CLEAN GRID ALLIANCE
Delivering Midwest Renewable Energy

FACT SHEET

WHAT HAPPENS AT THE END OF A WIND TURBINE'S LIFE

Repowering a turbine means replacing existing technology with newer technology

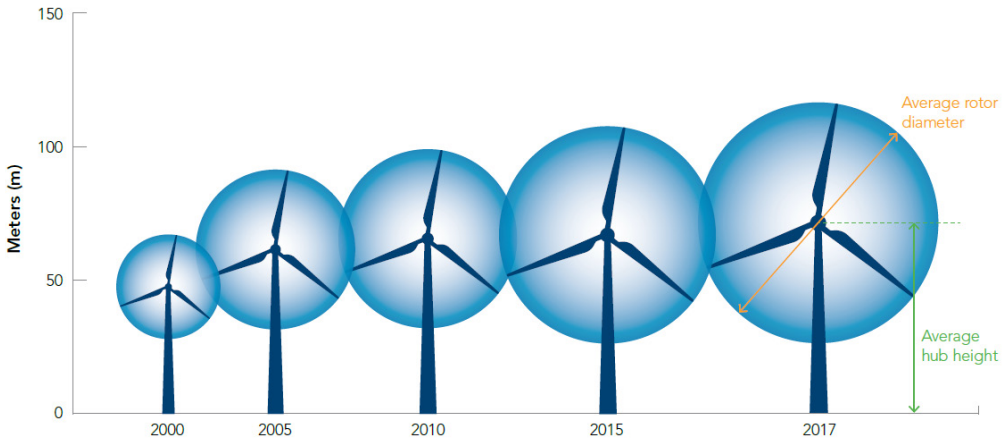
The most common decision when a wind turbine reaches the end of its life is to repower it. This means upgrading existing components of the turbine with more powerful, modern parts. It can also mean making changes to the wind turbine's foundation, tower, and blades. As wind technology has advanced, existing machines may be replaced with more efficient units that are able to reliably produce more electricity. In addition to increased electricity generation, modern turbines run more slowly and quietly.[1]

Wind turbines today are 50 times more powerful than 20 years ago.[2]

Repowering means more efficient, profitable turbines

Thirty years ago, many wind turbines were small, 50 kWh machines. Today's taller turbines have a wider rotor diameter so they can capture the steadier and stronger winds that blow higher in the atmosphere. Longer blades also increase the capacity factor, which means the turbine can generate more electricity, even at lower wind speeds.[3] This increases the value of a wind project, and sometimes the number of turbines can be reduced,

Figure 72
Evolution of the "Average" Utility-Scale Turbine



Year	Average Hub Height (m)	Average Rotor Diameter (m)
2000	58	49
2005	75	75
2010	80	84

Year	Average Hub Height (m)	Average Rotor Diameter (m)
2015	82	102
2017	86	113

Source: AWEA 2017 U.S. Wind Industry Annual Market Report

As technology has advanced, wind turbines have grown taller. A larger swept area allows turbines to generate more electricity more often.

TYPES OF REPOWERING

FULL REPOWERING
Includes complete decommissioning and removal of existing turbines, including foundations. The site is redeveloped using more modern wind technology.

PARTIAL REPOWERING
Leaves some of the existing structure, usually the tower and foundation, and replaces the other portions with more modern wind technology.

RETROFITTING
Replacing outdated control systems with more modern technology to increase efficiency. Does not change the tower, foundation, or blades.

1. "Repowering gives new life to old wind projects," American Wind Energy Association. http://www.aweablog.org/repowering-gives-new-life-to-old https://windonthewires.org/blog/59/renewable-energy-growth-is-surging-and-boosting-u-s-economy https://windonthewires.org/blog/59/renewable-energy-growth-is-surging-and-boosting-u-s-economy-wind-sites/
2. "Development in size and power of wind turbines, 1990-2015," Energy Transition. https://book.energytransition.org/node/127
3. "These huge new wind turbines are a marvel. They're also the future," David Roberts, Vox. https://www.vox.com/energy-and-environment/2018/3/8/17084158/wind-turbine-power-energy-blades

ADDRESS
570 Asbury Street, Suite 201, St. Paul, MN 55104

OFFICE
651.644.3400

WEB
CleanGridAlliance.org

REPOWERING SAVES MONEY

Why Repower a Project?

