Pulling much more than its own weight

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Newly developed ground-based winch system shortens the amount of time needed to replace large components

When a large component of a wind turbine fails, the operator often has no other choice but to have the damaged component replaced. This often involves a considerable amount of organisational work and financial expense – not just for the spare part itself but also for the logistics and infrastructure required to carry out the replacement.

The loss of income due to system downtime also has a significant impact. The service provider GFW, a subsidiary of Deutsche Windtechnik, has developed a new ground-based winch system (GBWS for short) for replacing large components that can save tens or even hundreds of thousands of euros.

Using the laws of nature for specific purposes

The GBWS's intelligent system of pulling and weight mechanisms makes the use of large cranes and the modification of local infrastructure that goes along with it unnecessary. The heart of the GBWS consists of load winches, support winches, support frames, counterweights and a control system. After the support frame has been securely set up on a suitable surface, the load ropes are pulled to the hub of the wind turbine.

Depending on the type of large component that needs to be replaced, clamping devices, guides/pulleys or transport devices are then installed. When the work was carried out the first time, two clamping beams were fixed to the rotor blade and the blade bearing attachment was detached from the rotor. The rotor blade was then lowered and safely placed on a blade support located outside of the danger area. The procedure has a decisive advantage:

The system is installed freely on the ground without any other connection to the wind turbine, so the rotor blades can be detached from the rotor hub at a precise angle of attack. Since the winches are not changed or moved while the blade bearing is being replaced, the load application points and the mounting angle remain the same and reassembly can take place immediately.

Drastic cost savings proven in practice

Jürgen Fuhrländer, Managing Director of GFW, sees the benefits confirmed by these first practical applications: 'The projects show that the final cost savings can be in the five to six-digit range.' This sounds like an attractive alternative for the operator. So, what is the main difference between this system and conventional methods for (dis) assembling large components? The budget for this type of work can be broken down into four main cost blocks: machines and equipment, infrastructure, personnel, and lost earnings.

Cost block: machines and equipment

The need for a large crane is a particularly expensive factor in the conventional method. The cranes usually used for service work on wind turbines with hub heights of up

to 150 meters and blade lengths of up to 60 meters are in the 1,000 to 1,500-tonne range. Route planning and transport permission, which include heavy transport, frames, qualified personnel, putting into and taking out of operation, already costs somewhere between 80,000 and 100,000 euros. In addition, workdays on site cost approximately 8,000 to 12,000 euros.

This means the operator can avoid costs for transport to and from the site, costs for putting the crane into and taking it out of operation and operating costs that add up to more than 100,000 euros. In addition, lost workdays for large cranes (for example due to strong winds) are much more expensive than corresponding lost workdays for the GBWS and the specialist personnel needed to operate it.

Cost block: infrastructure

Using a conventional large crane goes hand in hand with creating the necessary local infrastructure. The space-saving structure of the GBWS only requires a level patch of ground approximately 8x8 meters somewhere close to the wind turbine. The pre-assembled GBWS is transported using an EU-standardised articulated lorry. The expansion of access roads and the blocking of parts of roads for heavy transport that are often associated with the use of large cranes are no longer required. The same goes for the necessary agreements and possible compensation for residents in the vicinity of the wind farm. The amount saved strongly depends on the project, so the actual numbers can vary.

