Dimethyl terephthalate (DMT).

Superalloys made of cobalt have improved strength and wear & corrosion-resistance characteristics at elevated temperatures. Another use of cobalt-based superalloys is in turbines for pipeline compressors and jet aircraft engines. Hard-facing or cutting tools with cobalt alloys provide greater resistance to wear, heat, impact

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

(In million tonnes)

State	Reserves Total (A)	Remaining Resources				Total Resources (A+B)
		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	
All India	-	30.63	2	0.28	12	44.91
Jharkhand	-	-	2	-	7	9
Nagaland	-	-	-	-	5	5
Odisha	-	30.63	-	0.28	-	30.91

and corrosion. Cobalt powder finds an important application as a binder in the production of cemented tungsten carbides for heavy-duty and high-speed cutting tools. It is also used on bonded tools for Diamond Industry. Cobalt application improves the coating/adhesive property of enamel in steel appliances and is used in manufacturing steel-belted tyres. Cobalt-molybdenum-alumina compound is used as catalyst in hydrogenation and for petroleum desulphurisation. Elemental Cobalt-60 (radioactive isotope, a production of atomic pile) is used in industrial radiography and therapeutics. Cobalt can retain ferromagnetic property up to a temperature of 1,100 °C, highest for any metal. It is used in the manufacturing of Alnico magnets, magnetic recording media, soft magnetic material, alloys for spacecraft, etc. Cobalt is alloyed with aluminium and nickel to manufacture powerful magnets. Permanent magnets are used in wind turbines and electric motors for automobiles & aircraft. Other significant uses of cobalt are in battery electrodes, airbags in automobiles, etc. Further, as per Avicenne (CRU), 2015, different types of lithium-ion batteries with composition of cobalt are available in the market, i.e. Lithium-Cobalt Oxide (LCO) which contains 60% of cobalt oxide is used in high capacity storage cellphone, iPad cameras and wearables; NMC-Lithium-Nickel-Manganese-Cobalt oxide that contains 10-20% of cobalt sulphate is used in the manufacturing of low capacity but high specific power batteries which have longer cycle life have found applications in laptops and electronic vehicle (EVs); and NCA Lithium-Nickel-Cobalt Aluminium-oxide that contains 9% cobalt sulphate is used in EVs, electric grid storage (Tesla's EVs and Smart Grid/home storage and laptops).

INDUSTRY & PRODUCTION

Presently, there is no production of cobalt in the country from primary cobalt resources. The demand for cobalt is usually met through imports.

Refining capacity of cobalt in India is estimated at about 2,060 tonnes per year. Of these, Nicomet Industries Ltd, Cuncolim, Goa and Rubamin Ltd, Vadodara, Gujarat were India's leading producers of cobalt cathodes and

compounds. Installed capacity for cobalt metal and different cobalt salts at Nicomet is 1,000 tpy.

Nicomet Industries Ltd manufactures cobalt cathodes of LME-approved specifications under NICO Brand along with nickel cathodes & sodium sulphate in Mumbai, Maharashtra. Vedanta Group is also exploring ways to produce cobalt for batteries as the Group has become the latest entrant among companies that seeks to capitalise on the anticipated electric vehicle boom. Cobalt metal powder is reportedly recovered from cemented carbide scrap by Sandvik Asia Ltd at its pilot plant in Pune, Maharashtra. In addition, spent cobalt catalyst from plants producing DMT, TPA and oxo alcohols are also understood to be reprocessed by several small cobalt chemical processors. However, information on reprocessing of cobalt from scrap is not available. It is expected that recycled cobalt would continue to be used for domestic supply.

