

Why OEMs, Operators Opt for Ultracapacitors in Wind Pitch Control

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Wolfgang Beez is senior business portfolio manager wind for the group and works closely with wind operators to integrate ultracapacitor wind pitch control retrofit systems in wind farms across the globe.

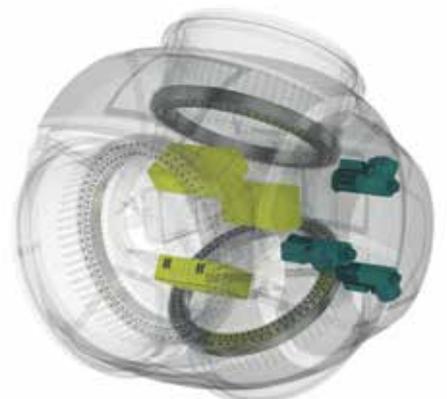
Ultracapacitors - the fast-responding, power-packed energy storage devices that have been adopted into a variety of applications and industries across the globe are the leading pitch technology used for turbines today, taking the leading share position of 43% in newly installed turbines worldwide in 2015. Batteries take 20% of electric pitch systems; the remaining 37% of turbines are hydraulic.

The wind industry is witnessing a strong trend toward ultracapacitor wind pitch systems, due to the technology's several advantages over battery-based pitch systems. An Ultracapacitor stores energy in an electric field, rather than in a chemical reaction, so it can survive hundreds of thousands more charge and discharge cycles than a battery can; it can also operate in much lower and higher temperatures since they don't contain chemicals that are susceptible to environmental conditions. Ultracapacitors are known for their special ability to provide a high surge of power—unlike batteries, they can capture and release energy quickly and efficiently.

Ultracapacitors are a critical safety part of the turbine pitch control system, managing the pitch for each blade individually and performing critical functions by “feathering” the blades to enhance the efficiency of wind energy conversion, as well as shutting down the system by pitching the blades to zero in the case of high winds or a grid failure for fail safe operation. Ultracapacitor-based wind pitch systems have earned a

reputation of contributing to reliability, increased safety and reduced overall operational cost.

Improved profitability is one of the major advantages ultracapacitor-based pitch systems have to offer. Generally speaking, the cost to replace batteries compounds over time. Operators must shut off the wind turbine for several hours to perform scheduled maintenance or to respond to



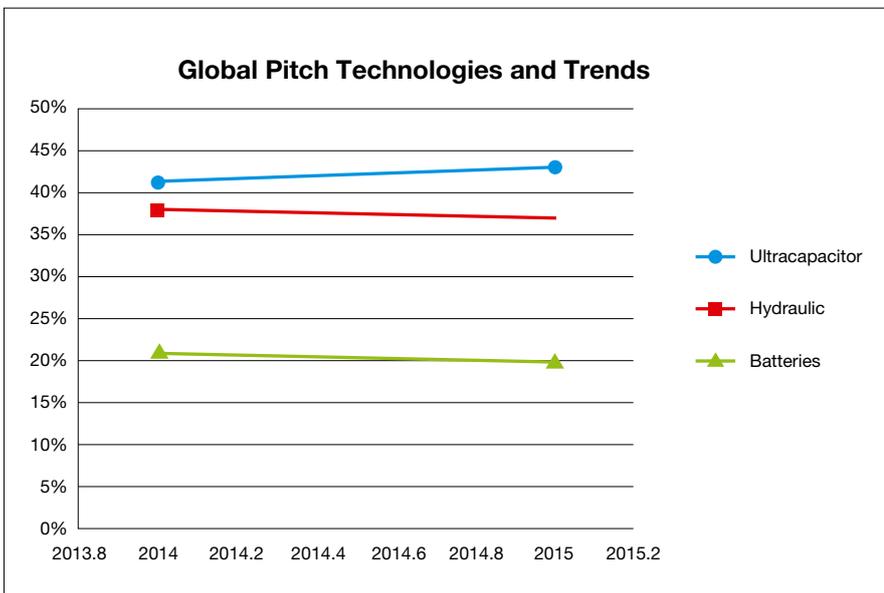


“Long life is a tremendous advantage for wind farm operators with remote turbine locations.”

unscheduled events, such as battery fault conditions, and the opportunity for energy capture is lost during this downtime. The cost of technician hours spent on maintenance is thrown in the mix, not to mention the safety risk of turbine climbs and having to transport hefty replacement batteries. It is safe to estimate that service related costs combined can easily reach and surpass \$3,000 per year and per turbine.

Ultracapacitor-based wind pitch systems require minimal, if any, maintenance due to their high cycle life and ruggedness in wider temperature ranges. Depending on operation and use, ultracapacitors could achieve 15+ years without replacement versus more frequent battery changes. Batteries generally have to be replaced every four to six years and in practicality, more frequently based on environmental conditions and as the turbines age. Some OEMs recommend replacing batteries even every three years.

Long life is a tremendous advantage for wind farm operators with remote turbine locations. Consider an offshore windfarm that is difficult, and many times dangerous, to access—fewer service trips by



“Ultracapacitors achieved an increasing market share due to their benefits”



technicians reduces risks to maintenance personnel (climbing turbines) and improves profitability for asset owners who would otherwise have to spend revenue on maintenance and replacement for battery systems, which require much more upkeep than the resilient ultracapacitor system.

Wind farm operators that retrofit existing turbines with ultracapacitor-based pitch control systems have the advantage of a drop-in replacement system that interfaces with existing EPU (Emergency Power Unit), and controls. Also, ultracapacitors don't present the issue of collateral damage that can be caused by battery acid leakage. An additional benefit to a retrofit is that ultracapacitors can be fully discharged to provide safer conditions for technicians when they are working in a turbine's confined space and could eliminate special permit requirements.

Batteries have been the standard technology for wind pitch control systems for decades, so it is refreshing to see the multiple benefits that ultracapacitors have offered over the past 17 years. Ultracapacitors have achieved an increasing market share in wind pitch control due to their ability to achieve the longest life, require minimal to no maintenance, operate in a wider operating temperature range, and provide higher

reliability for an overall lower total life cost of all other technologies currently available. For these reasons, ultracapacitors make the most business sense when purchasing new wind turbines and upgrading existing wind turbines for better performance. ■

To learn more about the 54,000-plus turbines with Maxwell Ultra capacitors, visit www.maxwell.com or contact mmarketing-emea@maxwell.com

Maxwell Technologies is the global leader and manufacturer of innovative, cost-effective energy storage and power delivery solutions. Our ultracapacitor products provide safe and reliable power solutions for various applications.

Maxwell's global organisation, deep experience and proven track record spanning over five decades, give customers the confidence that comes with dealing with an acknowledged leader, in each of the markets we serve with lines of high-reliability products.

Today, there are more than 35 million Maxwell ultracapacitor cells operating in multiple applications, including reliable wind pitch control systems in onshore and offshore wind turbines, bridge power, start-stop systems in automotive applications, regenerative braking systems for railways, and grid firming technology.

A critical element of Maxwell ultracapacitors' industry-leading cost position and unparalleled longevity and performance lies in our proprietary energy storage electrode technology. A combination of materials science and electrode formulation, along with the industrialised fabrication process, makes the Maxwell ultracapacitor one of a kind in the energy storage world.

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