ip INNOVATIVE PROJECTS for the German wind market

The following pages are dedicated to companies whose new products, processes or methods ensure the continued development of the wind industry.

An excerpt of the BWE Industry Report **‚Wind Industry in Germany 2022'**

Photo: ENERTRAG Betrieb (Silke Reents)

ECOZINS: CAPITAL FOR THE ENERGY TRANSITION

The energy transition is clean, decentralised, and participatory – it provides responsible investors with sustainable investment opportunities in projects with attractive returns and socio-ecological added value.

As a young and dynamic FinTech company from Marburg, we want to drive the energy transition forward and rethink funding. Our core task is to match sustainable projects in the fields of renewable energies, e-mobility, and energy efficiency with responsible investors. We are developing the relevant technical solutions to achieve this and are advocating more sustainable financial awareness, because sustainable actions are necessary to preserve our planet for future generations.

Increasing access to investments in renewable energies

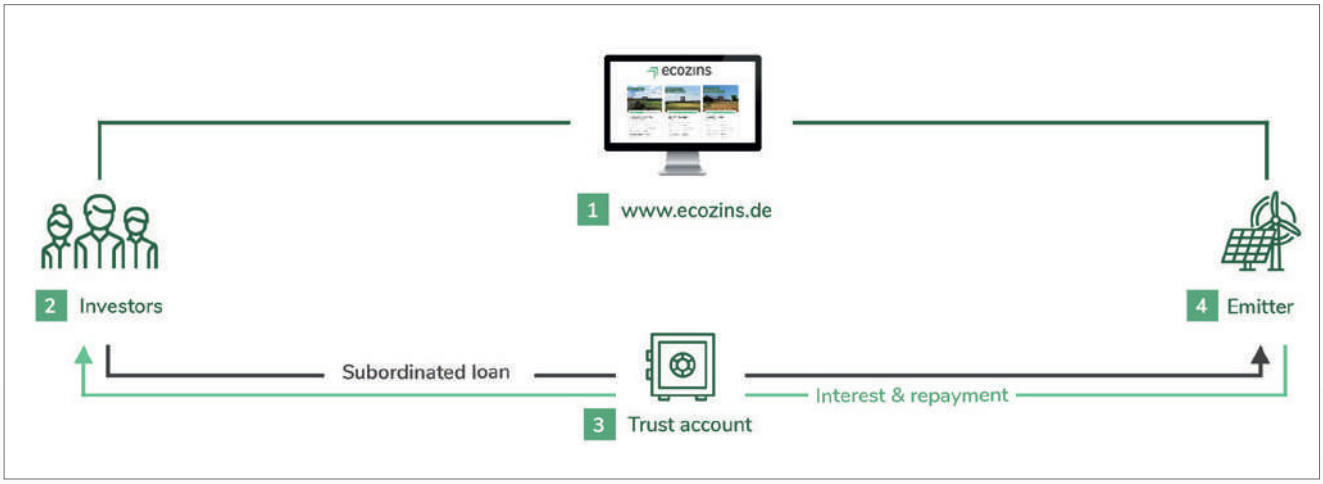
With its crowd-investment platform, ecozins, AUDITcapital GmbH has taken an innovative step towards sustainability and green investments to ensure that sustainable approaches also take root in the financial sector. Private investors can use the online platform to invest easily in projects that generate returns while also protecting the climate. Investments in climate-neutral energy production facilities are extremely capital-intensive. Investment volumes in wind farms, for example, are regularly in the double-digit million range, which is why this asset class has been the preserve of institutional investors until now.

Ecozins wants to make the renewable energies asset class accessible to private investors as well. Project developers who implement the energy transition in a decentralised, grass-roots-based, and participatory manner, benefit from the additional capital injected by investors, which will enable them to realise more climate protection projects. This is why they are happy to pay attractive dividends.

