



Increasing availability
and reliability



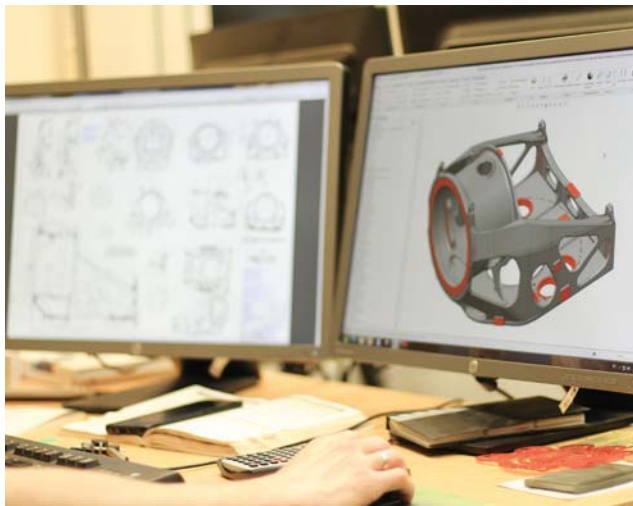
User Article: Insulation monitors
in wind turbines

The generation of electric energy in wind turbines is a major element on the way to the energy transition aspired. Its goal is to reduce the emission of greenhouse gases to stop global warming. The availability of a wind turbine is decisive for its economic operation. It can be increased by comparatively simple measures in the electrical system while improving fire protection at the same time. Insulation monitors by Dold play a major role in this respect.

If the nacelle of a wind turbine catches fire, this usually ends with the total loss of a turbine. For a simple reason: The turbines are rising higher and higher, and with hub heights of far beyond 100 meters, they are simply out of reach of fire brigades. Controlled burning is usually the only option. The fire brigade must concentrate on reducing the danger caused by burning parts falling down. Apart from the material damage, which usually is covered by an insurance, a fire often adversely affects the image of the manufacturer and operator. For this reason, the prevention of fires is even more important. Lightnings and faults in the electrotechnical system are the most common causes of fires. This is why turbine manufacturers such as W2E Wind to Energy GmbH from Rostock count on comprehensive safety systems, as managing director Dr. Torsten Schütt explains: Especially in terms of the safeguarding of the electrotechnical installation at the generator and converter, a lot can be achieved by suitable measures.

Holistic concept for wind turbines

In 2003, W2E was founded as an engineering office for the development and design of wind turbines. With its 20 employees, the company is active worldwide today. "We develop and design the wind turbines for our customers in a holistic way - from mechanical design and the dimensioning of rotor, tower, converter and power train up to the creation of part lists, drawings, software, calculations as well as production and maintenance manuals", Schütt explains the concept. The range of services also includes customer trainings. W2E has planned and installed wind turbines with a total power of more than 1,000 MW worldwide. The power of the individual turbines ranges from 2 MW to 9 MW. Apart from wind turbines in numerous Western European countries, W2E has projects in China, India, Ukraine, Turkey and Iran as well as prospective business in the Middle East.



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Wind turbines planned by W2E are installed in the USA, Europe, and Asia. Erected in 2006, the W2E-2.5/90 with its 160 m high lattice tower was the highest turbine of the world for 10 years.

In all areas, safety is an important aspect for the planners. When it comes to electrotechnical installation, they pay particular attention to the network between generator, converter and transformer that is in charge of the transformation to medium voltage required for the feeding. In this area, either an earthed TN-S network or an unearthed IT network can be used. In both cases, the network should be monitored for insulation errors. With earthed networks, this is performed by a fault current monitoring that separates the voltage source in case of a fault. Short circuits, on the other hand, are separated by circuit breakers. The disadvantage of this configuration: If the circuit breaker trips, the turbine comes to a standstill, and these faults naturally involve a loss of earnings. In order to detect a gradual deterioration of the insulation, it is possible to implement a residual current monitoring detecting the deterioration of the insulation level before a stillstand of the plant occurs. Then, the service staff can interfere before a possible failure and prevent the fire hazard by high residual currents.



Wind park with 25 turbines of the type W2E-2.5/100 in Kazanlak (Bulgaria)

Monitoring IT networks

When operating an IT network, this hazard does not exist for the moment, as a first insulation fault between the external conductor and the earth just represents an earthing of this conductor. As no active conductor is connected to the earth, no short circuit current flows in case of a dielectric breakdown fault or an earth fault. The only consequence is a low residual current whose size depends on the insulation resistors and the capacity of the conductors and system components. The low current flow does not involve any fire hazard. The big advantage of this so-called single error safety is the fact that the operation of the system can be continued for a certain period of time. In case of wind turbines, this feature especially prevents potential loss of earnings. As such insulation faults are not automatically detected, insulation monitors should always be provided in these networks. "As a young engineer in the 1990s, I was made aware of the importance of monitoring - both in earthed and unearthed networks - by a surveyor after a fire in a wind turbine", Schütt recalls his early days in the industry.

W2E almost always plans new turbines with IT networks, as generators and converters are usually designed like that. For insulation monitoring in the 690-V grid the planners apply insulation monitors of the type RN 5897 from the series VARIMETER IMD by Dold. The insulation monitor offers an alert threshold and an early warning threshold that can be set independent of each other. An integrated LCD display shows the current insulation value. The device has two signal relays that can output the triggering of the early warning and of the alarm, e.g. to a higher-level control system. The front of the insulation monitor is protected from manipulation by a sealable transparent cover.

Connection to the PLC

The message outputs of the insulation monitor are read out from the PLC of the turbine that can react accordingly. "In case of an alarm, the service is informed and can take a first look at the exact status of the turbine online", Schütt describes the procedure. "After that, it can be decided how urgently a member of the service unit has to travel to the turbine to rectify the fault on site." In case of an insulation fault, the wind turbine can continue to operate for another eight hours - a significant advantage of the combination of the IT network and the insulation monitor. Furthermore, in case of a fault high currents or electric arcs that may ultimately cause a fire can be avoided. Schütt is very happy with the insulation monitors from Dold: "In the end, they perfectly fulfil their function, and they offer us a perfect price-performance ratio."



Insulation monitor of the type RN 5897 from the VARIMETER IMD series by Dold in the control cabinet of a current wind turbine.



Dr. Torsten Schütt, managing director of W2E: "We usually plan the electrotechnical system with IT networks applying insulation monitors from Dold."