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Wake recovery in collocated wind plants RAL BAYON CAL, HAWWA KADUM, Portland State University, MIKE QUIGLEY, GERARD CORTINA, MARC CALAF, University of Utah — Large eddy simulations approach is used to investigate the power production enhancement mechanisms in collocated wind plants in which twelve clusters of vertical axis wind turbines are collocated with a 3x4 horizontal axis wind turbine array. Three cases are studied: 1.) a standard wind plant (SWP), 2.) an aligned collocated wind plant (CWP_{al}), and 3.) a staggered collocated wind plant (CWP_{st}). A control volume analysis is employed to examine the energy balance and relevant terms for the various characteristic compounded wakes. The results show that collocated configurations have an averaged 48.5% higher power than the standard wind plant due to the faster wake recovery and improved vertical transport of mean kinetic energy. The collocated plants spatial heterogeneity is found to play a significant role in mean kinetic energy vertical transport advancement by increasing the dispersive stress with an average of 37.5% increase in the vertical kinematic shear stress from the standard wind plant, consequently reinforcing the mean kinetic energy flux which is the lead term in mean kinetic energy budget. This arrangement resulted in 4% higher power production for the aligned configuration than the staggered even though the latter has faster wake recovery.

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