DESIGN OF A MICROHYDRO POWER GENERATING SYSTEM BASED ON VORTEX TURBINE AS AN ALTERNATIVE ENERGY SOURCE FOR LIGHTING AND IRRIGATION OF FIELDS

Ihzaaq Hanan Margianto ,
Program Studi Teknik Elektro, Fakultas Sains & Teknologi
Universitas Teknologi Yogyakarta
Jl. Ringroad Utara Jombor Sleman Yogyakarta
E-mail : ihzaaghanan90@gmail.com

ABSTRACT

The demand for electrical energy in the agricultural sector, particularly for irrigation and lighting in rice fields, necessitates environmentally friendly and sustainable solutions. This research aims to design and develop a micro-hydro power generation system utilizing a vortex turbine to meet the electricity needs of rice fields. The research methodology includes a literature review, mechanical design of the vortex turbine system, electronic prototype design, and performance testing and analysis of the device. The designed system comprises a vortex turbine as the primary driver, a DC generator for electricity production, an XH-M604 module as a battery charging controller, an XL6009E1 step-up module to increase voltage, a battery, and a DC-AC inverter. Test results indicate that the generator produces an average DC voltage of 5.08 V without a load, which increases to 15.88 V with a load. Under load, the generator voltage ranges from 3.8 to 4.5 V DC, while the output voltage from the boost converter is 14 to 15 V DC, sufficient to charge a 12 V battery. The system can power AC loads up to 40 watts and performs effectively for lighting applications. This research demonstrates that harnessing moderate water flow through a vortex turbine can serve as an effective alternative renewable energy source for agricultural activities.

Keywords: Vortex Turbine, Microhydro Power Plant, DC Generator, Rice Field Lighting