

start up

Start-ups are entering the market with new ideas.
A selection is presented on the following pages.
Be inspired by their innovative power.



An excerpt of the
BWE Industry Report
„Wind Industry in
Germany 2020“



Sustainable energy storage systems to support the energy transition

CMBlu Energy AG is a pioneer and market leader in the field of **organic flow batteries**. Its aim is to provide sustainable and highly cost efficient storage technology to secure the success of the energy transition. It also aims to support e-mobility by enabling the expansion of charging infrastructure by means of buffer storage.

One of the largest research and development centres for organic flow batteries worldwide is located in Alzenau, Lower Franconia (Bavaria). CMBlu is working on a key component for the successful energy transition – large-scale and cost efficient storage batteries for electricity grids.

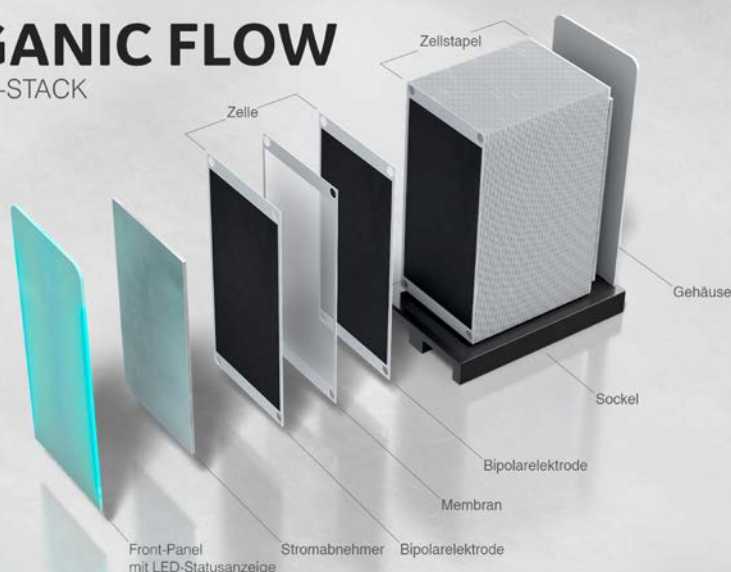
Functional principle

The functional principle is similar to that of conventional redox flow batteries. These essentially consist of two tanks with aqueous solutions, so-called electrolytes, and an energy converter. The converters consist of a large number of cells arranged in a row, also called “battery stacks”. The electrolytes are pumped through the stacks in a closed

cycle, charging or discharging the stacks as required.

From initial idea to marketable product The business idea for redox flow batteries with organic electrolytes (“organic flow”) first arose in 2011 and has been the subject of intensive research and development at CMBlu since 2014. Dr Peter Geigle is one of the founders and CEO of CMBlu. Trained as a medical doctor, he spent decades working on the energy supply of brain cells. The basic idea goes back to the human body where nutrition is converted into energy in the citric acid cycle. This is another redox reaction but one that is based on organic molecules – ring molecules that are able to take up energy, store it and discharge it as needed. This principle is now being transferred to industrial applications. The start-up is currently preparing to market its first commercial systems in 2021 together with its industrial partners Schaeffler, Mann+Hummel and Schunk.

ORGANIC FLOW BATTERIE-STACK



Founding year	2014
Staff	70
Focus	Energy stores
We offer	Large-scale, modular and sustainable energy stores for integrating wind and solar energy and for e-mobility charging infrastructure.
We are looking for	Customers with large storage needs and outputs of at least 200 kW or capacities of > 1MWh, for delivery from 2021 onwards.

High and very affordable resource availability

The electrolytes of organic flow batteries can be obtained from lignin, a natural material that contains particularly large numbers of ring molecules. Lignin is contained in every plant with structure, where it lends them stability. Straw and wood are especially high in lignin. Lignin therefore represents a renewable raw material, of which more than 50 million tons are generated annually as a waste product in pulp and paper production. The majority is currently incinerated due to the lack of alternative uses. The long-term availability of this resource for electrolyte production is therefore ensured. Moreover, the value added chain is entirely local and no scarce resources need to be used, making the organic flow battery particularly sustainable.



