

Performance Analysis of Horizontal Axis Wind Turbine as a Pump Energy Source for Agricultural Irrigation using Homer Software

Title	Performance Analysis of Horizontal Axis Wind Turbine as a Pump Energy Source for Agricultural Irrigation using Homer Software
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Accreditation	3
Abstract	<p>The high cost of fuel has become a significant challenge for farmers in operating water pumps for irrigation in agricultural fields. The pumps are rendered economically inefficient due to the associated high operational costs. Therefore, the proposed solution to address this issue is the utilization of wind energy. Wind energy is converted into electrical energy to power water pumps. This research aims to: determine the average power in the wind use statistical method based on the average of windspeed, evaluate the efficiency of wind power generators, and select the appropriate wind turbine type for installation in the Kedungweru region, Kebumen, Central Java. The study was conducted at the Wind Power Plant (PLTB) in Kedungweru Village, Kebumen Regency, Central Java, and the Laboratory of Thermal Systems Engineering and Renewable Energy at Jenderal Soedirman University. Sampling methods included measuring wind speed, voltage, and current, as well as data from the Hybrid Optimization of Multiple Energy Resources (HOMER) software. The variables of this research were maximum/minimum/average wind speed, electric pump load, power generated by the wind power plant, and the efficiency of wind turbine performance. The results of the study indicate that Kedungweru has a relatively good wind energy potential, with an average wind speed of 4.79 m/s. From the HOMER simulation using 2 AWS HC 650 W wind turbines, the generated electrical energy reached 2,543 kWh/year. Additionally, the simulation showed an electrical surplus of 33.2%, indicating a well-performing system as almost all generated energy can be efficiently utilized without wastage. Thus, the use of wind energy as a renewable resource for irrigating agricultural fields can be an efficient and economical solution to address the high operational costs resulting from expensive fuel prices.</p>
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