Renewable energies: a safe investment opportunity

The legally guaranteed feed-in tariff for renewable energies makes for investment security and predictable, stable cash flows, from which the dividends are paid out to the investors. Under the crowd funding exemption regulation enshrined in the German Investment Act, up to six million euro may be raised without a BaFin approved securities prospectus. The online sales and investment process also ensures compliance with the provisions of the Small Investor Protection Act. Investors can accumulate a sustainable and diversified portfolio due to the relatively small investment amounts, which start at just 100 euro (up to a maximum of 25,000 euro). All investment-related documents, such as contracts, interest and redemption schedules, and tax certificates are securely stored in the customer's ecozins account.

This is how ecozins works: Simple. Digital. Secure.



"I am passionate about citizen participation in renewable energy projects, because I'm convinced that the energy transition will only succeed if it happens hand-in-hand with the public, rather than passing them by."

Tim Weinel, Managing Director of AUDITcapital GmbH

More opportunities through crowd-funding and participation platforms

The first variant of the innovation described above involves crowd-investing in sustainable projects, by means of which large volumes can be raised jointly by a large number of people. It is free to invest via the ecozins online platform at any time and from anywhere in the world. The second variant gives companies the chance to commission AUDITcapital GmbH to set up a bespoke participation platform based on their own ideas and customised for their own projects with their own name and corporate branding.

Conclusion

We want to expedite the energy transition and ensure that the financial sector transitions towards greater sustainability takes account of the goals and values of investors. Because we are passionate about our planet, we are also passionate about promoting sustainable and green projects and facilitating their implementation by raising investment capital. Let's meet this challenge together.

Project overview

Platform	**ecozins**
Facts and figures	**Launch of the ecozins platform: 2019 Successfully financed projects: 12 Registered users: over 1,100 Raised capital: more than 3.6 m € Repaid capital: more than 600,000 € Interest: between 3.0 – 6.0 %**
Description	**Climate-friendly dividends for private investors. Comfortably invest money in sustainable projects online.**
Types of projects/ investment opportunities	**Renewable energies, e-mobility, energy efficiency, sustainability**
Conditions	**Individual investments between 100 € – 25,000 €**
Locations	**Across Germany**

ecozins
Klimafreundlich Rendite erzielen

You are interested in crowdinvesting, mezzanine financing or public participation? Then don't hesitate to contact us. Our contact can be found in the **company profile on page 138.** ▶

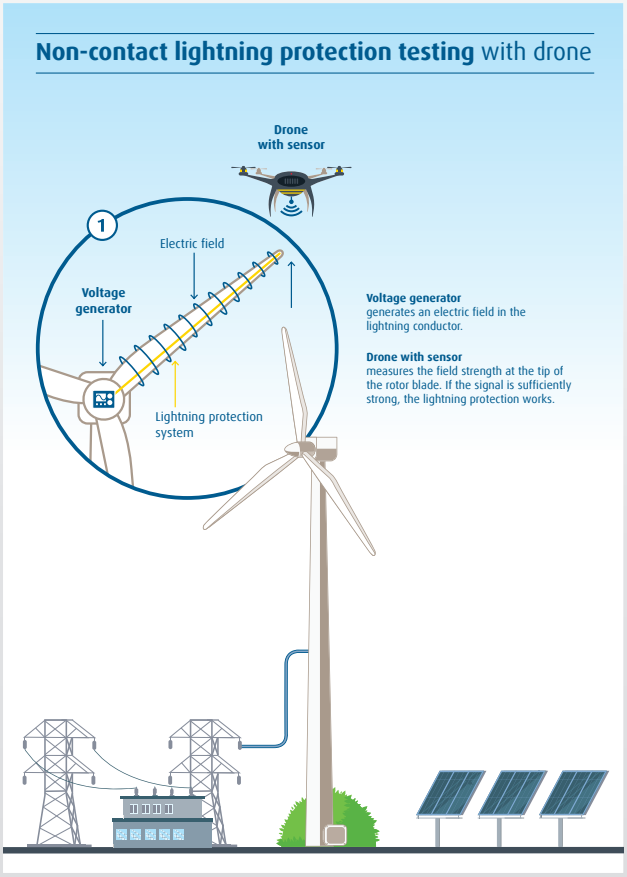
NEW ROTOR BLADE INSPECTION METHOD

ENERTRAG Operation has developed an innovative procedure that improves rotor blade inspections, including lightning protection system testing, and optimises them to meet the increasing demands of the market.