A versatile energy storage system

There is no question that storage systems play a significant role in a future energy system that largely relies on wind energy. The share of wind and solar energy in the electricity mix can only be increased if very large storage capacities become available. Organic flow batteries are highly scalable in terms of output and capacity, making them attractive for a wide range of uses such as interim storage of renewable energy or balancing peak loads in industry. When used as buffer storage systems, these batteries also enable the introduction of comprehensive charging infrastructure for e-mobility.

“Over hundreds of millions of years nature has developed very efficient and safe methods for storing energy. Our ideas are based on how energy is stored in the human body. This uses a redox reaction within the citric acid cycle based on organic molecules. We are proud to be able to apply this principle to the large-scale storage of electrical energy using unlimited and renewable resources. We therefore enable very large and cost-efficient energy storage systems.”

*Stefan von Westberg,
Director, Distribution & Marketing*

Conclusion

Organic flow batteries by CMBlu enable energy to be stored sustainably and cost-efficiently and in a way that can be flexibly scaled. The batteries are suitable for various applications, including interim storage of solar and wind energy, balancing peak loads in industry, and providing high output to simultaneously fast-charge electric vehicles.

cms@wind – Innovative Condition Monitoring

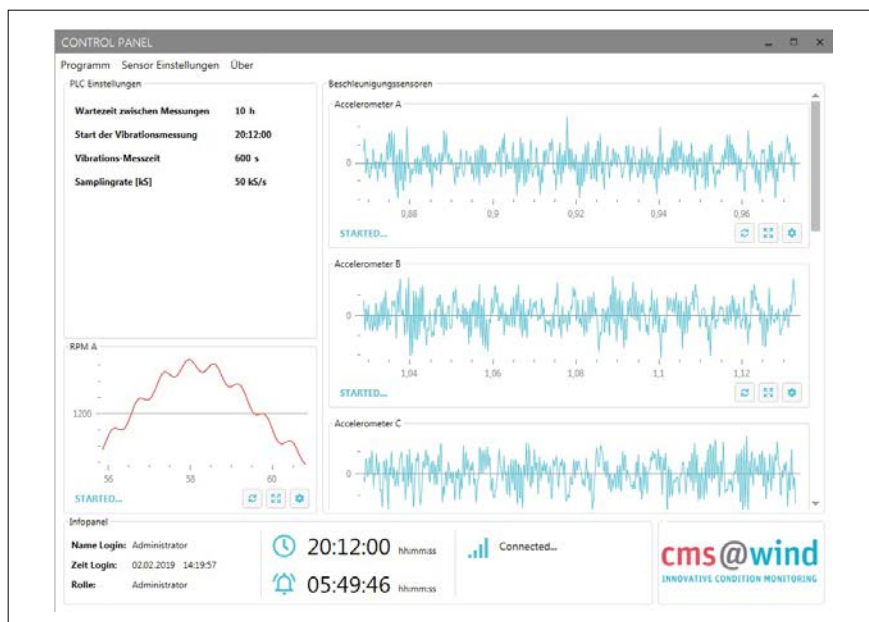
cms@wind GmbH uses innovative CM methods to monitor large slow-turning components in drive trains that move at variable speeds

Condition Monitoring is a red flag for many in the wind industry. For us as a young and innovative company the challenge is to develop a working solution that is also customer-friendly. We start where other systems stop: with components that are difficult to monitor because of their good damping properties in combination with slow, irregular movements. These pose particular challenges to CMS.

Analysis is at the heart of what we do. Our innovative algorithms make us successful even in cases where systems designed for other demands fail. Our CMS delivers the diagnoses required by key directives and much more. But we get there in a different way. Analyses are non-parametric and can therefore be automated.

For analyses to be relevant, it is essential for the signal base to contain the elements that are critical for early fault detection. This strongly limits the choice of suitable systems. Our sensors, hardware and post-processing are fine-tuned to this. CMS consists of many details, and they all have to fit together if we are to meet our own demands.

