Co

Cobalt

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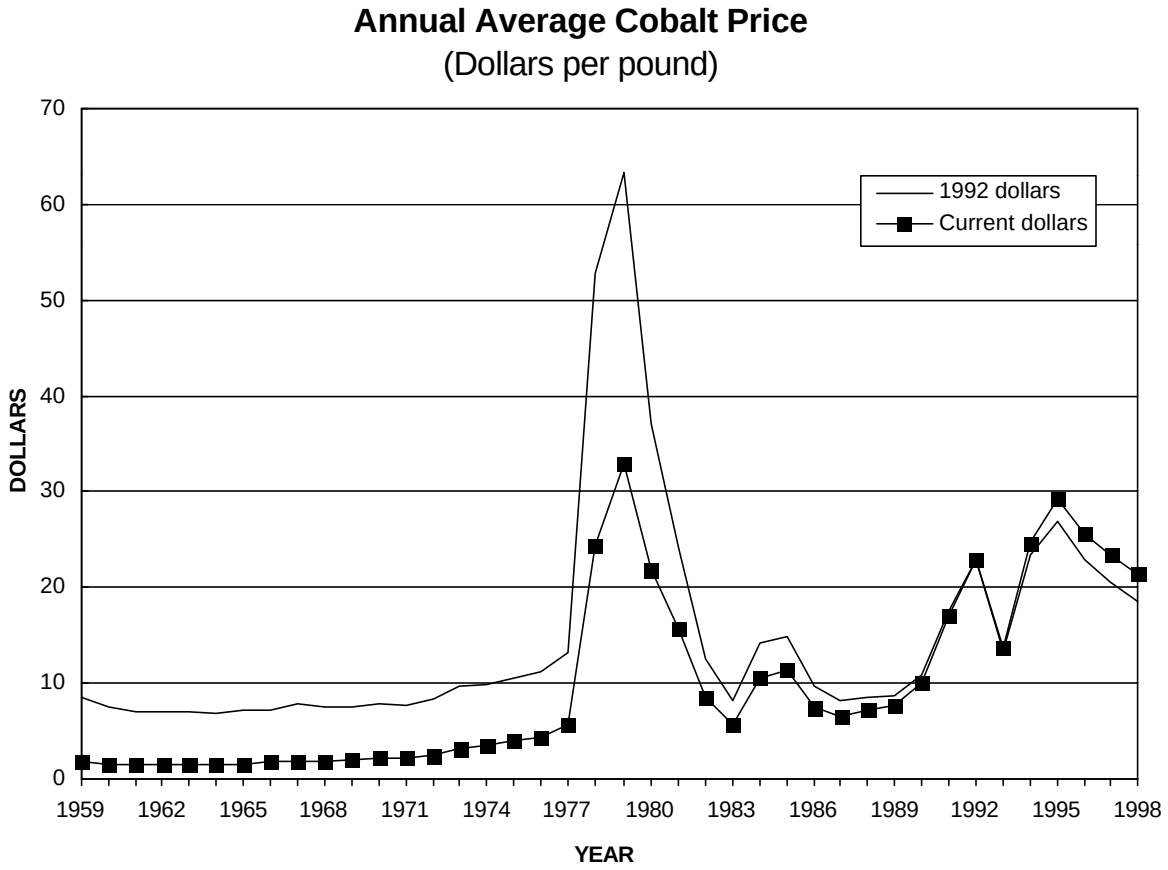

Significant events affecting cobalt prices since 1958

1967-1976	Sales of significant quantities of cobalt from U.S. Government stockpile
1978	Strong cobalt demand, Zaire's copper-cobalt mining region invaded, and free market developed
1981-1982	Sharp recession
1984	Zaire and Zambia announce a joint producer price
1990-1991	Recession
1990	Strikes in Zaire and political unrest in Zambia, cave-in at Zaire's Kamoto copper-cobalt mine, and Russia began exporting cobalt to Western markets
1991	Unrest in Zaire and dissolution of the Soviet Union
1992-1993	Economic downturn and decrease in U.S. defense spending
1993-1998	Sales of cobalt from the U.S. Government stockpile
1994	Producer price was changed to a reference price

Cobalt is a strategic and critical metal used in many diverse industrial and military applications. The largest use of cobalt is in superalloys, which are used to make parts for gas turbine aircraft engines. In its metal and/or chemical forms, cobalt is also used to make magnets; corrosion and wear-resistant alloys; high-speed steels; cemented carbides and diamond tools; catalysts for the petroleum and chemical industries; drying agents for paints, varnishes, and inks; ground coats for

porcelain enamels; pigments; battery electrodes; steel-belted radial tires; and magnetic recording media. Various forms of cobalt metal, including briquettes, cathode (electrolytic cobalt), fines, granules (shot), ingot, powder, and rondelles, have been produced and marketed. Cobalt prices presented in the table for 1969 onward are for cobalt cathode, which is produced by electrowinning. In the electrolytic cell, cobalt metal is deposited on the cathode, usually as a continuous sheet of cobalt metal. Following removal from the cathode, the sheet of cobalt can be broken into small pieces and sold as "broken cathode" or cut into squares and sold as "cut cathode." Current spot prices quoted in Platt's Metals Week are for cathode with a minimum cobalt content of 99.8%.

