

Solar Panels in Your Community

Key Takeaways

- 1 Solar panels are made of materials like glass, aluminum, copper, and semiconductors commonly found in consumer electronics.
- 2 Solar panels are designed for durability, but in the event of breakage, damaged panels are typically identified, removed, and replaced. A polymer sealant holds glass in place to help prevent shatter and scatter in the case of damage.
- 3 The two most used solar cells in the U.S. are: Crystalline Silicon (c-Si) at 79% of new utility-scale capacity added in 2024,¹ followed by Thin-Film Cadmium Telluride (CdTe).² Risk assessments indicate that both c-Si and CdTe panels pose minimal risk to human health in normal conditions or if panels are damaged.
- 4 Decommissioning plans are designed to return land hosting a solar project to a useful, productive condition at the end of a project's operating life.

Background

Solar energy continues growing rapidly across America. As new facilities are proposed, residents have questions about what materials are included in solar photovoltaic (PV) panels, and if they pose an environmental or health risk to surrounding neighbors.

Learn more about solar panel materials and how developers take proper safety measures for utility-scale solar facilities in your community.



Photo credit: Cypress Creek

What's inside a solar panel?

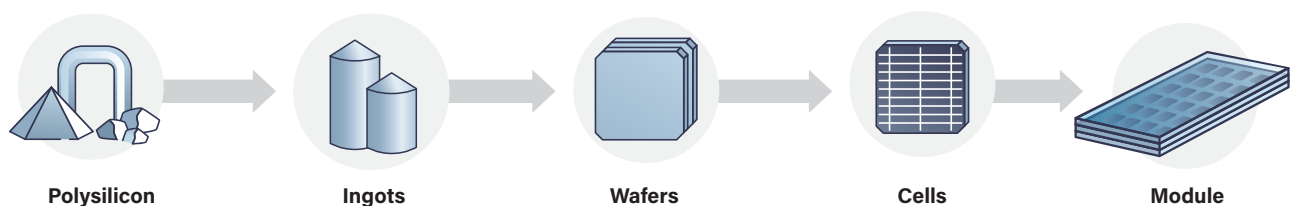
Solar panels are made up of glass, aluminum, copper, and solar cells.

Solar cells are semiconductor materials, made up of thin layers of silicon or other photovoltaic material responsible for converting energy from sunlight into electricity. The thin layer of solar cells is sealed on both sides and covered with glass, a polymer sealant, and a frame (often aluminum) for protection from outside elements.

The main solar cell technologies are crystalline silicon (c-Si) and thin-film cadmium telluride (CdTe).

Crystalline Silicon (c-Si)

Most solar panels use crystalline silicon as the semiconductor. Manufacturing involves multiple steps (polysilicon → ingots → wafers → cells → modules) across a network of specialized suppliers, creating a globally distributed production ecosystem.

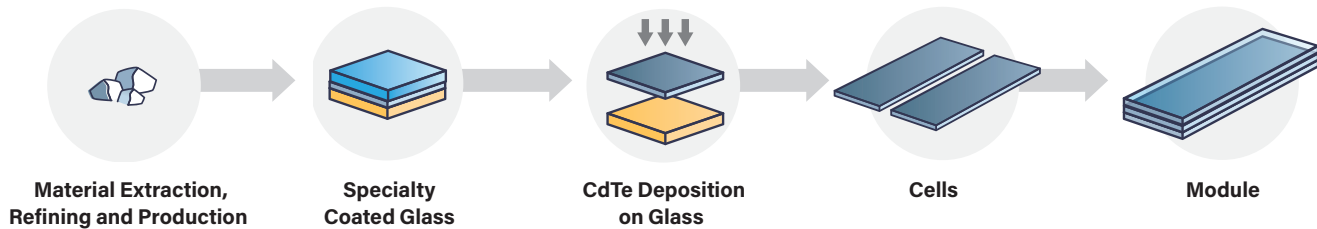


¹ Seel, Joachim, et.al., "U.S. Utility-Scale Solar, 2025 Data Update," Energy Technologies Area, Berkeley Lab, 2025. Available: <https://emp.lbl.gov/publications/us-utility-scale-solar-2025-data>

² "Solar Photovoltaic Cell Basics," Integrated Energy Systems Office, U.S. Department of Energy. Available: <https://www.energy.gov/cmei/systems/solar-photovoltaic-cell-basics>

Thin-Film (CdTe)

Thin-film panels typically use cadmium telluride as the semiconductor, deposited directly onto specialty glass, allowing all manufacturing steps to occur within a vertically integrated process completed at a single facility.



Can materials inside solar panels escape?

