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DESIGN OF HYBRID WIND-WAVE ENERGY SYSTEM

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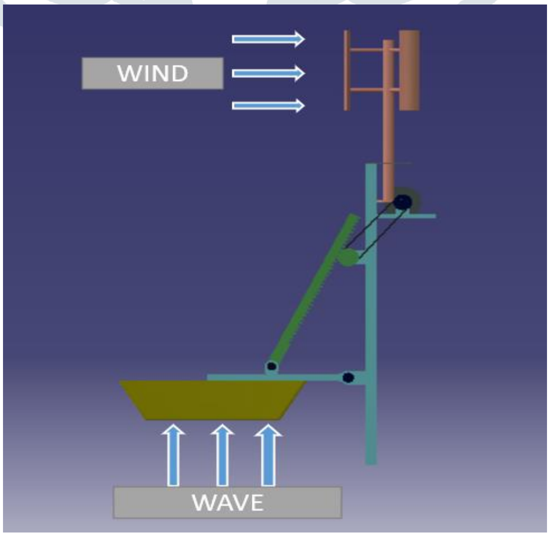
Abstract: Vertical axis wind turbines and wave energy converters are coupled in a hybrid wind wave system. This technique maximizes power production at a shared platform by using both wind and wave energy. The focus of this field's study is on designing hybrid wind-wave systems, which are employed to improve efficiency. A little amount of extra power can also be generated by merging the two techniques. The NACA s1046 airfoil profile is utilized in vertical-axis wind turbines for greater efficiency. The worm gear is used to link the turbine and generator shafts. Wave energy is captured using floating buoys and a rack and pinion system. The primary shaft is linked to both systems via belt drives. This electricity may be utilized for local power needs in remote areas near the shore. In the future, hybrid wind-wave systems could help produce large quantities of electricity, when more wave energy converters and vertical axis wind turbines are connected in series.

Keywords - Vertical axis wind turbine, wave energy, wind energy

I INTRODUCTION

A relatively recent hybrid design combines the vertical axis wind turbine with a wave energy converter to provide more electricity at a lower cost. The mooring system, electrical network, and other elements are shared in this way. It is possible to lower the overall cost of installation, operation, and maintenance. The wave energy converter (WEC) should ideally be included to lower the platform's total motion response and perhaps stabilize the entire system. The system's wind energy production component may perform better. Previous researchers have investigated and tested a few hybrids wind-wave energy systems (HWWES) designs. Technologies for hybrid wind-wave energy are still in their infancy. Although the inclusion of WEC appears to lower overall costs and may enhance motion and power performance, there are a number of difficulties and unknowns that must be resolved.



1.1WAVE ENERGY

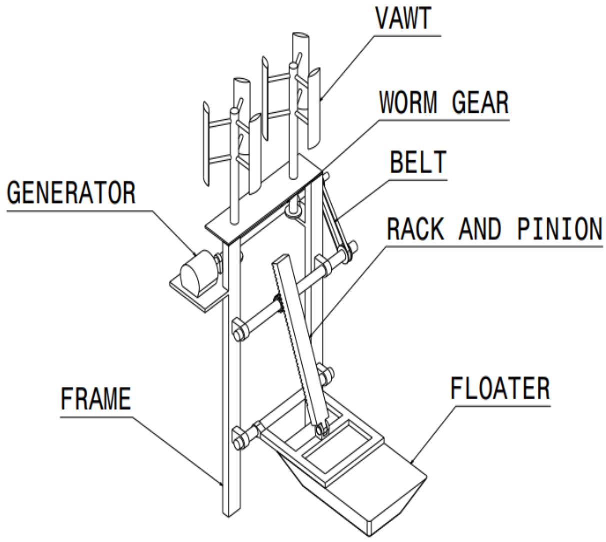
The endless motion of the waves as they roll against the coast and then out again is the source of wave energy. Ocean waves appear to be a seemingly limitless source of clean energy. Another sort of ocean-based renewable energy source that harnesses the energy of the waves to produce electricity is ocean wave energy, also referred to as wave energy. Wave energy employs the vertical movement of the surface water that creates tidal waves as opposed to tidal energy, which uses the ebb and flow of the tides. By installing equipment on the water's surface that catches the mechanical energy produced by the wave movement and transforms it into electrical power, wave power is able to turn the periodic up-and-down movement of the ocean waves into electricity. Point absorbers, oscillating water columns, wave overtopping reservoirs, tidal lagoon power, ebb-and-flood generation, and several more techniques are well-established, although they have few practical applications. Waves carry energy from the far-off location in the ocean where they were produced by storms to the beach. But unlike a basic sinusoidal wave, a typical ocean wave is more irregular and complicated. The only motion that closely approaches a sinusoidal wave, as opposed to locally produced wind waves, is the continuous up-and-down motion of a large surge. The technique stretches perpendicular to the wave's direction and either captures or reflects the wave's energy. However, floating variants have been created for offshore applications. These devices are often onshore or nearshore.

