

PENGARUH *OVERLAP RATIO* PADA PROTOTIPE TURBIN ANGIN *SAVONIUS* MENGGUNAKAN TEKNOLOGI *3D PRINTING*

ABSTRAK

Penelitian ini bertujuan untuk merancang dan membuat prototipe turbin angin *Savonius* dengan memanfaatkan teknologi *3D printing* berbahan *PLA (Polylactic Acid)*, serta mengkaji pengaruh variasi kecepatan angin dan *overlap ratio* terhadap performa turbin. Metode yang digunakan adalah eksperimen skala laboratorium dengan variasi kecepatan angin sebesar 5 m/s, 6 m/s, dan 7 m/s, serta variasi *overlap ratio* 0,1; 0,15; dan 0,20. Parameter yang dianalisis meliputi putaran poros, torsi, daya turbin, efisiensi, koefisien daya (C_p), dan koefisien torsi (C_t). Hasil penelitian menunjukkan bahwa prototipe berhasil dibuat menggunakan teknologi *3D printing* dan mampu beroperasi dengan baik. Putaran tertinggi diperoleh pada *overlap ratio* 0,1 dengan kecepatan angin 7 m/s, yaitu sebesar 761,2 RPM pada kondisi tanpa beban. Daya turbin maksimum sebesar 3,1 W juga diperoleh pada *overlap ratio* 0,1 dan kecepatan angin 7 m/s. Nilai C_p tertinggi sebesar 0,037 dicapai pada *overlap ratio* 0,1 dengan kecepatan angin 5 m/s, sedangkan nilai C_t maksimum sebesar 4,396 diperoleh pada *overlap ratio* 0,1 dan kecepatan angin 7 m/s. Adapun efisiensi tertinggi sebesar 3,73% diperoleh pada *overlap ratio* 0,1 dan kecepatan angin 5 m/s. Hasil tersebut menunjukkan bahwa variasi kecepatan angin dan *overlap ratio* berpengaruh terhadap kinerja turbin *Savonius*.

Kata kunci: Turbin angin *Savonius*, *3D printing*, *PLA*, *overlap ratio*, daya, efisiensi.

THE EFFECT OF OVERLAP RATIO ON A SAVONIUS WIND TURBINE PROTOTYPE USING 3D PRINTING TECHNOLOGY

ABSTRACT

This study aims to design and fabricate a Savonius wind turbine prototype using 3D printing technology made from PLA (Polylactic Acid), and to analyze the effect of variations in wind speed and overlap ratio on turbine performance. The method used was a laboratory-scale experiment with wind speed variations of 5 m/s, 6 m/s, and 7 m/s, as well as overlap ratio variations of 0.1, 0.15, and 0.20. The parameters analyzed included shaft rotational speed, torque, turbine power, efficiency, power coefficient (C_p), and torque coefficient (C_t). The results showed that the prototype was successfully manufactured using 3D printing technology and operated properly. The highest rotational speed was obtained at an overlap ratio of 0.1 and a wind speed of 7 m/s, reaching 761.2 RPM under no-load conditions. The highest turbine power, amounting to 3.1 W, was also achieved at an overlap ratio of 0.1 and a wind speed of 7 m/s. The maximum C_p value of 0.037 was obtained at an overlap ratio of 0.1 and a wind speed of 5 m/s, while the maximum C_t value of 4.396 was obtained at an overlap ratio of 0.1 and a wind speed of 7 m/s. The highest efficiency, namely 3.73%, was obtained at an overlap ratio of 0.1 and a wind speed of 5 m/s. These results indicate that variations in wind speed and overlap ratio affect the performance of the Savonius wind turbine.

Keywords: Savonius wind turbine, 3D printing, PLA, overlap ratio, power, efficiency