Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Overview of Wind Energy Grand Challenges[1] PAUL VEERS, National Renewable Energy Laboratory — Progress in wind energy depends on the scientific understanding of the fundamental physics that drive the systems and our ability to translate that understanding to actionable design decisions. A recent gathering of experts from around the world discussed the challenges that limit our ability to drive innovation and create wind systems able to supply half or more of our electricity demand by midcentury. Three grand challenges were identified: i) understanding the physics of the atmosphere in the critical zone of wind turbine and plant operation; ii) aeroelasticity, system dynamics and manufacturing of the largest rotating machines ever built; and iii) controlling and optimizing wind plants to support the reliability and resilience of the future, renewables-dominated grid. One major theme is the tremendous range of scales in both time and space involved in computing wind plant performance, driving technology innovation, and operating the electrical grid. Bridging the fluid-dynamic scales, from the atmospheric weather systems down to the boundary layer of the airfoils, runs through the center of the grand challenges. Education that develops both a deep understanding of the physical phenomena and the systems interplay from the atmosphere to the grid is discussed.

[1]This work was authored in part by the National Renewable Energy Laboratory, operated by Alliance for Sustain- able Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Wind Energy Tech- nologies Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

Paul Veers
National Renewable Energy Laboratory

Date submitted: 03 Aug 2020 Electronic form version 1.4