SUBSTITUTES

Cobalt is used in specialised applications and is difficult to be substituted. Potential substitutes include barium or strontium ferrites, neodymium-iron-boron or nickel-iron alloys in magnets; nickel, cermets or ceramics in cutting and wear-resistant materials; nickel-based alloys or ceramics in jet engines; nickel in petroleum catalysts; rhodium in hydroformylation catalysts; and cerium, lead, manganese, iron, or vanadium in paints. Presently, about one-third of cobalt is replaced by cobalt-manganese-nickel in lithium-ion batteries. In some applications, substitution for cobalt would result in a loss in product performance. Potential substitutes include barium or strontium ferrites, neodymium-iron-boron, or nickel-iron alloys in magnets; cerium, iron, lead, manganese, or vanadium in paints; cobalt-iron-copper or iron-copper in diamond tools; copper-iron-manganese for curing unsaturated polyester resins; iron, iron-cobalt-nickel, nickel, cermets, or ceramics in cutting and wear-resistant materials; iron-phosphorous, manganese, nickel-cobalt-aluminum, or nickel-cobalt-manganese in lithium-ion batteries; nickel-based alloys or ceramics in jet engines; nickel in petroleum catalysts; and rhodium in hydroformylation catalysts.

RECYCLING

Recycling technologies for recovery of cobalt especially from waste Li-ion batteries have been an evolving process. The need for technologies which can recover valuable metals and the commercialisation of that technology by the industry is highly desirable. The technology related to “Recovery of cobalt from Li-ion batteries of mobile phones” developed by National Metallurgical Laboratory (NML), Jamshedpur, reportedly claims up to 95% recovery of pure cobalt from Li-ion batteries. Considering the need and significance of the problem related to energy materials like Ni and Co, CSIR-IMMT has developed suitable process flow sheets for the processing of secondary resources, such as, alloy scrap and spent catalyst to produce Ni/Co based precursor material that can be used for battery applications particularly in preparing electrodes of Li-ion batteries. In addition to this CSIR-IMMT has taken up another project from MIDHANI to produce high purity cobalt metal from impure cobalt hydroxide.

The Mobility Mission held consultations with industry to develop battery recycling as a sustainable method for ensuring up to 95% recovery of critical minerals, such as, lithium, nickel, cobalt etc. from spent batteries, thereby ensuring regular supply of raw materials for battery maintenance.

TRADE POLICY

As per the Foreign Trade Policy 2015-2020, imports of cobalt ores & concentrates under Heading No. 2605 and cobalt alloys and its products under Heading No. 8105 are allowed freely, except cobalt waste & scrap (ITC-HS Code No. 8105 3000) which are restricted.

WORLD REVIEW

The world cobalt reserves are estimated at 7 million tonnes of cobalt metal content. Cobalt reserves are mainly in the Congo (Kinshasa) which contributes (51%) to the total reserves followed by Australia (20%). Besides, major reserves are also located in Cuba (7%), Philippines & Russia (4% each) and Canada 3%. The world reserves of cobalt are provided in Table-2.

The world mine production of cobalt in terms of metal content decreased by 21% to 123 thousand tonnes in 2019 as compared to 155 thousand tonnes in the preceding year. The Democratic Republic of Congo (DRC) Congo Dem P.R. was the principal producer contributing about (63%) which is followed by Australia & Philippines (5% each) and Russia, Cuba & Canada (4% each). (Table-3).

**Table – 2 : World Reserves of Cobalt
(By Principal Countries)**

(In tonnes of metal content)	
Country	Reserves
World: Total (rounded off)	7100000
Australia	1400000 ^a
Canada	220000
China	80000
Congo (Kinshasa)	3600000
Cuba	500000
Madagascar	100000
Morocco	14000
Papua New Guinea	51000
Philippines	260000
Russia	250000
South Africa	40000
USA	53000
Other countries	560000

Source: USGS Mineral Commodity Summaries, 2021.

^aFor Australia, Joint Ore Reserves Committee-compliant reserves were 6,40,000.

