

Solar Panels

The Problem

A solar panel converts the sun's radiant energy into electricity using cells, called photovoltaic (PV) modules, and semiconductors. Each Photovoltaic panel has a [life expectancy of 20-30 years](#), as stated by the leading Industry Association, and most solar products have not reached the end of their first life cycle. The International Renewable Energy Agency published information on [end-of-life management for PV Panels \(2016\)](#) and provided empirical data on frequent causes of PV panel failures, including degradation of the anti-reflective coating of the glass, discoloration of the ethylene vinyl acetate, delamination, contact failures in the junction box, glass breakage, loose frames, etc.

During their entire life cycle, from the production to their final disposal, considerable quantities of non-renewable resources [generate pollution and waste](#) with a high environmental impact. As PV panels are being removed from residential and commercial installations, recycling and proper end-of-life management becomes an increasingly imminent problem. The large amounts of mostly recyclable waste imposes the need to plan effective processes for removal, dismantling, disposal and/or reuse. International Renewable Energy Agency suggests end-of-life management is based on the extended-producer-responsibility (EPR) principle, holding producers responsible for the environmental impact of their products through to end-of-life and provides incentives for the development of greener products with lower environmental impacts and contributes funds to finance proper collection, treatment, recycling and disposal systems.

Want to know if an old solar panel make or model is considered hazardous?

The California Energy Commission maintains a list of PV modules available for purchase. The list only shows information about the PV modules such as manufacturer, model number, but also includes information about the panel regarding the hazardous content.

[Review the Full List of PV Models.](#)

California

In 2015, CPSC supported the passage [Senate Bill 489 by Senator Monning](#) which [authorizes DTSC](#) to adopt regulations to designate used/spent solar panels that are currently hazardous wastes as universal waste. On May 9, 2018, the California Energy Commission voted unanimously to adopt new building standards that [require solar photovoltaic systems starting in 2020](#).

Other States

In July 2017, Washington became the first state to pass a solar stewardship bill ([ESSB 5939](#)), requiring manufacturers selling solar products into the state to have end-of-life recycling programs for their own products. ESSB 5939 finds that a convenient, safe, and environmentally sound system for the recycling of PV modules, minimization of hazardous waste, and recovery of commercially valuable materials must be established. The responsibility for this system must be shared among all stakeholders, with manufacturers financing the take-back and recycling system.

- [Washington State Solar Panel Recycling Program](#)



Other Countries

Countries in the EU being early adopters of this technology have already seen panels coming in for recycling and have taken steps to adapt their rules and regulations to include Extended Producer Responsibility (EPR) principles ([Mehta, 2017](#)). The EU introduced its very first EPR legislation for waste electrical and electronic (WEEE) management in 2002 and was revised in 2012 to include PV as a separate category, in anticipation of this looming issue of end-of-life management.

Research & Relevant Articles

- [Solar Panels: Discovering a Circular Economy in Solar Panels](#) - CPSC, 7/11/22
- [Towards a successful re-use of decommissioned photovoltaic modules](#)- Progress in Photovoltaics, 9/29/21
- [Best Practices at the End of the Photovoltaic System Performance Period](#)- NREL, 2/21
- [Solar Panel Recycling Research from the Counties of Butte and San Mateo and the City of Santa Monica](#) - IEEE Photovoltaics Specialists Conference, 6/18/20
- [Solar Panel Recycle Research Report from Three Jurisdictions in CA](#)- CPSC, 4/20
- [California Pushes for Solar Panel Waste Policy](#)- Waste360, 3/31/30
- [What's Happening with the Growing Volume of Wasted Solar Panels?](#) - Waste 360, 9/30/19

Links

- [International Renewable Energy Association](#)
- [Solar Energy Industry Association](#)
- [European Union Solar Panel Recycling Program](#)
- [First Solar](#)– PV Manufacturer with a take-back program