

COBALT

(Data in metric tons of cobalt content unless otherwise noted)

Domestic Production and Use: In 2020, the nickel-copper Eagle Mine in Michigan produced cobalt-bearing nickel concentrate. In Missouri, a company produced nickel-copper-cobalt concentrate from historic mine tailings. Most U.S. cobalt supply comprised imports and secondary (scrap) materials. Approximately six companies in the United States produced cobalt chemicals. About 43% of the cobalt consumed in the United States was used in superalloys, mainly in aircraft gas turbine engines; 10% in cemented carbides for cutting and wear-resistant applications; 16% in various other metallic applications; and 31% in a variety of chemical applications. The total estimated value of cobalt consumed in 2020 was \$300 million.

Salient Statistics—United States:	2016	2017	2018	2019	2020^e
Production: ^e					
Mine	690	640	480	500	600
Secondary ¹	2,750	2,750	2,750	2,750	2,100
Imports for consumption	12,800	11,900	11,900	13,900	10,000
Exports	4,160	5,690	6,950	4,070	3,500
Consumption (includes secondary):					
Reported	9,010	9,240	9,290	9,050	7,300
Apparent ²	11,500	8,950	7,700	12,500	8,700
Price, average, dollars per pound:					
U.S. spot, cathode ³	12.01	26.97	37.43	16.95	16.00
London Metal Exchange (LME), cash	11.57	25.28	32.94	14.88	14.00
Stocks, yearend:					
Industry ⁴	969	1,020	1,060	1,090	1,000
LME, U.S. warehouse	195	160	130	102	80
Net import reliance ⁵ as a percentage of apparent consumption	76	69	64	78	76

Recycling: In 2020, cobalt contained in purchased scrap represented an estimated 29% of cobalt reported consumption.

Import Sources (2016–19): Cobalt contained in metal, oxide, and salts: Norway, 20%; Canada, 14%; Japan, 13%; Finland, 10%; and other, 43%.

Tariff:	Item	Number	Normal Trade Relations 12–31–20
	Cobalt ores and concentrates	2605.00.0000	Free.
	Chemical compounds:		
	Cobalt oxides and hydroxides	2822.00.0000	0.1% ad val.
	Cobalt chlorides	2827.39.6000	4.2% ad val.
	Cobalt sulfates	2833.29.1000	1.4% ad val.
	Cobalt carbonates	2836.99.1000	4.2% ad val.
	Cobalt acetates	2915.29.3000	4.2% ad val.
	Unwrought cobalt, alloys	8105.20.3000	4.4% ad val.
	Unwrought cobalt, other	8105.20.6000	Free.
	Cobalt mattes and other intermediate products; cobalt powders	8105.20.9000	Free.
	Cobalt waste and scrap	8105.30.0000	Free.
	Wrought cobalt and cobalt articles	8105.90.0000	3.7% ad val.

Depletion Allowance: 22% (domestic), 14% (foreign).

Government Stockpile:⁶ See the Lithium chapter for statistics on lithium-cobalt oxide and lithium-nickel-cobalt-aluminum oxide.

Material	Inventory as of 9–30–20	FY 2020		FY 2021	
		Potential acquisitions	Potential disposals	Potential acquisitions	Potential disposals
Cobalt	302	—	—	—	—
Cobalt alloys, gross weight ⁷	3	—	—	50	—

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Events, Trends, and Issues: Congo (Kinshasa) continued to be the world's leading source of mined cobalt, supplying approximately 70% of world cobalt mine production. With the exception of production in Morocco and artisanally mined cobalt in Congo (Kinshasa), most cobalt is mined as a byproduct of copper or nickel. China was the world's leading producer of refined cobalt, most of which was produced from partially refined cobalt imported from Congo (Kinshasa). China was the world's leading consumer of cobalt, with more than 80% of its consumption being used by the rechargeable battery industry.

Cobalt mine and refinery production were forecast to decrease in 2020. Estimated annual average cobalt prices declined from those of 2019. Cobalt production in Madagascar was suspended to prevent the spread of COVID-19. Increased production from recently started operations in Congo (Kinshasa) was more than offset by reduced production at other operations in response to low prices and restrictions resulting from the COVID-19 pandemic.

World Mine Production and Reserves: Reserves for multiple countries were revised based on industry reports.

	Mine production		Reserves ⁸
	2019	2020 ⁶	
United States	500	600	53,000
Australia	5,740	5,700	⁹ 1,400,000
Canada	3,340	3,200	220,000
China	2,500	2,300	80,000
Congo (Kinshasa)	100,000	95,000	3,600,000
Cuba	3,800	3,600	500,000
Madagascar	3,400	700	100,000
Morocco	2,300	1,900	14,000
Papua New Guinea	2,910	2,800	51,000
Philippines	5,100	4,700	260,000
Russia	6,300	6,300	250,000
South Africa	2,100	1,800	40,000
Other countries	6,320	6,400	560,000
World total (rounded)	144,000	140,000	7,100,000

World Resources:⁸ Identified cobalt resources of the United States are estimated to be about 1 million tons. Most of these resources are in Minnesota, but other important occurrences are in Alaska, California, Idaho, Michigan, Missouri, Montana, Oregon, and Pennsylvania. With the exception of resources in Idaho and Missouri, any future cobalt production from these deposits would be as a byproduct of another metal. Identified world terrestrial cobalt resources are about 25 million tons. The vast majority of these resources are in sediment-hosted stratiform copper deposits in Congo (Kinshasa) and Zambia; nickel-bearing laterite deposits in Australia and nearby island countries and Cuba; and magmatic nickel-copper sulfide deposits hosted in mafic and ultramafic rocks in Australia, Canada, Russia, and the United States. More than 120 million tons of cobalt resources have been identified in manganese nodules and crusts on the floor of the Atlantic, Indian, and Pacific Oceans.

Substitutes: Depending on the application, substitution for cobalt could result in a loss in product performance or an increase in cost. The cobalt contents of lithium-ion batteries, the leading global use for cobalt, are being reduced; potential commercially available cobalt-free substitutes use iron and phosphorus. Potential substitutes in other applications 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, ceramic-metallic composites (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 titanium-based alloys in prosthetics.

⁶Estimated.

¹Estimated from consumption of purchased scrap.

²Defined as secondary production + imports – exports + adjustments for Government and industry stock changes for refined cobalt.

³As reported by Platts Metals Week. Cobalt cathode is refined cobalt metal produced by an electrolytic process.

⁴Stocks held by consumers and processors; excludes stocks held by trading companies and held for investment purposes.

⁵Defined as imports – exports + adjustments for Government and industry stock changes for refined cobalt.

⁶See Appendix B for definitions.

⁷Inventory is cobalt alloys; potential acquisitions are samarium-cobalt alloy; excludes potential disposals of nickel-base and aerospace alloys.

⁸See Appendix C for resource and reserve definitions and information concerning data sources.

⁹For Australia, Joint Ore Reserves Committee-compliant reserves were 640,000 tons.