**Table – 3 : World Mine Production of Cobalt
(By Principal Countries)**

(In tonnes of metal Content)			
Country	2017	2018	2019
World:Total (rounded off)	136000	155000	123000
Congo, Dem. P.R.	82461	109402	77964
Philippines	3700	5400	6700
Australia ^b	5221	5616	5693
Russia	4900	5450	5500
Cuba	5407	5300 ^c	5200 ^c
Canada	6058	5608	5132
Madagascar	3090	2890	2930
Papua New Guinea	3308	3275	2915
Morocco ^c	1924	1806	2397
Other countries	18348	9846	6705

Source : BGS, World Mineral Production, 2015-19.

b: Years ended 30 June of that stated: ,

c: Metal and/refined

In India, cobalt consumption is showing rising trend. It is very important to recover cobalt from various secondary sources. At Hindustan Zinc Ltd, process for recovery of cobalt from purification cake has been explored at lab-scale and cobalt sulphate crystal of about 60% purity with 50% recovery has been generated.

To provide a generalised view of the development in various countries in respect of cobalt, the countrywise description, as sourced from the latest available publication of 'USGS 2017' Minerals Yearbook, Release is furnished below:

Australia

In 2017, cobalt mine production as a by product of nickel mining in Western Australia & Australian production of refined cobalt decreased. A number of nickel mines from which cobalt had been produced in the past remained on care-and-maintenance status. The first of these operations ceased production in late 2008, and additional shutdowns continued into 2017, owing to low nickel prices. In 2017, BHP announced that it planned to build a 1,00,000 tonnes per year nickel sulfate plant at the Kwinana refinery and could also produce cobalt sulfate if it increased the recovery rate for cobalt at the Kalgoorlie smelter and added a cobalt circuit at Kwinana. In 2017, the plant of First Quantum Minerals Ltd produced 17,837 tonnes of nickel and based on the hydroxide containing 40% nickel and 1.4% cobalt, an estimated 620 tonnes of cobalt, down from 23,624 tonnes of nickel and an estimated 830 tonnes of cobalt in 2016.

Canada

In 2017, Vale S.A.'s global cobalt production was 5,811 tonnes, essentially unchanged from the 5,799 tonnes produced in 2016. Vale produced 1,675 tonnes of refined cobalt metal at its Port Colborne, Ontario, refinery; 1,231 tonnes of refined cobalt metal at its Long Harbour, Newfoundland and Labrador, refinery; 2,780 tonnes of cobalt as intermediate product at its nickel operation in New Caledonia; and 125 tonnes of cobalt contained in other intermediate products, such as, nickel concentrates. Vale's cobalt originated from company-owned nickel sulfide mines at Sudbury in Ontario, Thompson in Manitoba, and Voisey's Bay in northeastern Labrador; from company-owned nickel laterite mines in Indonesia and New Caledonia; and from purchased feedstock materials. Vale reported that 840 tonnes of

cobalt came from Sudbury, 138 tonnes came from Thompson, 1,829 tonnes came from Voisey's Bay, 2,780 tonnes came from New Caledonia, and 224 tonnes came from external sources, including ore from PT Vale Indonesia.

In 2017, Vale shipped a greater portion of the nickel concentrate produced at Voisey's Bay to its hydrometallurgical refinery in Long Harbour than in 2016; the remaining nickel concentrate was smelted and refined at Vale operations in Ontario and Manitoba. During the year, Vale began production of refined cobalt at Long Harbour, in the form of electrolytic metal rounds. Vale was phasing out smelting and refining at Thompson, owing to Canadian sulfur dioxide emission standards that came into effect in 2015. The company shut down one furnace in 2017 and planned to shut the remaining furnace in 2018. Most of the future nickel concentrate produced at Thompson was to be sent to Sudbury and Long Harbour for refining.

