Dear Planning Board, as usual, last minute haste- there’s so much material and the RSV has still got a grip on me. So forgive the discontinuity. I’m sure you get my drift. Thanks, Annie

<https://www.washingtonpost.com/climate-solutions/interactive/2022/suzanne-simard-mother-trees-climate/?itid=pr_enhanced-template_1> [**CLIMATE SOLUTIONS**](https://www.washingtonpost.com/climate-solutions/)

# **With forests in peril, she’s on a mission to save ‘mother trees’**

<https://www.politico.com/news/2022/12/26/china-trade-tech-00072232?utm_source=POLITICO.EU&utm_campaign=a7bac34adf-EMAIL_CAMPAIGN_2022_12_27_05_07&utm_medium=email&utm_term=0_10959edeb5-a7bac34adf-%5BLIST_EMAIL_ID%5D>

[**SPECIAL REPORT**](https://www.politico.com/news/special-report)

## **‘A sea change’: Biden reverses decades of Chinese trade policy**

This gives First Solar a huge boost, including US funding of 500 million for a huge solar entity in India, thus undermining China’s market as well.

First Solar doesn’t used silicon so doesn’t suffer from the Forced labor prohibition, or the panel dumping tariffs, supply chain inspection, increased costs. Nonetheless it has 20+ pages in its SEC report including how its financing money owed tto the fund that was supposed to be available for panels sold before 2013, when First Soplar was built on the ethos of funding recycling. This funding was placed in a separate fund, with independent overseer etc. All of that's over and it looks like they’re still playing catchup.?

<https://s2.q4cdn.com/646275317/files/doc_financials/2021/ar/First-Solar-Annual-Report-2021-Web-version-(final-from-Merrill).pdf>

Risk assessment- pages and pages 34-35 references to toxic materials, 77, for one refers to liability for pre- 2013 recycling fund

<https://www.greentechmedia.com/articles/read/solar-panel-landfill-deemed-safe-as-recycling-options-grow> **Landfilling Old Solar Panels Likely Safe for Humans, New Research Suggests**

Recycling the materials from spent PV panels and wind blades is the ultimate goal but doing so remains costly.

**JASON DEIGN APRIL 02, 2020 Two quotes from this article written 2020…**

**“He ( the co-author scientist) stressed that the study had yet to complete its peer-review process and that it did not cover all the potentially toxic materials in each type of module.**

**“First Solar, uniquely, has a longstanding recycling scheme that recovers up to 90 percent of its cadmium telluride thin-film modules. For the most part, though, the more common crystalline-silicon modules have been handled by mainstream glass, metal or electronic waste recycling facilities.” (Up until 7 years ago- but understood since that information is still found with an immediate google search and is still intimated as part of their business model.**

First Solar’s claim to recycle as the basic safety in their model. Why then is Longroad saying their decommissioning recycling is to Sell used cdte panels if under ten years of age and if between 15-25 years, to give them away.

First Solar has long moved away from their built in recycling of all materials which built their reputation. This is discussed in their Risk Assessment SEC report 2021.

<https://s2.q4cdn.com/646275317/files/doc_financials/2021/ar/First-Solar-Annual-Report-2021-Web-version-(final-from-Merrill).pdf>

There is no mention of recycling except for its liability in a defunct program that must keep its promise.

That’s not recycling, that’s passing the expensive process of regaining cd and te off to some party not willing to pay more to recycle than they paid for the cheap or free panels From Longroad as called rcycling by Mr. Klevens.

[First Solar: A Leader In Sustainability](https://youtu.be/4HPFKcsgNrk) video no date.  
“90% of semi-conductors and glass recycled”

All of this sustainable First Solar is no longer a part of their product. It is wholly dependent on the buyer to commit to sustainable recycling of CdTe, which is repeatedly called essential for environmental and societal health.

