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20 years of eno evolution 136

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Dear Readers,

After an almost endless break, both life and the professional environment in relation to Covid-19 seem to be slowly getting back to normal.

We used the enforced break to work on the eno Group's many new topics and to address these new as well as old issues with an anniversary edition to mark eno energy's 20th birthday in this year's edition of enomag.

In an interview, Karsten Porm looks back over the past 20 years while also giving a characteristically energetic, bold yet realistic appraisal of the future. The various eno136 articles report on the many ways in which eno has changed in the past few years, as well as on its further development through cooperation, and on our international activities.

We are pleased to present our enomag to you today, hot off the press, and in these turbulent times that give cause for reflection hope you will enjoy reading, reminiscing and remembering, as well as thinking ahead, as we strive to do on a daily basis.

Kathleen Zander
M&A/Project Purchasing/Marketing



eno energy over the years

Next year will mark 30 years since Karsten Porm began his career in the wind energy industry. After training as an electrician and while studying general mechanical engineering, he started working in the design department of the wind division at Husum shipyard. In addition to tasks in international sales, the production of 250 kW turbines in Madras, India was soon added to his responsibilities.

he next company then brought about the next challenge to be mastered – from existing construction drawings to the installed machine, Karsten Porm was responsible for two new two-blade turbines. License production in India went into series production, the two new turbines were in operation or under construction, and so the next challenge was accepted. In Rerik, the Baltic seaside resort, he was responsible for procuring materials for the German and Danish Nordex plant. Having switched from purchasing to project management, projects of various sizes were set up independently in Asia and Europe, and wind farms were also built in North America and North Africa.

Six turbines were planned, financed, in part sold and in part taken over into the company's own stock for its own account. As such, this order made it easier for Nordex to launch the new N54Mk III. Thus, he no longer had to make a living solely from tapping beer in the Husum brewery.

During this time, Karsten Porm made the decision to design, produce and market wind turbines himself. Since this path was to be taken through self-developed projects, his self-employment consequently began with project development, turnkey construction and marketing of wind farms, initially only in Germany. By 2005, the time had come for the initial work on wind turbine production to begin. In parallel to negotiations on license production of a turbine from an established manufacturer, talks were held with banks to finance the first "made by eno" projects - right down to the tip of the blade. Thanks to the founder's decades of extensive experience and the early involvement of international financial institutions, a high level of technology acceptance and a partnership-based cooperation for the successful implementation of projects were achieved. In the meantime, energy company Nordost GmbH became eno energy after taking over the two co-founders' stakes in the company.

After that, things happened fast. In 2008, the self-developed eno82, named after Porm's daughter "Emily", rolled through the factory doors in Rostock. "We were all excited and proud when the prototype was built. Many colleagues have been with us since that day," says Karsten Porm. The eno92 was built two years later and the eno100 in 2013. The 3 to 4 MW platform then followed in 2014. Even today, the eno Group's activities are characterised by Karsten Porm's quality-oriented and reliable selection of suppliers and his personal responsibility for design.

Over these 20 years, eno energy has distinguished itself as a reliable wind turbine manufacturer and partner and sets clear quality standards for project-planning friendly, operator-friendly and low-maintenance wind turbines with short delivery times. Thanks to his experienced management team, as well as around 200 employees in three countries, to date almost 200 eno wind turbines have been installed across Europe in the past twelve years.

Numerous banks, customers and suppliers have accompanied the Group's development from the beginning. German and foreign power supply companies as well as investors have been eno's customers since the very beginning and are still satisfied operators of eno technologies, benefiting from the manufacturer's innovative strength.

As a team, eno focuses on the development and manufacture of the eno136 4.5 MW to be able to react more flexibly in the international market. Eno intends to continue developing its innovative and sustainable processes in the field of renewable energy in the future. Read more about this in the interview with Karsten Porm on the following pages.





"We have had a longstanding partner-ship with eno, in which we work together excellently even in difficult times."

