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Effect of complex terrains on wind energy production ABIGAYLE ELAINE MOSER, Iowa State University, KAITLIN KELSEY, TAE HYUNG KWON, CLARICE NELSON, Purdue University, PERCY MIGUEL RUEDA PUELLES, Universidad Nacional de San Antonio Abad del Cusco, LUCIANO CASTILLO, Purdue University — Access to electricity remains a challenge in mountainous regions due to difficulties in power grid interconnection. Wind turbines carry the opportunity to resolve the power deficit in remote areas; however, wind farm performance in complex terrain remains largely unknown. The potential to generate power in complex orographic conditions provides a greater economic benefit in the renewable energy sector. This study explores the viability of exploiting wind farms in the mountainous regions of Peru by investigating the impact of complex topographic characteristics on turbine wake recovery and power generation. In order to better understand the effect of the complex terrains, wind tunnel experiments were performed on a 1:290 scale model wind farm. To explore the advantages of complex topographic regions, scaled-down turbine in the model of Ollantaytambo region of Peru were used to analyze the wake effects through power output and particle image velocimetry (PIV). The results from the model wind farm over the complex terrain are indicative of greater efficiency in wind farms in terms of power output. Additionally, we will discuss the role of high-gradient surface slope on the energy entrainment and the vertical transport of momentum and kinetic energy over the model wind farm.

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