Wind turbines that learn like humans

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Depending on the weather, wind turbines can face whispering breezes or gale-force gusts. Such variable conditions make extracting the maximum power from the turbines a tricky control problem, but a collaboration of Chinese researchers may have found a novel solution in human-inspired learning models.

Most turbines are designed to produce maximum allowable power once winds reach a certain speed, called the rated speed. In winds above or below the rated speed, control systems can make changes to the turbine system, such as modifying the angle of the blades or the electromagnetic torque of the generator. These changes help keep the power efficiency high in low winds and protect the turbine from damage in high winds.

Many control systems rely on complex and computationally expensive models of the turbine's behavior, but the Chinese group decided to experiment with a different approach. The researchers developed a biologically inspired control system, described in the American Institute of Physics' *Journal of Renewable and Sustainable Energy*, that used memory of past control experiences and their outcomes to generate new actions. In simulations, the controller showed initially poor results, but quickly learned how to improve, matching the performance of a more traditional control system overall.

The memory-based system is attractive because of its simplicity, the researchers write, concluding that "the human-memory-based method holds great promise for enhancing the efficiency of wind power conversion."

More information: "A Bio-inspired Approach to Enhancing Wind Power Conversion" is published in the *Journal of Renewable and Sustainable Energy.*

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