

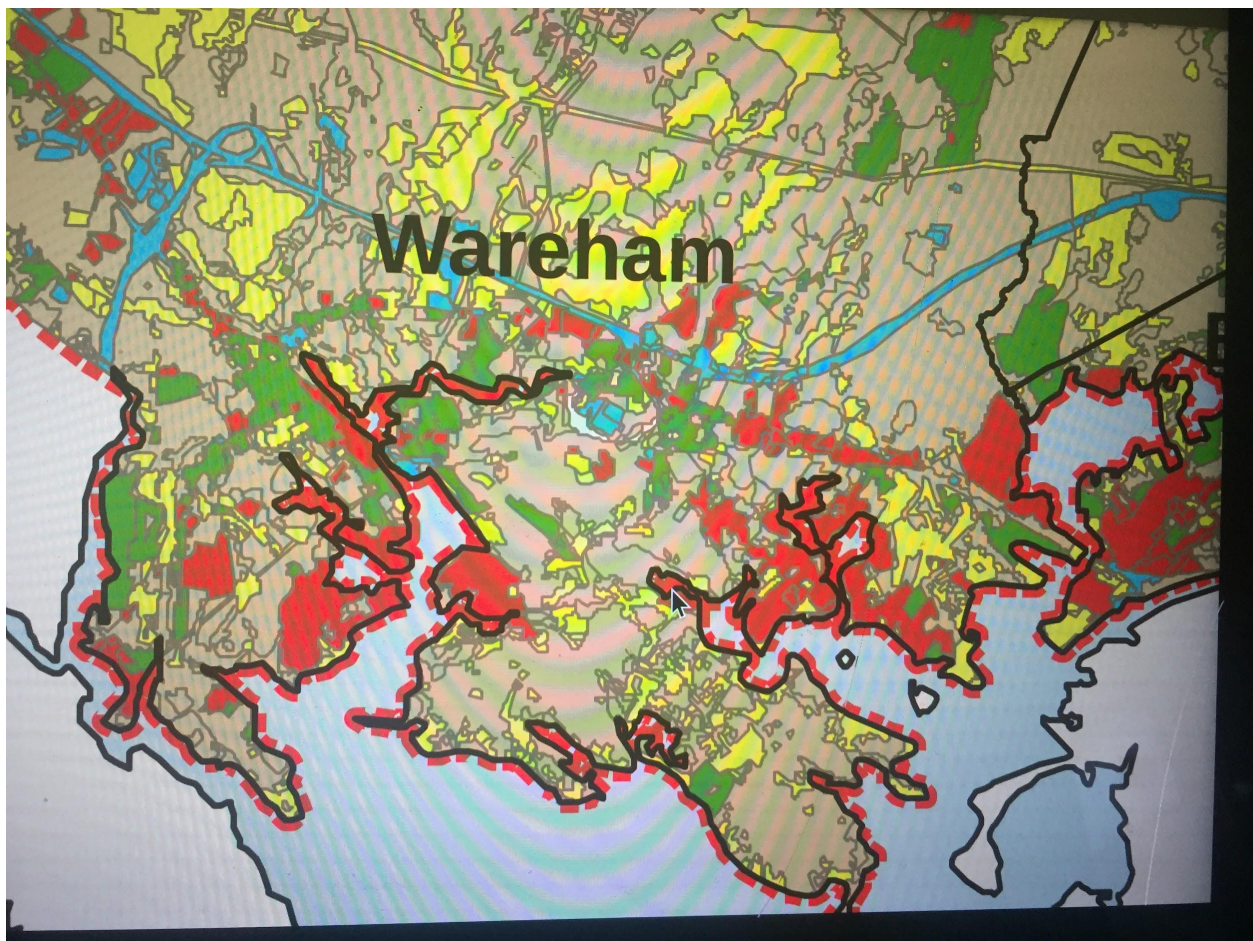
Solar project 0-25 is sited to the right of the Rte. 25 marker furthest to the left.

Why are we deforesting upland forests so that in 25 years salt water can wash over denuded ground into our private wells and aquifer with no protection?

