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# Change in wind turbine performance is predicted based on wear and tear of blades FREE

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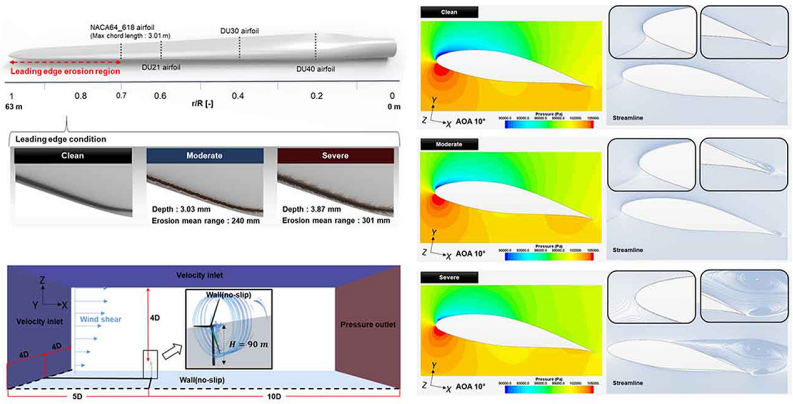
**Computational fluid dynamics and a twelve-year-old turbine blade are used to model the effect of wind erosion on turbine productivity.**




Longer blades on wind turbines can capture more wind, but the higher linear velocity at the blade tips also means more wear and tear from mechanical stress as well as wind erosion. This trade-off, if not well balanced, can lower the productivity of the turbine due to an increased need for maintenance.

Heejeon Im and Bumsuk Kim studied the effect of blade damage on overall turbine productivity using computational fluid dynamics (CFD) analysis. They performed simulations using a model based on an actual wind turbine blade that had been in use for twelve years. Specifically, they examined the damaging effect from contaminant accumulation and erosion, caused by dust, rain and hail along the leading edge of the blades.

The authors compared different areas of damage on the blade of a tip airfoil and classified the damages on the blade as clean, moderate, or severe. Through simulations, they found that lift coefficient of the airfoil decreased by up to 15% under the moderate condition and up to 23% under the severe condition, where the drag coefficient increased by 100%. This reduction in aerodynamic efficiency corresponds to an annual energy production decrease of up to 4%.

According to Kim, their method can be used to estimate optimal maintenance points for wind turbines and may help develop technology for extending the life of the blades, such as the regular application of protective tapes and other coating materials during regularly scheduled surface inspections.

**Source:** "Numerical study on the effect of blade surface deterioration by erosion on performance of large wind turbine," by Heejeon Im and Bumsuk Kim, *Journal of Renewable and Sustainable Energy* (2019). The article can be accessed at https://doi.org/10.1063/1.5115080.