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Field characterization of the effect of wind veer on wind turbine power generation. LINYUE GAO, JIARONG HONG, Saint Anthony Falls Laboratory, 2 3rd AVE SE, University of Minnesota, Minneapolis, MN, USA 55414 — Wind direction variation with height (wind veer) plays an essential role in the inflow wind field for the current utility-scale wind turbines. We explore the interactions of wind veer and wind turbine blades and their impact on the turbine performance using a 5-year field dataset. Wind veer exhibits an appreciable diurnal variation that veering and backing winds tend to occur during nighttime and daytime, respectively. We further propose to divide the wind veer conditions into four scenarios based on their changes in turbine upper and lower rotors which have different influence on the lift and drag acting on different rotor sections: VV, (upper rotor: veering, lower rotor: veering), VB (upper rotor: veering, lower rotor: backing), BV (upper rotor: backing, lower rotor: veering), BB (upper rotor: backing, lower rotor: backing). Such division allows us to elucidate the impact of wind veer on turbine power generation. The clockwise-rotating turbines tend to yield substantial power losses in scenarios VV and VB and small power gains in scenarios BV and BB. The counterclockwise-rotating turbines follow exactly opposite trends as the clockwise turbine. The findings are generalizable to onshore and offshore wind sites with varying wind veer conditions for power evaluation.

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