1.2 WIND ENERGY

The process of converting wind energy into mechanical or electrical energy, which may then be used, is known as wind power. Commercial wind turbines use rotational energy to power generators, which in turn produces electricity. A vertical-axis wind turbine (VAWT) is a type of wind turbine where the main rotor shaft is set transverse to the wind while the main components are located at the base of the turbine. This arrangement allows the generator and gearbox to be located close to the ground, facilitating service and repair

II WORKING PRINCIPLE OF WAVE AND WIND ENERGY CONVERTER

The system comprises of mechanical components that would allow continuous wave energy to be caught, transferred, and turned into mechanical energy. Thus, the float is in direct touch with the ocean wave. As the wave passes through the system, the float will absorb energy and, at the same time, the gear will begin to rotate in accordance with the wave's intensity. Thus, the connecting gear sent energy to the generator, which then produced electricity that was either stored or used right away; the system continued to operate in the same cycles.



The vertical axis wind turbine (VAWT) is used to harness wind power and produce electricity. Numerous curved aero foil blades installed on a spinning shaft or framework make up the turbine. Only at very high spinning speeds can the blade be strained in tension due to the blades' curvature. One of the most crucial elements in the design of a wind turbine is the airfoil configuration for the blades. This configuration allows the turbine to convert wind kinetic energy into energy using a rotor and generator, which transform mechanical energy into electrical energy, with high efficiency. The rotor begins to create power at the cut-in speed, whereas, at the cut-out speed, it begins to slow down and produce less power.

III PARTS OF HYBRID VERTICAL AXIS WIND TURBINE AND WAVE ENERGY CONVERTER SYSTEM

BASE FRAME

The frame is the primary component of the system, on top of which all other components will be installed. Onshore, we can mount the frame by screwing in the rear or the bottom. The horizontal frame, floater, rack & pinion, vertical axis wind turbine, driving shafts, belt drive, generator, and battery are the parts that will mate in this system.

3.1 FLOATER

The floating object takes in the energy of the waves that are coming at it from all sides. The efficiency of these devices is unaffected by the direction of the wave since they are modest in comparison to the wavelength. The point absorber principle is used in a variety of devices, but for the sake of this research, we'll concentrate on the most well-known. The floaters of WECs (wave energy converters) are often exposed to hostile maritime conditions with significant environmental load uncertainties, which makes assessing their reliability difficult.

3.2 RACK AND PINION

In a rack and pinion linear actuator, a circular gear (the pinion) engages a linear gear (the rack), converting rotational motion into moving the rack linearly, which drives the pinion into rotation. Both straight and helical gears can be used in a rack and pinion drive. The pinion shaft is installed in the frame, and the rack is attached to the floater.

3.3 VERTICAL-AXIS WIND TURBINE (VAWT)

VAWTs are compact, silent, simple to install, and wind-resistant. The gearbox and generator are placed at the base of the wind turbine, which has the rotor as its main moving component. This makes installing a VAWT an easy task that may be finished quickly. The VAWT rotor, which consists of many blades with constant cross-sections, is intended to produce good results. This is because each blade's local angle of attack is determined by its azimuthal position. However, VAWT blades are made in a way that allows them to function well aerodynamically at all angles of attack during a revolution, producing high time-averaged torque.

IV CONCLUSIONS

Previous research mostly focused on large offshore setups with significant installation, maintenance, and operation costs. To increase the efficiency of energy output, systems like vertical axis wind turbines and wave energy converters are incorporated. It may be set up in remote coastal areas and islands where power production and power transformation are more expensive. In addition to creating a brand-new market for alternative energy technologies, this lowers the target person's reliance on outside energy sources.

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