CLEAN GRID ALLIANCE
Delivering Midwest Renewable Energy

FACT SHEET

WIND TURBINES AND ICE

Winter is prime season for wind energy.

Due to a variety of factors, winter is the season that provides optimal conditions for the production of electricity from wind turbines. Cold temperatures increase air density, providing a stronger force to push wind turbine blades. The wind itself is also stronger, which allows for greater amounts of power to be produced.[1] The formation of ice on wind turbine blades can counteract these positive effects, so de-icing strategies are important for maximizing the wind's electricity-generating potential.

John Hart - Wisconsin State Journal

De-icing measures can be taken to mitigate build-up on wind turbine blades.

During the winter in cold climates, it is possible that ice can buildup on wind turbine blades, which can significantly reduce turbines' ability to generate electricity. However, certain strategies can prevent and reduce the formation of ice on the blades. Measures like water-resistant coatings and internal heating of wind turbine blades can reduce and prevent ice buildup.[2] The internal heating of wind turbines uses electricity produced by the turbines themselves, heating the blades just enough to prevent ice formation. This method can help maintain at least 90% of the turbine's production, depending on siting and climatic conditions.[3] Aside from the blades, to keep the turbines running in freezing temperatures, cold weather packages can be installed on the gearbox and other internal components to heat the equipment and allow it to run smoothly. These strategies allow wind turbines to operate in temperatures as low as –22 degrees Fahrenheit.[4]

Vestas Anti-Icing System

Siting setbacks prevent damage to nearby structures if ice falls off wind turbine blades.

If mitigation measures are not taken, it is possible for ice to build up on turbine blades. Due to the combined forces of rotation and gravity, this ice may fall. It is typical for wind turbines to have required setbacks from residential structures for a variety of reasons, including access, traffic safety, and compliance with local ordinances.[5] As a result, if a turbine were to accumulate ice on its blades, the likelihood that this would impact nearby structures is slim to none. Recommended setbacks are 1.5 times hub height, (hub height + rotor diameter) which is sufficient to separate nearby structures from turbines in many locations.[6]

1 Hu, Hui. "How to keep winter ice off a Wind Turbine's blades." Energy Post, 24 Mar. 2021, https://energypost.eu/how-to-keep-winter-ice-off-a-wind-turbines-blades/
2 Carpenter, Scott. "Why Wind Turbines in Cold Climates Don't Freeze: De-icing and Carbon Fiber." Forbes, 16 Feb. 2021, https://www.forbes.com/sites/scottcarpenter/2021/02/16/why-wind-turbines-in-cold-climates-dont-freeze-de-icing-and-carbon-fiber/?sh=542fc84e1f59
3 "Vestas Anti-Icing System: Part of Vestas Cold Climate Solutions." Vestas Wind Systems A/S, 2018, https://puc.sd.gov/commission/dockets/electric/2018/el18-003/exhibits/staff/s7.pdf
4 "Wind Energy in Cold Climates." Government of Canada, https://www.nrcan.gc.ca/energy/energy-sources-distribution/renewables/wind-energy/wind-energy-cold-climates/7321
5 "Community Impacts of Wind Energy." WINDExchange, Office of Energy Efficiency and Renewable Energy, https://windexchange.energy.gov/projects/community
6 Wahl, David, Giguere, Phillip. "Ice Shedding and Ice Throw – Risk and Mitigation." GE Energy, 2006, https://www.ge.com/content/dam/gepower-new/global/en_US/downloads/gas-new-site/resources/reference/ger-4262-ice-shedding-ice-throw-risk-mitigation.pdf

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