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**Wind Turbine Box - energy fluxes around a characteristic wind turbine** MARC CALAF, GERARD CORTINA, Department of Mechanical Engineering, University of Utah, VARUN SHARMA, School of Architecture, Civil and Environmental Engineering, cole Polytechnique Fdrale de Lausanne — This research project presents a new tool, so called “Wind Turbine Box”, that allows for the direct comparison between the flow around a single wind turbine and the flow around a characteristic wind turbine immersed within a large wind farm. The Wind Turbine Box consists of a limited control volume defined around each wind turbine that is timely co-aligned with each corresponding turbine’s yaw-angle. Hence it is possible to extract flow statistics around each wind turbine, regardless of whether the turbine is fully isolated or it is plunged within a large wind farm. The Wind Turbine Box tool has been used to compute the energy fluxes around a characteristic wind turbine of a large wind farm to better understand the wake replenishment processes throughout a complete diurnal cycle. The effective loading of the wind farm has been gradually increased, ranging from quasi-isolated wind turbines to a highly packed wind farm. For this purpose, several Large Eddy Simulations have been run, forced with a constant geostrophic wind and a time varying surface temperature extracted from a selected period of the CASES-99 field experiment. Results illustrate the differences in the flow dynamics as it evolves around a characteristic wind turbine within a large wind farm and its asymptotic transition to the fully developed wind turbine array boundary layer.

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