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Micro Wind Turbine Design Considerations to Utilize Maximum Wind Energy

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Abstract

To combat climate change, advance environmental sustainability, guarantee energy security, and promote social and economic advancement globally, a transition towards renewable energies is imperative. There is a finite supply of non-renewable energy sources including natural gas, coal, and oil. There are several advantages to switching from non-renewable to renewable sources, such as wind, geothermal, and solar energy. advantages include reduced carbon footprint, low energy use, and minimal environmental influence. The world's shift to cleaner, more sustainable energy sources will probably depend more and more on wind energy. In India, 10% of all energy is produced by wind power, which was first used in 1985. Micro wind turbines are windpowered generators intended for distributed electricity production. Unlike larger wind turbines commonly found in wind farms, micro wind turbines are typically used to power individual homes, businesses, or small-scale applications. This paper aims to present some design considerations, that may follow in the pre-design stage to achieve more wind power. Some methods are adopted for all these experiments such as CFD simulation, wind tunnel test, on-field data measuring, and many others. Computational-fluid-dynamics (CFD) simulation is an analysis process used to model and find out the characteristics of fluid flows, heat transfer, and related phenomena. We consider some parameters such as the best location of a micro wind turbine for more wind potential, the structure of the turbine- its blade shape, geometrical ratio, and material specifications should be weather resistant. Surrounding build forms which have an impact on wind flow patterns. Results show that these design considerations could catch more wind, ability to accelerate wind power, and increase energy production from wind energy. The future of wind energy appears promising, with ongoing advancements and developments that position it as a key architect of the transition to a more sustainable and renewable energy landscape.

Keywords: Computational fluid dynamics; Microgeneration; Renewable energy; Sustainability; Wind corridor.