

With more solar panels entering the US waste stream, EPR policy and standards emerge

A Northeast Recycling Council webinar covered how manufacturing and standards must converge to handle this growing material stream.

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As more solar panels are expected to enter the waste stream, experts at a recent Northeast Recycling Council webinar said policy and recycling markets are working hard to catch up.

U.S. demand for solar energy is increasing, with a [record](#) 28.8 million kilowatts of solar panels shipped in 2021, according to the U.S. Energy Information Administration's [annual report](#). Recyclers say more panels in operation will mean more to recycle at their end of life.

Speakers discussed the rollout of the country's first solar panel extended producer responsibility program in Washington state, anticipated recycling standards that could shape how recyclers manage the materials, and examples of how manufacturers can incorporate recycling into manufacturing processes. Here are some key takeaways from the discussion:

Solar panel recycling represents growing opportunity

Solar panel recycling may not be as established as other U.S. markets, but the process represents an opportunity to reclaim significant amounts of material as more photovoltaic, or PV, panels are expected to enter the waste stream in coming years, said Parikh Sinha, director of sustainable development for First Solar, a solar panel manufacturer and recycler.

Solar panels have slightly different components depending on the manufacturer, but the main parts of a panel with recycling potential are glass, aluminum, copper and semiconductor material, he said. As the market for recycled PV panels grows, the recoverable value could reach \$15 billion by 2050, he said, citing a [study](#) from the International Renewable Energy Agency.

First Solar began recycling PV panels in 2005, and Sinha said the

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company sees itself as a model for how other manufacturers and recyclers can plug into the PV recycling landscape as more solar panels reach their end of life. The company has participated in Washington state's solar panel EPR stakeholder process.

In the years since the company began, First Solar has also updated its panels' design with recycling in mind. "We can get involved not only at the end of the life, but at the beginning of life at the design phase," he said, adding that the company has a recycling team that provides input on PV design so updates don't negatively affect the recycling process.

Some of the recycled materials go back into making new PV panels, while some of its glass goes to other manufacturers and some of the encapsulant goes into making rubber products.

"We've shown [recycling] can be done at a commercial scale, and there's more opportunity there," he said.

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Washington's EPR policy aims to think years ahead of markets

While companies like First Solar are planning for a future with more EPR-style regulations and more recycling opportunities, Washington state is preparing for 2025, the year its EPR for solar panel regulation takes effect. So far, Washington is the only state with such a program, which will require manufacturers to fund collection and recycling for large PVs, such as solar panels on homes and in large-scale arrays.

Al Salvi, solid waste technical services unit supervisor for Washington Department of Ecology, said the state's regulations are several years ahead of the market and the infrastructure needed to make the program work. The state considers solar panels hazardous material and does not allow them in solid waste landfills, but Washington currently does not have any solar panel recyclers.

"A fair amount of people call us to say, 'hey, what can I do with my panels?' and we don't have a lot of good answers for them right now," he said.

As of 2020, the state had about 264 megawatts of solar installed, which Salvi said is only 0.26% of the whole U.S. market. "We get a kick out of being the first to run a program like this for such a small market share," he said.

Though Salvi anticipates impact will be small at first, he sees potential in ramping up the EPR program today. Washington expects about 834 MW in the next five years and counts 42 different PV manufacturers selling in the state. The EPR law requires 87% of each solar panel to be recycled, which he says will drive recycling markets just from the aluminum and glass, which make up 19% and 70% of the panels respectively.

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EPR is mandated under the Waste Electrical and Electronic Equipment Directive. PV manufacturers and recyclers have been following those regulations since 2013, which includes requirements for how many panels are collected and the amount of material recycled from the panels, Sinha said.

Recyclers in the U.S. don't have an equivalent regulation to follow. Many U.S. recyclers have been certified to the R2 e-scrap certification standard, an environment, health and safety certification held by about 1,000 e-scrap recyclers worldwide.

Nonprofit group Sustainable Electronics Recycling International, which oversees R2, is considering [adding solar panels](#) to its certification standard, a process that's finally gaining traction after about 10 years of discussions, said Kelly Keogh, co-founder of Greeneye Partners, which helps recyclers prepare for certification. A PV working group is expected to release a draft regulation by the end of the year, and it could be adopted as early as the second quarter of 2023, she said.

"The electronics recycling industry has been seeing photovoltaic modules hit the floors of our [recycling centers] for about the last 15 years," and many are ready for more clear guidelines on how to responsibly manage the materials, she said.

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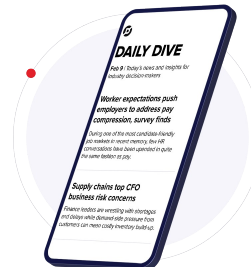
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