

Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Enhanced wind-farm performance using windbreaks LUOQIN LIU, RICHARD STEVENS, University of Twente — Many studies have considered wind farm performance optimization by manipulating the interaction between wind turbine wakes and the atmospheric boundary layer. Previous studies showed that windbreaks can increase the power production of a row of turbines, but found that the additional drag imposed by the windbreaks makes them ineffective when used in an infinite wind farm array. We use large eddy simulations of a wind farm with six rows to show that windbreaks can increase the power production of large wind farms. In a wind farm, the optimal windbreak configuration depends on a balance between this speed-up effect and the additional drag imposed by the windbreaks. Therefore, we find that the optimal windbreak height in a wind farm is significantly lower than the windbreak height used for stand-alone turbines. In large wind farms without windbreaks, the vertical kinetic energy flux that brings down high-velocity wind from above the wind farm to the hub-height plane plays a crucial role. However, surprisingly, we find that this effect is not important in wind farms with windbreaks. Instead, the turbines benefit from the favorable total pressure flux created by windbreaks of intermediate height.

Luoqin Liu
University of Twente

Date submitted: 03 Aug 2020

Electronic form version 1.4