Jesús Mayor
Ingeteam Wind Managing Director under the spotlight

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DNV GL Renewables Certification – the life of turbines

Ton Bos
CEO Mega Wind Force on new wind turbines

Anne Schipper BSc
Bosch & Van Rijn talks about Virtual Reality

WIND

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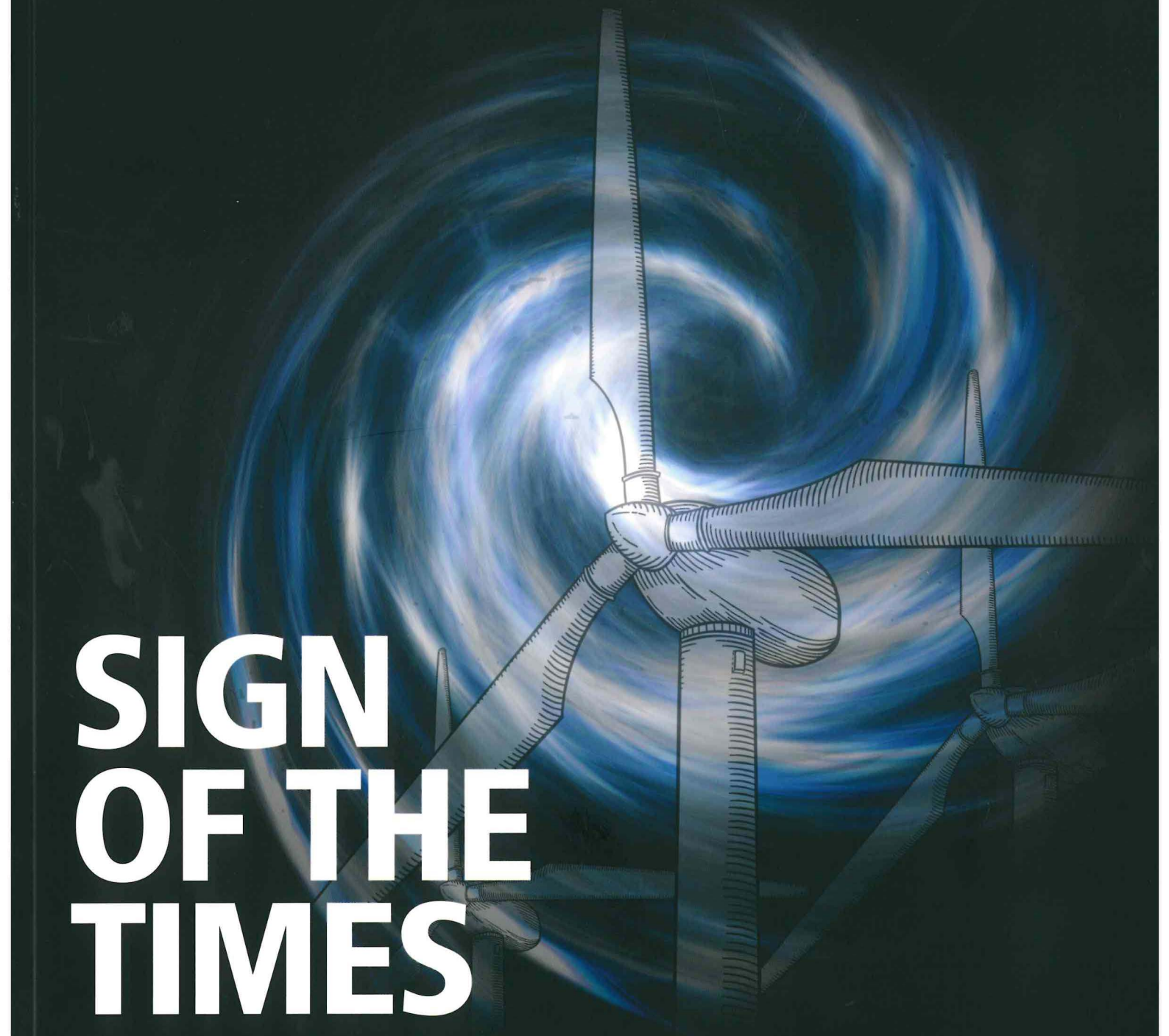
POWER AND ENERGY SOLUTIONS • ISSUE 1, 2016



SIGN OF THE TIMES

The long term prospect is good for offshore wind. We look forward to 2020.