Salt water intrusion beneath the surface will happen before hand and it is estimated to travel many feet before it's visible. In North Carolina, the rich black earth farms first sparkle with salt crystals.

https://www.washingtonpost.com/national/ruined-crops-salty-soil-how-rising-seas-are-poisoning-north-carolinas-farmland/2019/03/01/2e26b83e-28ce-11e9-8eef-0d74f4bf0295_story.html “Of climate change’s many..

plagues — drought, insects, fires, floods — saltwater intrusion in particular sounds almost like a biblical curse. Rising seas, sinking earth and extreme weather are conspiring to cause salt from the ocean to contaminate aquifers and turn formerly fertile fields barren. A [2016 study in the journal Science](#) predicted that 9 percent of the U.S. coastline is vulnerable to saltwater intrusion — a percentage likely to grow as the world continues to warm. Scientists are just beginning to assess the potential effect on agriculture, Manda said, and it's not yet clear how much can be mitigated.



This map shows Wareham's current areas of High Risk for pollution of our Aquifer. We know our town is replete with water ways and bodies that need greater protection.

Forests protect water, filter water, aerate and mineralize water. They are needed for 15% of our climate goals. They aren't replaceable. They provide oxygen for us. Why would we be destroying them for solar that belongs somewhere else. Have we gotten used to this insanity. Ask anyone in town. "Why would you destroy forests to protect the environment?" That questions crosses all demographics.

[Leaching of cadmium and tellurium from cadmium telluride \(CdTe\) thin-film solar panels under simulated landfill conditions - PMC](#)

<https://www.mdpi.com/1996-1073/14/2/398>

<https://www.researchgate.net/publication/348883160>
[Leaching via Weak Spots in Photovoltaic Modules](#)

Unstable layers open penetration paths for water-based solutions; finally, the leaching results in delamination. In CdTe containing module pieces, the CdTe itself and the back contact are unstable and highly soluble.

<https://www.uni-stuttgart.de/en/university/news/all/Pollutants-in-photovoltaic-modules--how-do-they-get-into->

[the-environment/](#) “Solar energy from photovoltaic installations is, actually, considered ecologically beneficial. But most of the photovoltaic modules contain contaminants, among others cadmium and lead. These can leak into the soil or groundwater when the modules are disposed. Scientists of the University of Stuttgart now examine how the poisonous substances are released and how this can be prevented.”