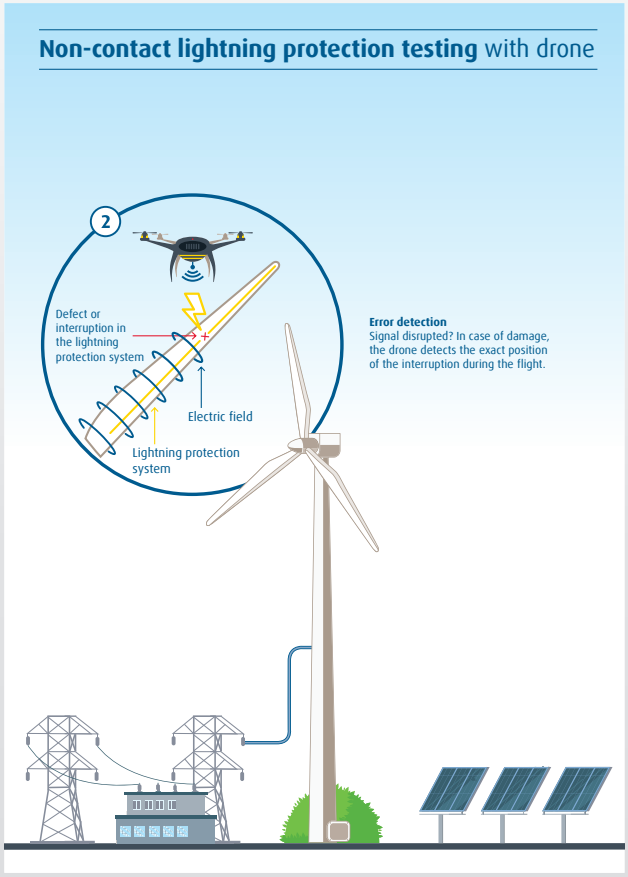
The next generation of turbines will have hub heights far in excess of 150 m and rotor diameters of up to 160 m. For safety reasons, it will no longer be possible to use climbing ropes to access turbines of this size as there is an increased risk of ropes of this length swinging too much or getting snagged on the hazard lights on the tower. Such situations are difficult to control and, therefore, represent an enormous hazard for the relevant personnel.

Drone-based contactless lightning protection inspection

"There are several benefits to this process", as Dr Konrad Iffarth, authorised signatory at ENERTRAG Operation and a key driver of this innovative approach,



Description of the wind turbine rotor blade lightning protection system inspection procedure



Drone-based contactless lightning protection system inspection

Picture of a ready-to-use drone for rotor blade inspection and contactless lightning protection system inspection

explains: “On the one hand, the use of drones saves a lot of time. According to our most recent tests, it only takes about 30 minutes to inspect all of the rotor blades, which means that it will be possible to test many more wind turbines in succession in future. “On the other hand”, he continues, “the new inspection system simulates a lightning strike much more accurately than it is possible with the current testing methods. This reduces erroneous results and the system should be universally applicable to all wind turbine types.“

More accurate and efficient and in use from 2022 onwards

The prototype development and subsequent test phase were completed in autumn 2021 and a successful feasibility test has since been carried out. Another important milestone is the final validation by the TÜV Nord.

Wind turbine operators will be particularly happy about the enormous downtime reductions, which already begin with the test and tour planning, which also involve the use of smart combinations. The field strength meter can even be taken along during the regular mechanical inspection of the nacelle, so there is no need to climb the tower twice, which means that the rotor blades and the lightning protection system inspection can be completed efficiently at the same time and under almost any weather conditions.

The spectacular image quality and the autonomous flight pattern also facilitate a higher fault detection rate. High-resolution, wide-angle surface images of rotor blades of any size can be recorded using technology from our well-respected collaboration partner Sulzer Schmid.

The decisive factor is that, following an initial artificial intelligence-based analysis of the data, our experts will carry out a deeper analysis. Having acquired years of experience in evaluating inspection data and classifying defects, the benefits of this smart symbiosis will be obvious to operators.

