

Wind Turbine Disposal and Recycling Strategies



Wind energy plays an important role in creating a cleaner, healthier environment. It's a leading climate change solution that decreases smog-creating air pollution and saves billions of gallons of water annually. Studies show a typical wind turbine repays its carbon footprint within six months.¹

Wind turbines are made up of many materials that have substantial salvage value at the end of its operational life and are recyclable. In fact, 80-94% of a wind turbine's mass consists of easily recycled materials, such as steel / iron (approximately 88% of a turbine's mass), aluminum (approximately 0.7%), and copper (approximately 2.7%).^{2,3,4} Other wind turbine components such as blades, nacelle covers and rotor covers are made of up composite materials, mostly fiberglass and carbon fiber, which, while non-toxic and safe, are more difficult to process for other purposes. However, these components make up roughly only 8% of a wind turbine's total mass.⁵ In addition, as described more below, the wind energy industry and other partners are expanding options to recycle and reuse even these historically tougher to process materials.

While wind energy projects are expected to operate for 20 to 35 years, individual wind turbine components like rotor blades and covers may need upgrading or replacing sooner because of normal wear from exposure to the elements, or improvements in technology.

Reduce

Reducing the need to replace components by extending the lifetime of existing blades is one of the most economically and environmentally friendly measures wind developers take to limit the number that need to be disposed of through reuse, recycling or landfilling. While the blades are very durable, decades of exposure to the elements can slowly chip away at their efficiency. Blade repair and monitoring technology is rapidly improving, allowing the industry to use fewer and fewer blades to produce the same amount of clean, zero-carbon electricity. General improvements in turbine technology are also leading to greater electricity generation per turbine, adding to these blade efficiency improvements. Improvements to wind resource assessment and modelling allow manufacturers to better understand the loads on blades, leading to improvements in life and maintenance costs.

Reuse

The U.S. wind power industry, along with multiple stakeholder groups including scientists, researchers, national laboratories, and environmental collaborators, is developing innovative methods to re-purpose turbine blades. Intact blades are being evaluated for reuse at other wind farms to improve performance or reshaped for use as utility poles. For blades that are not suitable for

Innovative partnerships like Re-Wind⁹, a collaboration between the Georgia Institute of Technology and Queen's University Belfast, are deploying design and logistical concepts in the field, such as prototyping methods to reuse the decommissioned blades in buildings, infrastructure, landscape and public art.¹⁰

Recycle

Today, wind turbine blades are recycled into raw material and fuel for cement production, through a partnership between GE, Veolia North America, and other companies, generating jobs and reducing the emissions of cement production.¹¹



