Diffuser Shroud Design to Maximize Horizontal Wind Turbine Rotation at Low Wind Speed

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ABSTRACT

Wind speed is one of the important parameters for turbine performance, since wind speed is directly proportional to turbine output power. The diffuser shroud is one of the technologies used to maximize the utilization of low wind speeds to improving turbine performance. This research was conducted to analyze the effect of the ratio between the throat diameter and the outlet diameter of the diffuser that affect to the performance of the wind turbine. The design that used is a Cii type diffuser (Ohya, 2012) with variations in the ratio of the throat diameter and outlet diameter of 1,193, 1,294 and 1,406 at wind speeds of 4 m/s, 5 m/s, 6 m/s, and 7 m/s. . The test was carried out using the CFD simulation method using solidwork and the experimental method using a blower. The simulation method is used as a reference to select the shroud design, while the experimental method is to compare the performance of conventional wind turbines and diffuser shroud wind turbine. The results of the study showed that there was an increase in wind speed by 25% in type 1193, 29% in type 1294, and 23% in type 1406 against the initial wind speed. The use of shroud in turbines is able to increase wind speed by up to 11% at the throat point of the sheath, with an average increase in the highest output power value of 36%, highest average increaseof rpm value of 29%, and the highest average increase of turbine coefficient (Cp) at 22% compared to conventional wind turbines.

Keywords : Wind turbine, CFD Simulation, Diffuser Shroud, Wind speed, Rpm, TSR, power coefficient (Cp)