Optimization of Blade Angle of Attack of a Low Speed Giromill Vertical Axis Wind Turbine

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The search for forms of alternative energy has led to wind turbines, hydro-electric dams, bio-diesel, and nuclear power being tested but can only be used in specific areas, restricting their effectiveness to some degree. The purpose of this experiment is to optimize the design of a Vertical Axis Wind Turbine (VAWT) for the wind conditions in Shreveport, Louisiana. The hypothesis that if the angle of attack (AOA) affected the amount of lift of a giromill vertical axis wind turbine, then the optimal AOA would be 20 degrees was tested. A National Advisory Committee for Aeronautics (NACA) 6 series airfoil was tested at an AOA ranging from 0 to 350 degrees in a homemade low speed wind tunnel to determine lift generated by the airfoil. Cumulative forces at 90o angles were calculated to narrow the test range. The amount of weight lifted at a 20o angle of attack was 55g, 64g at 250, 73g at 30o, 78g at 35o, 90g at 40o, 83g at 45o and 61g at 50o. Based on these results, a two blade and four blade VAWT were tested in the wind tunnel with an AOA ranging from 35o to 50o at 5o intervals and the RPM measured with an optical tachometer. A four blade VAWT design at an AOA of 35o produced 169 RPM, 40o produced 280 RPM, 45o produced 244 RPM and 50o produced 164 RPM. The airfoil produced the greatest lift and the highest RPM or work at an AOA of 40 degrees.

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