Solar panels are designed and manufactured to withstand harsh environmental conditions and most extreme weather events. For example, utility-scale solar projects are generally designed to meet building codes, which commonly incorporate the American Society of Civil Engineers standard *Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7)*.³ The standard includes solar-specific provisions and sets minimum design requirements for wind, rain, snow, ice, earthquakes, and other hazards. Solar panels are sealed and framed for protection from the elements, supporting plans to keep facilities operating for 30 years or more.⁴

Risk assessments show that **leaching of lead from c-Si and cadmium from CdTe solar panels poses little risk to human health, whether broken panels are left in the field or disposed of in a landfill.**^{5, 6}

One study compared soil directly beneath panels to soil farther from the project site and found no significant differences in lead or cadmium concentrations, and no measured elements exceeded soil screening thresholds.⁷ At end of life, solar panels are evaluated under the Resource Conservation and Recovery Act (RCRA) using the Environmental Protection Agency's (EPA) toxicity characteristic leaching procedure (TCLP), which simulates landfill conditions to measure whether hazardous substances could leach out. Most modern crystalline silicon and CdTe panels are reported to pass the TCLP test and are classified as non-hazardous waste.⁸ This testing is typically commissioned by manufacturers.

What happens if a solar panel is damaged?

Solar panels are designed and tested to industry standards for long-term durability, but a small percentage may break during installation or operation. Like any other type of infrastructure, solar facilities cannot always withstand the harshest forces of nature and can be damaged after taking a direct hit from an extreme weather event. When broken, the bonding encapsulant that seals the layers of a solar module generally holds broken glass in place, much like the spiderweb appearance of a broken car windshield or a glass shower door, rather than shattering and scattering it.⁹

ACP members report that facility design, installation, operations, and maintenance follow applicable codes, standards, and regulations that safeguard workers and communities, and that operators coordinate with local authorities and utilities. When a panel is damaged in the field, it is identified through inspections and monitoring, then removed and replaced.

Manufacturers can also have their panels tested against advanced hail standards that go beyond minimum certification requirements.¹⁰ Risk assessments that model broken c-Si and CdTe panels left in the field under worst-case assumptions show little risk to human health.¹¹

For more information on extreme weather and panel breakage, see ACP's Fact Sheet: [Clean Energy Resilience – Designing and Adapting for Extreme Weather](#).

3 American Society of Civil Engineers, "Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-22)," 2022.

Available: <https://www.asce.org/publications-and-news/codes-and-standards/asce-sei-7-22>

4 Montoni, Nicholas, Justin Lindemann, Isaac Panzarella, Anna Weitz, "Health and Safety Impacts of Solar Photovoltaics," Carolinas Development Assistance and Siting Hub, NC Clean Energy Technology Center, 2026. <https://cms.carolinas-dash.org/wp-content/uploads/2026/02/Health-Safety-Impacts-of-Solar-PV-Carolinas-DASH-March-2026.pdf>

5 Sinha, Parikhit, Garvin Heath, Andreas Wade, and Keiichi Komoto, "Human health risk assessment methods for PV, Part 2: Breakage risks, International Energy Agency (IEA) PVPS Task 12, Report T12-15:2019," International Energy Agency Photovoltaic Power Systems Program, 2019. Available: https://iea-pvps.org/key-topics/iea-pvps-t12-15_human-health-risk-assessment-methods-for-pv-part-2/

6 Sinha, Parikhit, Garvin Heath, Andreas Wade, and Keiichi Komoto, "Human health risk assessment methods for PV, Part 3: Module disposal risks, International Energy Agency (IEA) PVPS Task 12, Report T12-16:2020," International Energy Agency Photovoltaic Power Systems Program, 2020. Available: <https://iea-pvps.org/key-topics/human-health-risk-assessment-methods-for-pv-part-3-module-disposal-risks/>

7 Robinson, S.A., and G.A. Meindl, "Potential for leaching of heavy metals and metalloids from crystalline silicon photovoltaic systems," *Journal of Natural Resources and Development*, 2019. <https://www.researchgate.net/publication/339029474>

8 See Citation 4.

9 See Citation 5.

10 U.S. Department of Energy, Federal Energy Management Program, "Hail Damage Mitigation for Solar Photovoltaic Systems." Available: <https://www.energy.gov/femp/hail-damage-mitigation-solar-photovoltaic-systems>

11 See Citation 5.

Are the materials in solar panels safe?

Risk assessments indicate solar panels do not contain enough hazardous material to pose a meaningful risk to human health, even in the event of breakage or fire.^{12,13}

Crystalline Silicon (c-Si) Panels

Silicon is the primary component in c-Si solar cells, the second-most common element on earth and the most common semiconductor used for computer chips.¹⁴ Those chips power everyday consumer electronics like cell phones, smart watches, and tablets.

