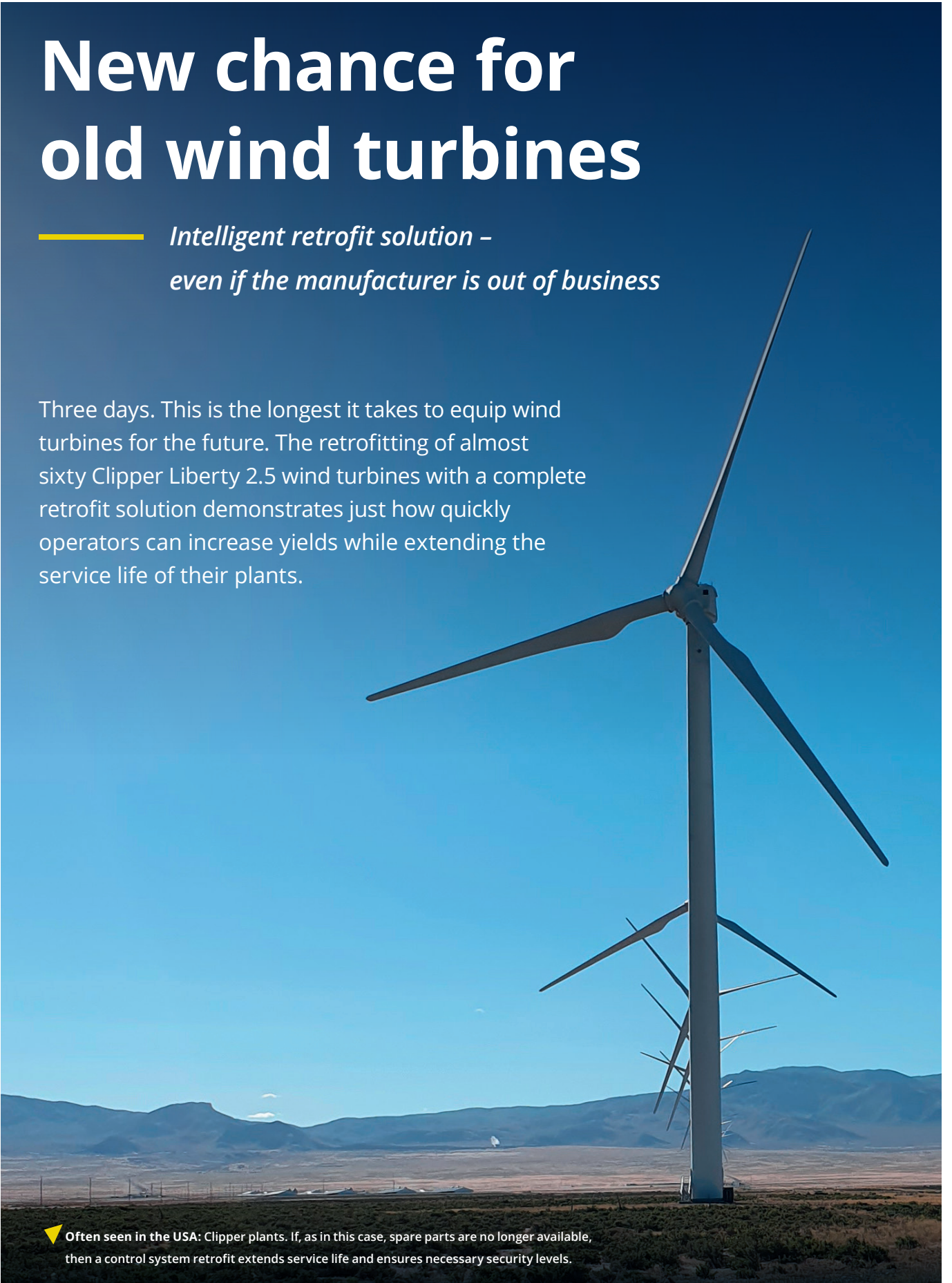


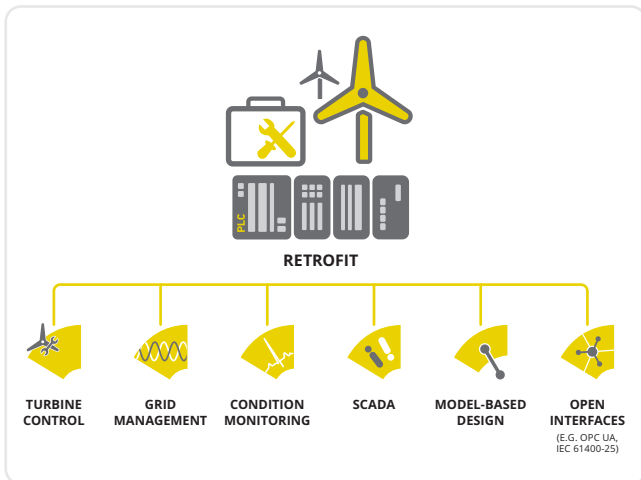
New chance for old wind turbines

*Intelligent retrofit solution –
even if the manufacturer is out of business*

Three days. This is the longest it takes to equip wind turbines for the future. The retrofitting of almost sixty Clipper Liberty 2.5 wind turbines with a complete retrofit solution demonstrates just how quickly operators can increase yields while extending the service life of their plants.

▶ Often seen in the USA: Clipper plants. If, as in this case, spare parts are no longer available, then a control system retrofit extends service life and ensures necessary security levels.





▼ Bachmann's retrofit solution is based on six pillars, ranging from the turbine to grid management and open interfaces.

