

## The Characteristics of the Operating Parameters of the Vertical Axis Wind Turbine for the Selected Wind Speed

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**Abstract :** The paper discusses the results of the research into a wind turbine with a vertical axis of rotation which was performed with the open return wind tunnel, Gunt HM 170, at the laboratory of the Department of Thermodynamics, Fluid Mechanics and Propulsion Aviation Systems of Lublin University of Technology. Wind tunnel experiments are a necessary step to construct any new type of wind turbine, to validate design assumptions and numerical results. This research focused on the rotor with the blades capable of modifying their working surfaces, i.e. absorbing wind kinetic energy. The operation of this rotor is based on adjusting angular aperture  $\alpha$  of the top and bottom parts of the blades mounted on an axis. If this angle  $\alpha$  increases, the working surface which absorbs wind kinetic energy also increases. The study was performed on scaled and geometrically similar models with the criteria of similarity relevant for the type of research preserved. The rotors with varied angular apertures of their blades were printed for the research with a powder 3D printer, ZPrinter® 450. This paper presents the research results for the selected flow speed of 6.5 m/s for the three angular apertures of the rotor blades, i.e. 30°, 60°, 90° at varied speeds. The test stand enables the turbine rotor to be braked to achieve the required speed and airflow speed and torque to be recorded. Accordingly, the torque and power as a function of airflow were plotted. The rotor with its adjustable blades enables turbine power to be adjusted within a wide range of wind speeds. A variable angular aperture of blade working surfaces  $\alpha$  in a wind turbine enables us to control the speed of the turbine and consequently its output power. Reducing the angular aperture of working surfaces results in reduced speed, and if a special current generator applied, electrical output power is reduced, too. Speed adjusted by changing angle  $\alpha$  enables the maximum load acting on rotor blades to be controlled. The solution under study is a kind of safety against a damage of a turbine due to possible high wind speed.

**Keywords :** drive torque, renewable energy, power, wind turbine, wind tunnel

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