And yet, First Solar’s PR material has never stopped touting this factor of their production. As seen in buyers’s statements, it is assumed that this is what they too can tout- knowingly or naively. Clearly project Longroad, as stated by M. Klevens’ repeatedly and in writing, believes it can sell or give away panels thereby avoiding any obligation to recycle. Cheap manufacturing, whole life-cycle toxicity and end of life “see you later.” Best odds, in the landfill where the Stuttgart leaching study of 1.5 years at different relevant (landfill) ph is said by Longroad representative Ms. Planck to be inapplicable.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8709075/> Recovery of Valuable Materials and Methods for Their Management When Recycling Thin-Film CdTe Photovoltaic Modules

“The recycling process used by First Solar consists of grinding modules and then removing the laminates by bathing them in 30% hydrogen peroxide. Liquid–solid separation occurs using centrifuges and vibrating screens, and metal recovery is accomplished by precipitation and filtration. This process significantly reduces the negative impact of used thin-film modules with CdTe, for example, by reducing the total energy demand from 81 MJ/m2 to 12 MJ/m2 [[14](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8709075/#B14-materials-14-07836)]. It is also possible to reduce the harmful impact of this type of module on the environment by about 10% in categories such as: general energy demand, acidification, eutrophication, global warming, and photochemical ozone hole creation [[14](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8709075/#B14-materials-14-07836)].”

<https://www.nrel.gov/pv/cadmium-telluride-solar-cells.html>

Research and Development Our R&D model differentiates us from much of our competition due to its vertical integration, from advanced research to product development, manufacturing, and applications. We continue to devote substantial resources to our R&D efforts, which generally focus on continually improving the wattage and energy yield of our solar modules. We also have R&D programs to improve module durability and manufacturing efficiencies, including throughput, volume ramp, and material cost reduction. Based on publicly available information, we are one of the leaders in R&D investment among PV solar module manufacturers, maintaining a rate of innovation that enables continual wattage gains and cost reductions. 4 In the course of our R&D activities, we explore various technologies in our efforts to sustain competitive differentiation in our modules. We primarily conduct our R&D activities and qualify process and product improvements for full production at our Perrysburg, Ohio plant and systematically propagate them to our other facilities. We believe that our systematic approach to technology change management enables continuous improvements and ensures uniform adoption across our production lines. In addition, our production lines are replicas or near replicas of each other and, as a result, a process or production improvement on one line can be rapidly and reliably deployed to other production lines. We regularly produce research cells in our laboratories, some of which are tested for performance and certified by independent labs, such as the National Renewable Energy Laboratory. Cell efficiency measures the proportion of light converted to electricity in a single solar cell at standard test conditions. Our research cells are produced using laboratory equipment and methods and are not intended to be representative of our manufacturing capability. Our module conversion efficiency has improved on average more than half a percent every year for the last ten years. We currently hold two world records for CdTe PV cell efficiency, achieving an independently certified research cell efficiency of 22.1% and a module aperture area efficiency of 19.7%. We believe that our record cells demonstrate a potential mid-term module efficiency entitlement of 25% in a multi-junction application, which is achievable using our commercial-scale manufacturing equipment. Sustainability We are committed to reducing our carbon footprint and enhancing the social and economic benefits of our products. Our thin film modules are manufactured through an integrated process that uses less energy, water, and semiconductor material than conventional crystalline silicon modules. Accordingly, our modules provide an ecologically leading solution to climate change, energy security, and water scarcity. On a lifecycle basis, our thin film module technology has the fastest energy payback time, smallest carbon footprint, and lowest water use of any competing PV solar technology. The energy payback time of our module technology, which is the amount of time a module must operate to recover the energy required to produce it, is facilitated by our proprietary production process. Our module energy payback time is approximately four months, which represents a 90-fold energy return on investment over a theoretical 30- year system lifetime and an abundant net energy gain to the electricity grid. Furthermore, our modules have a carbon footprint that is 2.5 times lower and a water footprint that is three times lower than conventional crystalline silicon modules, measured on a lifecycle basis that accounts for the energy and water used for the raw materials, throughout our manufacturing process, and during end-of-life module recycling. In addition, our industry-leading PV solar module recycling process further enhances our sustainability advantage by recovering approximately 90% of the glass for reuse in new glass products and over 90% of the semiconductor material for reuse in new modules. We are the only PV solar module manufacturer with global in-house recycling capabilities. Our Series 6TM (“Series 6”) and Series 6 PlusTM (“Series 6 Plus”) modules are the world’s first and only PV products to be included in the Electronic Products Environmental Assessment Tool (“EPEAT”) Registry’s Photovoltaic and Inverters product category. The EPEAT Registry enables the identification of credible sustainable electronic products from a broad range of manufacturers based on several factors, including the product’s raw materials, manufacturing energy, water use, product packaging, end-of-life recycling, and corporate responsibility. We have also committed to the RE100 campaign, a collaborative, global initiative of influential businesses committed to 100% renewable electricity, in which we plan to utilize renewable sources to power our manufacturing operations by 2028. We expect this commitment to further reduce the carbon footprint of our modules by 40%, further enabling our customers to achieve their sustainability objectives.