Christian Klingelstein
Head of Sales, Strategy and
Communication,
Reuther STC GmbH



"From my own experience I can say that a smaller company – and eno is one of the small wind turbine manufacturers – can only survive and thrive over such a long period through a great deal of commitment and innovation. The main task to be solved is primarily to boldly reinvent yourself time and again, because only then can you celebrate such an anniversary and Mr Porm has obviously succeeded ... Congratulations!"

Holger Fritsch
Managing Director
Bachmann Monitoring GmbH

Regulatory backlog and delays

Outlook for the wind industry in 2020



We talked to Karsten Porm, shareholder and managing director of the eno Group, about the most frequently asked questions:

Mr Porm, how is business for the eno Group?

Not bad, not bad. However, that has to be seen in the context of the current market situation, for example in Germany. We have not seen the decline in the number of installations that most other companies have, down to around minus 80 per cent. On the other hand, we currently lack a substantial park in Germany and we are only working on small parks with up to five turbines, which were approved more slowly compared to previous approval practice due to greater species protection efforts.

Are you driving the business forward yourself?

Well, I wanted to be less operationally involved, but I'm now fully concentrating on making the 2021 financial year return to the previous level.

Which turbines do you install, eno wind turbines? If so, do you think the turbines' size is still in line with the market?

Of course we install eno wind turbines! If colleagues' turbines seem more suitable for a particular location for various

reasons, something else is built. France is an example of this. Until now, we had not decided to enter the market with our technology, so we installed turbines from other brands in the parks planned by our subsidiary Energie Eolienne France. We are now entering the market with the first three eno126/4 MW/ NH 117 m in Normandy.

France should also be mentioned when it comes to scale. Since tip heights are limited to 180 m or similar in many places, our 126 and 136 are a great fit. Our plans alone that feature these turbines will be ready for construction to the extent of over 250 MW by the end of 2021.

With regard to Germany and Sweden, for example, the end of this size class is in sight.

Do you only supply your 4 and 4.8 MW turbines for projects that result from your own project development work?

Not at all, for example we recently signed a supply contract with a Kazakh customer. But it is also true that the unique drop in prices and thus margins in the years 2017 to 2019 led to eno reducing production. This also resulted in sales activities being adjusted.

Specifically, this means we limited the quantities and put our energy into redesigning the turbines, combined with optimisation of the supply chain. The result are the very powerful 4.8 MW turbines with 126 m and 136 m rotors.

Can eno deliver at short notice, which capacities are available and which markets are served?

Without taking any special measures, one turbine can leave our factory per week and correspondingly more for shift operation. The limitations are rather in our Spanish blade production facility. That is why small batch sizes of three to five turbines can be delivered within twelve months, but for larger batches we have to expand our blade-shaping capacity. For now, we do not see any geographical market restrictions; every project is assessed in terms of its realistic, economic feasibility.

German onshore projects with rotors of between 150 m and 170 m are currently being planned – does eno have a short-term answer?

Hopefully in the foreseeable future. As an OEM, we primarily focus on cooperation with efficient and reliable suppliers. We do so in a very targeted manner in order to survive in a volatile market. For strategic reasons, only a few power electronics components, such as inverters and rectifiers, are manufactured in-house. Nevertheless, we are currently developing various concepts. If our requirements for reliability and economy for an ultimately profitable wind energy project over the park's entire lifetime meet our supplier's offer, something new will come about.

With the innovative ability of eno, which has been proven many times over the past few years, this seems a bit meagre – is that all?

No, of course not. We are still involved in various research projects at the level of various assemblies or in relation to control systems for wind turbines. We are also looking very closely at energy conversion and storage, for example with the help of electrolysis.



To conclude, please give us your take on the future, Mr Porm. For several months, things have been really challenging for many market participants. Where do you see yourself?

Good question, it will certainly not be easy. Generally speaking, based on our business model, we have demonstrated that we are resistant. This means that as planners and manufacturers who are active in several European countries, we are able to cushion fluctuations well. For one thing, this means that we monitor the other markets with regard to installation deliveries and seize opportunities that arise, and evaluate them for possibilities for reliable, long-term business, but on the other hand we also look for other options in Germany. With regard to Germany, but also elsewhere, we hope that in the very short term politicians will overcome the regulatory backlog and delays, set promising signals and create regulations that, for one thing, will make the energy industry, at least within our economy, more stable and reliable through renewable energy sources in order to withdraw from nuclear and coal-fired power generation quickly and without problems.