In addition to general economic conditions and supply/demand fundamentals, the following factors have influenced cobalt prices over time: most cobalt is produced as a byproduct of either copper or nickel, resulting in a certain amount of supply inelasticity; cobalt is produced by a limited number of countries, one of which, the Democratic Republic of the Congo (formerly Zaire, formerly the Belgian Congo), was the world's dominant producer from the 1920's until the 1990's; and cobalt is considered to be a strategic and critical metal, and as a result, purchases for and sales from Government stockpiles have added to demand and supply, respectively.

During much of its history, the price of cobalt metal was set primarily by producers. Before World War II, the leading Belgian, British, Canadian, Finnish, and French producers agreed to control cobalt supply and to maintain a uniform price. Following the War, prices quoted by the Belgian Congo were generally followed by other producers (Young, 1960, p. 8). Beginning in the mid-1980's, Zaire and Zambia cooperated in setting the producer price (Jones, 1986; Cobalt Development Institute, 1987). During times when producers controlled the market, the majority of cobalt sales were directly between producers or their sales agents and consumers. These sales were conducted under medium- or long-term agreements at the producer price or at the producer price minus quality and quantity discounts. In the early 1990's, the African producers lost much of their influence on cobalt prices (Kielty, 1992, p. 2). This was the result of reduced production from Zaire and Zambia at a time when an increasing amount of cobalt was entering the free market. The producer price was renamed the "reference price" in 1994, and since then, most cobalt has been sold at free market prices.

In the free market, sales are between merchants (independent traders) and consumers or merchants and other merchants (intermerchant trading). Cobalt in the free market can originate from producers, either officially or unofficially; from Government stockpile releases; or consumers with excess metal. The volume of free market sales has varied over time and from country to country. Free market prices sometimes change very rapidly. Although they reflect overall supply and demand, they can be strongly influenced by buyer perceptions of short-term availability, and the reasons for sudden changes are not always evident.

Historically, cobalt prices were relatively stable until the late 1970's, when a series of events resulted in concerns over cobalt supply and a rapid increase in prices to more than $40 per pound. The key factors and events leading up to the "cobalt crisis" were as follows: the cessation of cobalt sales from the U.S. Government stockpile in 1976, a drawdown of Zairian producer inventories following 2 years of sales exceeding production, a sharp increase in demand, a reduction in cobalt allocations by the Zairian producer, limited world cobalt production capacity, and an invasion of the copper-cobalt mining region in Zaire (Mining Journal, 1979; Kirk, 1985). Although Zaire's annual production actually exceeded that of the previous year, the "cobalt crisis" had long-term impacts on the cobalt market. For the first time in many years, a strong free market in cobalt developed, and cobalt prices gained the reputation of being unstable.

Following the "crisis," production capacity was increased, recycling and recovery of cobalt from secondary materials also increased, and consumers conserved or substituted cobalt where possible. The recession in the early 1980's added to the reduction in demand and an oversupply situation developed (Kielty, 1988). Beginning in the mid-1980's, Zaire and Zambia worked together to stabilize cobalt prices. They established a joint producer price and limited sales of cobalt to the free market (Kramer and Salak, 1984). In addition, Zaire acted as a "swing producer" by reducing its production and inventories to meet demand (Kielty, 1990, p. 2-3, 10). From late 1986 until mid-1990, Zaire and Zambia were successful in returning stability to cobalt prices.

Free market price stability ended during the second half of 1990. In early 1990, delayed shipments from African producers, planned cutbacks in nickel production by Canadian nickel-cobalt producers, assumptions regarding reduced inventory levels in Zaire, and tightening of cobalt supplies on the free market caused concern over future cobalt availability. In July, the free market cobalt price began to rise following reports of strikes in Zaire and political unrest in Zambia. News of a cave-in at Zaire's Kamoto copper-cobalt mine in late September added to concerns over cobalt availability.

During 1990, Russia began exporting cobalt to Western markets. The breakup of the Soviet Union, a reduction in Russian military production, and an increase in demand for hard currency led to increased exports in 1991. As a result, Russia became a net exporter of cobalt, and Russian cobalt developed into a significant component of Western supply. Most of this cobalt was sold by merchants in the free market.

The free market cobalt price slowly decreased during the first 9 months of 1991. Speculation continued during this period regarding potential supply shortages, but demand was limited by recessionary economic conditions. Political and economic tensions in Zaire continued to increase. The price of cobalt began to rapidly increase following news of renewed unrest in September and October. The cobalt price peaked at

more than $30 per pound in late December 1991/early January 1992.