Apart from our innovative early fault detection system, which has been used by certifiers since 2018 for end of warranty assessments, we introduced an affordable hardware in 2018 that was developed between 2016 and 2018 in an AiF-funded project and successfully tested in a turbine. The hardware is now ready for serial production. We added a user interface so that no commissioning engineer needs to leave the turbine without first checking that all sensors are working correctly. The interface was conceived to be especially suitable for the mobile measurements that are frequently demanded by periodic inspections.



User Interface

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Founding year **2015**

Staff **4**

Focus **Condition Monitoring an unregelmäßig drehenden Großkomponenten**

We offer

- Independent measurements
- Innovative CMS solutions for large slow-turning components in drive trains that move at variable speeds
- Optimised for wind energy
- Monitoring of slewing bearings, tested up to 4 m

We are looking for

- Contracts, new clients, partners
- Interesting tasks related to measurement, periodic monitoring, new turbines, old turbines, reference measurements, resonance analysis, relation to other physical parameters
- We start where others stop.

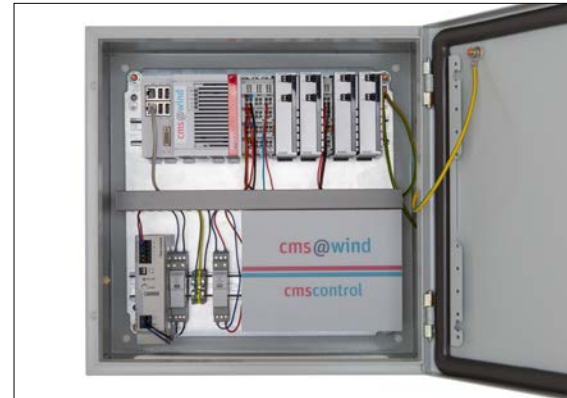
As a young company, we had many smaller familiarisation projects in older turbines in our first three years. The oldest turbine was 27 years old. These turbines often have some damage that is merely being watched as repairing it is no longer worth it. Here, it is important to recognise critical states early in order to avoid danger. Methods of early fault detection do



CMSmobil

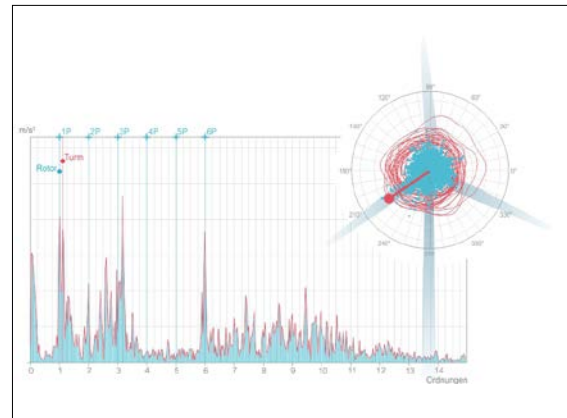
not help here. We developed a concept that enables remote monitoring through a combination of innovative analytical methods, affordable hardware and classic fracture mechanics, in order to respond quickly if the turbine is in a critical state. If the turbine is to be decommissioned earlier than planned, the system can be easily transferred to another turbine where it can continue operating.

In 2019 we began to market the second product developed in our AiF-funded project. The main bearings in wind turbines are a real challenge to structure-borne sound diagnostics. Together with the new hardware we tested a high resolution sensor that relies on infrasound and delivers convincing signals. As it is flat in shape, the sensor can easily be mounted onto parts that are difficult to access.

