Vertical wind turbine

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Although they are not the frontrunner for 5-MW-10-MW land-based systems, VAWTs may be the favored technology for larger offshore systems in the 10-MW-20-MW scale, where the vertical-axis rotor architecture offers potentially large reductions in cost of energy (COE) for operations and maintenance, substructure, installation, and infrastructure.

This idea is currently being tested at Sandia National Laboratories in New Mexico, where a research team is evaluating the feasibility of VAWT architecture for large-scale deployment in the offshore environment. The goal is to reduce the biggest barrier to offshore wind development—high COE—by 20% or more through the application of VAWT rotor technology. The research project will:

Sandia National Laboratories is undertaking a project to test the feasibility of vertical-axis wind turbine (VAWT) architecture for large-scale deployment in the offshore environment. Image: Sandia National Laboratories

"Modeling suggests the COE reduction opportunities follow from three fundamental characteristics of the VAWT: lower turbine center of gravity, reduced machine complexity, and the opportunity for scaling the machine to the 10-MW-20-MW size," says Matthew Barone, one of the project's lead researchers in Sandia's Wind & Water Power Technologies Department.

"The most original and innovative aspect of this work will be the suite of rotor design solutions we are developing that simultaneously address the need for reliable aerodynamic braking, while also smoothing out power and torque oscillations associated with VAWTs," says Barone. "By addressing these design requirements through rotor innovations, we hope to retain the VAWT's inherent advantage of simplicity of design, while improving its overall cost-effectiveness in the offshore environment."

The ultimate VAWT rotor design may also create manufacturing challenges. The complexity and scale of a 10-MW-20-MW VAWT blade structure, along with significant differences in blade loading, may require specialized manufacturing processes. Researchers will also identify the best materials, coatings, and manufacturing options for the VAWT rotors.

This standard applies to elevators permanently installed in a wind turbine tower to provide vertical transportation of authorized personnel and their tools and equipment only. Such elevators are typically subjected to extreme temperatures, humidity variations, and substantial horizontal motions.Table of Contents

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John Dabiri may not be able to talk to the animals, but, in a way, they’ve started talking to him. He realized that the kind of flowing motion birds in flocks and fish in schools summon might just be applicable to the world of wind turbines.

“Big questions ultimately included: ‘How will wind do when a turbine isn’t next to an open field but next to a building?’” says Dabiri, who was teaching at CalTech when he was first inspired. He is now a professor of mechanical, civil, and environmental engineering at Stanford University. “The work early on, as it often does, involved doing a computer model. The numbers were promising.”

It might seem strange to contemplate that grouping things close together would work for turbines. After all, conventional thinking for turbines holds that they should be set far apart to avoid the airflow being influenced by other wind turbines. The theory holds that this preserves the performance of the downwind turbines. Dabiri believes there is power in numbers.

“We noticed birds or fish are contending with the fact that neighboring birds or fish are disturbing the air or water,” he says. “Rather than spreading out as far apart as possible, they align themselves in pretty regular geometric patterns, such as staggered formations. What they’re doing is finding locations in the area around their neighboring animals where the flow that’s created by the neighbor can actually improve their performance.”

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