Further information is available at:
betrieb.enertrag.com

Project overview

Initiator	**ENERTRAG Operation and Sulzer Schmid**
Implementation	**From 2022**
Figures and facts	**~25 % reduction of costs compared to rotor blade inspection by rope access technique in combination with machine inspection (e.g. recurring inspection)** **• Flight time of 30 to 45 minutes per turbine (incl. setup time)** **• Applicable at wind speeds up to 12 m/s**
Project status	**Advanced field tests and validation**
Location	**In wind farms across Germany**

ENERTRAG
One energy ahead
Operation

Are you interested in the project and want to know how your community or your business can benefit from it? Contact us. Our contact can be found in the **company profile on page 145. ▶**

TRAINING INFRASTRUCTURE SETS NEW STANDARDS IN WIND POWER

A potent branch of the cooperative with a unique infrastructure offering basic and advanced, supplier-unaffiliated personnel training.

More and more highly trained craftsmen are needed for operating and expanding wind power installations. Demographic change and increasing personnel fluctuation create additional demand. These factors result in a markedly greater need for basic and advanced training. Training institutions also face significantly higher demands regarding infrastructure, didactics, action and distance learning.

Training on real plant technology

In order to meet such market requirements, KWS Energy Knowledge eG in Essen, Germany, has been establishing its own unique infrastructure. The cooperative's design with currently around 160 members from the power industry offers an ideal legal and business framework.

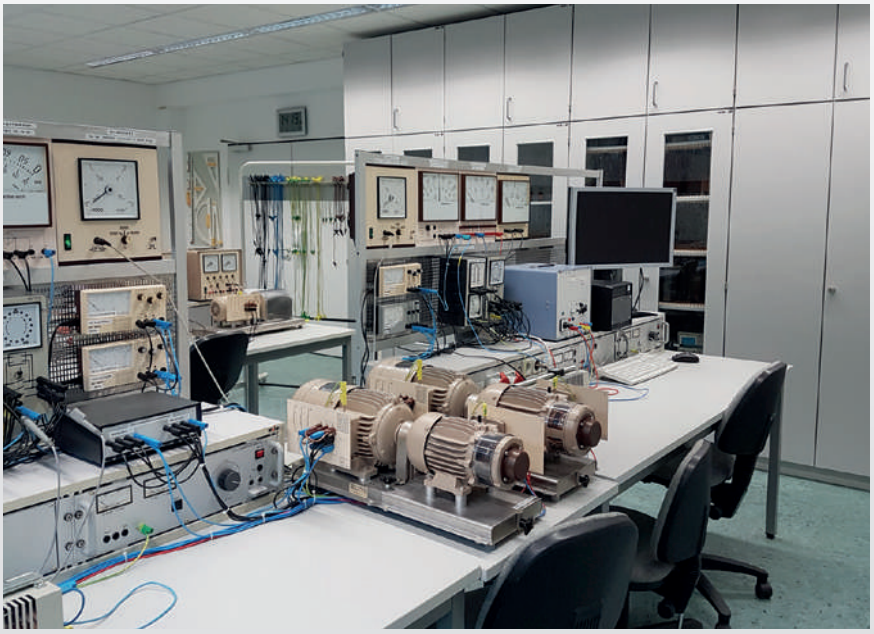
The key instruction component is a wind power training installation employing real-world technology: Nordex S70, hub height 14 m, engine room complete with full operating equipment, hub with rotor shaft, rotor blades and yaw control system, wind velocity indicators and lighting installation, fully functional electrical, measurement and control engineering technology for training operations, and transformer station.

In addition, KWS operates 7 training laboratories with OEM technology including control engineering, electrical engineering, and measurement engineering. This permits

a wide range of training and educational content to be customized to client-specific demands for realistic training and examination purposes. Based on more than 60 years of professional experience in the field, all theoretical contents are also on offer for both classroom instruction in Essen as well as distance learning.