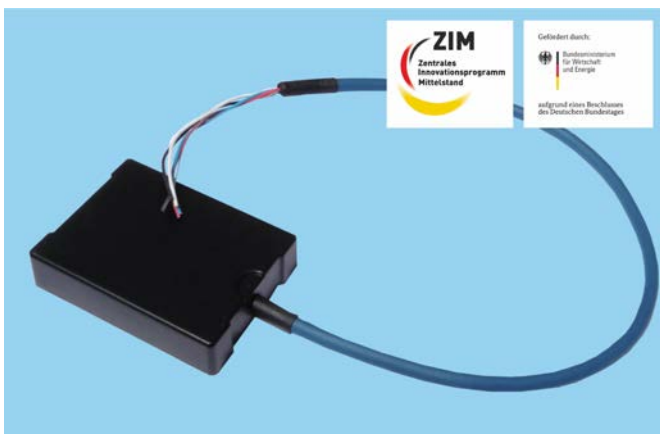


CMScontrol

Exciting topics continue to be presented to us. In 2018, after a long and interesting mobile project in a very large wind farm, we decided to integrate unbalance measurements as an add-on in the online system. We also incorporated multi-axis MEMS sensors in our portfolio.



Example – evaluation – rotor/tower resonance (unbalance measurement)



CMSinfra

Conclusion

As a young company we cover a very exciting mix of topics and are keen to see how the wind energy market will develop over the coming years. We are always open to interesting challenges and are receiving more and more contracts from other sectors where we offer development services in the field of CMS especially during the winter months.

A small wind turbine for urban and rural environments

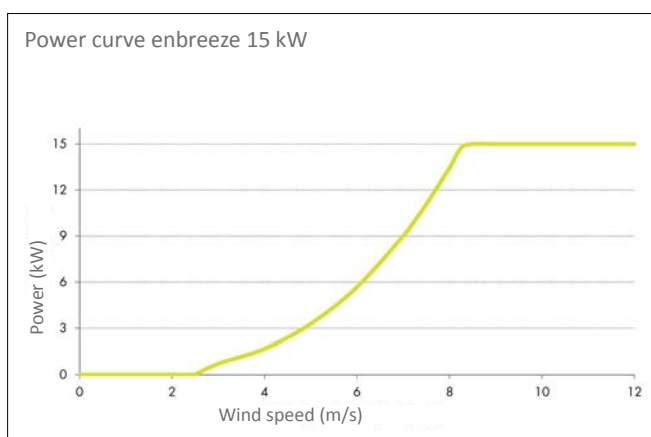
The small wind turbine of the Berlin-based manufacturer enbreeze is economical in its operation and opens up new locations for wind power. Rather than merely scaling down a large turbine, innovative technical solutions were found.

More than six years of development time have gone into enbreeze's small wind turbine.

The result is a robust product that is low in maintenance and tailored to the specific wind conditions at ground level. Unlike the usual small wind turbines, the innovative 15 kW turbine operates economically despite its hub height of only 20 metres. On average, it produces 30,000 kWh per year. Because of the simpler approval requirements and low noise emission it is also suitable for urban spaces. As a result, countless sites that used to be unsuitable for wind power are suddenly worth considering.

These could be industrial estates, similar to the company's premises in Berlin-Marzahn where the turbine has been placed directly by the roadside. Since September 2018, it has been providing the company and an electric filling station with environmentally friendly and decentralised energy.

The innovative small wind turbine is particularly interesting for agricultural settings. Farms can become more independent of energy providers, especially when using the turbine in conjunction with a PV plant. With a total height of below 30 metres, the turbine is hardly noticeable next to a stable building. It is not necessary to be in a designated priority area for wind energy to install the enbreeze 15 kW turbine: they can be erected as secondary structures outside of designated areas. Germany thus has innumerable sites where electricity can now be sensibly obtained from wind. Suitable locations might be medium-sized companies, municipalities, research and teaching establishments, or large superstores that want to rely on local power that is generated without emissions. Companies could also use their staff car park to deliver electricity, thus sending a strong signal to support sustainability.





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Founding year 2009

Staff 10

Focus

- Turnkey small wind turbines for low-wind areas
- System integration and integrated energy
- Project development for small wind turbines
- Decentralised energy supply

We offer

We are your partner in decentralised energy supply from the initial planning approval to the commissioning of your small wind turbine.