Not every wind project has an economic case to be repowered. Many factors must be considered and add up to make repowering financially viable. First, developers determine the economics of operating the site as-is in the present and future and compare it to the cost of repowering. They evaluate changing the hub heights, replacing turbine components, and the layout the wind farm itself. To offset the costs associated with upgrading the turbines, developers may resell existing turbine components to international markets. Finally, developers must perform a study with the electric grid operator to make sure the grid can accommodate more energy coming from the wind project.

Repowering Saves Money for Electric Utilities and Ratepayers

Wind energy is already a least-cost source of new electricity generation in much of the U.S.[1] Repowering a wind project can make the cost of wind energy even cheaper. If a project owner chooses to repower a wind project, the electric utility who purchases the power often negotiates a new or updated agreement with a lower rate. This benefits the owner, the electric utilities, and the ratepayers.

Decommissioning

A wind project is decommissioned at the end of its life if it is not repowered. This means the turbine and foundation are removed and the land restored to its original state. The wind project owner is bound by law and financial incentives to responsibly oversee the decommissioning process, even in the event a company goes bankrupt. Local governments and landowners are not responsible for this process. Often, the wind project owner can recycle the turbine materials, which can recoup up to 80% of decommissioning's cost. In this way, it is in the project owner's best interest to oversee the process and ensures a positive outcome for everyone. To date, only 21 utility-scale wind turbines have been decommissioned in the Midwest over the past 20 years.[4]

Case Study: Mendota Hills Wind Farm

Repowering reduced costs 30%-50% per MW/h

Photo: Mendota Hills Wind Farm, Contemplative Imaging, CC BY-NC-SA 2.0

Leeward Renewable Energy recently repowered the 52 MW Mendota Hills wind project in Illinois. Their financial models indicated that repowering would provide a 30%-50% reduced cost per MW/h, and those savings are passed on to the electric utility and their customers.[3]

"The benefit of [repowering] will flow through to our customers," said Leeward CEO Greg Wolf.

FUN FACTS

ALMOST EVERY COMPONENT IN A WIND TURBINE CAN BE RECYCLED or resold, including the foundation, tower, generator, and components of the gearbox.

California hosts some of the first wind projects built in the U.S., and THE STATE HAS ALREADY REPOWERED OVER 1,500 TURBINES.[2]

15 U.S. WIND PROJECTS WERE REPOWERED IN 2017, totaling 2,136 MW. Put in perspective, the U.S. added a total of 7,000 MW of new wind power capacity in 2017.[3]

THE CAPACITY FACTOR for a wind project, the amount of energy it provides over a period of time, INCREASES FROM 30% TO 40% OR 50% AFTER REPOWERING. The typical coal plant has a capacity of 54%.[3]

1. "Wind Energy Is One of the Cheapest Sources of Electricity, and It's Getting Cheaper," Scientific American. https://blogs.scientificamerican.com/plugged-in/wind-energy-is-one-of-the-cheapest-sources-of-electricity-and-its-getting-cheaper/
2. "Zombie wind and solar? How repowering old facilities helps renewables keep cutting costs," Utility Dive. https://www.utilitydive.com/news/zombie-wind-and-solar-how-repowering-old-facilities-helps-renewables-keep/429047/
3. "U.S. Wind-Farm Upgrades Are Attracting More Capital," Institute for Energy Economics and Financial Analysis. http://ieefa.org/u-s-wind-farm-upgrades-are-attracting-more-capital/
4. WindIQ Database, American Wind Energy Association. https://www.awea.org/windiq

ADDRESS
570 Asbury Street, Suite 201, St. Paul, MN 55104

OFFICE
651.644.3400

WEB
CleanGridAlliance.org