

ABSTRAK

Energi diperlukan seiring dengan pertumbuhan ekonomi, populasi, dan konsumsi energi yang luar biasa. Sementara permintaan energi dunia terus meningkat, bahan bakar fosil menyumbang lebih dari 86% dari total energi. Karena berlimpah dan dapat diperbaharui, energi angin adalah sumber energi terbarukan yang sangat berpotensi untuk dikembangkan. Turbin Angin Sumbu Vertikal (TASV) dianggap ideal untuk digunakan di lingkungan dengan kecepatan angin rendah, kecepatan angin di Indonesia umumnya berkisar antara 3 m/s dan 6 m/s. Dalam penelitian ini dilakukan studi baik secara eksperimen maupun teori terhadap kinerja rancang bangun TASV dengan blade model limas dan pengujian TASV dilakukan di lapangan (field test) di Tanggul Muara Baru, Jakarta Utara serta eksperimen dilakukan baik tanpa beban maupun dengan beban planetary gearbox rasio 1:50. Kinerja turbin dinilai secara bersamaan melalui parameter terukur seperti kecepatan angin, kecepatan putar rotor, nilai tegangan dan arus listrik dan nilai torsi, juga menganalisis koefisien daya (C_p), koefisien torsi (C_t) dan *tip speed ratio* (TSR) sebagai parameter tidak terukur (*non-dimensional*). Hasil pengujian didapatkan melalui perhitungan dan analisis seperti data dan parameter-parameter. Dari hasil perhitungan dan analisis menghasilkan nilai efektif koefisien daya (C_p) dan koefisien torsi (C_t) efisien pada kecepatan angin 4.2 m/s dengan kecepatan putar rotor 7.2 RPM dengan nilai 0.59 % dan 0.000662 % serta *tip speed ratio* (TSR) dengan nilai 0.00111 pada kecepatan angin 7.4 m/s.

Kata Kunci: Turbin Angin Sumbu Vertikal (TASV); Koefisien Daya (C_p); Koefisien Torsi (C_t); *Tip Speed Ratio* (TSR); *Planetary Gearbox*



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EXPERIMENTAL STUDY OF A 2 STACK 4 BLADE VERTICAL AXIS WIND TURBINE (VAWT) AT MUARA BARU EMBANKMENT

ABSTRACT

Energy is needed as the economy, population and energy consumption grow tremendously. While the world's energy demand continues to rise, fossil fuels account for more than 86% of total energy. Being abundant and renewable, wind energy is a renewable energy source that has great potential to be developed. Vertical Axis Wind Turbine (TASV) are considered ideal for use in environments with low wind speeds, wind speeds in Indonesia generally ranging between 3 m/s and 6 m/s. In this research, both experimental and theoretical studies were conducted on the performance of the TASV design with a pyramid blade model and TASV testing was carried out in the field (field test) at Muara Baru Embankment, North Jakarta and experiments were carried out both without load and with a planetary gearbox load ratio of 1:50. Turbine performance was assessed simultaneously through measurable parameters such as wind speed, rotor rotational speed, voltage and current values and torque values, as well as analyzing the coefficient of power (C_p), coefficient of torque (C_t) and tip speed ratio (TSR) as non-dimensional parameters. The test results are obtained through calculation and analysis such as data and parameters. From the results of calculations and analysis, the effective value of the power coefficient (C_p) and torque coefficient (C_t) is efficient at a wind speed of 4.2 m/s with a rotor rotational speed of 7.2 RPM with a value of 0.59% and 0.000662% and tip speed ratio (TSR) with a value of 0.00111 at a wind speed of 7.4 m/s.

Keywords: Vertical Axis Wind Turbine (TASV); Coefficient Power (C_p); Coefficient Torque (C_t); Tip Speed Ratio (TSR); Planetary Gearbox

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