We are looking for

We implement your visible contribution to the energy transformation by helping you to supply your farm or company with renewable energy.



The efficient design of the rotor blades is a core feature of the turbine. Because of the low hub height of the enbreeze 15 kW turbine, the rotor blades were specifically designed to cope with variable wind speeds at ground level, setting them apart from large wind turbines. This led to an aerodynamically robust design that is tailor-made for the demands of small wind turbines. The peak efficiency is 52 percent; with less than 45 decibels of noise emission the turbine is also very quiet.

An elaborate pitch regulation system like that in large turbines would be far too expensive for a small wind turbine. enbreeze therefore developed a passive pitch regulation system that sets the aerodynamic forces on the rotor blade against the generating torque. If the generating torque is kept constant once the rated power has been reached, the rotor blades passively pitch out of the wind – turning

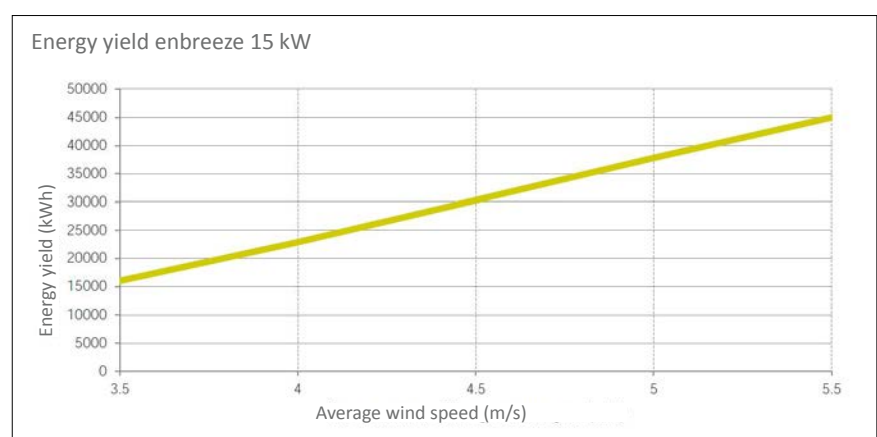


by exactly the right degree to ensure the rated power is reached. If the generating power is reduced to zero, the rotor blades automatically pitch out of the wind.

enbreeze GmbH was founded as a start-up in Cologne and today is part of the Berlin-based Elpro Group. The international staff is characterised by its long years of project know-how and innovative ideas.

Conclusion

Small wind turbines have a reputation for being uneconomical. The enbreeze turbine changes this as it was specially designed for variable wind speeds at ground level. Innovative technical solutions bring down operating costs and ensure a good energy yield. Because of its low noise emission, the turbine can even be placed in urban spaces. This opens up countless sites to wind energy that were previously inconceivable. The product can also ensure electricity supply in off-grid areas.



The world's first modular wind energy system: efficient and scalable

One of the biggest technological and economic challenges in the near future is to ensure an energy supply that is not only renewable and environmentally friendly but also economically viable. MOWEA, a Berlin-based start-up, has recognised this challenge and is ready to tackle it head-on.

MOWEA provides flexible modules for scalable wind energy solutions based on the Lego principle. This enables efficient B2B and B2C applications, saving energy costs and bringing down CO2 emissions. MOWEA's aim is to make an effective and economical contribution to achieving global climate targets, inspired by the ambition of becoming the world's first point of contact for flexible, demand-driven wind energy solutions.

MOWEA was founded as a spin-off by Dr Till Naumann and Andreas Amberger, two graduates of Berlin Technical University. Both founders had already focused on wind energy topics during their studies, and were able to successfully merge the research fields of aerodynamics and electrical engineering. It all started with the IBB-ProFit R&D project "Mowian", which successfully validated a method to reduce the costs of small wind turbines: a multi-rotor system consisting of a large number of highly efficient microturbines which can be produced in great numbers. Dr Naumann wrote his doctoral thesis on the aerodynamics of rotor blades with the aim of improving the performance of small rotor blades. He is recognised as an expert and enthusiast in the field of wind energy.





