

Inventions & Innovation Project Abstract

Variable Length Wind Turbine Blade

Current wind turbine technology utilizes wind turbine blades of fixed length. Various strategies such as variable pitch, variable speed, flexible blades, and teetered rotors have been used to increase energy capture and reduce system loads. The use of variable length blades, in comparison, has a much more dramatic effect on the wind turbine's performance, efficiency, and cost effectiveness. Use of variable length blades improves the economics of wind turbines operating at any site, but particularly at low wind sites. Energy Unlimited, Inc. is developing a variable length wind turbine blade that will allow higher energy capture in low wind conditions while minimizing mechanical loads in high wind conditions.

The technology uses variable blade length to allow a larger rotor to be used on a wind turbine so that extra energy may be extracted from a given wind site. By retracting the blades, mechanical loads and electrical power can be regulated during high wind conditions. Retraction of the blades also limits the mechanical loads on the blades and other system components during high wind storm conditions in which the turbine is parked. The variable blade length is made possible because there are two parts to the blade, an inboard portion and an outboard portion. The outboard portion is mounted inside of the inboard portion and guided to be able to be telescoped relative to the inboard portion. An actuator system moves the outboard portion of the blade radially to adjust the wind turbine's rotor diameter. A PLC controller measures electrical power and retracts the outboard portion of the blade when rated power is reached or nearly reached.

A single 120 kW wind turbine produces approximately 300 MWh of electricity per year. The variable length blades are expected to increase energy capture by approximately 33% compared to commercially available fixed length blades. Therefore, each set of variable length blades will help generate approximately an additional 100 MWh of wind energy. Every MWh produced by wind displaces production that would otherwise be made by conventional processes.



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