Numerous qualifications available

The following vocational qualifications in the field of electrotechnology may be attained (official German acronyms in parentheses): Electrically Instructed Person (EUP); Electrically Qualified Person for Specified Duties (EFKffT); Electrically Qualified Person (EFK), Responsible Electrically Qualified Person (VEFK); Electric Safety in Low Voltage Systems; Switching Authority up to 155 kV; Qualified Person (TRBS 1203); Requalification for Electrical Installations and Equipment (DGUV3).



In the area of technology, the following topics are covered: Wind power installation mechanical engineering, drive train alignment, transmission inspection with video endoscopy and transmission technology, hydraulic systems setup, functions, maintenance and repairs, switchgear and electro-hydraulics. Also covered is the full scope of operations and maintenance including mechanical and electrical malfunctions identification.

Workplace safety instruction follows GWO and DGUV (German Public Accident Insurance) standards, e.g. high altitude work and rescue (DGUV-R 112-198/199), in-house first aider (DGUV-1), in-house fire warden (DGUV-I 205-023), and load slinging (DGUV Regulation 100-500). We also conduct special training for hub, nacelle top, and azimuth area rescue.

Conclusion

Demand for realistic and supplier-unaffiliated basic and advanced training continues to rise significantly. KWS Energy Knowledge eG in Essen, Germany, provides the complete infrastructure and many years of experience in the field.

Project overview

Initiator	**KWS Energy Knowledge eG**
Implementation	**Courses and training (theory and practice) on original systems, conducted at KWS' premises in Essen**
Figures, data, facts	**KWS provided a total of around 230 training sessions and courses in 2020**
Project status	**Ongoing**
Location	**KWS Energy Knowledge eG, Deilbachtal 199, 45257 Essen, Germany info@kws-eg.com**

Are you interested in the project and want to know how your community or your business can benefit from it? Contact us. Our contact can be found in the **company profile on page 163.** ▶

SOCIAL AND LOW-RISK LOCAL PARTICIPATION

Provided that locals are involved in a fair and socially acceptable manner, the relationship between wind farms and local residents can be fairly robust. **MLK** and **REZ** have joined forces to develop new concepts in Brandenburg.

Wind farm participation concepts are designed to enable local residents to participate in the economic success of a project. In the early years, this objective was achieved through citizen-owned wind farms. Such participation concepts are currently returning in the guise of cooperative and crowdfunding models. Still, most local investors either underestimate or shy away from the entrepreneurial risk associated with investing in a wind farm. Local residents do not want to and should not risk losing money.

Risk-free participation concepts for local residents

REZ and MLK have developed a number of participation concepts that can benefit local residents economically without subjecting them to financial risk and which also take account of various social factors. Even population groups with no disposable funds of their own or who cannot risk losing their invested capital should be able to participate. Projects should also be as specific and tangible as possible: Whilst community participation schemes are very good and politicians appreciate them, it can take some time before they reach the public at large.

Neighbourhood power supply deals and day care centre collaborations

The projects implemented so far include neighbourhood power supply deals, citizen savings projects and direct wind farm participation opportunities. A partnership agreement was also concluded with a day-care centre as a model project, which not only included agreements on joint projects, but also provided equipment and ensured a daily supply of milk to the day-care centre.

In terms of local power supplies, a subsidised tariff has been launched in collaboration with green electricity suppliers whereby the participating wind farms pay the electricity supplier an annual subsidy of between 156 and 180 euro for each contract. In one of the projects there is a social subsidy of another 60 euro per year. The local resident tariff is currently tax-neutral for the beneficiaries and also has no negative consequences for unemployment benefit recipients. MLK have made it possible for the recipients to combine their subsidised package with that of ENERTRAG, a neighbouring planner, at certain locations near Prenzlau, which results in some incredibly low-cost offers – despite the fact that they are delivering green electricity.

A total of 200,000 and 300,000 euro respectively was provided with a guaranteed annual interest rate of 3 percent in two citizen savings projects, which were implemented in collaboration with the DKB in 2017 and 2020. The 3-year programme was without any real risk for the investors, as the amounts deposited were secured by the Bank Guarantee Fund.