China

China was the world's leading producer and consumer of refined cobalt. In 2017, China's total production, including an estimate for Umicore's Ganzhou Yi Hao plant, was estimated to constitute more than 60% of world refined cobalt production. China's estimated production was 75,000 tonnes, a 50% increase from 49,900 tonnes in 2016, when production had declined in response to low demand, excessive inventories and decreasing prices. China's consumption of refined cobalt increased by 26% from that of 2016, with about 80% used to make cathode materials for rechargeable batteries.

In 2017, nearly 90% of China's refined cobalt was produced by 10 companies and about 55% was produced by 3 companies-Jinchuan Group Co. Ltd, Shenzhen GEM High-Tech Co. Ltd (including subsidiary Jiangsu Cobalt Nickel Metal Co. Ltd), and Zhejiang Huayou Cobalt Co., Ltd.

Only a small portion of China's cobalt production originated from domestic mines. Most of the production was from imported cobalt intermediate chemical compounds, the majority of

which was sourced from Congo (Kinshasa). China's imports of cobalt concentrates have decreased in recent years, as more concentrates have been processed to intermediates within Congo (Kinshasa).

Congo (Kinshasa)

Congo (Kinshasa) was the world's leading producer of mined cobalt and was estimated to represent more than 60% of global production. Most of the country's cobalt mine production was from copper-cobalt ores mined by industrial or mechanised methods; a lesser amount was gathered by tens of thousands of artisanal miners by handpicking cobalt-rich ores. The Government of Congo (Kinshasa) reportedly extended a moratorium on its 2013 ban on exports of copper and cobalt concentrates, because of inadequate power supply to process the concentrates in the country. Most of Congo (Kinshasa)'s ores and concentrates were processed in Congo (Kinshasa) to intermediate materials (mainly crude cobalt hydroxide, but also some crude cobalt carbonate and cobalt-bearing alloys, such as, *alliage blanc*). Some concentrates were exported, and only small quantities were refined in Congo (Kinshasa) to cobalt metal. The amount of cobalt refined to metal within Congo (Kinshasa) was forecast to increase over the next 5 years, however, because cobalt salts producers in China were expected to shift from processing cobalt intermediates to processing cobalt metal for economic and environmental reasons.

State-owned La Générale des Carrières et des Mines SARL (Gécamines) held a minority interest in most of the copper-cobalt operations in Congo (Kinshasa) and has been the sole producer of refined cobalt in the country since late 2015, when Kamoto Copper Company SA (KCC) ceased production at its Luilu cobalt refinery. In 2017, Gécamines produced 120 tonnes of refined cobalt at its Shituru refinery in Likasi, up from 50 tonnes in 2016. KCC [Katanga Mining Ltd (a subsidiary of Glencore plc), Gécamines, and La Société Immobilière du Congo] commissioned Phase 1 of the whole ore leach project at its copper-cobalt mining and refining operation in Lualaba Province and began producing copper cathode. KCC expected to begin cobalt production in early 2018 and announced a production guidance of 11,000 tonnes per year of cobalt in hydroxide for the year.

In 2017, KCC began design work to upgrade and debottleneck the Luilu cobalt plant, so that it could reliably produce the anticipated average life-of-mine production of 30,000 tonnes per year of cobalt in hydroxide. Glencore was KCC's majority shareholder and had life-of-mine offtake agreements for all of KCC's copper and cobalt output.

Cuba

Moa Nickel S.A. Joint Venture between Sherritt and General Nickel) mined nickel-cobalt laterites at Moa, Holguin Province, and produced intermediate nickel-cobalt sulphide, which was sent to the Joint Venture's Fort Saskatchewan refinery in Canada. In 2017, the sulphide contained 34,595 tonnes of nickel and cobalt. The Government-owned Empresa Niquelífera Ernesto Che Guevara operation (also known as Punta Gorda) in Moa, Holguin Province, mined and processed nickel-cobalt laterites. During 2017, Empresa Niquelífera Ernesto Che Guevara focused on lowering the cost of production. Nickel and cobalt originating in Cuba could not be imported into the United States because of a United States embargo on imports from Cuba.

