Focus on: Managing Solar Panel Waste



Figure 1. A grid tied solar photovoltaic panel array

Solar panels convert solar energy into electricity through solar cells (also known as photovoltaic cells). Solar panels sometimes contain toxic metals, which means they may be subject to the Dangerous Waste Regulations, chapter 173-303 WAC.[1] Proper recycling and disposal are essential to protect the environment and human health.

This publication explains the regulations and exclusions that could apply to solar panels and solar panel waste generated by businesses or residences, including:

- Reuse
- Manufacturer recycling or take-back programs
- Proper waste disposal

When do solar panels become waste?

Solar panels become solid waste[2] when they reach their end of life. This means the solar panel will no longer be used for its intended purpose and you've decided to discard it (for example, due to damage or it's reached its life expectancy).

Reuse

If you reuse a solar panel,[3] or send it off-site for reuse, it isn't a solid waste and therefore the Dangerous Waste Regulations don't apply. Solar panels are generally sturdy and can function for many years after their warranty expires. They produce less electricity over time, but most are guaranteed by their manufacturer to

[1] https://app.leg.wa.gov/WAC/default.aspx?cite=173-303
[2] https://app.leg.wa.gov/WAC/default.aspx?cite=173-303-016
[3] https://www.epa.gov/hw/solar-panel-recycling#Solar%20Panel%20Reuse

produce 80 percent of their original labeled power output after 25 years of use. Used solar panels can be reconfigured with new inverter systems or reused in other situations, like charging a travel trailer battery.

How do businesses manage solar panel waste?

Recycle

Most solar panels are a mix of glass, plastic, and metal. About 80% of the solar panel's weight is aluminum and glass, which are easy items to recycle.

With care, any solar panel can be recycled and turned into new products. Silicon, plastics, glass, and metals are all recovered in solar panel recycling. Manufacturers can reuse these elements to make new solar panels and other items.

Interim electronic waste exclusion

Businesses may choose to recycle waste solar panels under Ecology's Interim Enforcement Policy for Conditional Exclusion for Electronic Wastes.[4]

Under this policy, businesses:

- Have the option to assume solar panels are dangerous waste, rather than following all designation procedures in WAC 173-303-070.
- Must follow all conditions in the interim policy.
- Must send them to a recycler that accepts solar panels,[5] or a manufacturer takeback stewardship program[6] that recycles solar panels (contact your solar manufacturer to see if this is an option).

Solar panels must be legitimately recycled.[7] This includes reclamation and reuse of parts. Solar panels sent for recycling can only be accumulated for up to 180 days and must be moved off-site to a facility for recycling within 180 days.

When you recycle solar panels under Ecology's policy, then the waste:

- Does not count as a dangerous waste.
- Does not affect your generator category.
- Does not require a manifest when transported off-site (although Department of Transportation requirements[8] for transporting hazardous materials may still apply).

[4] https://apps.ecology.wa.gov/publications/summarypages/0204017.html
[5] https://www.epa.gov/hw/solar-panel-recycling#where
[6] https://ecology.wa.gov/waste-toxics/reducing-recycling-waste/our-recycling-programs/solar-panels
[7] https://app.leg.wa.gov/WAC/default.aspx?cite=173-303-019
[8] https://ecfr.io/Title-49/

Manage as dangerous waste

If you choose not to or are otherwise unable to recycle or reuse your solar panels, then you must designate your solar panel waste to determine if it's dangerous waste. This can be demonstrated by:

- Analytical test results that show whether the panel is dangerous.
- Using your knowledge of the materials in the panel.

Solar panels sometimes designate as dangerous waste by exceeding the limits for lead, silver, or cadmium (see Toxicity Characteristics List (WAC 173-303-090))[9] or designate as toxic for state-only criteria (WAC 173-303-100).[10] You can also test if a waste meets state-only toxic criteria by using the method 80-12, Biological Testing Methods for the Designation of Dangerous Waste.[11]

Silicon solar panels are the most common type. They may contain small amounts of metals within the panel, such as lead or silver. Thin-film solar panels contain thin layers of semiconductor material, such as cadmium telluride or copper indium gallium diselenide (CIGS), layered on a supporting material. Cadmium telluride thin-film solar panels are more likely to designate as dangerous waste because they contain cadmium in significant concentrations.

If your solar panels designate as dangerous waste and are not going to be reused or recycled, manage them as fully regulated dangerous waste under the Dangerous Waste Regulations (Chapter 173-303 WAC). This requires treatment by a permitted facility before being sent to a Subtitle C hazardous waste landfill for disposal.

Household hazardous waste exclusion

If the solar panel is on a residential home, it likely meets the household hazardous waste exclusion (WAC 173-303-071(3)(c)).[12] "Household wastes" means any waste material (including, but not limited to, garbage, trash, and sanitary wastes in septic tanks) derived from households (including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

If your solar panel waste meets this definition, you can:

- Recycle it at a recycling center that accepts solar panels,[13] or
- Dispose of it at a standard Subtitle D Solid Waste Landfill, with approval from the landfill.

Note: If a utility leases solar panels to a residential location, then this is a business waste and isn't eligible for the household hazardous waste exclusion.

[9] https://app.leg.wa.gov/WAC/default.aspx?cite=173-303-090#:~:text=toxicity%20characteristics%20list
[10] https://ecology.wa.gov/regulations-permits/guidance-technical-assistance/dangerous-waste-guidance/dangerous-waste-basics/designation/check-washington-state-only-criteria
[11] https://apps.ecology.wa.gov/publications/summarypages/8012.html
[12] https://app.leg.wa.gov/WAC/default.aspx?cite=173-303-071#:~:text=(c)-,Household%20wastes,-%2C%20including%20household%20waste
[13] https://www.epa.gov/hw/solar-panel-recycling#where

Future Rules

Federal and state laws impact end-of-life solar panels and these laws continue to evolve as the industry evolves. In Washington, legislation passed to implement a solar panel takeback program.[14]

The United States Environmental Protection Agency (EPA) plans to propose new rules to add solar panels to the universal waste regulations[15] (40 CFR 273). For more information, check out EPA's website on this future rulemaking.[16]

ADA Accessibility

To request an ADA accommodation, email HWTRPubs@ecy.wa.gov, call (360) 407-6700, or dial 711 to call us through the Washington Telecommunication Relay for services such as TTY. Visit ecology.wa.gov/ADA for more information.

[14] https://ecology.wa.gov/waste-toxics/reducing-recycling-waste/our-recycling-programs/solar-panels
[15] https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-273
[16] https://www.epa.gov/hw/improving-recycling-and-management-renewable-energy-wastes-universal-waste-regulations-solar