By SUPPLY CHAIN CONNECT STAFF

What Happens to End-of-Life Solar Panels?

As an alternative energy source, solar presents some unique "circularity" issues when it comes time to replace end-of-life panels.

The solar energy movement got underway decades ago, but it has picked up more speed as governments, organizations and consumers attempt to wean themselves off of traditional energy sources like electricity and fossil fuels. This trend has created a new challenge of what to do with solar panels that have reached end-of-life and are no longer usable.

This isn't a new issue by any means, but it is receiving more attention right now. It also extends to wind turbines—those hulking masses that churn wind into energy on both land and sea, where offshore wind farms have been cropping up on shallow offshore waters. In May, *CNBC* published a piece acknowledging the growing importance of both solar and wind energy to the U.S. power grid, but also highlighted the massive amounts of waste that will be created as "millions of photovoltaic (PV) solar panels, wind turbines and lithium-ion EV batteries reach the end of their respective lifecycles."

Wind and solar energy combined to generate 13.6% of utility-scale electricity last year, according to the U.S. Energy Information Administration (EIA), and those numbers will undoubtedly rise as renewable energy continues to scale up. *CNBC* says the average lifespan of a solar panel is about 25 to 30 years, and estimates that there are more than 500 million already installed nationwide.

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Currently, about 90% of end-of-life or defective solar panels end up in landfills, largely because it costs less to dump them than to recycle them. "With solar capacity now rising an average of 21% annually, tens of millions more panels will be going up — and coming down," CNBC reports. "Between 2030 and 2060, roughly 9.8 million metric tons of solar panel waste are expected to accumulate."

Keeping Solar Panels Out of Landfills

Some recycling plants are already focusing on how to better manage the anticipated influx of solar panels and related waste. In Yuma, Ariz., for example, We Recycle Solar processes end-of-life panels, roughly 10% of which are recycled (with 90% winding up in landfills).

Solar panels are mostly made of glass, which accounts for 75% of their weight and is highly recyclable, *azcentral* reports. They also contain plastic and metals like aluminum, copper, silver, tin, lead and cadmium, among others. With a typical lifespan of about 25 years, panels can often continue converting sunlight into energy past that point, although it may be at a reduced output over time.

Many of the panels We Recycle Solar receives can have a second life because their solar cells remain functional and can be sold at a fraction of the original price, often in overseas markets. CEO Adam Saghei told azcentral that his company can recycle up to 60% of the materials in the panels. It uses a large robotic arm that lifts the heavy panels and places them on a conveyor belt. The materials separation process involves powerful magnets that isolate the metals from the glass and separate them from each other by type.

Addressing PV Waste Challenges

In the European Union (EU), French photovoltaic (PV) recycler ROSI opened its first facility in 2023 and is opening a second site in early 2025. The company uses an innovative pyrolysis process—heating in an oxygen-poor environment—to break down the polymer encapsulant that holds a module together and which can then much more effectively and cleanly separate glass and silicon cells, according to *pv magazine*.

Using the pyrolysis process, ROSI separates and supplies highly pure glass cullet back to glass manufacturers, the publication adds. The company has been working with a European glass manufacturer to test the quality of its recycled glass material.

For now, ROSI is paid to provide solar module recycling as a service, underlining the importance of clear regulation in the sector and the specialized legislation that PV Cycle and others are advocating. "As PV waste begins to mount up," *pv magazine* states, "the processes and business models for solar recycling will be key to keeping materials in circulation."