/ eno136 – low-wind locations

enol36 offers up to a **nine per cent** increase in yield compared to enol26 4.8

Significant modifications for the eno136 for such locations include:

- Innovative eno split tower® design for cost-effective access to large hub heights in low-wind locations with tubular steel towers
- / Rotor blade design based on proven, powerful EB56/61.6 of the eno114/126
- / Innovative, certified lightning protection system based on EB61.6 of the eno126
- / Proven four-point bearing for the platform to relieve the load on the gearbox eno live-train®
- Proven, innovative serration design that enables significant reductions in the sound power level for sound-critical locations

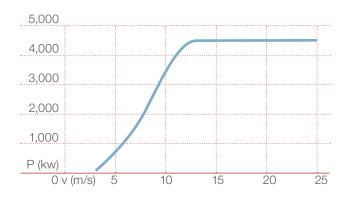
With these modifications, the eno136 – based on a certified electrical system using the 4.8 MW technology of the eno114/126 4.8 – achieves a nominal output of 4.5 MW. Modular full converters ensure high availability and compliance with current grid connection conditions. Refined and coordinated in this way, the new eno136 achieves up to a nine per cent increase in yield compared to the eno126 4.8.

By combining innovative solutions with excellent technical availability, the eno136 is a high-quality investment for maximum yields. This applies in particular to locations that to date have fallen victim to project developers'/accountants' tight calculations. The eno136 stands for new investment opportunities with sustainable success. In addition to its own product portfolio, eno also offers corresponding wind turbines with a short delivery time.

or its self-developed wind turbines, eno energy aspires to offer the technologically best and most efficient solution to its customers for every inland location. For wind turbines, this means being able to meet all geographic and meteorological requirements. On the one hand, these are peak loads that an eno wind turbine has to absorb and

convert in storms, on the coasts or in the mountains. The 114/126 platform has proven itself many times over. On the other hand, inland locations with average mild and erratic winds should also deliver an attractive yield and thus be economically viable. With such wind turbine technology, investors and operators can expand the radius of developable areas.

In an evolutionary process, eno has adapted its wind turbine organism to the special conditions of low-wind locations. These include the specifics of rotor blades, tower, turbine and drive technology. The eno136 wind turbine has been available for development projects in Europe for two years. It is based on the eno114/126 platform, which has been field-tested since 2014, and is designed in accordance with IEC IIIA for optimised efficiency in low-wind locations.



eno**136**

4.5 MW

Calculated annual energy yield

	Yield in MWh
5.0 m/s	6,835
5.5 m/s	8,779
6.0 m/s	10,840
6.5 m/s	12,933
7.0 m/s	15,064
7.5 m/s	17,056





Smart collaboration for "more energy for our future"

The worldwide expansion of renewable energy continues to see rapid growth. Since wind energy in particular is one of the cleanest and cheapest renewable technologies, these expansion rates are reflected in the sales figures of wind turbine manufacturers.

ince the German Electricity Feed-in Act provided the initial spark for commercial wind power in December 1990, around 600 gigawatts of wind power have been installed worldwide, and the trend is rising. The wind industry has become a highly professional industry and wind turbine construction has become a noteworthy, globalised industry. And as in every adolescent industry, wind energy is now subject to strong competitive pressure with associated consolidation effects. If you want to survive successfully in such a market environment, you must either be big or very good. eno and Vensys are currently proving the latter through their cooperation in the field of rotor blade production.

