Wind Energy and the Need to Understand Turbulence

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Wind energy has become one of the cheapest energy sources that can be used for our human energy demand. Thus more and more wind turbines are installed preferably in regions with high wind speeds and so they are operating under highly turbulent working conditions. Wind turbines can be considered as the largest turbulence machines we construct nowadays. For the design of wind turbines several aspects of the features of the turbulent wind conditions are taken into account. In this contribution we will discuss how far this standard wind characterization is sufficient. We will discuss which aspects of the advanced understanding of turbulence are relevant for the wind energy conversion process and where we see new challenging research topics related to turbulence and wind energy.