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A Dual-Function Oscillating Water Column and Slotted Breakwater: a Wave-flume study

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Wave energy conversion holds promise for renewable energy, but challenges like high initial costs hinder commercialization. Integrating wave-energy converters (WECs) into shore-protection structures creates dual-function structures for both electricity generation and coastal protection. Oscillating water columns (OWCs), with their out-of-water power take-off (PTO) system, minimize fouling effects and maintenance costs. This study combines an OWC-type WEC with a bottom-sitting slotted barrier to optimize transmission coefficient, wave power extraction, and minimize wave loading. In a small wave flume with a piston-type wave generator, the experiment uses a circular orifice at the pneumatic chamber's top to emulate the PTO system. Wave power extraction is measured with a differential pressure sensor, and wave loading with a single-axis force balance. Examining tide level and slotted barrier porosity effects on wave power extraction and loading under different wave conditions reveals valuable insights. Key results encompass reflection, transmission, and energy loss coefficients, wave power extraction efficiency, and wave loading data, contributing to the understanding of dual-function structure performance.