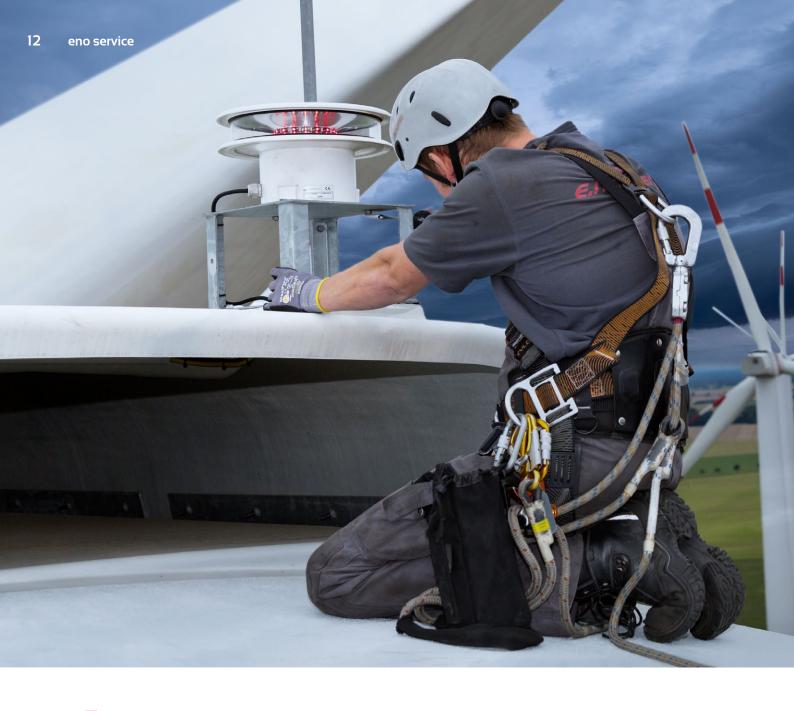
The rotor blades largely determine factors such as the wind turbine's performance, sound properties and turbulence behaviour. In addition, rotor blade design is decisive for the load level of the other support structures. In short, rotor blades determine a wind turbine's essential properties and thus represent a strategic key component. As they are also one of the most expensive components in a turbine, a secure supply at competitive prices is essential for plant builders. This is where the cooperation between eno energy systems and Vensys Energy AG comes in. Since 2013, eno had been obtaining the rotor blades for the successful eno114 and eno126 models from Germany. They were produced according to the build-toprint principle, whereby eno provided the in-house developed blade design and the necessary moulding tools and had high-quality blades shaped in Lohn. After this increasingly put pressure on profitability due to the high unit costs, eno was on the lookout for new options and found what it was looking for in cooperation with Vensys Energy AG, the Saarland manufacturer of directly driven wind turbines.

With its Spanish subsidiary, rotor blade manufacturer Eblades Technology SL, rotor blades will be manufactured for future installation generations.

As a result, the moulds for the reliable EB56 and EB61.6 blade models were moved from Germany to the Spanish blade factory of Vensys subsidiary Eblades in Granada. After successfully ramping up blade production, the blade factory now produces this rotor blade family for the combined needs of both companies. This has significant advantages for eno and Vensys. The relocation to southern Spain and the bundling of capacities result in significant cost advantages, which significantly improves the respective turbines' competitiveness without losing the strategic independence from classic rotor blade manufacturers in terms of delivery and design.

The fact that both manufacturers offer turbines of a similar size with the same rotor sizes is not a competitive problem. Vensys Energy AG has always built wind turbines with its tried-and-tested, directly driven, permanent magnet synchronous generator, whereas eno favours the established, resolved drive train concept with a freely suspended gearbox and external synchronous generator. These fundamentally different turbine concepts sufficiently separate the products from each other, leading to hardly any overlap and therefore hardly any competitive situations on the customer side. For this reason, both Vensys and eno look forward to continuing their cooperation. Further collaboration on the next rotor blade from the EB family, the EB66.9, has already been agreed. The eno136 from eno energy systems is based on this rotor blade.





