Wind Turbine Recycling and Disposal

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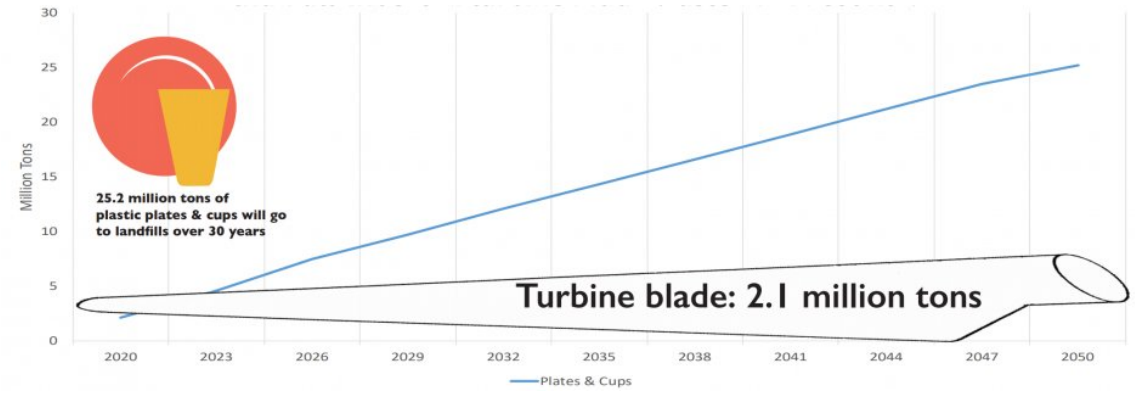
Wind energy is one of the country's leaders in advancing the transition to clean energy. Thanks to technological advancements, prices for this renewable energy source are plummeting. The price of wind energy has fallen 70 percent in the last decade, making it the cheapest source of renewable energy on the market. However, as older projects reach the end of their lifespan, the question of how to sustainably dispose of them is coming to the forefront.

Wind turbines can operate for 20 to 30 years. While most of the components of a turbine can be recycled or sold, the blades are finding themselves in landfills across the country. Fortunately, according to the American Wind Energy Association, unlike other energy source waste, wind turbine blades are made from non-toxic fiberglass and therefore completely landfill-safe. Although turbines blades are large, the Electric Power Research Institute (EPRI) reports that all turbine blade waste through 2050 represents approximately 0.05% of all the municipal solid waste going to landfills every year.

In Casper, Wyoming, accepting turbine blades at the Casper Regional Solid Waste Facility has been an economic benefit for the community. Since May 2019, the city of Casper has received more than $600,000 for taking the blades. This revenue has been used to help keep trash collection and other service rates low.

According to the EPRI, it is estimated that there will be 2.1 million - 4 million tons of cumulative blade waste combined through 2050. In comparison, 2.1 million tons of plastic cups and plates end up in landfills every 2.5 years. By 2050, plastic cups and plates would make up 25.2 million tons of waste, and require 12 times more landfill space than all expected national turbine blade waste in the next 30 years.



The need for a recycling process that is environmentally responsible is growing, and it is entirely possible. Currently, 85 to 90 percent of a wind turbine's parts can be recycled or sold. This includes the foundation, tower, gear box and generator. Fiberglass used to make blades is also reusable, and can be randomly rearranged, flattened into a sheet or even woven into a fabric. In Europe, some blades are repurposed as

sound barriers or thermal insulation. In the United States, there are few companies that recycle turbine blades and the need for recycling processes is creating a business opportunity. Startups like Global Fiberglass Solutions are developing processes to break down wind turbines blades and transform them into other useful materials, such as railroad ties and panels. "We can process 99.9% of a blade and handle about 6,000 to 7,000 blades a year per plant," said Chief Executive Officer Don Lilly.

So, how exactly are turbine blades recycled? Currently, there are two answers to that question. Blades can be recycled in one of two ways: Mechanical or Thermal Recycling.

Mechanical Recycling
Mechanical Recycling entails cutting and dismantling blades on-site. The parts are shredded into raw fiberglass material that produces fine and course particulates that can be mixed with rock, plastic or other fillers. The mixture is then turned into thermoplastic fiberglass pellets or panels for use in various products. These pellets can also be used in injection molding and extrusion manufacturing processes, decking boards, warehouse pallets, parking bollards, manhole covers, building walkways and weather-resistant siding.

Thermal Recycling
Thermal Recycling is essentially crushing and burning blades. The composition portion is combustible when burned and can be used for electricity generation or industrial processes, such as cement production. In fact, thermal recycling saves concrete production 16 percent of its overall carbon dioxide emissions. The leftover glass and carbon fibers go through what is referred to as "co-processing." This is where fibers are mixed with fillers and reused in concrete, paint and glue.

Another 44 gigawatts of wind is expected, which will generate another $62 billion for the economy and power an additional 15 million homes. As more projects come online, the necessity for proper recycling and disposal of wind turbines will increase. The ability to more fully recycle turbines and create other useful products will make this already-carbon-free power source even more sustainable - and that's just smart!

For more information, check out our fact sheet on turbine recycling and disposal!