Forget tariffs. Biden’s actions to crack down on Beijing’s tech development will do more to hinder the Chinese economy — and divide the two nations — than Trump ever did.

<https://insideclimatenews.org/news/21092022/epa-immortal-chemicals/> how epa stalled on regulating

immortals- intensely lasting toxic chemicals used to, among others, solar panels.

<http://www.clca.columbia.edu/papers/deWild%20etal%20-%20paper%20EPVSEC22%20Milano%20-%2020070830%20MdW.pdf>immortals chems in solar panel production 2007

Mason county on cd te in your coffee

<https://solarformasoncounty.com/fact-about-cadmium-telluride-panels/>

<https://www.solarpowerworldonline.com/2021/01/think-before-trashing-the-second-hand-solar-market-is-booming/> second hand boom and no mention of eol recycling which will cost way more than the second hand panels cost– not good business

<https://www.pv-tech.org/the-pv-review-q3-2022-ira-passed-in-the-us-india-expands-pli-scheme-europes-largest-solar-plant-commissioned/> india first solar?

<https://www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/PVTP_6pp_First-Solar-recycling-hi.ashx> pv tech no date written by first solar?

<https://www.pv-tech.org/the-pv-review-q4-2022-us-ad-cvd-probe-thickens-supply-chain-clog-domestic-manufacturing-ramps-up-pv-prices-start-to-fall/>

Changes in anti dumping, commerce tarrifs/ yughur slave labor and IAEA warning China rules silicon production

Bankability<https://www.pv-tech.org/top-50-most-bankable-module-suppliers-in-the-pv-industry-today/>

5 Chinese with Yughur conection and First solar at 1,2 of pyramid. Capex= Capital expenditure- solar projects fully owned by installer in order to benefit from the srecs= full ownership with no responsibility from the manuf these are on top of the pyramid no responsibility. Stuttgart leaching test for CdTe was said to be inappliable, following what read as good scientific controls and data. The usual testing for leachate - I called Mass. certified lab in Mansfield as well- is for 24-48 hours. Stuggaart may do the kind of investigation no solar panel company wants. Bankability pyramid does not include environmental responsibility.

Read this- It can be done and was First Solar’s original model What happened– Bankability? Which is complete divestment of any forward responsibility for the product materials unless the developer/owner or landowner/owner (Capex,Apex?) is contracted to do so with the permitting agreement.

[https://www.utilitydive.com/news/recycling-and-disposal-of-early-renewables-batteries-solar-near-e](https://www.utilitydive.com/news/recycling-and-disposal-of-early-renewables-batteries-solar-near-end-of-life/597228/)

<https://www.novergysolar.com/solar-capex-vs-opex/>

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<https://www.sciencedirect.com/science/article/abs/pii/S0048969720310962> Life-cycle human health and environmental risks from mining and smelting cadmium.

