

Performance Simulation of a Small Scale Vertical Axis Wind Turbine (VAWT) with the Integration of a Wind Deflector System

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Abstract

The vertical axis wind turbine is renowned for its simple design, low maintenance and low cost over the Horizontal axis wind turbine. But as the solidity (ratio of blade area to swept area) and tip speed ratio (λ) are lesser, either the coefficient of performance (C_p) or the turbine efficiency is somewhat lower than the Horizontal axis wind turbine.

In order to increase the coefficient of performance (C_p) or the turbine efficiency, a deflector system was introduced. The deflector system can guide the wind towards the turbine blades. Based on the Computational Fluid Dynamics (CFD) simulation, small scale vertical axis wind turbine was simulated along with a wind deflector system. Then the simulated data obtained with and without the deflector system were analysed and compared. The flow solver is based on the, Two dimensional Navier –Stokes equations and the the computational domain is divided into cells and the integral forms of the governing equations are discretized via the finite volume method.

In both cases coefficient of performance was evaluated against the tip speed ratio (λ). It was observed that the C_p value obtained with deflector system attached to the turbine was shown significant increment than the C_p value obtained without the deflector system. Simulations in CFD software have shown that the C_p value was increased from 0.16 to 0.24, which is a 50% increase, by introducing the deflector system to the turbine.

Keywords: *Wind Turbine, Wind deflector*

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