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Multi-faceted Wind Turbine Siting and Resource Characterization Over Complex Terrains ABIGAYLE MOSER, Iowa State University, DIEGO SIGUENZA-ALVARADO, ALI DOOSTTALAB, LUCIANO CASTILLO, Purdue University — Power transmission across vast expanses remains a major barrier in providing energy security to underserved regions. Renewable energy sources such as wind and solar power are unique solutions to solve imbalances and connectivity in hard-to-reach areas. This study seeks to outline a framework for resource characterization and wind farm implementation in isolated regions through meteorological assessments coupled with experimental data. Wind turbine siting criteria includes integrating atmospheric dynamics with existing and hypothetical wind farm locations to evaluate their performance. A fusion of meteorological data and satellite imagery were used to assess wind turbine siting based on wind and solar resource availability. In order to examine the effect of complex terrains on wind power production, wind tunnel experiments were performed with a scaled-down model wind farm. Computational fluid dynamics (CFD) simulations were performed to validate the experimental data and investigate wind-farm wake interaction with complex topographies. The results from the modeled wind farm demonstrate the role of high-gradient topographic slopes on wind-farm power output and wake recovery by means of energy entrainment.

Abigayle Moser
Iowa State University

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