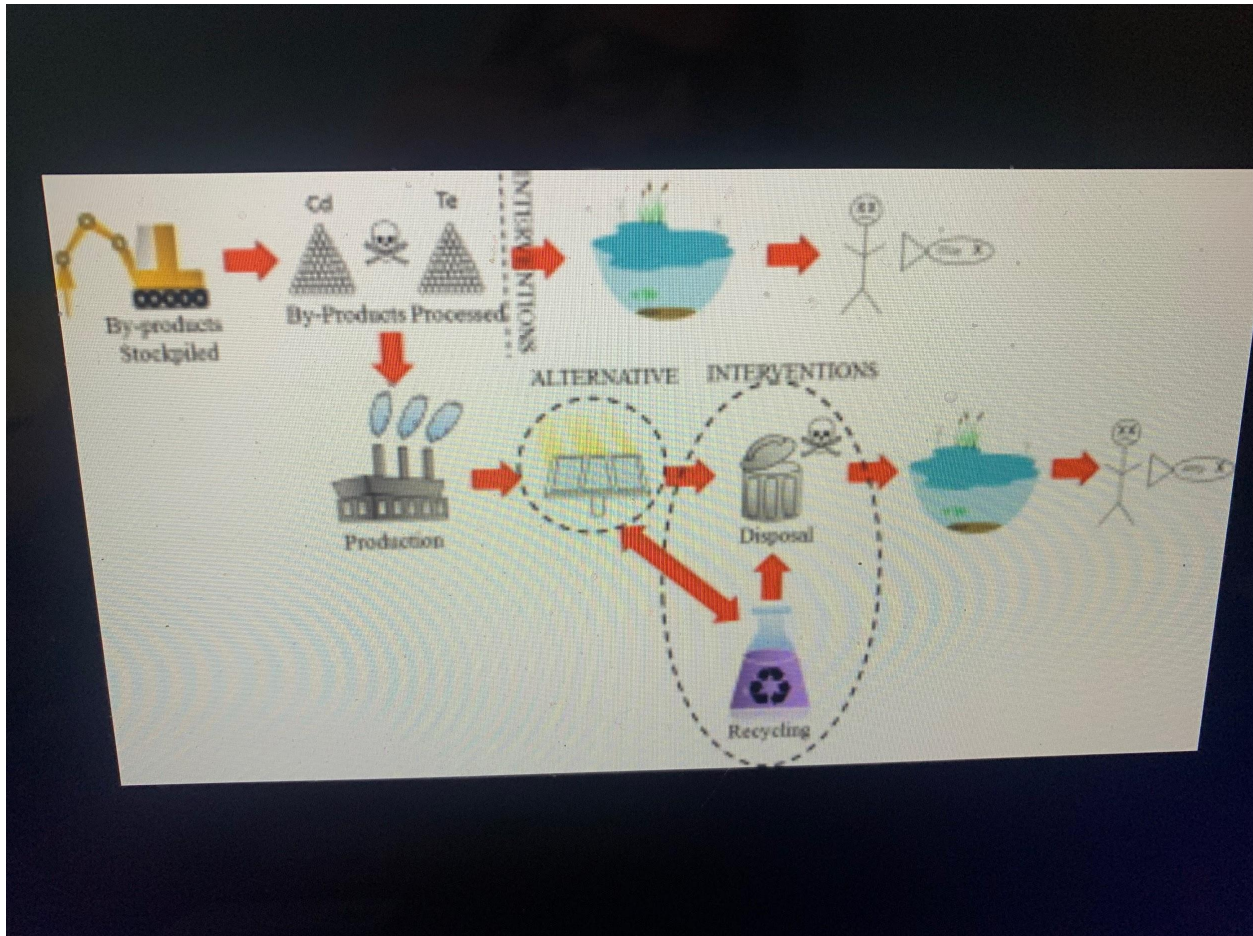
[CdTe in thin film photovoltaic cells:
Interventions to protect drinking water
in production and end-of-life -
ScienceDirect](#)

Thin-film PV cells use CdTe as a semiconductor material because of its advantageous band gap and high solar absorption efficiency. However, CdTe as well as cadmium and tellurium species can be toxic to aquatic and terrestrial ecosystems and pose serious health

hazards to humans when present in drinking water.

As stated earlier, most PV cells are disposed in municipal landfills. This poses serious hazards to terrestrial and aquatic ecosystems as the Cd and Te may leach out of the landfills and contaminate soils, groundwater, and surface water. This is especially a concern as the global use of PV modules increases. Global and local regulation is required to ensure that the hazardous materials in PV modules, including Cd and Te, be extracted and disposed of in a controlled hazardous waste landfill. The most effective way to enforce this regulation would be to implement a mandatory recycling

framework and provide necessary resources to make it feasible. When materials are being separated for recycling purposes, the components that are hazardous and cannot be recycled are disposed in controlled hazardous waste landfills instead of municipal landfills. This increases disposal cost, but instead of externalizing the cost of disposal in the form of environmental degradation, the cost is internalized in a form that is easier to mitigate.



<https://nn-labs.com/products/cadmium-telluride-quantum-dots-ct> The high-quality cadmium telluride (CdTe) core nanocrystals from NN-Labs provide an excellent size distribution, high stability, and optical quality. These nanomaterials attract interest in the research and development of thin-film solar cells because they maintain an ability to be coated onto thin and flexible substrates to reduce the overall size and mass of the cell when compared to traditional silicon photovoltaic cells. Furthermore, with the introduction of nanometer-sized

particles, even fewer materials are needed to capture the same level of sunlight.

Potential applications: solar (photovoltaic) purposes, thin-film solar cells..”

