TELLURIUM

(Data in metric tons, tellurium content, unless otherwise specified)

Domestic Production and Use: Tellurium is recovered principally as a byproduct of the electrolytic refining of primary copper, where it accumulates in the residues of copper anodes. In 2024, two primary electrolytic copper refineries operated in the United States, one in Texas and one in Utah, and produced copper telluride from tellurium-bearing anode slimes. Tellurium was not refined in the United States; copper telluride from both U.S. facilities was exported for further processing. Downstream companies processed imported tellurium to manufacture high-purity tellurium products, tellurium compounds for specialty applications, and tellurium dioxide. Domestic tellurium production, consumption, and stocks were withheld to avoid disclosing company proprietary data.

Tellurium was used predominantly in the production of cadmium telluride (CdTe) for thin-film solar cells. Another significant end use was for the production of bismuth telluride (BiTe), which is used in thermoelectric devices for cooling and energy generation. Metallurgical 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 control the depth of chill, and in malleable iron as a carbide stabilizer. Tellurium 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. In 2024, estimated end uses for tellurium in global consumption were solar power cells, 60%; thermoelectric devices, 20%; metallurgy, 15%; and other applications, 5%.

Salient Statistics—United States:	2020	2021	2022	2023	2024[e]
Production, copper telluride	W	W	W	W	W
Imports for consumption	12	42	37	8	7
Exports[1]	([2])	2	1	15	4
Consumption, apparent[3]	W	W	W	W	W
Price, annual average, dollars per kilogram:					
United States[4]	59.37	69.72	70.34	79.09	75
Europe[5]	56.05	67.26	68.10	76.74	80
Stocks, producer, yearend	W	W	W	W	W
Net import reliance[6] as a percentage of apparent consumption	>75	>95	>75	E	<25

Recycling: For traditional metallurgical and chemical applications, there was little or no scrap from which to extract secondary tellurium because these uses are highly dispersive or dissipative. A very small amount of tellurium was recovered from scrapped selenium-tellurium photoreceptors employed in older photocopiers in Europe. Tellurium was recycled from CdTe solar cells in the United States, but 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 (2020–23): Canada, 58%; Philippines, 19%; Japan, 9%; Germany, 5%; and other, 9%.

Tariff: Item	Number	Normal Trade Relations 12–31–24
Tellurium	2804.50.0020	Free.

Depletion Allowance: 14% (domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: The supply of tellurium is directly affected by the supply of materials from which it is a byproduct, primarily copper. In 2024, recovery of copper telluride from domestic copper anode slimes was estimated to have increased from that in 2023, reflecting greater output of copper cathode from electrolytic refineries in the United States. Owing to a well-supplied North American market, the annual average price for tellurium in U.S. warehouses decreased by 5% to an estimated $75 per kilogram in 2024 from $79.09 per kilogram in 2023. In Europe, limited availability of tellurium, steady demand, and higher costs of purchasing tellurium from China increased the annual average price by 4%, to an estimated $80 per kilogram in 2024 from $76.74 per kilogram in 2023.

The leading U.S. producer of solar modules opened its fourth domestic manufacturing facility in 2024 and was constructing a fifth plant that was projected to be commissioned in 2025. The company expected its solar panel production capacity in the United States to reach 14 gigawatts per year by the end of 2026.

Prepared by **Daniel M. Flanagan [(703) 648–7726, dflanagan@usgs.gov]**

TELLURIUM

China was the leading producer of refined tellurium in 2024 and accounted for approximately 75% of estimated global output (excluding production in multiple countries for which available information was inadequate to make reliable estimates of output). Production in China increased significantly over the past 10 years, corresponding with an increase of about 60% in the production capacity of electrolytically refined copper. The production capacity of copper anode, the feedstock material for electrolytic copper refineries, nearly doubled over the same time period.

World Refinery Production and Reserves: The values shown for reserves reflect the estimated tellurium content of copper reserves except for those of China and Sweden, which represent reported reserves of tellurium. Reserves for Canada, Sweden, the United States, and "Other countries" were revised based on company and Government reports.

	Refinery production[7]		Reserves[8]
	2023	2024[e]	
United States (copper telluride)	W	W	3,800
Bulgaria	1	1	NA
Canada	[e]27	27	900
China	725	750	3,100
Japan	[e]65	70	NA
Russia	[e]73	70	5,800
South Africa	[e]4	4	800
Sweden (concentrates)	36	46	740
Uzbekistan	[e]13	13	NA
Other countries[9]	NA	NA	20,000
World total (rounded)	[10]944	[10]980	35,000

World Resources:[8] Reserves for tellurium are based on identified copper deposits and average tellurium content. More than 90% of tellurium has been produced from anode slimes as a byproduct of 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. Amorphous silicon and copper indium gallium diselenide are the two principal competitors with CdTe in thin-film photovoltaic solar cells. Bismuth selenide and organic polymers can be used to substitute for BiTe in some thermoelectric devices. 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.

[e]Estimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data.

[1]May include exports of copper telluride.

[2]Less than ½ unit. Export data reported by the U.S. Census Bureau in 2020 were adjusted by the U.S. Geological Survey.

[3]Defined as production (tellurium content of copper telluride) + imports – exports ± adjustments for industry stock changes.

[4]Minimum purity of 99.95%, free on board, U.S. warehouse. Source: Argus Media Group, Argus Non-Ferrous Markets.

[5]Minimum purity of 99.99%, in warehouse, Rotterdam. Source: Argus Media Group, Argus Non-Ferrous Markets.

[6]Defined as imports – exports ± adjustments for industry stock changes.

[7]Unless otherwise noted, data relate to refinery output only insofar as possible. Countries that produced tellurium contained in copper ore and concentrates, copper smelter products (blister and anodes), and (or) refinery residues but did not recover refined tellurium from these materials are excluded.

[8]See Appendix C for resource and reserve definitions and information concerning data sources.

[9]In addition to the countries listed, Australia, Belgium, Chile, Germany, Indonesia, Kazakhstan, Mexico, and the Philippines may have produced refined tellurium, but available information was inadequate to make reliable estimates of output.

[10]Excludes U.S. production.