However, attempts to enable groups with little capital of their own to participate in the economic success of wind farms did not met with immediate success. A loan with an associated interest rate of over 4 percent over almost 4 years was set up on the DKB crowdfunding platform, yet the local response was muted in spite of local marketing measures. The crowdfunding community, by contrast, subscribed to the remaining amount within a few hours. A low "risk affinity" in that area and Covid-19-related limitations that affected the on-site campaign were identified as possible reasons.

"We want to continuously develop our participation opportunities and enable local residents to share in our success; that's the least we can do."

Heinrich Lohmann, founder and managing director of the MLK Group

Conclusion

Local participation concepts must also include groups that have few or no assets of their own. This can be achieved through neighbourhood electricity tariffs, citizen savings schemes, participation via crowdfunding or collaboration with kindergartens or other social institutions. High-risk investments, by contrast, are difficult. Getting local participation and buy-in requires project transparency and, very importantly, face-to-face events.

Project overview

Initiator	**MLK Gruppe and Regenerative Energien Zernsee (REZ)**
Implementation	**MLK Group – in partnership with regional energy suppliers or DKB depending on the project**
Facts, figures, and data	**Neighbourhood electricity tariffs available in nine localities, two citizen savings projects and a crowdfunding campaign carried out, day-care sponsorship in place since 2015**
Project status	**Ongoing**
Location	**Mainly in Brandenburg**

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REZ MLK

Are you interested in the project and want to know how your community or your business can benefit from it? Contact us. Our contact can be found in the **company profile on page 178 (REZ) and 168 (MLK). ►**

CONTACTLESS LIGHTNING PROTECTION

Alternative test method for lightning protection measurement on wind turbines: **TOPseven's** patented technology for contactless lightning protection measurement on wind turbines has been validated and verified by an independent organization.

"TOPseven's drone-based contactless rotor blade lightning protection inspection system represents a milestone for the wind power industry. In collaboration with TOPseven, I and a number of experts from our Wind Energy Department carried out the project for the validation and verification of version 1.0 of their new system and am pleased to say that we were able to complete it successfully."

Dr.-Ing. Ralf Frentzel,
TÜV SÜD Industrie Service GmbH,
Senior Expert EMC and Lightning Protection.

Wind turbines are particularly prone to lightning strikes due to their exposed locations and these strikes can have serious consequences including everything from downtime for repairs to the destruction of the entire system. That is why wind turbine lightning protection systems have to be reliable and operators have to be able to detect any potential damage as soon as possible, which means that lightning protection system tests and visual inspections have to be carried out on a regular basis.

Up until now, inspections have almost exclusively been carried out by industrial climbers although drones equipped with cameras and controlled by specialist pilots have also been deployed for this purpose over the past few years. However, there are drawbacks to both of these approaches such as high costs and the need for third-party specialists.

TOPseven has developed an alternative technology for this and can now provide a globally unique automated and drone-aided contactless lightning protection inspection system. Users receive training from specialists, which enables them to carry out the inspections independently.

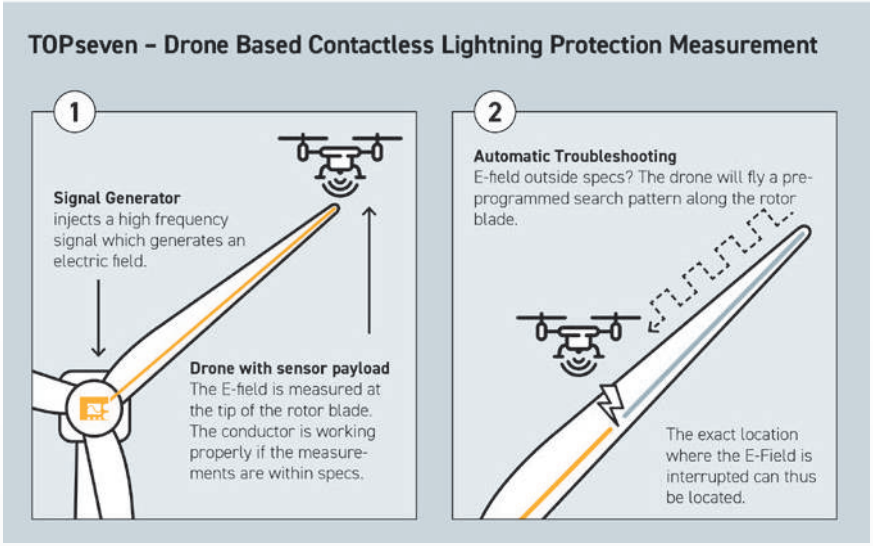
The contactless lightning protection inspection system is completely automatic, and it is no longer necessary to employ a specialist pilot or rope climber for the task. All that is required is a short training course, after which the inspection can be carried out by in-house staff. Not only does this eliminate capacity bottlenecks and dependency on skilled personnel from third-party companies, but also facilitates more flexible and rapid inspections.