Finland

According to the Cobalt Institute (2018), in 2017, Freeport Cobalt Oy [Freeport-McMoRan Inc. (FCX), Lundin, and Gécamines] produced 9% more cobalt at its Kokkola refinery than it produced in 2016. The company produced a wide range of cobalt chemicals and metal powders. In 2017, the main feed for the refinery was crude cobalt hydroxide supplied under a long-term agreement by the Tenke Fungurume operation in Congo (Kinshasa).

New Caledonia

In 2017, estimated recoverable mine production decreased by 18% as compared with that of 2016 because Société Le Nickel was no longer producing matte from which cobalt was recovered and no lateritic ore was exported to Australia for refining. Vale Nouvelle-Calédonie S.A.S. (Vale and Société de Participation Minière du Sud Caledonien S.A.S.) continued to ramp up production at its Vale New Caledonia project in the southern tip of New Caledonia's main island. The project consisted of a

nickel-cobalt laterite mine, a high-pressure acid-leaching processing plant, and a refinery. In 2017, Vale produced 2,780 tonnes of cobalt from New Caledonia. Vale New Caledonia was expected to have a nominal production capacity of 57,000 tonnes per year of nickel contained in nickel oxide and 4,500 tonnes per year of cobalt contained in an intermediate cobalt carbonate over the next 5 to 6 years.

Russia

Nornickel, the sole producer of refined cobalt in Russia, produced 33% less refined cobalt than it produced in 2016. The company mined and beneficiated nickelcopper sulphide ores and smelted the concentrates at its Polar Division on the Taymyr Peninsula and at Kola MMC on the Kola Peninsula. The resulting matte from the Polar Division was refined at Kola MMC's newly constructed Severonickel refinery at Monchegorsk on the Kola Peninsula, where high-grade electrolytic cobalt (cobalt cathode) was produced. In addition to producing refined cobalt, Nornickel reportedly also produced about 2,000 tonnes of cobalt in crude cobalt hydroxide in 2017, about one-half of which was exported, and the remainder was either stockpiled or processed in Russia.

Turkey

Meta Nikel Kobalt A. exported 23,130 tonnes of intermediate nickel-cobalt hydroxide containing nearly 4,000 tonnes of nickel and 220 tonnes of cobalt from its high-pressure acid-leaching plant at Gordes. The plant used nickel laterite ore from mines in Gordes in Manisa Province and Yunusemre in Eskisehir Province as feed. Meta Nikel planned to increase the plant's efficiency and production capacity and to study the option of producing value-added products

FOREIGN TRADE

Exports

During 2019-20, about 2 tonnes of cobalt ores & concentrates were exported as compared to 1 tonne in the preceding year.

Exports of cobalt and alloys including waste and scrap increased slightly by 11% to 107 tonnes in 2019-20 from 96 tonnes in the previous year. Exports were mainly to UK (36%), UAE (22%), USA (13%) and Netherlands & Finland (9% each). Out of the total exports in 2019-20, exports of cobalt and alloys were at 89 tonnes and those of cobalt & scrap were at 18 tonnes. Similarly, during 2019-20 exports of cobalt powder were at 3 tonnes and that of cobalt (other articles) were at 63 tonnes. (Tables- 4 to 10)

Imports

During the period 2019-20, 2 tonnes of cobalt ores and concentrate were imported, while it was only one tonne in the previous year.

Imports of cobalt & alloys including waste and scrap increased slightly by 55% to 1,296 tonnes in 2019-20 from 834 tonnes in the previous year. Imports in 2019-20 were mainly from China (23%), Netherlands (22%), Japan (12%), Belgium (8%), USA & Bahamas (7% each) and UK (6%) Out of the total imports in 2019-20, imports of cobalt & alloys were at 1,296 tonnes and those of cobalt & scrap were 'Nil'. Besides, imports of cobalt in the form of cobalt powder, other articles and unwrought cobalt were at 334 tonnes, 285 tonnes and 678 tonnes, respectively (Tables - 11 to 17).