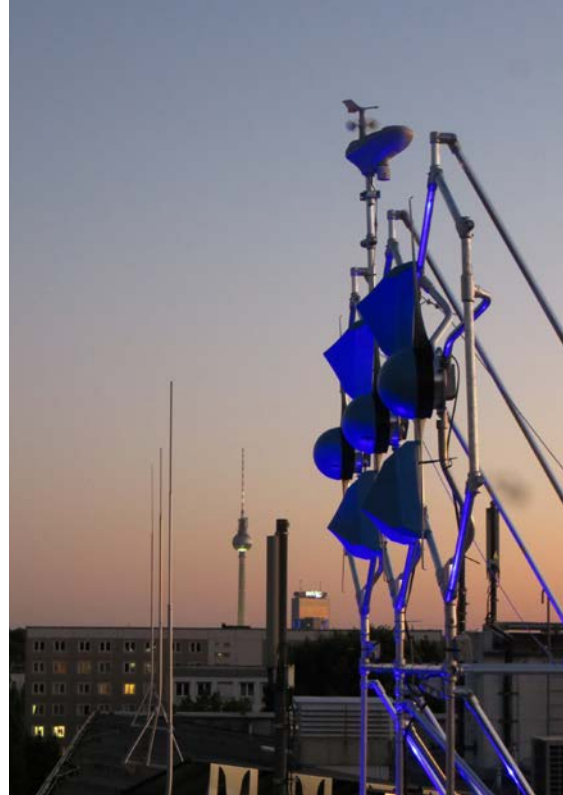
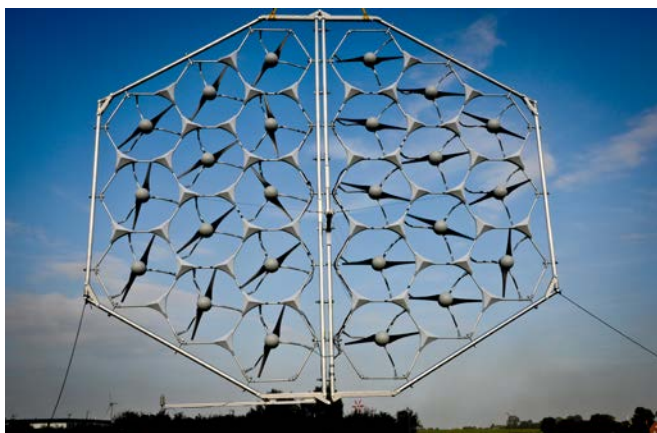
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Founding year	2016
Staff	4
Focus	Energy technology & renewable energy systems
We offer	Efficient, scalable and modular small wind turbines and technical expertise
We are looking for	Industrial project partners, sales partners, production capacities

Motivated by the positive results of the research project, his doctorate and the potential of this technology, he was compelled to explore his vision further. The intensive research that followed was financed by renowned funding programmes, including ProFit funding as well as the EXIST Business Start-up Grant (Federal Ministry for Economic Affairs and Energy, BMWi) with over EUR 1.5 million.

Traditional small wind turbines still lack quality and standardisation, which makes them cost-intensive and expensive. The decisive advantage of MOWEA wind turbines is the scalability of cost-effective, standardised and modular components designed for mass production. Through the innovative use of high-tech, highly efficient aerodynamics and state-of-the-art control technology, MOWEA is setting new standards in small wind turbine technology and reaches top performance values in energy production (certified by Germanischer Lloyd).

MOWEA offers the ideal complement to solar/photovoltaic systems for independent energy supply in industry, real estate and urban areas. The use of several identical small wind generators in one interconnected plug and play technology system ensures high efficiency and allows for flexible applications of the MOWEA systems.



For the market launch, MOWEA has specialised in the field of telecommunications and the application of a modular wind energy system on a telecommunications mast, supported by the expansion of the new 5G radio technology. The company entered a strategic partnership with Vodafone to run a market test and lays claim to two patents. MOWEA is also part of the Vodafone UPLIFT accelerator programme. Large-scale production is planned to start next year.