This patented process is primarily based on the non-invasive application of an electromagnetic field to the lightning protection system as well as a contactless inspection of the rotor blades by a drone fitted with a special field current sensor. With the aid of special mensuration technology, this inspection system is able to determine the functionality of a lightning protection system faster, more efficiently, and more accurately than conventional methods.

The TOPseven system also precisely identifies the location of any potential damage, which means that it can be relocated at any time for subsequent repairs.

The Bundesverband WindEnergie (German Wind Energy Association or BWE) reissued the technical guidelines for testing wind turbine lightning protection systems in March 2021, whereby one crucial innovation is that alternative test methods can also be used to test the systems, provided that they have been validated and verified by an independent and accredited body. Through its independent validation and verification tests, the TÜV SÜD has confirmed that the TOPseven inspection system is a suitable alternative test method for the section of a wind turbine's lightning protection system that extends from the tip of the rotor blade to the blade flanges and that it complies with the relevant BWE Technical Guidelines.

A European patent for our innovative inspection system was also granted and published in July 2021 (EP 3 596 570).



Conclusion

The innovative, patented TOPseven system is unique on the global market and solves inspection bottlenecks for operators and surveyors as well as for industrial climbers. Contactless lightning protection inspections by drone are efficient, precise, and cost-effective. The ability of end users to operate the technology in-house guarantees a level of corporate independence that is still unique today.
Our mensuration system has been validated and verified by TÜV SÜD as an alternative test system for the section of a wind turbine's lightning protection system that extends from the tip of the rotor blade to the blade flanges.

Location **TOP seven GmbH & Co.KG**
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www.TOPseven.com

TOP7
MAKING DRONES SMARTER.

Are you interested in the project and want to know how your community or your business can benefit from it? Contact us. Our contact can be found in the **company profile on page 183.** ▶

RETROFIT FOR THE CONTINUED OPERATION OF WIND TURBINES

Wieland Electric is supporting wind turbine operators by providing them with a complete system for the simple retrofitting of the work and safety lighting for safe continued operations.

Under the Renewable Energy Sources Act (EEG), many wind turbines will lose their remuneration entitlement this year. Initially, this will apply to facilities with a total output of just under 4000 megawatts. More wind turbines with an average output of up to 2400 megawatts will then follow each year until 2025. However, the benefits of these turbines are considerable, even after their remuneration period has expired. They can continue to contribute to climate protection and to resource conservation through their use of existing infrastructure. Even after they have reached their design life of 20 years and have been amortised, wind turbines in favourable wind locations can continue to operate for many years.

QUICK INSTALLATION, LONG OPERATION

Smart lighting solutions using efficient and durable components

PLUGGABLE CONNECTION SYSTEMS RST® MINI AND RST® CLASSIC

- Time-saving, tool-free plug & play installation
- Pre-wired with colour and mechanical coding for safe installation
- High level of protection up to IP68

MAINTENANCE-FREE LED LIGHTS PODIS®

- Time-saving, tool-free installation using connector plugs and magnets
- High quality material for a long service life
- Resistant to shocks, vibration and extreme temperatures from -40° C to +50° C

UNINTERRUPTABLE POWER SUPPLY

- Stable supply voltage for high availability of safety lighting
- Central installation and comprehensive diagnosis for simple and plannable maintenance
- Buffering times can be adapted to countries and demand

Complete system for retrofitting work and safety lighting

Crucially, continued operations of this kind depend on the condition of all components that are relevant to the stability and functionality of the safety devices, system controls, and braking systems. The framework conditions are set out in the Principles for Carrying out an Assessment and Verification Concerning the Continued Operation of Onshore Wind Turbines (BPW), which also covers testing and inspecting the wind turbine's lighting system and safety lighting. Retrofitting represents the best remedial option in this respect. Wieland Electric can support plant operators with a complete system that can be retrofitted quickly and easily and with no need to dismantle the existing lighting system.