Made to measure or off the shelf?

Wind farm

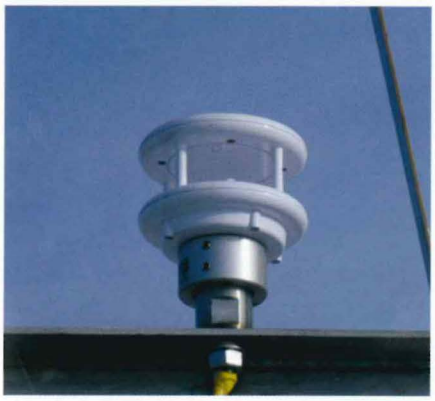
Klaus Hirzel, CEO at Lufft Mess- und Regeltechnik GmbH, questions why turbine manufacturers have never asked suppliers for their ideal set of environmental sensors....

Taller, more extreme, more reliable: in parallel with the increasing requirements on wind turbines, the demands on wind sensors for the monitoring and maintenance of the systems are also on the rise. But how can wind sensor manufacturers meet these needs? And what are the requirements for the wind sensors of the future anyway? On the basis of the current framework conditions and trends in the wind energy market, the environmental sensor manufacturer Lufft has compiled a wish list for the wind sensors of the future.

Framework Conditions

In recent years, more than 200,000 wind turbines have been installed around the world in connection with the energy transition. Meanwhile, China is the largest market, followed by the USA, Japan, the United Kingdom, India and Germany. The market for renewable energies will continue to grow globally in the coming years.

"The sensor technologies (radar, ultrasonic, laser etc.) must offer long-term stability, ideally without drift"



Lufft V200A ultrasonic wind sensor on Dongfang wind turbine in China

The risks for the installations are increasing: ever taller, ever more extreme. Developers of wind turbines are already dreaming of generating wind production without turbulent flow at heights where only laminar flow prevails. The "extreme" in this application refers to both cold-climate installations as well as offshore applications in high saline environments.

The turbines have to operate trouble-free for very long periods. Unscheduled maintenance, in particular, is complex and expensive. Users and investors expect a guaranteed service life of over 10 years in conjunction with guaranteed energy harvesting. The thinking of the manufacturers thus revolves not only around proactive maintenance (too early and possibly unnecessary), but is already also concerned with "predictive maintenance" and "reliability centered maintenance".

The environmental conditions are not only tough; they will also be characterized in future by more extreme weather (storms). Similar to the stock market, the "volatility" of the weather is increasing. Timely switch-off and positional adjustments for the turbine are becoming more important. Ultrasonic wind sensors today can measure wind speeds of up to 300 km/h. Detecting the first signs of icing on the blade tips at near sonic velocity remains a challenge for measurement technology.

Environmental Information

More than 50% of the wind sensors installed on turbines still operate with mechanical moving parts (dynamic sensors). By contrast, ultrasound technology (static with no moving parts), which has an extremely fast response (reaction) time, is used on modern turbines.

In very few cases, the measurement of this important variable is "redundant". However, a defective wind sensor results in the loss of energy harvesting; hence the manufacturers demand an extremely high availability of 99.99%.

In many cases manufacturers who plan redundant versions in the technical design quite often use the same sensor. Due to the fact that identical sensors generally demonstrate exactly the same behavior under identical conditions, when icing problems occur both sensors will cease to provide data at the same time.

In this respect, hybrid applications make sense, where either two ultrasonic sensors from different manufacturers are used or an ultrasonic sensor is combined with a dynamic sensor. With two different measurement methods, in case of icing it is unlikely that both sensors will temporarily fail at the same time.

For the timely positional adjustment of the turbine, measuring the wind "behind the blades" is too late. The understandable desire is to measure the wind at a distance of up to 2 km upstream of the turbine and thus always position the turbine correctly in the wind.

