

Abstract Submitted
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Evaluating Contributions of Turbulent kinetic Energy Fluxes To Streamtube Analysis of Wind Turbines in an Array¹ JOSE LEBRON, LUCIANO CASTILLO, Rensselaer Polytechnic Institute, CHARLES MENEVEAU, The Johns Hopkins University — Ever since the streamtube concept was introduced by Betz in 1926, the analysis have been widely used for describing the flow upstream and downstream of wind turbines. The analysis is used to relate power output to the differences of kinetic energy fluxes at the inlet and outlet of the streamtube. However, the classical analysis assumes ideal flow, neglecting, in particular effects of turbulence. For applications to large arrays of wind turbines placed in the highly turbulent atmospheric boundary layer, these assumptions do not hold. In the current study, PIV data taken in a wind tunnel 3x3 turbine array experiment (Cal et al. 2010, J. Renewable and Sustainable Energy), is analyzed. The fluxes of turbulent kinetic energy at the streamtube control surfaces are computed in order to determine their overall impact and to better understand the energy exchange between the turbine and the Atmospheric Boundary Layer.

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