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Virginia Tech reference by First Solar states the end of life of CdTe panels must recycle. Mr. Klevens presented but did not reference that part of the study. .<https://www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/Sustainability-Peer-Reviews/Virgina-Tech-Peer-Review.ashx> Quoted text:

“4. End of Life Management

At the end of the 25 to 30 year service life of the solar panels in a utility-scale photovoltaic installation, a significant volume of solar panels must be decommissioned, disposed of, or recycled. It was recognized at least a decade ago that large solar facilities presented unique challenges and opportunities for recycling photovoltaic modules [34]. One challenge is that the semiconductor material, CdTe, is a very small fraction of a thin film photovoltaic module (∼ 0.1% by weight), but it still must be extracted to provide raw material for future thin film photovoltaic module production. Because of the small quantity and low solubility of semiconductor material and the module encapsulation, the modules are characterized as federal non-hazardous waste at end-of-life using the Toxicity Characteristic Leaching Procedure [31]. 10 Unlike spent consumer electronics and batteries which are small and widely distributed, utility-scale photovoltaic panels at the end of their service life are centrally located at solar facilities. This makes photovoltaic panel recycling a much more manageable problem than, for example, recovering and recycling Cd from Ni-Cd batteries [18]. Programs to collect used batteries have limited effectiveness, so it is difficult to recycle more than a modest fraction of spent batteries — the rest end up in landfills. In addition to the relative ease of collecting modules from solar facilities, the simple construction of CdTe photovoltaic modules and limited number of components make it relatively straightforward to separate the materials for recycling. Industrial crushing and classification schemes separate the glass and metallic components so they can be re-manufactured. During recycling, the CdTe film is also extracted from the panel’s glass substrate with chemical solvents (concentrated sulfuric acid and hydrogen peroxide) [35]. With current technology, over 90 percent of a CdTe photovoltaic power system is recyclable; that is roughly twice what is recoverable from consumer electronics such as laptops and desktop computers [36]. Recycling of decommissioned CdTe photovoltaic modules is now available on an industrial scale at several sites around the world, including in the United States. A proactive recycling plan for the modules can help ensure CdTe is available for use in future thin film photovoltaic module production. Recycling is important for all photovoltaic technologies to recover energy intensive, valuable, and environmentally sensitive materials.

**Award Abstract # 2044886**

**CAREER: Environmental Sustainability of Photovoltaics in the US**

**(Dr. Annick Anctil whose earlier “solar is safe” statement was presented by Longroad as proof there are no pfas or other concerns.”**

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<https://www.nsf.gov/awardsearch/showAward?AWD_ID=2044886&HistoricalAwards=false> Longroad’s Mr. Klevens presented a page document by Annick Anctil, scientist at U Michigan saying solar was benign. Dow Chemical of Midland, Mich., home of UMich, financed millions to UMich engineering, her department, and likely grantor. Dr. Anctil’s most recent grant from NSF has a different attitude, citing the problems of solar and the need for a whole life- cycle assessment in relation to toxicity, human health and the environment.The original is on the Wareham website exhibits from Longroad.

South Africa assessed First Solar investment for sustainability by life-cycle reusability of CdTe

<https://www.firstsolar.com/en-EMEA/-/media/First-Solar/Sustainability-Documents/Sustainability-Peer-Reviews/CRSES2015_06_First-Solar-CdTe-Module-Technology-Review-FINAL.ashx>

“ PV systems have the potential to be constructed, operated and decommissioned in ways that avoid excessive impact on land and habitats. Recycling is the most sustainable manner in which modules can be handled at the end of their useful life, not only from an environmental impact perspective but also in terms of resource efficiency. Literature recommends that the use of cadmium as a toxic element is recycled, despite cost implications, and that tellurium recovery is seen as an additional benefit. Environmentally sensitive metals, such as Pb, Cd, In, Ga, Se, Te, Cu and Ag, are common in the industry and therefore recycling is important for all PV technologies. With currently over 177 GW of PV installed worldwide, recycling is crucial to managing large, future PV waste volumes and to reclaiming valuable materials. Following the visit to the (First Solar)recycling plant at the Perrysburg site and the related discussions, it is clear that the recyclability is fully integrated in the module design. In terms of the current process recycling technology, over 90% of the semiconductor and 90% of the glass material is recycled for its beneficial reuse. Looking to the future, regulatory frameworks, greater experience and rising disposal costs will likely lead to smaller and more mobile recycling facilities, with the operational costs of such facilities expected to fall below hazardous waste disposal costs.

