

US wind plants show relatively low levels of performance decline as they age

May 13 2020



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Wind plants in the United States—especially the newest models—remain relatively efficient over time, with only a 13% drop in the plants' performance over 17 years, researchers at the Lawrence Berkeley

National Laboratory report in the May 13 issue of the journal *Joule*. Their study also suggests that a production tax credit provides an effective incentive to maintain the plants during the 10-year window in which they are eligible to receive it. When this tax credit window closes, wind plant performance drops.

"Since wind plant operators are now receiving less revenue after the tax credit expires, the effective payback period to recoup the costs of any maintenance expenditure is longer," says study author Dev Millstein, a research scientist at Lawrence Berkeley National Laboratory. "Due to this longer payback period, we hypothesize that [plants](#) may choose to spend less on maintenance overall, and their performance may therefore drop."

Wind power is on the rise, supplying 7.3% of electricity generation in the United States in 2019 and continuing to grow around the world due to its low cost and ability to help states and countries reach their carbon emission reduction goals. But while the technology is highly promising, it isn't infallible—like any engineered system, wind plant performance declines with age, although the rate of decline varies based on the location of the plant. In order to understand the potential growth of this technology and its ability to impact electricity systems, accurate estimates of future wind plant performance are essential.

Building from previous research with a European focus, Millstein and colleagues assessed the US onshore wind fleet, evaluating the performance of 917 US wind plants (including newer plants introduced in 2008 or later as well as older plants) over a 10-year period. Since measurements of long-term wind speed are typically not available for a given location, the researchers determined wind speed using global reanalysis data, accounting for shifts in available wind from one year to the next. They obtained data on the energy generated from each plant from the US Energy Information Administration, which tracks

[electricity generation](#) from each plant on a monthly basis, and they performed a statistical analysis to determine the average rate of age-related performance decline across the entire fleet.

Millstein and colleagues found significant differences in performance decline between the older and younger wind plant models, with older vintages declining by 0.53% each year for the first 10 years while their younger counterparts declined by only 0.17% per year during the same decade.

But a notable change occurred as soon as the plants turned 10 years old—a trend in decline that has not been observed in Europe. As soon as the plants lost their eligibility for a production tax credit of 2.3 cents per kilowatt-hour, their performance began dropping at a yearly rate of 3.6%.

Still, the researchers are optimistic about the ability of US [wind plants](#) to weather the years.

"We found that performance decline with age for US plants was on the lower end of the spectrum found from wind fleets in other countries, specifically compared to European research studies," says Millstein. "This is generally good news for the US wind fleet. This study will help people account for a small amount of performance loss with age while not exaggerating the magnitude of such losses."

As the wind energy sector continues to swell, the researchers note that their findings can be used to inform investors, operators, and energy modelers, enabling accurate long-term wind plant energy production estimates and guiding the development of an evolving electrical grid.

"The hope is that, overall, the improved estimates of wind generation and costs will lead to more effective decision making from industry,

academia, and policy makers," says Millstein.

More information: *Joule*, Hamilton et al.: "How Does Wind Project Performance Change with Age in the United States?"

[www.cell.com/joule/fulltext/S2542-4351\(20\)30174-4](http://www.cell.com/joule/fulltext/S2542-4351(20)30174-4) , DOI:
[10.1016/j.joule.2020.04.005](https://doi.org/10.1016/j.joule.2020.04.005)

Provided by Cell Press

Citation: US wind plants show relatively low levels of performance decline as they age (2020, May 13) retrieved 16 April 2024 from <https://techxplore.com/news/2020-05-decline-age.html>

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