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Optimizing Vertical Axis Wind Turbines to Suit Sri Lankan Residential Applications

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The increasing global demand for sustainable energy solutions has led to a growing interest in harnessing wind energy. This study focused on the optimization of Vertical Axis Wind Turbines to address the unique challenges and opportunities present in Sri Lanka. The country's tropical climate and diverse topography offer a rich potential for wind energy. Attuning wind turbines for household use presents an innovative approach to meet local energy needs. The study employed a multidisciplinary approach, integrating aerodynamics, structural engineering, finite element analysis, computational fluid dynamics, and environmental considerations to design and optimize a vertical axis wind turbine for efficiency and reliability. A comprehensive review of existing wind turbine technologies and their suitability to Sri Lanka serves as the foundation for this study. A weather pattern analysis is done to understand wind energy generation potential in Sri Lanka. Energy consumption patterns and the energy demand also studied, emphasizing the adaptability of wind turbines in Sri Lanka. This study present a VAWT with less cost per Watt and higher rated power compared to its counterparts in the market. This aims to enhance energy security, reduce carbon emissions, and promote sustainable development in the region. The findings provide insights into the field of renewable energy, with the potential to inspire similar initiatives in other tropical regions facing similar energy challenges.

Keywords: *wind energy, vertical axis, wind turbine, hybrid turbine*