

Technology development of the low power wind energy system

S. C. Tzeng¹ Y. C. Chen²

¹ Department of Mechanical Engineering, Chienkuo Technology University, ChanGhua 500, Taiwan, R.O.C.

² Department of Automation Chienkuo Technology University ChanGhua 500, Taiwan, R.O.C.

Abstract

This research aims to discuss the power generation performance of small capacity wind energy system. A blow-down open-type wind tunnel was specifically designed for the small capacity wind turbine generator according to experimental design, and the characteristics of wind turbine generator were tested using the velocities generated by the wind tunnel, and finally the test data was analyzed and discussed. With the measurement method of CNS7779 standard, a hot-wire anemometer was used to measure the wind velocity of the test section at outlet of wind tunnel, showing that the mean velocity ranged between 1.7 ~ 9.1 m/s. The experiment found that, the power of small capacity wind turbine generator would increase exponentially with the growing wind velocity. When the wind velocity is 4.6 m/s, the optimum wind energy conversion output efficiency is about 16.86 Watt; the wind power coefficient (C_P) is evaluated as 0.42, and the number of wind turbine generator's impeller revolution is approximate 390 rpm. This study also found that, the rotation speed of wind turbine generator's impeller would generate braking action with the reduction of system impedance. When the wind turbine generator is operated stably at the wind velocity of 6.22 m/s, the rotation speed of impeller is 488 rpm. When the system impedance declines gradually to 4.5 Ω , the rotation speed would slow down to about 350 rpm. On the whole, six-blades resistance wind turbine

generator has an efficiency 10 ~ 20 % higher than conventional multiple-blades one. The monitoring system, experimental method and results here to can provide necessary concept and data for experimental analysis of small capacity wind turbine generator in the future.

Keywords: small capacity wind energy system, blow-down wind tunnel, wind power coefficient.