Toxicity of cadmium telluride nanoparticles

[_https://pubmed.ncbi.nlm.nih.gov/25809595/](https://pubmed.ncbi.nlm.nih.gov/25809595/)

[_https://www.mdpi.com/1422-0067/16/10/23279](https://www.mdpi.com/1422-0067/16/10/23279)

Liver Toxicity of Cadmium Telluride Quantum Dots (CdTe QDs) Due to Oxidative Stress *in Vitro* and *in Vivo*

Key Laboratory of Environmental Medicine Engineering, Ministry of Education, School of Public Health, Southeast University, Nanjing 210009, China

Abstract

With the applications of quantum dots (QDs) expanding, many studies have described the potential adverse effects of QDs, yet little attention has been paid to potential toxicity of QDs in the liver. The aim of this study was to investigate the effects of cadmium telluride (CdTe) QDs in mice and murine hepatoma cells alpha mouse liver 12 (AML 12). CdTe QDs administration significantly increased the level of lipid peroxides marker malondialdehyde (MDA) in the livers of treated mice. Furthermore, CdTe QDs caused cytotoxicity

FTEL News First Tellurium

<https://www.5nplus.com/> **Pure Metals**

Starting with commercial quality materials, 5N Plus uses a combination of physical and chemical purification techniques to produce 5N, 6N and 7N purity metals, which we offer in a variety of shapes for electronic, consumer and industrial applications.

CONTACT US

CadmiumBi

CadmiumCadmium

4N - 7N

Cd

<https://investingnews.com/daily/resource-investing/critical-metals-investing/tellurium-investing/introduction-to-tellurium-investing/>China 300 of 400 pures te.
Thin film use bulk of global tellurium

[Leaching of cadmium and tellurium from cadmium telluride \(CdTe\) thin-film solar panels under simulated landfill conditions - PMC](#)

[Cadmium Telluride Photovoltaic Market Expected To See Significant Growth As Solar Demand Rises](#)

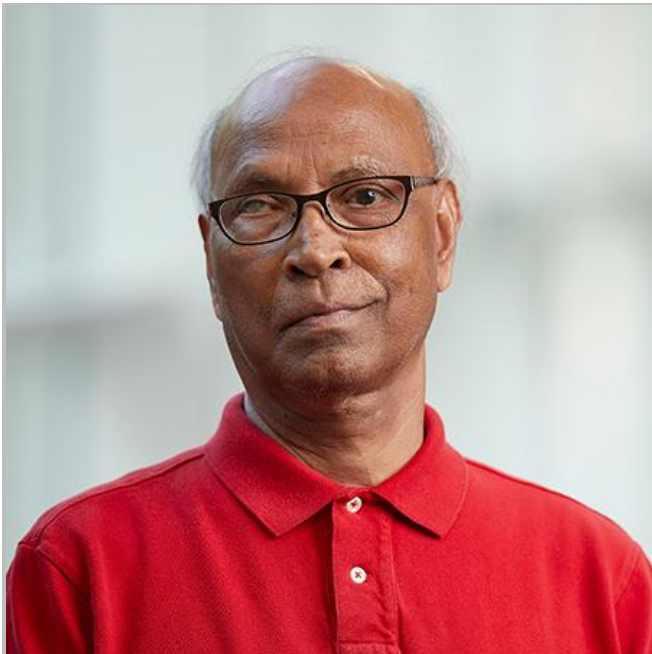
And Battery Fire Toxicity- What are the less hazardous options and why are they not being used?

A less toxic battery case to retard fires.

” One factor slowing more-rapid lithium-ion battery adoption is the small but real risk of fire. A failing battery cell or an external shock such as a collision can ignite fires that are difficult to extinguish and can release toxic chemicals. UNLV ingenuity is addressing that hazard, with a polymer invented on campus playing an important role in developing battery cases that reduce fire risk. The state's [Battle Born Venture](#) program provided pre-seed funding to [Quantum Copper](#), a Las Vegas startup based in the UNLV Black Fire building that makes use of the battery-safety technology invented by [Pradip Bhowmik](#), a longtime UNLV organic and polymer chemistry professor.

