

Vertical Axis Wind Turbines: Open Airfoils and Plastic Blades

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Abstract

The paper addresses two aspects of vertical axis wind turbines. In the first part, aerodynamic aspects were addressed. Two types of blade segments were tested in the wind tunnel, both defined by the NACA 0018 airfoil. One of the two blades had an opening of $1/3$ of the chord length at the trailing edge. The results showed that the airfoil's performance, in terms of lift/drag ratio, was not strongly affected by the opening. However, when applied for vertical axis wind turbines, the open blades (J blades) developed a higher productivity than the turbine with normal blades. The second part addresses the possibility of manufacturing small wind rotor blades (1.5 m) from HDPE plastic. The process consisted of three main steps: shredding the plastic, obtaining a plastic sheet through hot pressing, cold pressing the hot plastic sheet into a specially prepared mold. A blade segment was manufactured this way in order to prove the possibility. After this, a structural analysis was performed on a 1.5 m helical open blade. The simulations showed that this material could be a viable solution for small vertical axis wind turbines.

Keywords: vertical axis wind turbines, blades, wind tunnels, wind turbines, helical blades, CFD, reprocess, recycle

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