A high-performance system

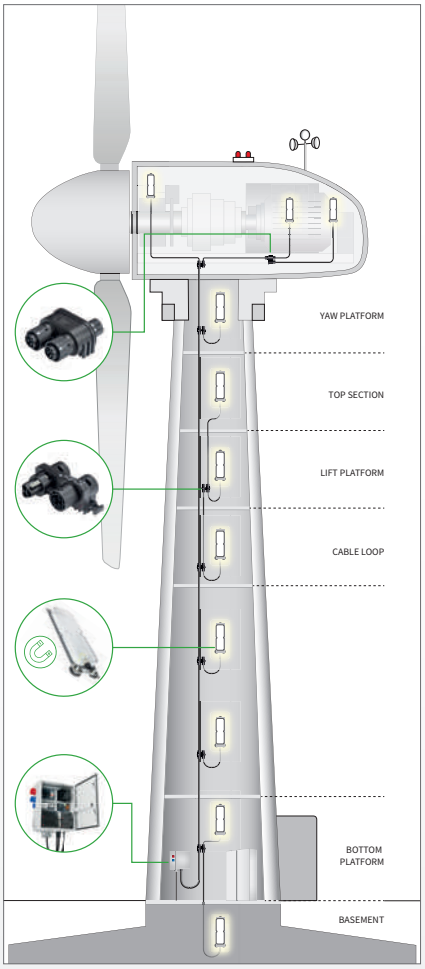
Wieland's complete solution ensures the hassle-free and profitable continued operation of the tower and nacelle lighting systems. It includes uninterruptible power supply, infrastructure cabling, and LED lights. It is a centrally powered safety lighting system, which can use either a secondary voltage of 48VDC (SELF) or normal mains voltage of 230V AC. It provides at least a 30-minute buffering period following a mains outage, although this period can be extended through the use of more powerful batteries. In contrast to the outdated technology where batteries are installed directly in the lights themselves, the Wieland Electric solution includes a central battery as well as modern, safe and easily maintained LED technology.

Can be installed in a single day

„One wind turbine, one day" was the motto under which a practical test was run on a 2004 Vestas V80 wind turbine. It proved how practical and time-saving the retrofit system solution actually is: just three engineers, equipped with Wieland products, carried out a complete overhaul of the turbine in a single day!

The following components were used:

- UPS cabinet, primary circuit: 1-phase 230 V AC supply voltage
- UPS cabinet, secondary circuit: 24 / 48V DC or 230V AC
- LED lights 24 - 60 V DC or 230 V AC
- Infrastructure cabling (example): Ölflex Classic 3G 2.5mm² (other cable type/ cables possible as required) as well as RST round cable connector for harsh environmental conditions



Conclusion

The mere fact that a remuneration entitlement expires does not necessarily mean that a wind turbine will no longer be profitable to operate: given the right strategy, continued operation may well be worthwhile. When it comes to continuing to operate the facility's lighting system in a profitable manner, retrofitting Wieland's products and solutions is the solution for you. Our innovative system saves time and money and will get your wind turbine in shape for future operations!

Project overview

Implementation	**Installation of a complete wind tower lighting system in a single day made possible with Wieland products and just three engineers.**
Description	**Wieland solutions enable the continued operation of the wind turbine despite the expiry of the remuneration entitlement.**
Location	**Worldwide**

wieland

Save time and money with our completely pluggable, maintenance-free system. The Wieland system has a central power supply and can be installed without tools. Our contact can be found in the
company profile on page 123. ▶