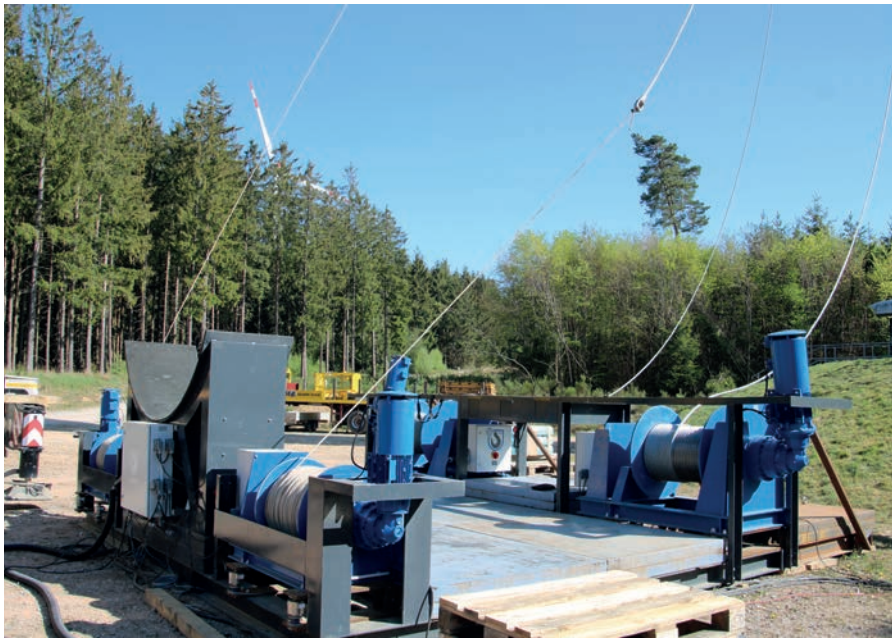
Cost block: personnel costs

Personnel costs are an often neglected item in budget calculations. Some of the main items in this cost block include personnel hours for locating a suitable large crane and the time-consuming paperwork that needs to be completed. The fact that large cranes are not always available also incurs personnel costs.

The amount depends on the individual project and the individual hourly wages. Since the GBWS was developed in-house, it is always available and can be mobilised immediately. Using it requires only a few documentation processes, and no special permits are needed. The number of employees involved drops significantly.

Cost block: lost earnings

Every day of downtime for the wind turbine means high loss of earnings for the operator. The rapid availability of the GBWS is an unbeatable advantage, especially when damage has already occurred. The GBWS



The GBWS support frame can be used immediately thanks to pre-assembly

The rotor blade is lowered safely using clamping beams and winches

The rotor blade is safely placed on the blade support using the GBWS

can also be used in critical wind conditions of up to 12 m/s, which means that downtimes can even be reduced considerably at higher wind speeds. Every day of downtime means lost production earnings for the operator of approximately 5,000 euros. Time really is money!

Comparative calculations confirm savings

The comparative calculation of the first projects carried out using the GBWS during the first half of 2020 is interesting. Jürgen Fuhrländer said: 'Potential customers are of course initially sceptical as to whether the savings are really that significant. We also wanted to know whether we did the calculation correctly. For this reason, we set up a comparative budget that assumes repairs would be carried out using a conventional large crane. It enables us to show quite clearly which amounts were saved in which areas.'

Safety is not sacrificed to save money

Despite all the financial advantages, the safety of the personnel and the wind turbine components is a top priority for Jürgen Fuhrländer. Using the GBWS requires in-depth knowledge of static and dynamic conditions as well as complete trust in the actions of the colleagues involved. This means that activities such as operating the GBWS and determining where to place the attachment and pull points are exclusively the domain of the team of specialists who have been trained specifically for this purpose.

Not one single step in the process is left to chance: they verify the technical details of the corresponding component and correct them if necessary. Since the load application points stay the same, the component can be brought back up to the hub of the wind turbine without the risk of material damage.

Further development for other components

The GBWS is not limited to replacing blade bearings. Generators have also recently been successfully replaced using the same principle. The system can be adapted for use with any component by making targeted modifications to it. GFW / Deutsche Windtechnik are currently in the process of patenting the ground-based winch system.

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Image credits Deutsche Windtechnik AG

Ground-based winch system successful in practical application

The pros and cons of an innovative pull rope system

Stillger & Stahl Vermögensverwaltung GbR has been advising investors on the topic of renewable energy for over 20 years. When trying to find cost-effective alternative methods for replacing blade bearings on several Kenersys K110 turbines, the company made the decision to use the ground-based winch system (GBWS). The system, which was developed by GFW, would now be tested in a practical setting for the first time. A greater risk or a calculated move? Björn Lahnstein, Project Manager at Stillger & Stahl, talked to PES about his experiences.

PES: Why did you decide to use the innovative GBWS to replace the blade bearings for the first time?

Björn Lahnstein: First and foremost, it was the openness and transparency of the whole GFW team. Thanks to that, we understood from the beginning that more practical experience would be needed. That was also evident in their attractive, detailed offer, which turned out to be almost identical to the final bill. In addition, the work was not outsourced. Instead, all tasks were carried out by the team of specialists themselves. That was important to us!

PES: We were wondering if you ran into any unforeseen events?

BL: During implementation, we realised that the technical data for the rotor blades was quite different from reality in some cases. Essential static calculations had to be corrected in these cases by the team on site. In addition, we also found that the schedule set for implementation proved to be overly ambitious. Both these factors caused a slight delay in the whole blade bearing replacement process. Ultimately, however, everyone involved worked intensively together to get the project completed quickly. Overall, we are very satisfied with how the project went.

PES: What would you say contributed to the positive outcome?

BL: We were able to get by without using a large crane. In addition to avoiding the crane-specific costs, this meant we were also able to avoid the cost of expanding local infrastructure, coordinating with residents and obtaining bureaucratic authorisations. This allowed many work steps to be skipped, so we were able to begin earlier. This is also ultimately reflected in the project costing, which was significantly higher without the GBWS.