



Inspecting wind turbines with FLIR thermal imaging cameras

Energy harvested from the wind through wind turbines is one of the most common forms of renewable energy. To that end new wind turbines are installed every year all over Europe and even all over the world. But all of these wind turbines have to be monitored and maintained. FLIR thermal imaging cameras can play an important role in the wind turbine predictive maintenance programs.



A thermal image of a wind turbine taken from ground level

Thermal imaging cameras from FLIR systems are used to inspect electrical and mechanical installations all over the world. The thermal data gathered help to prevent dangerous accidents and costly downtime. All critical components of a wind turbine can be monitored using a thermal imaging camera from FLIR Systems.

Accidents

Wind turbines incorporate many different electrical and mechanical components. Like all other equipment these components are susceptible to wear and can break down. This can cause not only costly downtime, but dangerous accidents as well.

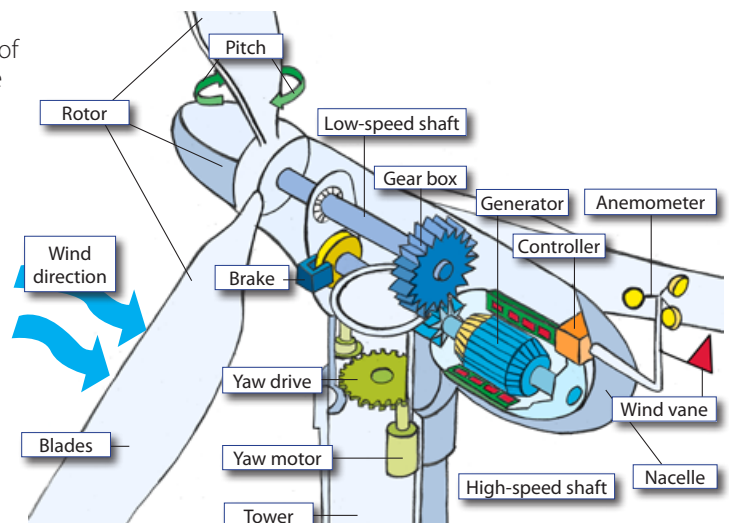
A common cause for these accidents is a failure in either the brake mechanism or in the gearbox. The gearbox and the brakes prevent the blades from turning too quickly. If either of these components fails then the turbine is allowed to revolve at many times

its normal speed, which imposes loads on the blades well in excess of what they were designed for.

Life-threatening

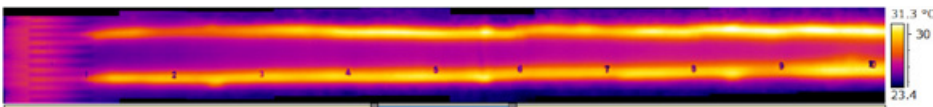
In such a case the tips of a rotor blade could be travelling at hundreds kilometers an hour, and when a blade or a piece of a blade suddenly detaches from the rotor it can have an enormous amount of kinetic energy and momentum as it is hurled away. This can lead to life-threatening accidents. There are many instances where large sections of broken blade

have been found tens of kilometers or even farther from the turbine they had broken off from.



Schematic overview of wind turbine components.





Using a method called flash thermography you can scan wind turbine rotors for damage in the composite material

Inspections with thermal imaging cameras can help prevent such accidents. Both for electrical and mechanical components the general rule is that a component will become hot before it fails. Thermal imaging cameras can be used to spot this rise in temperature before a failure occurs. These hot spots will show up clearly in the thermal image.

Thermal imaging helps you 'see' the problem. Where other technologies tell you whether there is a problem with the entire machine, thermal imaging cameras will show you exactly which component is causing the problem. Reliable, quick and efficient: thermal imaging can be used to spot signs of wear on bearings, shafts, gears and brakes, allowing you to repair or replace components before failures occur.

Check the entire system

Thermal imaging cameras can be used to inspect the electrical components such as transformers, connectors, controllers yaw motors and such. Thermal imaging is the only technology that allows you to inspect all electrical and mechanical components of the wind turbine and of the surrounding electrical system.

FLIR thermal imaging camera: the perfect tool

Wind turbine maintenance crews all over the world rely on thermal imaging cameras. An important factor in usability in the field is the camera design. All FLIR cameras are as compact as possible, ergonomically designed and easy to use, which is very important if you have to climb tens of meters to get to the wind turbine you are to inspect.

Another important factor is the lens. FLIR Systems offers optional 45° and 90° wide angle lenses. This allows you to capture large pieces of equipment in one go, even when you're up close. The fact that you can't take a step back when you're up high inspecting a wind turbine makes this a very important feature.

FLIR Systems offers a full range of thermal imaging cameras for predictive maintenance inspections. From the compact entrance model i3, through the practical T-Series to the advanced P660, FLIR Systems has exactly the right type of camera for each application.



This huge 12 ton gearbox and disk brake assembly is lifted with a crane to a height of 60 meters to be mounted in this wind turbine nacelle.

More than Predictive Maintenance alone

Thermal imaging cameras can do more than just predictive maintenance inspections alone. FLIR Systems also offers cooled thermal imaging cameras for research and development applications. These cooled cameras can be used to spot damage in the rotor blades' composite material structure.

As established earlier broken rotor blades can cause dangerous or even life-threatening situations. By using thermal imaging cameras you can make sure this doesn't happen. You can find out which blades need to be replaced before failures occur or accidents happen.

Pulse thermography

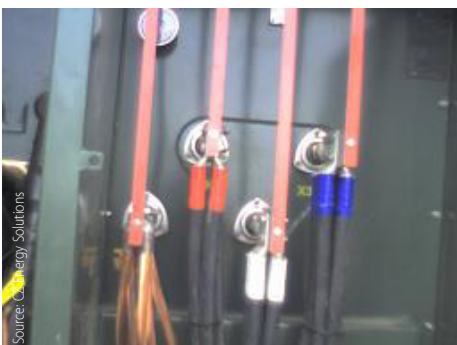
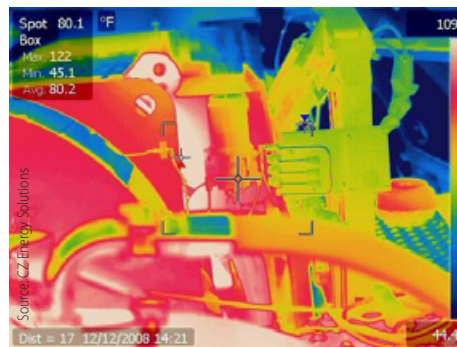
To detect delamination and micro-fractures in composite materials with FLIR thermal imaging cameras a method called pulse thermography is often employed. The composite material is excited with the use of a lamp. The thermal imaging camera is then used to monitor the thermal distribution through the material. Differences in the speed at which parts of the rotor blade heat up or cool down indicate damage.

FLIR has the right camera for you

Whether your aim is to perform predictive maintenance inspections on wind turbines or to check the composite material of the rotor blades, thermal imaging cameras are the right tool for the job. FLIR Systems offers a wide range of thermal imaging cameras, so you can be certain that FLIR Systems has exactly the right camera for your application.



A thermal imaging wind turbine transmission survey. This survey was performed at a height of around 50 meters.



Thermal imaging cameras can be used to scan the entire system surrounding the wind turbines as well. One of these three phase connectors, the rightmost one, is much warmer than the rest. This defect was spotted and was repaired before a failure occurred.



For more information about thermal imaging cameras or about this application, please contact:

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