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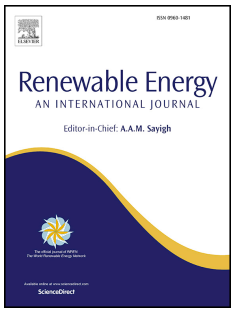

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Power output efficiency in large wind farms with different hub heights and configurations

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Abstract

Large-eddy simulation (LES) is used to investigate the effect of the spatial arrangement of a utility-scale wind turbine array on the power outputs. Eight turbine-array layouts are considered, where each has 120 turbines installed in 30 rows with aligned or staggered configurations along the wakewise direction. We perform the LESs of neutrally-stratified atmospheric boundary layer over the eight large wind farms with the turbines arranged with a perfectly-aligned configuration, four laterally-staggered configurations, and three vertically-staggered configurations. Unlike the alignment of the turbine micro-siting in the aligned wind farm, both the laterally-staggered and vertically-staggered configurations lead to the misalignment of the turbines with staggered arrangement in the lateral and vertical directions. Simulation results show that the power outputs in the wind farms have obvious decreases to 45-65% within the first 12 turbine rows and retain within that range in

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