**Table - 4 : Exports of Cobalt Ores & Conc.
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1	4496	2	9478
UAE	-	-	2	9478
Iran	1	4496	-	-

Figures rounded off

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**Table –5: Exports of Cobalt & Alloys (Including Waste and Scrap)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	96	425188	107	220378
UAE	12	80427	24	59027
USA	14	46695	14	47850
UK	12	25879	39	38846
Netherlands	29	107788	10	19505
Japan	++	229	4	11249
Hungary	++	7316	1	9930
Finland	1	7267	10	9237
Switzerland	++	5098	++	6623
Germany	1	2594	3	6355
Ghana	++	1825	1	3372
Other countries	27	140070	1	8386

Figures rounded off

**Table – 6: Exports of Cobalt & Alloys
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	83	411873	89	199964
UAE	12	80427	24	59027
USA	14	46695	14	47325
UK	11	24729	23	21408
Netherlands	19	100258	10	19505
Japan	++	229	4	11249
Hungary	++	7316	1	9930
Finland	1	7267	10	9237
Switzerland	++	5098	++	6623
Germany	++	1449	1	3903
Ghana	++	1825	1	3372
Other countries	25	136580	1	8386

Figures rounded off

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**Table – 7: Exports of Cobalt & Scrap
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	14	13315	18	20414
UK	1	1150	16	17438
Germany	1	1144	2	2452
USA	-	-	++	525
Netherlands	10	7530	-	-
Singapore	2	3490	-	-

Figures rounded off

**Table – 8: Exports of Cobalt Powder
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	21	123549	3	12908
USA	-	-	2	12282
UAE	1	6292	++	10
UK	++	659	++	463
Egypt	-	-	++	87
Bhutan	++	136	++	57
Czech Republic	-	-	++	10
Netherlands	14	85006	-	-
Korea, Rep of	4	17677	-	-
Singapore	2	13105	-	-
Brazil	++	639	-	-
Other countries	++	36	-	-

Figures rounded off

**Table –9: Exports of Cobalt (Other Articles)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	34	129874	63	128382
USA	14	46695	12	35043
UK	11	24070	23	20946
Netherlands	5	15253	10	19505
Japan	++	229	4	11249
Hungary	++	7316	1	9930
Finland	1	7267	10	9237
Switzerland	++	5024	++	6570
Germany	++	1449	1	3903
Ghana	++	1825	1	3372
France	1	11518	++	2437
Other countries	2	9229	1	6190

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	28	158450	24	58674
UAE	10	69243	24	58544
Switzerland	++	74	++	52
Korea, Rep. of	++	50	++	39
Botswana	-	-	++	39
Malaysia	18	89045	-	-
Lebanon	++	29	-	-
Brazil	++	10	-	-

Figures rounded off

**Table – 11: Imports of Cobalt & Alloys (Including Waste & Scrap)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	834	4763696	1296	4216989
China	155	826054	304	782718
Netherlands	118	627644	287	711266
UK	85	613210	79	638091
Japan	67	322066	154	413054
USA	103	536400	92	409471
Belgium	91	500454	110	315098
Bahamas	30	156297	85	202878
France	16	174829	8	166834
Germany	6	112562	9	136035
Australia	-	-	56	134431
Other countries	163	894181	112	307113

Figures rounded off

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**Table – 12: Imports of Cobalt Powder
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	266	1396428	334	996721
Belgium	78	434562	55	178727
Australia	-	-	56	134431
Netherlands	1	8177	43	113666
China	30	144556	38	109302
Japan	20	91562	28	108573
USA	50	250958	28	105980
Finland	36	200603	42	104789
Turkey	13	55704	17	48250
South Africa	11	56499	9	24326
Germany	2	15272	4	21299
Other countries	24	138534	14	47379

