Tellurium

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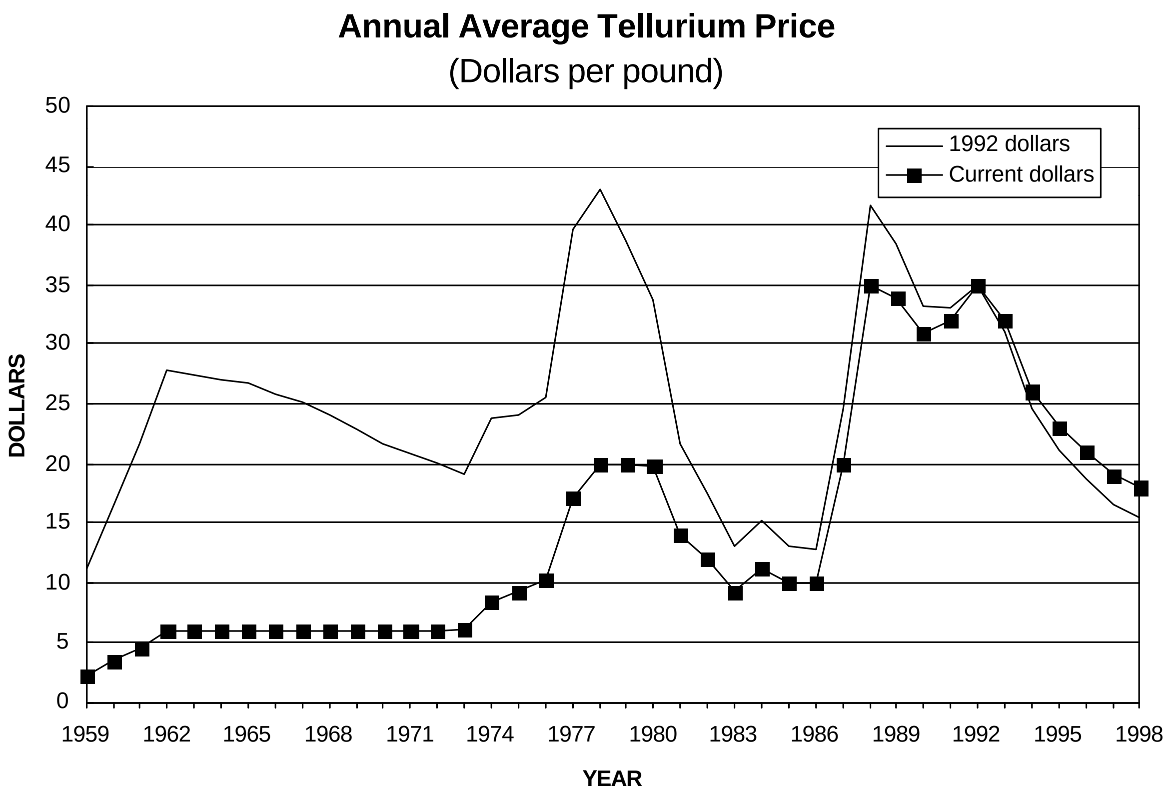

Significant events affecting tellurium prices since 1958

1959-62	Price rise coincides with growth in demand for thermoelectric devices
1962-73	Price remains invariant, high inventories, demand averages about 200,000 pounds per year, free-machining steel becomes dominant use
1973-80	Price controls during 1973 lifted in December, annual demand doubles stimulated by catalytic uses, reduced production from fall-off in copper production and tellurium content of ores, speculation affects prices
1980-86	Demand plummets, major catalytic use ends and consumer inventories return to marketplace, depressed domestic steel industry
1987-88	Demand for free-machining steel increases, reduced tellurium production, inventory depletion, price doubles
1989-93	Domestic and world demand weakens; production declines faster than consumption, resulting in a moderate fall-off in stocks and sustained high prices
1993-98	Oversupply situation develops as demand decreases faster than production, high-efficiency cadmium telluride solar cells fail to increase demand significantly

Tellurium is a relatively rare element, tied for 71st place with platinum and palladium in rank of crustal abundance. It is in the same chemical family as oxygen, sulfur, selenium, and polonium: oxygen and sulfur are nonmetals, polonium is a metal, and selenium and tellurium are semiconductors, although they are often referred to as metals when in elemental form. Tellurium was first identified in 1782 in Transylvanian gold ore (Azimov, 1994, p. 260). For more than a century, tellurium was an experimental material having little commercial value. Small quantities of tellurium were produced from anode muds generated during the electrolytic refining of copper. World tellurium production is still mainly a byproduct of copper processing. This byproduct nature has led to supply/demand imbalances that have had significant impacts on price (Elkin, 1985, p. 1,158).

By 1920, a small commercial demand had developed for tellurium in electronic equipment, electroplating, and chemical production (Heikes, 1922). Despite a consumption of only about 1,000 pounds per year, production of tellurium rose to more than 11,000 pounds per year by 1929 following the rise in electrolytic copper production (Heikes, 1933).

Additional significant commercial uses for tellurium were developed during the 1930's, and demand and production rose sharply, with production exceeding demand. Major uses included the purification of zinc-refining solutions, alloying with lead to improve its tensile strength and corrosion resistance, and rubber compounding to improve resistance to aging and abrasion.