/ Tomorrow's service today

A gale is blowing outside when the briefing is held at 7.00 a.m. in Rostock at the production site of wind turbine manufacturer eno. Service manager Jan Miesenburg, former managing director of WEA Service Coast GmbH in the area of Enercon Service, discusses the week's schedule with his team.



ith Jan Miesenburg taking over responsibility for eno service, the department has been reorganised and repositioned. As a first step, the internal service structures and employees for the areas of expertise, expert reports and rotor blade were integrated into the office-based technical team. During the further process, the focus was on supporting employees in the field. The position of Site Manager for Field Service has provided the service technicians with a direct contact person with competency in health & safety and training. "Health and safety is our top priority," says the service manager. To bind our customers to "enovative" service in the long term and to guarantee the highest possible availability of the installations, including for rotor blades, repair teams have been set up for rotor blades (abseiling and stage technology) in recent months. Thus, eno service covers all areas of competence in installation support and can completely do without external service providers for its own installation types. A positive side effect is that these teams can also be used by operators of other types of wind turbines. The company is also continuing to develop in the promising European market.

Health and safety is our top priority."

Jan Miesenburg, Head of Service at eno energy



As a manufacturer, eno already has plants in Sweden and therefore established its own service department in the country five years ago. In the past year, a large component replacement (change of blade bearings and tower segment) was successfully carried out on third-party installations made by Kenersys using our own expertise. Based on this experience, the service team is currently developing a multibrand strategy for Sweden. In addition to the concept in northern Europe, suitable service concepts are also being created for France, Poland, Belgium and Kazakhstan.



eno's service department relies on electric vehicles.

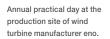
The overall concept can only be successfully implemented by a team of motivated technicians. In the long term, employees are retained in the company through exciting tasks at breathtaking heights, open communication, fixed wage/salary models and performance bonuses based on KPIs achieved, as well as company pension schemes and monthly fuel vouchers. "Every employee in the service department can make his or her contribution to the changing process with their ideas and suggestions and thus help shape the future of their workplace," says the service manager. Trust, responsibility, and sustainability are the key words that will continue to shape service at eno in the future. In the next step, the level of digitisation in the service area will be increased. Whereas today maintenance logs and repair reports are still written on paper, scanned, and manually transferred to the ERP system, this process will be purely digital as of the middle of the year. "I hope that this will significantly improve efficiency in service, and allow us to meet customers' requirements in the area of documentation," explains Miesenburg.













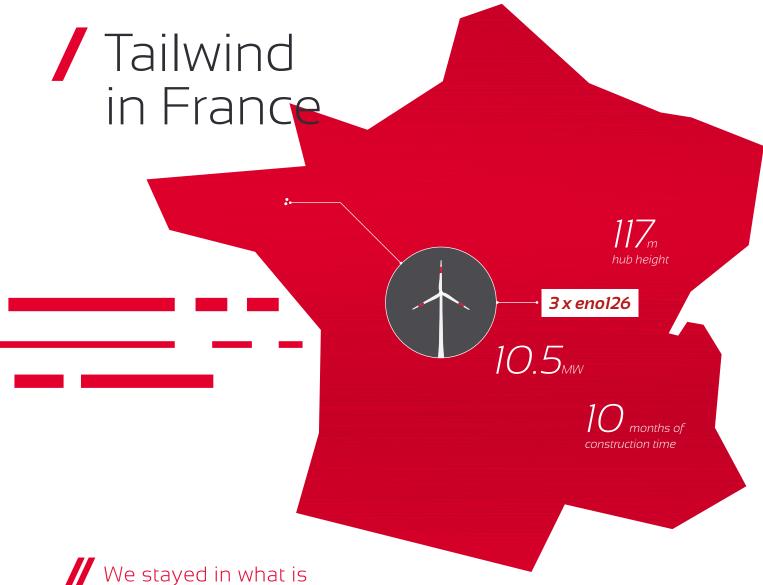
Employees are trained professionally and with a view to practicing how to behave in dangerous situations.

Link to the drone footage on YouTube: https://www.youtube.com/v=o5WHvIKqril



A little later, his service technicians climb into the new ECrafters, which are used for wind farms in the immediate vicinity. Service points close to wind farms mean that environmentally friendly electric vehicles can be used. Through this sustainable energy concept, eno demonstrates what tomorrow's service will look like, today.