Bhowmik's 2016 discovery makes polymers more fire resistant without the use of halogenated compounds such as chlorine and bromine, which retard fires but can be harmful to the environment and are difficult to dispose of safely."

ries



Pradip Bhowmik

Professor, Organic & Polymer Chemistry

Department(s)

Chemistry and Biochemistry

Office

[CHE 207](#)

Mail Code

4003

Phone

702-895-0885

Fax

702-895-4072

Email

pradip.bhowmik@unlv.edu

Expertise

Organic and Polymer Synthesis, Nanomaterials Synthesis, Green Chemistry, Ionic Liquids, Anticancer Drugs

Additional Information

My interests focus on organic and polymer synthesis in general. More specifically, we are interested in developing novel light-emitting and liquid-crystalline polymers for their multitude applications in modern technology, including biosensors. In another project, we are developing ionic liquids based on the concept of green chemistry, and liquid-crystalline and light-emitting organic salts to make them functional materials. Carbon nanotube-based composite materials based on ionic polymers are of significant interest in our group. In

recent years, we are also actively pursuing the development of cisplatin analogs for cancer therapy.

Education

Ph.D., Organic/Polymer Chemistry, University of Massachusetts at Amherst, 1990.

M.S., Physical/Organic Chemistry, University of Massachusetts at Dartmouth, 1987.

M.S., Physical/Inorganic Chemistry, University of Dhaka, Bangladesh, 1977.

B.Sc. (Honors), University of Dhaka, Bangladesh, 1975.

Standard and Poor

Access to tellurium has always been of critical importance to First Solar, which used to employ its own team of geologists to explore mineral claims. Like other manufacturers, though, First Solar faced intense competition from Chinese producers, and its strategy soon changed.

[First Solar's growth plans hinge on opaque market for tellurium](#)

<https://www.spglobal.com> › latest-news-headlines › first...

Dec 16, 2021 — First Solar's plan to spend **\$1.36 billion** to help increase module capacity to 16 GW by 2024 seems certain to strain the tellurium market.

You've visited this page many times. Last visit: 2/22/23

Dec. 21 is when the FLPA act was passed to be implemented in summer of 22

Uyghur Forced Labor Prevention Act

<https://www.cbp.gov> › trade › forced-labor › UFLPA

The Uyghur **Forced Labor Prevention Act** (UFLPA) was signed into law by President Biden on December 23, 2021. It establishes a rebuttable presumption that the ...

[First Solar powers new tellurium demand - North of 60 Mining](#)

[News](#)Critical Minerals Alliance- September, 2022 A look at the “possibilities” and new processes necessary to bring rare earth mining from China to the US.

First Solar Issues with Tellurium Sourcing, China Processing and Extraction, Opaqueness and How Will There Be Enough as Sales Skyrocket if Mining Extraction isn't Worth the Effort?

Standard and Poor

“Access to tellurium has always been of critical importance to First Solar, which used to employ its own team of geologists to explore mineral claims. Like other manufacturers,

though, First Solar faced intense competition from Chinese producers, and its strategy soon changed. “

First Solar's growth plans hinge on opaque market for tellurium

<https://www.spglobal.com> › latest-news-headlines › first...

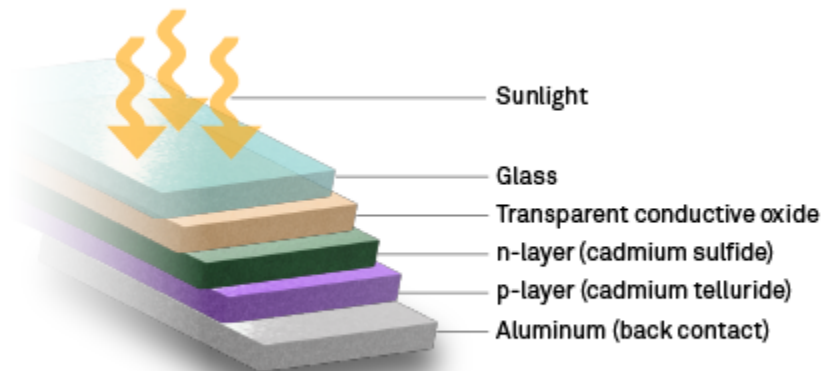
Dec 16, 2021 — First Solar's plan to spend **\$1.36 billion** to help increase module capacity to 16 GW by 2024 seems certain to strain the tellurium market. Tellurium also used in many other products—Tellurium is often used to improve the machinability of copper and stainless steel. It's used to make blasting caps, added to cast iron and ...