Icing sensors are needed to protect the turbine blades against imbalance and destabilization. Icing often starts at the blade tips. Direct detection is the safest method. In today's systems, the risk of icing at these points is not usually measured.

Visibility sensors are necessary for navigation lighting. Optical methods with forward scattered light are used. The disadvantage of this method is that the sensors are not maintenance-free. Precipitation (intensity) and air pressure are further data that are optionally required for the complete recording of environmental conditions.

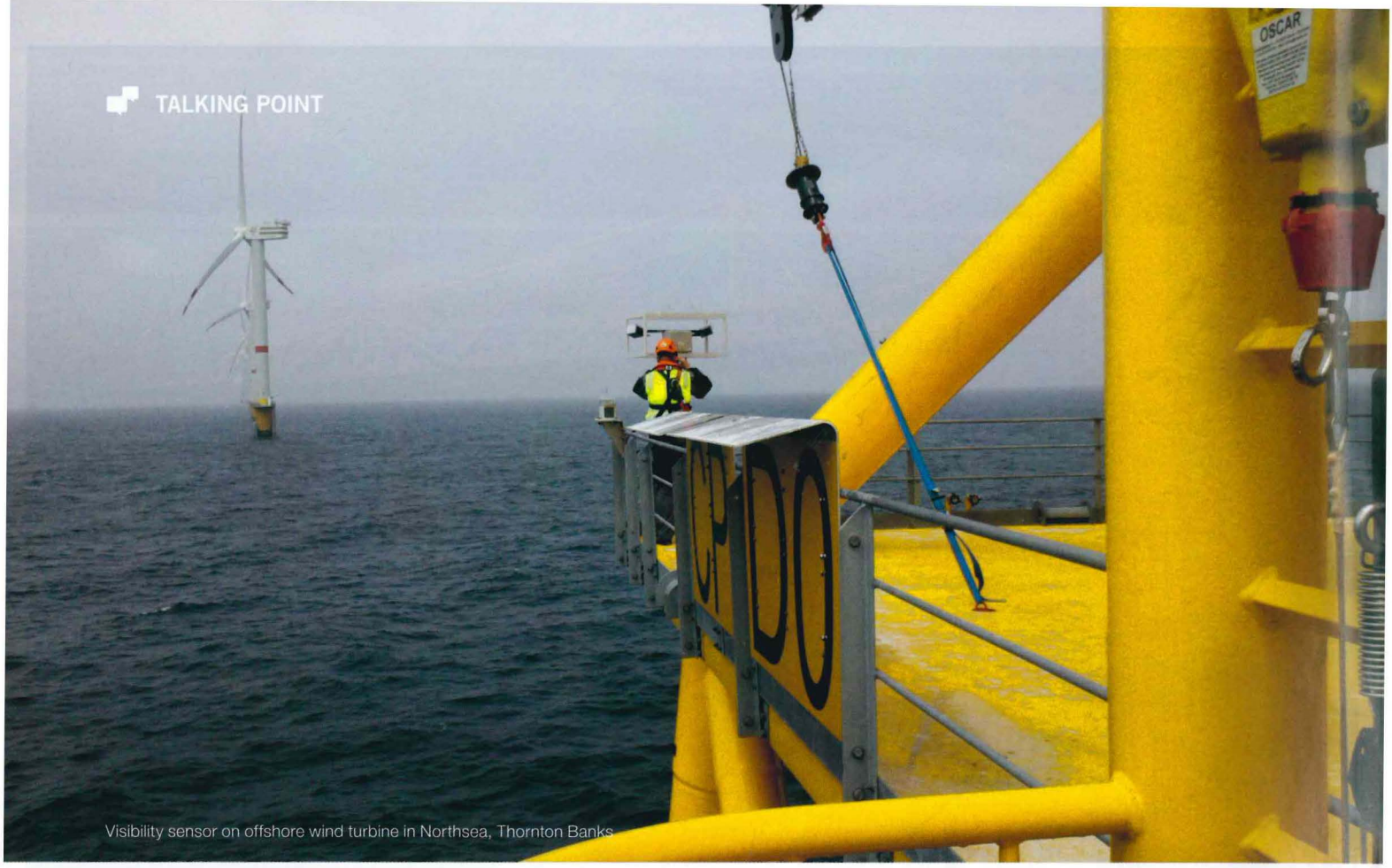
Product Requirements

With regard to the housing construction, the following applies: no plastic! Seawater-proof aluminum, corrosion-resistant - nothing else works in the long term. Vibration tests are essential before turbine testing can take place.