Figures rounded off

**Table – 13: Imports of Cobalt (Other Articles)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	240	1555475	285	1606750
UK	77	564987	72	617393
USA	50	269702	63	301987
France	6	102534	4	148799
China	23	101826	37	140981
Belgium	12	62979	55	134675
Germany	4	97058	5	114642
Japan	33	170640	18	56731
Congo, Dem. Rep.	22	119773	21	50563
Singapore	++	1258	5	20549
UAE	-	-	1	4665
Other countries	13	64718	4	15765

Figures rounded off

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**Table – 14: Imports of Cobalt (Unwrought)
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	326	1808483	678	1613518
Netherlands	111	588761	243	594459
China	101	579672	229	532434
Japan	15	59863	109	247750
Bahamas	30	156297	85	202878
UK	5	29080	4	11236
Morocco	1	5521	3	6449
Switzerland	40	262095	2	5754
Russia	-	-	2	5083
Sweden	-	-	++	2831
Belgium	1	2913	++	1697
Other countries	23	124282	++	2947

Figures rounded off

**Table – 15: Imports of Cobalt & Alloys
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	831	4760386	1296	4216989
China	155	826054	304	782718
Netherlands	118	627644	287	711266
UK	85	613210	79	638091
Japan	67	322066	154	413054
USA	103	536400	92	409471
Belgium	91	500454	110	315098
Bahamas	30	156297	85	202878
France	16	174829	8	166834
Germany	6	112562	9	136035
Australia	-	-	56	134431
Other countries	161	890871	112	307113

Figures rounded off

**Table – 16 : Imports of Cobalt & Scrap
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	3	3310	-	-
Singapore	3	3310	-	-

Figures rounded off

**Table – 17 : Imports of Cobalt ore & Conc.
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	1	4476	2	9253
UK	1	4476	2	9083
Canada	-	-	++	156
USA	-	-	++	14

Figures rounded off

FUTURE OUTLOOK

India does not have any primary cobalt resources. Two possible secondary sources are nickel-bearing laterite deposits in Odisha and copper slag produced by HCL, which have been under R&D studies for commercial applications over the years. The cobalt refiners in India have catered to the market for chemical applications or where the cobalt metal or salt is dissolved and converted to cobalt oxide for cutting tools application.

Due to specialised nature of applications and difficulty in substitution, the future demand for cobalt is likely to follow an increasing trend.

The bulk demand for cobalt in the world would be in cemented carbides used in cutting tools, catalysts in Petrochemical Industry, drying agent in Paint Industry and in superalloys used mainly in jet engine parts. The demand for cobalt is estimated to go up manifolds with use of superalloys in civil aviation, catalysts for gas-to-liquid production of synthetic liquid fuels, rechargeable batteries for hybrid electric vehicles, cellular telephones, aerospace and energy generation industries. The global demand for lithium-ion batteries has grown rapidly as a result of the increase in demand for mobile phones,

portable PCs & electronic devices. The demand projection for refined electronic devices has been staggering. As per CRU, cobalt consumption was forecasted to grow by an incredible rate of 68% in the period between 2015 and 2025.

In India, cobalt will find major applications in metallurgy due to greater demand in special alloys/superalloys and in cutting tools and as an alloy in permanent magnets. Cobalt powder demand will continue to grow as it is extensively used in the manufacture of bonded tools that are used in the Diamond Industry.

As far as cobalt is concerned the Indian Industry is very small, but it is growing at a steady pace in various sectors, especially in aerospace. The Aerospace Industry is mainly dependent on import of cobalt. Other industries are growing at a consistent level but cannot be compared to China. The total consumption could be 70 tonnes to 80 tonnes minimum and it could be 100 tonnes in maximum per month in terms of cobalt content. Cobalt sulphate is mostly used in Chemical Industries.

Battery manufacturing is considered as a major segment with huge potential in India which could trigger development of new technology and product upgrading.