Dec. 21 is when the FLPA act was passed to be implemented in summer of 22. It's when LG got out of the solar business because South Korea used Chinese panels indicated using forced labor.

After it implemented a restructuring plan to cut costs, the company in 2013 sold property in Colorado where tellurium had been discovered to a group of investors led by John Keller, First Solar's former exploration manager for North America. As First Solar retrenched, it focused on cutting the amount of tellurium it needs to make modules. Simon Jowitt and Brian McNulty,

economic geologists at the University of Nevada, Las Vegas, estimate the tellurium intensity of cadmium telluride solar modules has fallen by more than half in the past decade.

Cadmium telluride solar cell



Graphic accessed Dec. 8, 2021.
Source: U.S. Energy Department

"[First Solar] can puppeteer every single part of the process to make the modules more efficient," said Kelsey Goss, a solar analyst at the consulting firm Wood Mackenzie who previously worked at First Solar. "And that is something that I think they probably are doing" to manage their tellurium needs. How far companies can cut their demand for the material is unclear, however. "The industry will encounter fundamental mass limitations for how many solar cells it can manufacture due to

basic constraints in sourcing raw material," Samuel Goodman, an analyst at the U.S. International Trade Commission, or USITC, said in a 2019 article published in the Journal of International Commerce and Economics. "These are intensive processes," Goodman added, "whose expansion would not necessarily be economically viable unless downstream prices increased, especially for tellurium." Koralewski said initiatives are underway to further decrease the tellurium intensity of First Solar's modules, and Widmar has told investors that the company's module recycling program someday will offer at least a partial solution to its raw-material needs. In the meantime, First Solar is in the market for new sources of supply.

Record demand for First Solar modules In November, First Solar reported that module bookings were up more than 150% from the same period of 2020, and the company said it received its largest module order ever, from BP PLC and Lightsource BP Renewable Energy Investments Ltd. Increased tellurium demand should encourage more production, Goodman, the USITC analyst, said in an interview. "If [copper producers] see the financial case for it with the higher demand and the higher

tellurium price because of that, then you'll start seeing more of these capital investments," Goodman said. Tellurium prices need to increase "very, very, very significantly," however, to attract more investment, said Michael Husakiewicz, a metal trader at Lipmann Walton & Co. Ltd. "Tellurium is not really a metal where [copper producers] make serious money," Husakiewicz said. "If there's any possibility that it might cause any problems to the equipment, to the planning of processing, literally anything, then they're not going to bother, because what they make in copper probably in a day is way more than they would make on tellurium in a year."

Global risk: 'Uncertainty and lack of transparency'With First Solar aggressively expanding its business, sources of new tellurium supplies will be essential "unless significant amounts are stockpiled in warehouses, which does not appear to be the case," Keller, First Solar's former exploration manager, said in a statement. First Solar recruited Keller in November. New tellurium production in North America could help to provide a secure source of supply for First Solar's growing U.S. business."The US solar industry is at an important inflection point where it must continue the charge towards delivering 45% of our

country's electricity by 2050 while addressing the risks and uncertainty posed by increasingly volatile solar panel production, pricing, and supply," Georges Antoun, First Solar's chief commercial officer, said in a statement announcing the BP contract. "This is where we come in." But First Solar's operations stretch beyond the U.S. The company has factories in Vietnam, Malaysia and soon, it expects, in India. And a key ingredient in its technology comes from mines and refineries scattered around the globe. "In terms of transparency, it's an entirely global supply chain," Goodman said. "And China is the largest producer of tellurium. So, I would say that there is uncertainty and lack of transparency and potential risks due to all of those factors, as you would find with any other kind of globally traded commodity."

Mining tellurium in the US hasn't paid. It's been cheap from China where forced labor with displaced Tibetans and state ability to control pricing to undercut competition. Now, the cost of Tellurium is rising as well as the product being withheld to leverage against US tariffs on Chinese photovoltaics to undercut their sales in America. -Two fold objective to increase American solar so as not to be dependent on china and boost its

economy as it becomes more aggressive and counter to US security policy. First Solar's opacity appears to be referencing its past use of available and affordable and unethical Chinese mining and processing of Tellurium in the rare earth rich district of Xianxang where forced labor camps are constructed for polysilicon as well.

