

TELLURIUM

(Data in metric tons unless otherwise noted)

Domestic Production and Use: In 2018, one firm in Texas produced commercial-grade tellurium as a byproduct from domestic copper anode slimes. The primary producer and downstream producers further refined domestic and imported commercial-grade metal to produce tellurium dioxide, high-purity tellurium, and tellurium compounds for specialty applications. To avoid disclosing company proprietary data, U.S. tellurium production in 2018 was withheld.

Tellurium was used in the production of cadmium telluride (CdTe) for CdTe thin-film solar cells. Other uses were as an alloying additive in steel to improve machining characteristics, as a minor additive in copper alloys to improve machinability without reducing conductivity, in lead alloys to improve resistance to vibration and fatigue, in cast iron to help control the depth of chill, and in malleable iron as a carbide stabilizer. It was used in the chemical industry as a vulcanizing agent and accelerator in the processing of rubber and as a component of catalysts for synthetic fiber production. Other uses included those in photoreceptor and thermoelectric devices, blasting caps, and as a pigment to produce various colors in glass and ceramics.

Global consumption estimates of tellurium by end use are solar, 40%; thermoelectric production, 30%; metallurgy, 15%; rubber applications, 5%; and other, 10%.

Salient Statistics—United States:	2014	2015	2016	2017	2018^e
Production, refinery	W	W	W	W	W
Imports for consumption	109	76	73	163	230
Exports	28	41	3	2	10
Consumption, apparent ¹	W	W	W	W	W
Price, dollars per kilogram ²	113	79	36	38	79
Stocks, producer, refined, yearend	W	W	W	W	W
Net import reliance ³ as a percentage of apparent consumption	>75	>75	>75	>75	>75

Recycling: For traditional metallurgical and chemical uses, there was little or no old scrap from which to extract secondary tellurium because these uses of tellurium are highly dispersive or dissipative. A very small amount of tellurium was recovered from scrapped selenium-tellurium photoreceptors employed in older plain-paper copiers in Europe. A plant in the United States recycled tellurium from CdTe solar cells; however, the amount recycled was limited because most CdTe solar cells were relatively new and had not reached the end of their useful life.

Import Sources (2014–17): Canada, 66%; China, 27%; Germany, 3%; and other, 4%.

Tariff: Item	Number	Normal Trade Relations
Tellurium	2804.50.0020	<u>12–31–18</u> Free.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: In May 2018, the U.S. Department of the Interior, in coordination with other executive branch agencies, published a list of 35 critical minerals (83 FR 23295), including tellurium. This list was developed to serve as an initial focus, pursuant to Executive Order 13817, “A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals” (82 FR 60835).

Domestic tellurium production was estimated to have remained essentially unchanged from that in 2017. The sole domestic producer shipped at least a portion of its anode slimes to Mexico for treatment and refining. World production of tellurium in 2018 was estimated to be about 440 tons. In 2018, the domestic average monthly price of tellurium generally increased in the first 7 months of the year, from around \$52 per kilogram in January to \$100 per kilogram in July. The average monthly price then decreased slightly through September to an average of \$82 per kilogram through mid-October.

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Domestic imports of tellurium were estimated to have increased by about 41% in 2018 from those of 2017, mostly as a result of a significant increase in imports from Canada, Germany, and the Philippines. During the first 9 months of 2018, the United States imported 119 tons of tellurium from Canada, 32 tons from China, 24 tons from Germany, and 5 tons from the Philippines—an increase of 56 tons, a decrease of 5 tons, and an increase of 21 tons and 4 tons, respectively, compared with imports during the same period of the prior year. In 2017, 93% of the tellurium imports from China were imported between August and November, and for the past several years, most of the annual tellurium imports from China took place in 1 or 2 months of the year. In September 2018, imports from China were 25 tons, representing 78% of imports from China in 2018. China was the leading producer of refined tellurium, recovering tellurium from copper anode slimes and from residues generated during the lead, nickel, precious metals, and zinc smelting processes.

Subsidies and tax credits for new solar construction that were aimed at encouraging domestic solar projects continued in the United States. The subsidies had been set to expire at the end of 2016, but legislation passed by Congress in December 2015 extended the 30% Solar Energy Credit until January 1, 2019. After this date, the credit will begin to decrease incrementally, until it reaches 10% on January 1, 2022.

World Refinery Production and Reserves: The figures shown for reserves include only tellurium contained in copper reserves. These estimates assume that more than one-half of the tellurium contained in unrefined copper anodes is recoverable.

	Refinery production ^e		Reserves ⁴
	2017	2018	
United States	W	W	3,500
Bulgaria	5	5	NA
Canada	49	30	800
China	290	300	6,600
Japan	38	36	—
Russia	44	35	NA
South Africa	7	7	—
Sweden	35	32	670
Other countries ⁵	NA	NA	16,000
World total (rounded)	⁶ 470	⁶ 440	31,000

World Resources: Data on tellurium resources were not available. More than 90% of tellurium has been produced from anode slimes collected from electrolytic copper refining, and the remainder was derived from skimmings at lead refineries and from flue dusts and gases generated during the smelting of bismuth, copper, and lead-zinc ores. Potential sources of tellurium include bismuth telluride and gold telluride ores.

Substitutes: Several materials can replace tellurium in most of its uses, but usually with losses in efficiency or product characteristics. Bismuth, calcium, lead, phosphorus, selenium, and sulfur can be used in place of tellurium in many free-machining steels. Several of the chemical process reactions catalyzed by tellurium can be carried out with other catalysts or by means of noncatalyzed processes. In rubber compounding, sulfur and (or) selenium can act as vulcanization agents in place of tellurium. The selenides and sulfides of niobium and tantalum can serve as electrical-conducting solid lubricants in place of tellurides of those metals.

The selenium-tellurium photoreceptors used in some plain paper photocopiers and laser printers have been replaced by organic photoreceptors in newer devices. Amorphous silicon and copper indium gallium selenide were the two principal competitors of CdTe in thin-film photovoltaic solar cells.

^eEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

¹Defined as production + imports – exports + adjustments for industry stock changes.

²Average price published by Argus Media group—Argus Metals International for 99.95% tellurium, free on board, U.S. warehouses.

³Defined as imports – exports + adjustments for industry stock changes.

⁴See Appendix C for resource and reserve definitions and information concerning data sources.

⁵In addition to the countries listed, Australia, Belgium, Chile, Colombia, Germany, Kazakhstan, Mexico, the Philippines, and Poland produce refined tellurium, but output was not reported and available information was inadequate to make reliable production and reserves estimates.

⁶Excludes U.S. production.