

COBALT

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

Domestic Production and Use: In 2015, a nickel-copper mine in Michigan ramped up production of cobalt-bearing nickel concentrate. A Pennsylvania producer of extra-fine cobalt metal powder ceased producing the powder in 2015. Most U.S. cobalt supply comprised imports and secondary (scrap) materials. Six companies were known to produce cobalt chemicals. About 46% of the cobalt consumed in the United States was used in superalloys, mainly in aircraft gas turbine engines; 9% in cemented carbides for cutting and wear-resistant applications; 18% in various other metallic applications; and 27% in a variety of chemical applications. The total estimated value of cobalt consumed in 2015 was \$280 million.

Salient Statistics—United States:	2011	2012	2013	2014	2015^e
Production:					
Mine ^e	—	—	—	120	700
Secondary	2,210	2,160	2,160	2,200	2,500
Imports for consumption	10,600	11,100	10,500	11,400	11,500
Exports	3,390	3,760	3,850	4,500	3,900
Shipments from Government stockpile excesses ¹	—	—	—	—	—
Consumption:					
Reported (includes secondary)	9,180	8,660	8,090	8,560	9,000
Apparent ² (includes secondary)	9,230	9,510	8,670	8,920	10,000
Price, average, dollars per pound:					
U.S. spot, cathode ³	17.99	14.07	12.89	14.48	13.50
London Metal Exchange (LME), cash	16.01	13.06	12.26	14.00	13.10
Stocks, yearend:					
Industry	1,040	980	1,080	1,240	1,190
LME, U.S. warehouse	43	51	41	9	120
Net import reliance ⁴ as a percentage of apparent consumption	76	77	75	75	75

Recycling: In 2015, cobalt contained in purchased scrap represented an estimated 28% of cobalt reported consumption.

Import Sources (2011–14): Cobalt contained in metal, oxide, and salts: China, 19%; Norway, 13%; Finland and Russia, 9% each; and other, 50%.

Tariff: Item	Number	Normal Trade Relations⁵ 12–31–15
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: In FY 2015, the Defense Logistics Agency acquired 450 kilograms of lithium nickel cobalt aluminum oxide and 91 kilograms of lithium cobalt oxide.

Stockpile Status—9–30–15⁶

Material	Inventory	Disposal Plan FY 2015	Disposals FY 2015
Cobalt metal	301	—	—

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Events, Trends, and Issues: Congo (Kinshasa) continued to be the world's leading source of mined cobalt, supplying more than one-half of world cobalt mine production. Growth in world cobalt supply, mainly from increased production from new projects and expansions to existing operations, and growth in world cobalt consumption, driven mainly by the battery and aerospace industries, are thought to be in balance. During the first 6 months of 2015, world availability of refined cobalt (as measured by production) was 11% higher than that of the same period in 2014, mainly owing to increased production in China. China was the world's leading producer of refined cobalt and the leading supplier of cobalt imports to the United States. Much of China's production was from ore and partially refined cobalt imported from Congo (Kinshasa); stocks of cobalt materials also contributed to China's supply. China was the world's leading consumer of cobalt, with nearly 75% of its consumption being used by the battery industry.

World Mine Production and Reserves: Reserves for Brazil, Canada, the Philippines, South Africa, the United States, and "Other countries" were revised based on company or Government reports.

	Mine production		Reserves ⁷
	2014	2015 ^e	
United States	^e 120	700	23,000
Australia	5,980	6,000	⁸ 1,100,000
Brazil	2,600	2,600	78,000
Canada	6,570	6,300	240,000
China	7,200	7,200	80,000
Congo (Kinshasa)	63,000	63,000	3,400,000
Cuba	3,700	4,200	500,000
Madagascar	3,100	3,600	130,000
New Caledonia ⁹	4,040	3,300	200,000
Philippines	4,600	4,600	250,000
Russia	6,300	6,300	250,000
South Africa	3,000	2,800	31,000
Zambia	5,500	5,500	270,000
Other countries	<u>7,080</u>	<u>7,700</u>	<u>610,000</u>
World total (rounded)	123,000	124,000	7,100,000

World Resources: 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: 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.

^eEstimated. — Zero.

¹Cobalt metal. In 2014–15, the Defense Logistics Agency acquired cobalt-bearing battery precursor materials.

²The sum of U.S. net import reliance and secondary production, as estimated from consumption of purchased scrap.

³As reported by Platts Metals Week.

⁴Defined as imports – exports + adjustments for Government and industry stock changes for refined cobalt.

⁵Tariffs for certain countries and items may be eliminated under special trade agreements.

⁶See [Appendix B](#) for definitions.

⁷See [Appendix C](#) for resource/reserve definitions and information concerning data sources.

⁸For Australia, Joint Ore Reserves Committee-compliant reserves were about 390,000 tons.

⁹Overseas territory of France.