

Feasibility and Experimental Investigation about Integration of Micro Wind Turbines in Marine Systems

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Abstract

There is an increasing demand for the use of sustainable and low-emission energy solution which has raised the need to create an alternative onboard power source. This study explores the feasibility of integration of a micro wind-turbine into marine systems to support auxiliary and emergency power requirements. The proposed design focuses on a hybrid configuration that combines Darrieus and Savonius rotors to achieve both efficient operation and reliable self-starting capability.

The research involves a systematic approach involving conceptual design, 3D modelling using software, computational analysis, prototype fabrication and experimental testing. Key parameters such as blade geometry, rotor dimensions and aerodynamic performances were evaluated to optimize the turbine's functionality under controlled wind conditions similar to that of marine atmosphere. The computational analysis results indicate that the vertical axis hybrid turbine performs effectively with improved starting behavior at low wind speeds and stable operation across varying conditions. The system demonstrates consistent rotational behavior and low vibration levels.

This study highlights the potential of micro-Vertical Axis Wind Turbines (VAWT) as a sustainable solution for marine energy emergency needs. By reducing dependence on conventional fuel sources and lowering emissions, the proposed system contributes to cleaner and more energy-efficient maritime operations, aligning with current sustainable development goals in engineering and renewable energy adoption.

Keywords

Auxiliary power supply, marine renewable energy, sustainability, vertical axis wind turbines.