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Method and Apparatus for Energy-Water Nexus Powered by a Hydraulic Wind Turbine

Hydraulic wind turbine system couples renewable energy with desalination, lowering water/energy costs by up to 19%.

Electricity generation and water desalination are critical technologies to society but currently drive a large portion of global carbon dioxide (CO2) emissions. In an effort to decrease the carbon emissions of these necessities, researchers at Purdue University have developed a coupled energy generation and water desalination system powered by wind turbines. In Purdue's approach, the wind turbine drives a hydraulic pump to feed high pressure fluid to motors at the base of the turbine for electricity generation and water purification. This reduces the conversion losses associated with converting between wind energy to electricity to water desalination in a decoupled approach. These efficiency gains lead to a levelized cost of water/energy (LCOW/LCOE) improvement of 19% compared to other renewable based desalination systems. This technology has applications in companies and governments seeking to reduce dependence on fossil fuels for energy and water desalination.

Advantages:

-Zero emission water desalination

-Zero emission energy generation

-Up to 19% improvement in LCOW/LCOE

-Can be used in remote areas

-Damping torque fluctuations

-Multiscale application

-High power quality

-Continuous variable transmission

-Improved structural stability for offshore wind turbines

Technology ID

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Category

GreenTech/Water & Resource Management

Energy & Power Systems/Power Generation

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Applications:

-Water Desalination

-Electricity Generation

-Wind Turbines

-Renewable Energy

-Fluid Power

Technology Validation:

This technology has been validated through the fabrication of a proof-of-concept prototype system.

TRL: 4

Intellectual Property:

Provisional-Patent, 2024-01-09, United States

PCT-Patent, 2025-01-06, WO

Keywords: desalination, energy independence, Fluid power, fossil fuels, Green Technology, Mechanical Engineering, net-zero emissions., Purification, water scarcity, wind