Conclusion

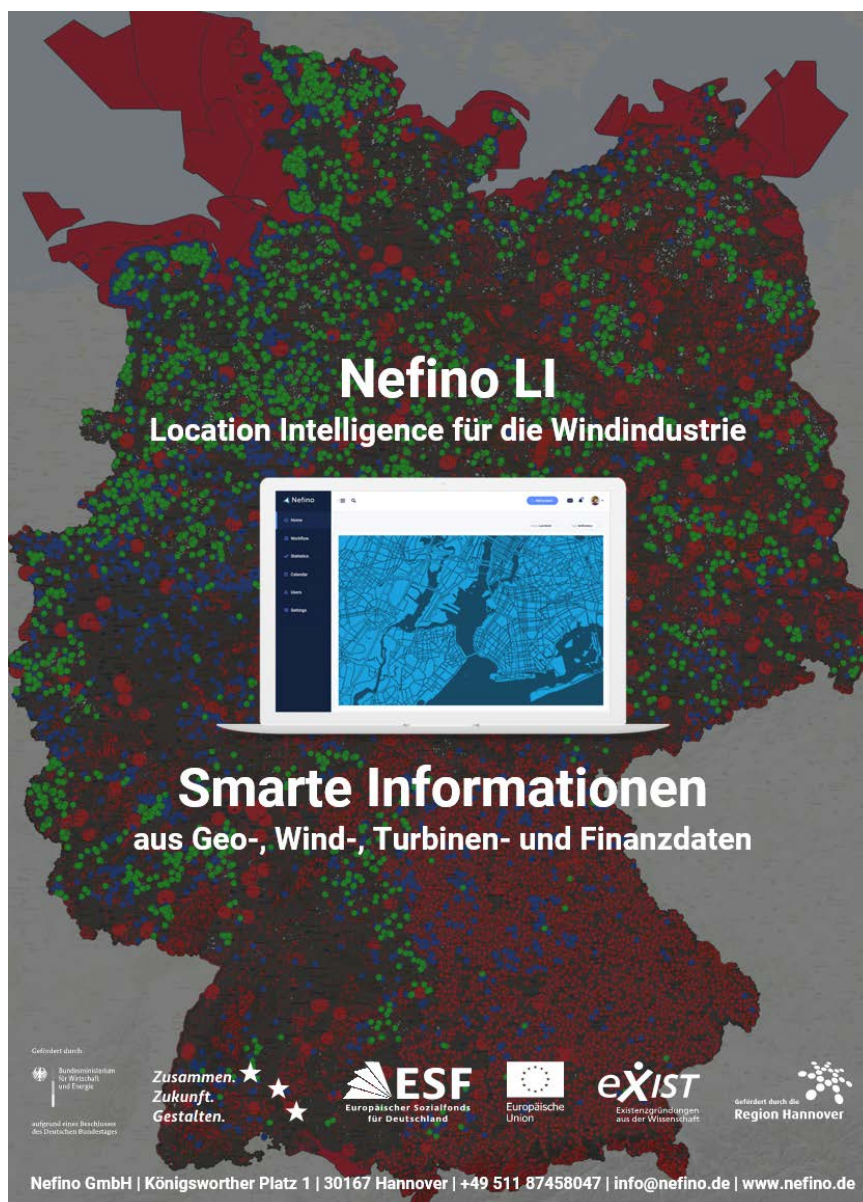
In summary, it is clear that more green energy is needed globally in order to achieve ambitious climate targets. However, what is still lacking are efficient small wind turbines with flexible application opportunities, which are also cost-effective and can be easily installed and maintained. With its modular and scalable wind energy systems MOWEA offers a solution to this problem.

Location intelligence for the wind energy sector

Digitisation can no longer be ignored by the wind energy sector. In a market that is becoming increasingly competitive, it is more important than ever to respond to market changes early and to use new business opportunities efficiently.

