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Where Will the Used Turbines & Solar Panels Go?

Long viewed as more "environmentally-friendly" energy solutions, solar and wind energy both present their own set of environmental downsides.

Last year, about 4.23 trillion killowatthours (kWh) of electricity was generated in the U.S. The bulk of it (or roughly 60%) came from fossil fuels while 21% came from renewable sources like solar and wind. The remaining 18% of the electricity came from nuclear energy sources, according to the U.S. Energy Information Administration (EIA).

Breaking those numbers down further, the EIA says that an additional 61 billion kWh of electricity generation in 2022 was generated by small-scale solar photovoltaic systems. Long seen as being more environmentally friendly than fossil sources like coal and natural gas, both solar and wind come with their own set of environmental downsides.

"The potential impacts of solar photovoltaic electricity begin with the materials used to make solar panels and continue through their full life cycle — from manufacture to disposal," Joshua Antonini writes in "Bright Panels, Dark Secrets: The Problem of Solar Waste." More specifically, he says solar produces 300 times more toxic waste per unit of energy than does nuclear energy.

Shorter Life Spans

Solar panels themselves have a relatively short lifespan of 20-30 years, compared to the 50-year life cycle of a coal plant or the 80-year life of a nuclear facility, Antonini points out. "As a result, groups like the International Renewable Energy Agency estimate there will be almost 80 million tons of photovoltaic panel waste globally by 2050," he writes.

The reason this issue is surfacing now is because up until recently, solar produced no more than 3% of the nation's total energy. As that percentage continues to grow, the fact that many utilities have no solid plans for disposing of their solar waste is becoming a bigger concern.

In a 2021 article, "The Dark Side of Solar Power," Harvard Business Review said that as interest in clean energy was surging, used solar panels were going "straight into the landfill." At the time, it also reported that the replacement rate of solar panels was "faster than expected" and that given the current very high recycling costs, panels and wind turbines could both be taking a fast route to the landfill.

"Regulators and industry players need to start improving the economics and scale of recycling capabilities before the avalanche of solar panels hits," HBR said, adding that the renewable energy industry was "woefully unprepared" for the waste deluge waiting around the next corner.

Cheaper to Dump than Recycle

Fast-forward to 2023 and it doesn't look like the problem of responsibly disposing of solar and wind energy waste has been solved. In fact, *CNBC* says that as the Biden administration advocates for more wind power and solar energy, the problem may worsen before it gets any better.

"A wind turbine is recyclable, from the steel tower to the composite blades, typically 170 feet long, but most end up being thrown away, a waste total that will reach a cumulative mass of 2.2 million metric tons by 2050," *CNBC* reports.

"Currently, about 90% of end-of-life or defective solar panels also end up in landfills, largely because it costs far less to dump them than to recycle them."

As wind and solar both play a larger role in the U.S. power grid, both industries are expected to generate more waste as "millions of photovoltaic (PV) solar panels, wind turbines and lithium-ion EV batteries reach the end of their respective lifecycles," *CNBC* adds.

"It's important to make sure we keep in mind the context of these emerging technologies and understand their full lifecycle," National Renewable Energy Laboratory's Garvin Heath told the publication. "The circular economy provides a lot of opportunities to these industries to be as sustainable and environmentally friendly as possible at a relatively early phase of their growth."