<https://www.azcentral.com/story/money/business/energy/2020/01/07/first-solar-settles-lawsuit-investors-agrees-pay-350-million-tempe/2833693001/>

<https://www.blbglaw.com/cases-investigations/first-solar>First Solar Suit

The Amended Complaint alleges that, throughout the Class Period, Defendants made repeated misrepresentations to investors regarding the Module Segment’s development of its newest “Series 6” solar module, including the cost efficiencies it would achieve with that module. Unbeknownst to the market, however, the Series 6 modules had multiple significant problems, including manufacturing and performance defects, that negatively impacted the Series 6 modules’ purported cost benefits.

The Amended Complaint further alleges that, throughout the Class Period, Defendants made repeated misrepresentations to investors about the Systems Segment’s Project Development business, including concerning the strength of the Company’s Systems pipeline. In truth, and contrary to Defendants’ misrepresentations, the pipeline for the Project Development business had all but dried up before and during the Class Period, and the Systems Segment had lost 80% of its market share.

Lies admitting not wrong doing.

Annick Anctil Teflon is fine

<https://theintercept.com/2015/08/11/dupont-chemistry-deception/> The Teflon Toxin: Dupont and the Chemistry of Deception

75-02-5 Vinyl Fluoride p. 12.

<https://www.epa.gov/system/files/documents/2022-03/tri-chemical-list-changes-03-07-2022.pdf>

Chemicals Added For Reporting Year 2011 CAS Number Chemical Name 81-49-2 1-Amino-2,4-dibromoanthraquinone 3296-90-0 2,2-bis(Bromomethyl)-1,3-propanediol 110-00-9 Furan 556-52-5 Glycidol 78-79-5 Isoprene 93-15-2 Methyleugenol 91-23-6 o-Nitroanisole 75-52-5 Nitromethane 77-09-8 Phenolphthalein 116-14-3 Tetrafluoroethylene 509-14-8 Tetranitromethane 75-02-5 Vinyl Fluoride

[Vinyl Fluoride](https://www.sciencedirect.com/science/article/pii/B9780123864543011829)

A. Chattopadhyay, S. Podder, in [Encyclopedia of Toxicology (Third Edition)](https://www.sciencedirect.com/referencework/9780123864550/encyclopedia-of-toxicology), 2014

### Uses

Since the 1960s, VF has mainly been used in the production of polyvinyl fluoride (PVF) and other [fluoropolymers](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/fluoropolymers). Polymers of VF have excellent resistance to degradation by sunlight, chemical attack, and water absorption and exhibit great strength, chemical inertness, and low permeability to air and water. PVF is laminated with aluminum, galvanized steel, and cellulose materials and is used as a protective surface for the exteriors of residential and commercial buildings. PVF laminated with various plastics has been used to cover walls, pipes, and electrical equipments and inside [aircraft cabins](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/aircraft-compartment). PVF is sold under the trademarks Tedlar PVF film and Dalvor. Due to increase in demand for solar panels, the demand for photovoltaic materials such as Tedlar is high, forcing the manufacturer to boost VF production.

<https://ars.els-cdn.com/content/image/1-s2.0-S2588912520300199-ga1.jpg>

[https://doi.org/10.1016/j.energy.2017.07.031Get rights and content](https://doi.org/10.1016/j.energy.2017.07.031)

# **Environmental impacts of PV technology throughout the life cycle: Importance of the end-of-life regulatory policy governing cadmium-telluride photovoltaics: A case study contrasting life cycle management with the precautionary principle**

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# [**https://cen.acs.org/environment/recycling/Solar-panels-face-recycling-challenge-photovoltaic-waste/100/i18**](https://cen.acs.org/environment/recycling/Solar-panels-face-recycling-challenge-photovoltaic-waste/100/i18) **Excellent, thorough review of recycling 2023 globally 2023. “First Solar, uniquely, has a longstanding recycling scheme that recovers up to 90 percent of its cadmium telluride thin-film modules. For the most part, though, the more common crystalline-silicon modules have been handled by mainstream glass, metal or electronic waste recycling facilities.”**

# **That longstanding recycling program is long gone.**

<https://www.sciencedirect.com/science/article/abs/pii/S030142150700420X>