Production and demand for tellurium fluctuated markedly between 1940 and 1958, but generally supply outstripped demand. A demand peak in 1941, attributed to World War II, corresponded to the increased use of tellurium as a carbon stabilizer in cast iron, and a peak in 1951-52, attributed to the Korean Conflict, corresponded to tellurium's expanded use in copper alloying. Price-driven substitution of tellurium for selenium in some applications helped boost demand from 1955 through 1958.

Beginning in 1959, the byproduct nature of tellurium, with production being essentially independent of demand, and the small and specialized uses of tellurium combined to create volatility in the market. Prices rose from $1.70 per pound in 1958 to $6.00 per pound in 1962 before stabilizing at the higher level (Lansche, 1963, p. 148). This period was marked by increased shipments and speculative interest. The rise in price also corresponded to the growth in thermoelectric applications for tellurium, as well as its use in free-machining steel, which became the dominant use (Holowaty, 1964; Rathke and Morgan, 1965).

Prices remained stable at about $6.00 per pound until the early 1970's when growing demand for ferrous alloy applications was followed by a rapid growth in the catalytic applications of tellurium in petrochemicals processing. When a large domestic consumer of tellurium catalyst closed its plant in late 1979, reducing demand and returning large quantities of consumer stocks to the market, and tellurium consumption in steel fell abruptly 2 years later as steel production slumped, tellurium prices fell sharply from 1980 through 1983. Production also decreased owing to a decline in the tellurium content of domestic copper ores (Wills, 1982). By 1983, only one domestic producer of tellurium remained. Domestic production decreased in 1985 when imported high-tellurium copper concentrates were no longer processed. By 1987, with increasing demand in free-machining steels and low production of tellurium, inventories became critically low, and prices rose substantially and remained fairly stable until 1993, when a steady decline began that lasted through 1998. During this period, an oversupply situation developed owing to the fact that although production decreased, demand decreased more (Brown, 1998, p. 13-17).

The use of high-purity tellurium in cadmium telluride solar cells is very promising. Some of the highest efficiencies for electric power generation have been obtained by using this material, but this application has not yet caused demand to increase significantly.

Metal prices can be affected by national and international regulations. Tellurium scrap and that of certain other metals were banned from shipment from Europe to African, Pacific, and Caribbean (APC) nations in response to Basel Convention deliberations in 1997 which attempted to stop the "dumping" of toxic materials in APC countries (Metal Bulletin, 1997). This was in spite of many cases where APC countries were already importing scrap for processing by their metal industries, not merely for disposal. Actually, tellurium metal is not toxic. It was removed from the U.S. Environmental Protection Agency's most-hazardous materials list when its insolubility was pointed out to agency officials (U.S. Environmental Protection Agency, 1996).

Commercial-grade tellurium is usually marketed as minus 200-mesh powder but is also available as slabs, ingots, sticks, or lumps.

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Annual Average Tellurium Price
(Dollars per pound[1])

Year	Price	Year	Price	Year	Price	Year	Price
1917	3.00	1938	2.00	1959	2.33	1980	19.77
1918	NA	1939	2.00	1960	3.50	1981	14.00
1919	NA	1940	1.75	1961	4.63	1982	12.00
1920	NA	1941	1.75	1962	6.00	1983	9.25
1921	NA	1942	1.75	1963	6.00	1984	11.25
1922	2.25	1943	1.75	1964	6.00	1985	10.00
1923	2.00	1944	1.75	1965	6.00	1986	10.00
1924	NA	1945	1.75	1966	6.00	1987	20.00
1925	NA	1946	1.75	1967	6.00	1988	35.00
1926	2.02	1947	1.75	1968	6.00	1989	34.00
1927	1.91	1948	1.75	1969	6.00	1990	31.00
1928	1.91	1949	1.75	1970	6.00	1991	32.00
1929	2.07	1950	1.75	1971	6.00	1992	35.00
1930	1.70	1951	1.75	1972	6.00	1993	32.00
1931	2.00	1952	1.75	1973	6.05	1994	26.00
1932	2.00	1953	1.75	1974	8.34	1995	23.00
1933	2.00	1954	1.75	1975	9.28	1996	21.00
1934	2.00	1955	1.75	1976	10.33	1997	19.00
1935	2.00	1956	1.63	1977	17.15	1998	18.00
1936	2.00	1957	1.75	1978	20.00		
1937	2.00	1958	1.70	1979	20.00		

NA Not available
[1] To convert to dollars per kilogram, multiply by 2.20462.

Note:
1917-22, U.S. producer price for 99%-pure tellurium, *in* U.S. Geological Survey Mineral Resources of the United States.
1923-29, Domestic price for 99%-pure tellurium, *in* Engineering and Mining Journal.
1930-36, New York price for 99%-pure tellurium, *in* Engineering and Mining Journal.
1937-39, New York price for 99%-pure tellurium, *in* E&MJ Metal and Mineral Markets.
1940-66, New York price for 99.7%-pure tellurium, *in* E&MJ Metal and Mineral Markets.
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