- An assessment by the Ohio Department of Health found that information to date does not indicate a public health burden from c-Si in solar facilities operating under normal conditions, and that crystalline silicon itself is non-toxic to humans. The refined silicon is processed with small amounts of boron and phosphorus, which are not generally toxic to humans.¹⁵

Most commercially available c-Si panels contain trace amounts (less than 0.1%) of lead used to join the c-Si cells; however, manufacturers are seeking to decrease the use of lead for this purpose.¹⁶

While a large solar energy project contains thousands of panels, the lead portions of each panel are encapsulated in nonporous, non-toxic materials like glass and polymer, so the lead is not likely to enter the environment. Furthermore, the amount of lead used to solder the cells, commonly cited as about 13 grams per panel, is roughly 1/750th of the amount in a conventional car battery, or half of the amount in a single 12-gauge shotgun shell.¹⁷



Thin-Film Cadmium Telluride (CdTe) Panels

CdTe solar panels have a substantial and growing U.S. manufacturing base,¹⁸ and thin-film panels reached a new annual U.S. utility-scale deployment record of 6 GW in 2024.¹⁹

- CdTe is considered a thin-film technology because its active layers, including the semiconductor, are just a few microns thick, or about a tenth the diameter of a human hair.²⁰

In a CdTe panel, the semiconductor layer is encapsulated between two sheets of glass and sealed with a polymer laminate. The cadmium in these panels is part of a stable compound, which is less likely to leach than elemental cadmium.²¹



12 Sinha, Parikhit, Garvin Heath, Andreas Wade, and Keiichi Komoto, "Human health risk assessment methods for PV, Part 1: Fire risks, International Energy Agency (IEA) PVPS Task 12, Report T12-14:2018," International Energy Agency Photovoltaic Power Systems Program, 2018. Available: <https://iea-pvps.org/key-topics/hhra-methods-for-pv-part1-by-task-12/>

13 See Citation 5.

14 See Citation 2.

15 Ohio Department of Health, "Solar Farms and Photovoltaics Summary and Assessment," 2022. Available: <https://odh.ohio.gov/wps/portal/gov/odh/know-our-programs/health-assessment-section/media/summary-solarfarms>

16 Mirlatz, Heather, Henry Hieslmair, Silvana Ovaite, et al., "Unfounded concerns about photovoltaic module toxicity and waste are slowing decarbonization," *Nat. Phys.* 19, 1376–1378 (2023). <https://doi.org/10.1038/s41567-023-02230-0>

17 See Citation 15.

18 U.S. Department of Energy, Solar Energy Technologies Office, "Cadmium Telluride Photovoltaics Perspective Paper," DOE/EE-2765, January 2025. Available: <https://www.energy.gov/sites/default/files/2025-01/DOE%20SETO%20CdTe%20Photovoltaics%20Perspective%20Paper.pdf>

19 See Citation 1.

20 National Laboratory of the Rockies (formerly NREL), "Cadmium Telluride Solar Cells," U.S. Department of Energy, last updated February 4, 2026. Available: <https://www.nlr.gov/pv/cadmium-telluride-solar-cells>

21 See Citation 6.

Solar Facility Decommissioning

Developers typically prepare a decommissioning plan during the permitting phase — or prior to construction — as part of the lease agreement, or as a condition of the project permit. ACP's [model ordinance](#) recommends that decommissioning plans include a provision to return the property to a useful condition, similar to the preconstruction condition. Above-surface project facilities and infrastructure should be removed, and underground facilities should be removed to a depth of three feet below the surface, unless otherwise negotiated with the landowner, to allow the land to return to cultivation if desired.

For more information about solar facility decommissioning, see ACP's Fact Sheet: [Clean Power Decommissioning](#).

Myth vs. Reality

Myth:

Some potato growers incorrectly claim that when solar systems are decommissioned, leftover plastic and metal fragments could remain in the soil, and that potatoes, which grow underground, may engulf these foreign objects, creating food safety risks. Lawmakers have amplified this into claims that Frito-Lay refuses to buy potatoes from any farmland that has ever hosted solar.

Reality:

Experts consulted by Canary Media knew of no published research showing that solar facilities harm potato crops, and PepsiCo, Frito-Lay's parent company, has not issued blanket guidance rejecting fields with solar installations.²² Further, ACP's model ordinance²³ recommends that decommissioning plans require removal of underground infrastructure to a depth of three feet, well below the root zone of potatoes, which typically extends to 18-24 inches.²⁴

22 Gaffney, Austyn, "In new attack on solar, lawmakers spread myths about potato farms," Canary Media, June 1, 2026.

Available: <https://www.canarymedia.com/articles/solar/attack-solar-myths-potato-farms>

23 American Clean Power Association, "Utility-Scale Solar Energy Systems Model Ordinance Framework," Attachment: Model Decommissioning Language, 2024.

Available: <https://cleanpower.org/resources/model-ordinance-utility-scale-solar-energy-systems/>

24 King, Bradley A. and Jeffrey C. Stark, "Potato Irrigation Management," BUL 789, University of Idaho Cooperative Extension System, 1997.

Available: <https://content-hub.uidaho.edu/api/public/content/f3c59e137d2b49b8831f5f8a501522d8?v=d34906a5>