

TELLURIUM

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

Domestic Production and Use: In 2016, one firm in Texas produced commercial-grade tellurium as a byproduct from domestic copper anode slimes and lead refinery skimmings. 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 2016 was withheld.

Tellurium was used in the production of cadmium telluride (CdTe) solar cells, which was the major end use for tellurium in the United States. 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 devices 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:	2012	2013	2014	2015	2016^e
Production, refinery	W	W	W	W	W
Imports for consumption	36	65	109	76	70
Exports	47	42	28	41	40
Consumption, apparent	W	W	W	W	W
Price, dollars per kilogram, 99.95% minimum ¹	150	112	119	77	34
Stocks, producer, refined, yearend	W	W	W	W	W
Net import reliance ² as a percentage of apparent consumption	<50	>50	>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 (2012–15): Canada, 59%; China, 24%; Belgium, 8%; Philippines, 7%; and other, 2%.

Tariff: Item	Number	Normal Trade Relations
Tellurium	2804.50.0020	<u>12–31–16</u> Free.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: In 2016, reported domestic tellurium production decreased from that in 2015. The sole domestic producer shipped at least a portion of its anode slimes to Mexico for treatment and refining. World production of tellurium in 2016 was estimated to be about 400 tons. In 2016, the price of tellurium continued its downward trend, decreasing from \$77 per kilogram (\$35 per pound) in 2015 to an estimated \$34 per kilogram (\$15 per pound) in 2016.

In China, the Yunnan Provincial government instructed the municipal government of Kunming to launch an official investigation into the trading activities of the Fanya Metal Exchange Co. Ltd. (FME), which began trading tellurium in April 2014. The municipal government was instructed to determine if the FME had any physical assets in warehouses, concealed facts, created a capital pool and taken control of the funds within, and illegally possessed and used the funds that it had raised. In February, the owner of the FME was arrested, and in March, the Public Security Bureau announced that it was expanding its investigation into FME activities. The 170 tons of tellurium that was reported to be in FME warehouses has not been verified by the Government or a third party.

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Although imports of tellurium from Canada decreased by 35% to less than 51 tons, Canada remained the leading source of domestic imports of tellurium and supplied about twice as much as China, the next leading supplier. In Sweden, new mine operations that started to produce tellurium concentrate in 2012 reportedly produced 33 tons in 2015.

The Government of the United States extended subsidies and tax credits for new solar construction that were aimed at encouraging domestic solar projects. The subsidies were to expire at the end of 2016, but legislation passed by the U.S. Congress in December 2015 extended the 30% Solar Energy Credit until January 1, 2019. After this date, the credit begins to decrease incrementally, until it reaches 10% on January 1, 2022, and that is where it will remain for any new commercial construction that begins after 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		Reserves ³
	2015	2016 ^e	
United States	W	W	3,500
Canada	9	10	800
Japan	37	30	—
Peru	—	—	3,600
Russia	35	35	NA
Sweden	33	33	670
Other countries ⁴	NA	NA	16,000
World total (rounded)	NA	NA	25,000

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. Other 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.

¹Average price published by Metal-Prices for 99.95% tellurium.

²Defined as imports – exports + adjustments industry stock changes.

³See [Appendix C](#) for resource and reserve definitions and information concerning data sources.

⁴In addition to the countries listed, Australia, Belgium, Chile, China, Colombia, Germany, India, 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.