Viorel B., Ion B., Ivan R., Valeriu D., Rodion C. (2020) Vertical Axis Wind Turbines: The Behavior of Lift and Drag Airfoils. In: Visa I., Duta A. (eds) Solar Energy Conversion in Communities. Springer Proceedings in Energy. Springer, Cham.
https://doi.org/10.1007/978-3-030-55757-7_14

Vertical Axis Wind Turbines: The Behavior of Lift and Drag Airfoils

Bostan Viorel
Bostan Ion
Rabei Ivan
Dulgheru Valeriu
Ciuperca Rodion
Technical University of Moldova, Chisinau, Republic of Moldova

Abstract
The blade is the most important element of a wind turbine, as it is the component that largely governs the productivity and it is the main source of efficiency optimization. A blade is defined by the airfoil type. This paper addresses three different airfoil types tested for different wind conditions. The versions considered are: the symmetrical NACA 0018 airfoil, the asymmetrical FX 63-137 airfoil—both of lift type and one drag type of scoop shape. Based on these versions, three sets of blades were obtained and used to form three vertical axis wind turbines which were tested in a wind tunnel. Except for the blade's airfoil, all rotors had the same key parameters which refer to: rotor's swept area, number of blades, height, diameter, aspect ratio, blade length, chord length, solidity and pitch angle. As expected for low wind speeds, the scoop bladed turbine showed significantly higher efficiency than the other two versions. It was also noticed that the performance is not influenced by the curvature position that can be oriented either radially inward or outward in relation to the rotor's axis. For higher wind speeds the FX 63-137 turbine's efficiency increased dramatically while NACA 0018 turbine displayed weak performance in all cases.