ABSTRAK

STUDI EKSPERIMEN MODEL PEMBANGKIT LISTRIK TENAGA GELOMBANG LAUT TIPE *GEAR* (*RACK AND PINION*) SEARAH

OLEH

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Pemanfaatan energi gelombang laut sebagai sumber energi terbarukan di Indonesia terus dikembangkan untuk menghasilkan energi listrik. Penelitian ini mengkaji model pembangkit listrik tenaga gelombang laut tipe *gear* (*rack and pinion*) searah yang memanfaatkan gerakan naik turun pelampung akibat gelombang untuk diubah menjadi gerak rotasi dan menggerakkan generator. Pengujian dilakukan pada skala laboratorium menggunakan media air tawar dengan pembangkit gelombang buatan. Variasi parameter meliputi eksentrisitas 2, 3, dan 4 cm, kecepatan putar poros 46, 56, dan 62 RPM, serta panjang tabung 50, 55, dan 60 cm. Hasil pengujian berupa tegangan, arus, dan daya listrik. Hasil pengujian dianalisis dan dibandingkan dengan perhitungan teoritis untuk menentukan efisiensi konversi energi, yang dihitung dari perbandingan energi listrik yang dihasilkan dengan energi teoritis gelombang. Hasil penelitian menunjukkan bahwa kinerja pembangkit dipengaruhi oleh variasi eksentrisitas, kecepatan putar poros, dan panjang tabung, sehingga sistem ini berpotensi dikembangkan sebagai pembangkit listrik ramah lingkungan di wilayah pesisir.meskipun masih diperlukan pengembangan desain dan pengujian lanjutan.

Kata Kunci: Energi Gelombang Laut, Pembangkit Listrik Tenaga Gelombang Laut, Energi Terbarukan, *Rack and Pinion,* Efesiensi Konversi Energi.

ABSTRAK

EXPERIMENTAL STUDY OF A GEAR-TYPE (RACK AND PINION) DIRECT DRIVE OCEAN WAVE POWER GENERATOR MODEL

By

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The use of ocean wave energy as a renewable energy source in Indonesia continues to be developed to generate electricity. This study examines a unidirectional gear (rack and pinion) type ocean wave power plant model that utilizes the up and down movement of floats caused by waves to be converted into rotational motion and drive a generator. Testing was conducted on a laboratory scale using fresh water with an artificial wave generator. The parameters varied between eccentricities of 2, 3, and 4 cm, shaft speeds of 46, 56, and 62 RPM, and tube lengths of 50, 55, and 60 cm. The test results were in the form of voltage, current, and electrical power. The test results were analyzed and compared with theoretical calculations to determine energy conversion efficiency, which was calculated from the ratio of the electrical energy produced to the theoretical wave energy. The results of the study show that the performance of the generator is influenced by variations in eccentricity, shaft rotation speed, and tube length, so this system has the potential to be developed as an environmentally friendly power generator in coastal areas, although further design development and testing are still needed.

Keywords: Ocean Wave Energy, Ocean Wave Power Plant, Renewable Energy, Rack and Pinion, Energy Conversion Efficiency.