During the next 2 years, the free market cobalt price trended downward to approximately $11 per pound. The decrease during 1992 and 1993 was attributed to the following factors: reduced consumption because of a decrease in U.S. defense spending, a decrease in demand from the commercial aircraft sector, and an economic downturn in the United States, Europe, and Japan; reduced demand because of a drawdown of consumer inventories; and the availability of cobalt on the free market.

Following several years of decline, world refined cobalt production reached a low point in 1993. The U.S. Government began selling excess cobalt from the National Defense Stockpile (NDS) in March of that year. NDS cobalt was available to merchants, as well as to consumers, thus providing more cobalt to the free market. Although cobalt from the NDS and Russia was a lower quality than that typically offered to the market, consumers found ways to take advantage of the availability and lower cost of cobalt from these sources.

Beginning in mid-December 1993 and ending in mid-January 1994, the free market cobalt price more than doubled. This price increase reflected a growing concern over cobalt supply prompted by the following factors: delays by the African producers in announcing their 1994 pricing policy, consumers' reduced inventory levels resulting from buying on an as-needed basis, press reports that the copper-cobalt mining region in Zaire had declared autonomy from the rest of the country, expectations for reduced production in 1994, and merchants' reports of reduced supplies of Russian cobalt. The magnitude and speed of the price increase, however, suggested market manipulation (Kielty, 1994).

During 1994 and 1995, the supply of and demand for cobalt increased. World production increased, cobalt from Russia and the NDS continued to contribute to supply, and the amount of cobalt recovered from intermediate materials and recycled from scrap increased. Economic conditions improved, and world demand increased. The free market cobalt price was high and unstable, between $20 and $30 per pound, during most of this 2-year period. The overall trend in free market prices was upward, reaching more than $32 per pound by December 1995. High cobalt prices, combined with forecasts for large increases in nickel demand, resulted in the initiation of a significant number of projects that could produce cobalt within 3 to 6 years either as a byproduct of nickel or copper mining or from the processing of cobalt-bearing intermediate materials stockpiled during past copper production.

World cobalt production continued to increase in 1996. Demand remained strong, but the free market cobalt price decreased to approximately $21.50 per pound by yearend. Market sentiment shifted from concern about availability to forecasts of potential oversupply as future production increased at a faster rate than demand.

During 1997, world production was approximately equal to that of 1996, and demand remained strong. The free market cobalt price fluctuated between approximately $19 and $26 per pound. In 1998, the cobalt price declined significantly. It gradually decreased from a high of approximately $26 per pound in January to approximately $24 per pound in early June, and then rapidly decreased to approximately $10 to $11 per pound by yearend. The decrease in price suggests that plenty of cobalt was available to meet demand. Total sales and shipments of cobalt from the NDS were higher in 1998 than those of 1997, and on the basis of data from the first 6 months of 1998, world production was higher than that of the previous year. In addition, the following were cited as possible contributing factors to the decreasing prices: weak demand, particularly from the superalloy sector; reduced demand because of poor economic conditions in Asia and elsewhere; consumers buying only as needed, drawing down inventories, and delaying purchases while waiting for the price to bottom out; producers offering cobalt at low prices to reduce their inventories and/or to gain market share; and merchants pushing down prices to buy cheaper cobalt at a later date and/or to gain market share.

In 1999, three new projects in Australia are expected to begin producing cobalt as a byproduct of nickel. Plans for additional new cobalt production are underway or being considered at various projects in Africa, North America, and Oceania. This increase in production from more diverse sources is anticipated to put downward pressure on cobalt prices.

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Annual Average Cobalt Price

(Dollars per pound[1])

Year	Price	Year	Price	Year	Price	Year	Price
1937	1.29	1953	2.43	1969	1.92	1985	11.43
1938	1.36	1954	2.60	1970	2.20	1986	7.49
1939	1.40	1955	2.60	1971	2.20	1987	6.56
1940	1.50	1956	2.58	1972	2.45	1988	7.09
1941	1.50	1957	2.03	1973	3.04	1989	7.64
1942	1.50	1958	2.00	1974	3.47	1990	10.09
1943	1.50	1959	1.77	1975	3.98	1991	16.92
1944	1.50	1960	1.54	1976	4.47	1992	22.93
1945	1.50	1961	1.50	1977	5.62	1993	13.79
1946	1.50	1962	1.50	1978	24.52	1994	24.66
1947	1.58	1963	1.50	1979	32.83	1995	29.21
1948	1.65	1964	1.50	1980	21.82	1996	25.50
1949	1.76	1965	1.63	1981	15.67	1997	23.34
1950	1.80	1966	1.65	1982	8.56	1998	21.43
1951	2.18	1967	1.85	1983	5.76		
1952	2.40	1968	1.85	1984	10.44		

[1]To convert to dollars per kilogram, multiply by 2.20462.

Note: Annual average prices were derived from price changes reported in the following sources.

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