Where does First Solar get all the tellurium it needs? 2 US Mines- One started up last summer and at the end of the year will have produced (mined)20 tons. Where does it get processed? 5NP is its go to. The numbers don't add up.

<https://pubs.usgs.gov/periodicals/mcs2023/mcs2023-tellurium.pdf>

1 / 2 | - 100% +

Tellurium was predominantly used in the production of cadmium telluride (CdTe) for thin-film solar cells. Another important 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 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 photoreceptors and thermoelectric devices, blasting caps, and as a pigment to produce various colors in glass and ceramics.

Salient Statistics—United States:

	2018	2019	2020	2021	2022 ^e
Production, refinery ¹	W	W	W	W	W
Imports for consumption	192	59	12	42	50
Exports	4	1	(²)	2	(²)
Consumption, apparent ³	W	W	W	W	W
Price, average, dollars per kilogram:					
United States ⁴	79.55	68.11	59.37	69.72	70
Europe ⁵	73.67	60.45	56.05	67.26	66
Stocks, producer, yearend	W	W	W	W	W
Net import reliance ⁶ as a percentage of apparent consumption	>95	>95	>95	>95	>75

Recycling: For traditional metallurgical and chemical uses, there was little or no 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 photocopiers in Europe. A plant in the United States recycled tellurium from CdTe solar cells, 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 (2018–21): Canada, 52%; Germany, 24%; China,⁷ 12%; Philippines, 8%; and other, 4%.

Tariff:	Item	Number	Normal Trade Relations 12–31–22
	Tellurium	2804.50.0020	Free.

The US has production and refinery withheld (W). Imports for consumption 50 when it needs over 400 tons per annum. Consumption apparent W. Net import RELIANCE 75%.

Recycling - very little tellurium recovered because recycling hadn't commenced- new, most panels not at end of their life.

But in the SEC21 Report, their prepaid recycling project, dropped in 2013, was listed as a liability of 150 million. p.103”Our module collection and

recycling liability was 139.1 million as of Dec. 31, 2021.”

<https://www.miningmagazine.com/design-build/news/1432216/rio-tinto-begins-tellurium-production> Two articles on Rio Tinto- just starting

expecting 20 tons annually from fall start up in fall

Rio Tinto is now one of two producers of critical mineral tellurium in the U.S.

Approximately 20 tons of tellurium will be produced each year at Kennecott's new US\$29 million circuit. Tellurium is a by-product of copper production, reducing the amount of waste heading to Kennecott's mine tailings. The company is producing the mineral, used in advanced thin film photovoltaic solar panels, at its Kennecott copper mine in Utah.

"Approximately 90 percent of the world's tellurium resource is contained in copper ore and no other metal has more critical mineral by-products than copper," Rio Tinto chief operating officer Clayton Walker said. Tellurium is one of 10 metals and products extracted at Kennecott, Rio Tinto said.

[Kennecott's New Tellurium Recovery Plant Points to Metal's](#) growing importance. "Kennecott reported that the recovered tellurium will be refined in North America by 5N Plus. The refined tellurium will be supplied to Arizona-based First Solar Inc., the lone American company amongst the world's ten largest solar panel firms."

"A recent article by S&P Global Intelligence noted that First Solar's plan to spend \$1.36 billion to increase

module capacity to 16 GW by 2024 seems certain to strain the tellurium market. If First Solar achieves its goals, its annual demand for the mineral will exceed last year's estimated global tellurium production by up to 70%, according to researchers at the Institute of Environmental Science and Technology at the Autonomous University of Barcelona.”

Questions about opaque sourcing.

Raises questions about 5NPLUS processing in North America. 5NPLUA has many contact i china, including black market sources. 20 tons and

[5N Plus secures multi-year supply contracts with First Solar](#)

Semiconductor today 5N Plus has been a key supplier of semiconductor materials to First Solar since 2007 and over this period several long-term contracts have been signed and executed. During this period 5N Plus has become the leading supplier of engineered semiconductor compounds to the thin-film renewable energy industry, it is claimed.

[5N Plus secures new US\\$79m syndicated credit facility](#)