The sensor technologies (radar, ultrasonic, laser etc.) must offer long-term stability, ideally without drift. Sensor manufacturers provide users with this information on request; standard data sheets only contain this important information in exceptional cases.

Accuracies must be confirmed by means of laboratory calibration. A single calibration point is not usually enough, as sensors very rarely behave in a completely linear manner. A qualified manufacturer's certificate therefore contains various measurement comparisons over the entire extent of the measurement range.

The sensor system must be capable of quick and easy integration into multiple controller environments and have an open (standard) protocol. By means of the built-in microprocessor, parameterization, diagnostics and measurement queries today are very straightforward.

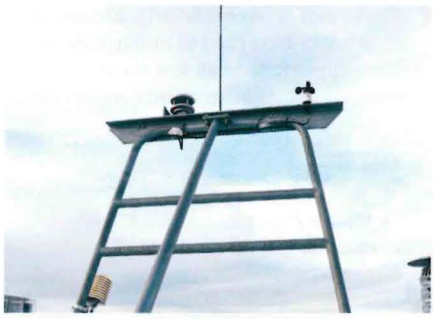


Visibility sensor on offshore wind turbine in Northsea, Thornton Banks

Maintenance of the Environmental Sensor System

The conventional concept of reactive maintenance (upon failure) is not adequate for the wind energy industry. The service and replacement costs are too high, while the downtime of the turbine is not acceptable.

Is proactive maintenance appropriate? In many cases, preventive replacement of the wind sensor takes place, for example after five years. However, MTBF (Mean Time before Failure) tests by the manufacturers show that such a sensor will operate reliably for more than 10 years. In this case, therefore, too much money is spent for security purposes.



Wind Park in Rivière au Renard monitored by Lufft VENTUS ultrasonic wind sensor

The concept of predictive maintenance works ideally, provided that the sensor has diagnostic capabilities. Or if, in combination with the other environmental sensors on the turbine, the controller detects that one of the sensors is due for replacement.

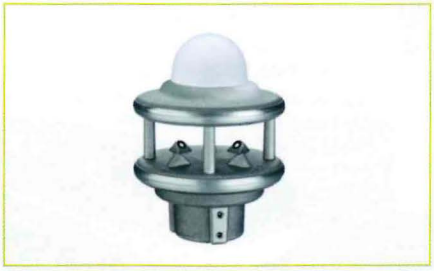
This is an ideal case for the application of the so-called Industry 4.0, where smart sensors negotiate with smart controllers the ideal point of time for replacement.

A further approach to intelligent timely maintenance is the concept of "reliability-centered maintenance". All these maintenance concepts require a loss of stability of the sensor to be detected in time.

Summary

To date, there is still no specific sensor family on the market that was designed exclusively for turbine applications. Many wind sensors, for instance from meteorological or military applications, were applied and their design improved in order to meet the requirements as closely as possible.

Why have turbine manufacturers never actually called for their ideal set of environmental sensors from the manufacturers qualified to provide this? The annual quantities support this requirement. The result would be "smart, modular and price-compliant". ■



VENTUS combined with radar precipitation sensor – future of wind measurement technology?

For more information please visit
www.lufft.com

About the Company

G. Lufft Mess- und Regeltechnik GmbH:

Since its founding by Gotthilf Lufft in 1881, G. Lufft GmbH has been the leader in the production of climatological measuring equipment – always with the motto "tradition meets innovation".

Lufft's capacity for innovation and precision has helped its products establish the solid reputation they enjoy around the world.

The company's products can be found in use wherever variables such as air pressure, temperature, relative humidity and other environmental factors need to be measured.

Together with its subsidiaries in the U.S. and in China, the company has 100 employees.

In November 2012, G. Lufft GmbH was awarded the German Standards Brand Prize and was named a "Brand of the Century".

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