

More knowledge means higher yield

The innovative sensors of a young Munich company show in detail what forces are pulling at a wind turbine. This extends its service life, reduces operating costs and even increases the energy yield.

The ascent to the wind turbine is 140 meters long. Peter Stähler takes him step by step, on an iron ladder the engineer climbs steeply up to the sky. After 20 strenuous minutes an intermediate goal: Stähler reaches the gondola house of the 3 MW plant. It is twelve meters long and contains a huge generator that converts movement into electrical energy. But Stähler must go on, his goal is the rotor blades. He will climb into them and attach what he brought from his Munich office: sensitive sensors that register every movement on the almost 70-meter long rotor blades. They provide a precise overview of the forces acting on the wind turbine. For the operators, it is an opportunity to generate significantly more electricity with their wind turbine.

No fear of lightning strikes

Peter Stähler works at fos4X, the developer of these sensors. Unlike most sensors, they work with light using so-called fiber optics. This is why there is no current flowing in the lines, but light. Therefore, these sensors can be mounted directly inside the rotor blade without lightning protection. Conventional sensors with their electronics would literally attract lightning strikes in the exposed wind turbines. Up to now, most wind turbines have been installed in the rotor blades without sensors.

When Stähler finally arrives, he feels the wind pulling at the rotor. "You have to be seaworthy," says the 35-year-old. Then he moves 25 meters from the hub into the blade, at the end it only works on all fours. Stähler feels exactly how gusts pull on the rotor - although the system is switched off. Nevertheless, the turbine is at the mercy of the forces of nature, there is a lot of raging and whistling up here. Stähler carefully sticks four sensors in each rotor blade, then he can descend again.

With the data, which the measuring device now supplies from the rotor, the software of fos4X calculates the exact condition of the wind turbine. Depending on how the material of the rotor expands and swings, it is possible to calculate which force acts at which point of the huge device. Then the pitch angle of the rotor blade is changed accordingly. "During one rotation there is a different wind at the lowest point of the rotor than at the top," says Peter Stähler.

Perfect control of the rotor blades

200 or 70 meters above ground - that means completely different wind conditions. For an optimal yield, however, the wind pressure would have to be evenly distributed at every point of the rotor. "With the aid of the measurements, the system control can change the pitch angle of the blades in such a way that the same wind pressure is applied to the rotor throughout the entire rotation," Stähler explains the process known as Individual Pitch Control. This means that the system runs much more quietly and supplies more power.

Another benefit of accurate measurement results of a wind turbine is its longer service life. The apps of fos4X show in detail how much the wind turbine is subjected to. This allows conclusions to be drawn about material wear. If the system was exposed to less extreme

loads, it could run even longer than calculated at the beginning. This additional time is cash money for the operators. The investment in sensors and measuring technology therefore pays off after just a few years, says Stähler when he returns to the ground.