This is where Nefino LI¹ comes into play. Nefino LI is an innovative, cloud-based and scalable geographic information system that benefits a wide range of actors in the global wind energy market. Nefino LI processes comprehensive geographic, wind, turbine and financial data in an integrated system consisting of spatial planning analyses, wind simulations and risk/return calculations. Data are prepared in such a way that users of the software-as-a-service solution obtain relevant information for their decision-making processes. Nefino LI thus enables high-performance analyses of the wind energy market at any spatial scale, ranging from individual wind turbines at the micro-level to large fleets of entire regions at the macro-level.

1—LI = Location Intelligence



Nefino LI
Location Intelligence für die Windindustrie

Smarte Informationen
aus Geo-, Wind-, Turbinen- und Finanzdaten

Gefördert durch:
Bundesministerium für Wirtschaft und Energie
aufgrund eines Beschlusses des Deutschen Bundestages

Zusammen.
Zukunft.
Gestalten.

ESF
Europäischer Sozialfonds
für Deutschland

Europäische Union

eXIST
Existenzgründungen
aus der Wissenschaft

Gefördert durch die
Region Hannover

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Founding year	2018
Staff	5
Focus	Software provider, as well as consulting and data analytics services
We offer	Software and analyses to identify greenfield, repowering and decommissioning potential as well as investment opportunities.
We are looking for	Partners interested in joint research projects.

Thanks to Nefino LI, actors such as turbine manufacturers and project planners, banks and investors as well as decommissioning and disposal companies can identify the life cycle phase of specific wind farms in an entire region at any time and anticipate the challenges the respective decision-makers will face in the future.

Users of Nefino LI can thus get a significant advantage in terms of time, information and sales opportunities over their competitors as the system allows them to efficiently identify greenfield and repowering potentials, investment and refinancing prospects, as well as decommissioning and recycling opportunities ahead of their competitors.

On the basis of extensive data specific to wind farms, which are partly collected on site and partly simulated ad hoc in Nefino LI, users of the Nefino LI system are able to proactively approach the decision-makers of wind farms, offering their own smart solutions and supporting them in handling the respective new challenges early and efficiently. In terms of time and cost efficiency, Nefino LI thus provides its users with the crucial first mover advantage which is often decisive in the initial approach to potential customers.

The Nefino LI founders have jointly collected and developed these unique data, models and methods over the last five years as part of their work as research associates at Leibniz University in Hanover. The business idea was born during the project “DemonNetXXL”, funded by the German Research Foundation (DFG), in which the founders analysed the selection criteria and development methods of sustainable and efficient post-utilisation strategies for wind turbines after they had benefited from subsidies under the German Renewable Energy Act (including continued operation vs. repowering).

Since the completion of the research project in September 2018, they have received follow-up funding from the Federal Ministry of Economic Affairs and Energy and the European Social Fund; they have also received an award as a lighthouse project from the Hanover region. With Nefino LI, they are now putting their many years of scientific research into practice, supporting actors in the wind energy market in managing new challenges on the path towards an ecologically and economically intelligent “energy transition 2.0”.



Dr. André Koukal
Co-Founder & CEO



Chris Stetter
Co-Founder & CTO



Jan-Hendrik Piel
Co-Founder & CIO



Martin Westbomke
Co-Founder & CSO

Conclusion

With Nefino LI, Nefino provides location intelligence for the wind industry, setting new standards in the digitised pre-screening of potential areas and operational wind farms. Be it a greenfield or repowering project, an investment or refinancing opportunity or the potential for decommissioning and recycling, Nefino LI lets you specify and take advantage of future business opportunities before your competitors will be able to do so.



The Who's Who of the German wind industry

**Your company is not listed in the publication?
You'd like to be included again next year?
Then don't hesitate!**

Specification:

- Company profile and/or Address entry in the printed Industry Report
- Free distribution around the world at trade fairs and conferences
- Your entry in the two online industry portals www.windindustry-in-germany.com and www.wind-turbine.com
- Editing and graphics of your company profile
- Free copies for your own marketing

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