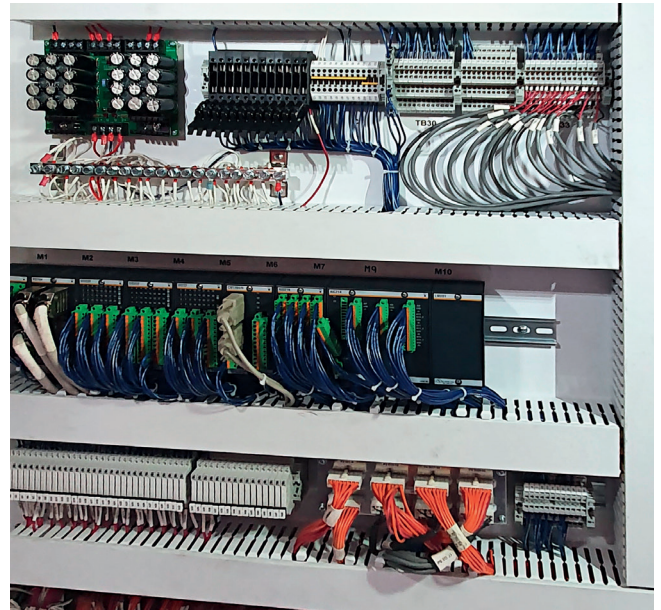
The operation of older wind turbines (WTGs) is complex and expensive: failures increase, and spare parts may no longer be available. System access and parameterization options are limited as is adapting software to different types of spare parts, such as sensors. Optimizing operations is difficult, resulting in rising operating costs and declining revenues. Bachmann's complete retrofit solution is the answer.

Extended lifetime

Bachmann equipped 58 2.5 MW Clipper plants with a new, modular turbine controller. The turbines themselves are state-of-the-art but spare parts are no longer available due to manufacturer insolvency. The new control system facilitates longer service life. At the same time, spare part availability is secured for years to come. In addition, the solution enables the adjustment of turbine parameters, for example to reduce load on the turbine as it ages.

Higher transparency, lower downtime

The software has also been updated to the latest technology: M1 WebMI pro provides efficient, on-site turbine visualizations via any web browser, and Wind Power SCADA allows remote web-based turbine control and monitoring. Speed, pitch and power set-point can be easily adjusted according to current wind loads and matched with grid capacity via the Smart Power Plant Controller. Furthermore, the wind tracking system and rotor brake can be manually controlled. Remote reset and self-start routines automatically restart turbine operations following any malfunctions.



▼ Thanks to the fully prepared, 1x1 m "swing panels", the retrofit solution is installed in no time at all. This ensures a safe, reproducible rollout of all systems.

Manageable maintenance

A fully integrated Condition Monitoring System for the entire drivetrain improves predictions about future turbine condition and optimizes O&M strategies. Visits to the site are thereby reduced. Transparent engineering tools improve efficiency during maintenance.

Rapid implementation

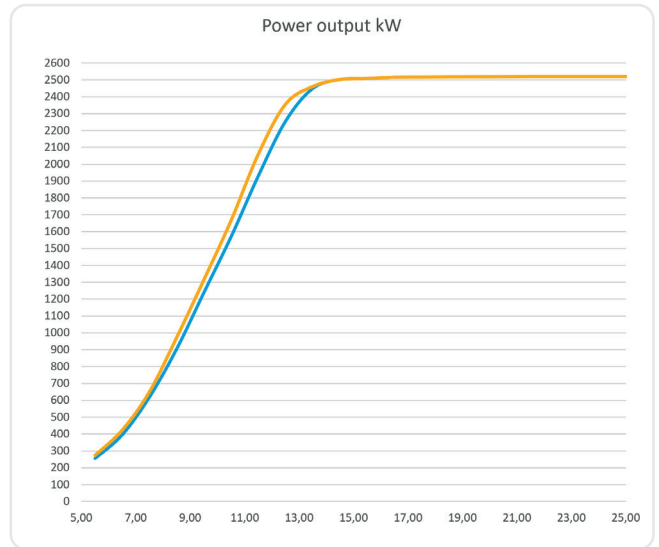
Installation and commissioning of the Clipper retrofits was completed in less than 72 hours. The pre-prepared control cabinet panels are partly to thank, facilitating a simple plug and play installation. This ensures a secure rollout of all turbines that can be implemented with minimal downtime. An intelligent installation app supports the install team with a quick, reliable implementation. Technicians are guided step by step through the installation and commissioning process, at the same time documenting their progress and creating an acceptance protocol.

Sensors provide important data

Low-cost 2D MEMS sensors are often used in a retrofit. The transducers can detect movements in two dimensions. They precisely measure vibrations, inclinations, and accelerations to enable accurate monitoring of turbine operation. By using 2D MEMS sensors, wind turbine operators can collect important data to plan maintenance work, prevent breakdowns and extend the service life of the turbines. Furthermore, the use of additional sensors, which can be positioned at different levels within



▼ A cost-effective 2D MEMS acceleration sensor provides the vibration data in the most basic configuration. Furthermore, the use of additional sensors, which can be positioned at different levels within the load-bearing structure (tower, transition piece, and foundation), enables an even more detailed evaluation.



▼ **3% more yield:** The intelligent control algorithms behind the retrofit solution take the current condition of rotor blades into account. This increases the tip speed ratio (TSR). The result: up to 3% increase in annual energy production.

the supporting structure (tower, transition piece and foundation), enables an even more detailed assessment of the condition of the wind turbine.

Ready for the future

The efficient retrofit solution ensures the productive and fully compliant operation of existing wind turbines for many more years. Thanks to the flexible hardware concept, operators can expand the controller functions whenever they choose: Additional I/O channels are available, for example, for the integration of more sensors to realize sophisticated control algorithms and further optimize the power curve.



FIND OUT MORE

Turbine Retrofit



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