So much progress within a year, but Jan Miesenburg is quick to point out that this is far from everything. In the coming years, he sees high growth potential for his area, which goes hand in hand with the installation growth of manufacturer eno. Jan Miesenburg and his young team also consider themselves to be well prepared for the manufacturer's further developments and will use the time until the new generation of systems arrive to further expand their team's expertise.



We stayed in what is probably the most famous area of Paris and are now operating our branch in La Cour des Shadoks to the delight of our employees. In particular, we have strengthened our finance, accounting and legal departments."

Eric Sauvaget,General Manager EEF

Ind turbine manufacturer eno energy is delivering three eno126 wind turbines with a hub height of 117 m for the French Noyal-Muzillac wind farm.

The client, an independent energy producer (IPP) from Hamburg, is impressed by eno's flexibility and full-service customer care. The cooperation partners are now looking forward to preparing the site for the project. Thanks to the wind turbine manufacturer's reliable assistance, the wind farm can be supplied with 10.5 MW within ten months after the contract is signed. Even after approval was granted and successful participation in the tender, eno supported the customer in financing the wind farm.

The French wind farm, with its three eno126, will go into operation at the end of 2020, joining the grid at the connection in Questembert, six kilometres away. Through the conclusion of a long-term full maintenance contract, eno is continuously promoting its activities in the European service business. At the same time, the eno Group's French team, Energie Eolienne France Sas (EEF for short), is growing and with almost 15 employees is expanding into a larger office in the Bastille area of Paris.

eno126 goes to Kazakhstan

11 x eno126

In the second half of 2020 and the first half of 2021, eno energy GmbH will deliver eno126 wind turbines with a hub height of 97 m to Kazakhstan for a wind farm project located approximately 150 km northeast of the Kazakh capital Nur-Sultan (formerly Astana and also Tselinograd).

he wind turbines will be supplied with the load-optimised 2.0 MW mode as well as in the standard mode with 4.8 MW, including a maintenance contract. This order shows that eno energy offers and can supply competitive wind turbines for various locations around the world. The order also underlines the flexibility of eno energy with regard to the relevant international markets and its ability to deliver. The customer is a Kazakh consortium comprising a finance company and a construction company. Before the order was placed, state approval had to be obtained and a tender had to be won. In addition, assurances had to be made that approximately 50 per cent of the added value would be generated within Kazakhstan. Further cooperation between the consortium and eno energy is planned for the future. Kazakhstan has huge wind energy potential and eno energy is determined to make its contribution to the growth of renewables and create local added value in this region. Since mid-March and until at least mid-April, business activity and freedom of movement have been severely restricted in Kazakhstan due to the spread of coronavirus. eno energy is therefore anticipating some delays in the scheduling of the overall project.

2.0mm 4.8mm

A constant fresh breeze from Sweden

eno has been active in Scandinavia since 2010 and is more convinced than ever that the market offers great opportunities. With the "Fossilfritt Sverige" (fossil-free Sweden) programme, the largest country in Scandinavia is pursuing an ambitious climate policy in northern Europe, which is set to make it climate neutral by 2045 through a complete reduction of net emissions to zero.

weden's simplification of the building permit procedure and the designation of new wind suitability areas also offer new opportunities.

2019 was a record year for the wind energy industry. In the first half of 2019, electricity production rose by almost 40 per cent compared to the same period in the previous year to over 10 terawatt hours.



Delivery and unloading of a tower at an eno construction site in Blombacka. Thanks to the many years of experience of parent company eno energy in Germany, we are well positioned in Scandinavia to optimise not only our customers' wind energy projects, but also our own."

Martina Köhn

Managing Director of eno energy Sweden AB



eno energy Sweden has put more than 30 MW into operation since 2015. In a very short time, eno Sweden AB doubled its implementable projects to 235.2 MW, with the majority of the projects being in Central and Southern Sweden as well as one project in Finland. A new office was opened at the new headquarters of eno energy Sweden AB in February 2019, a new service base was opened in Alingsås near Gothenburg in September 2019 and a new sales office was established in Vesterås,

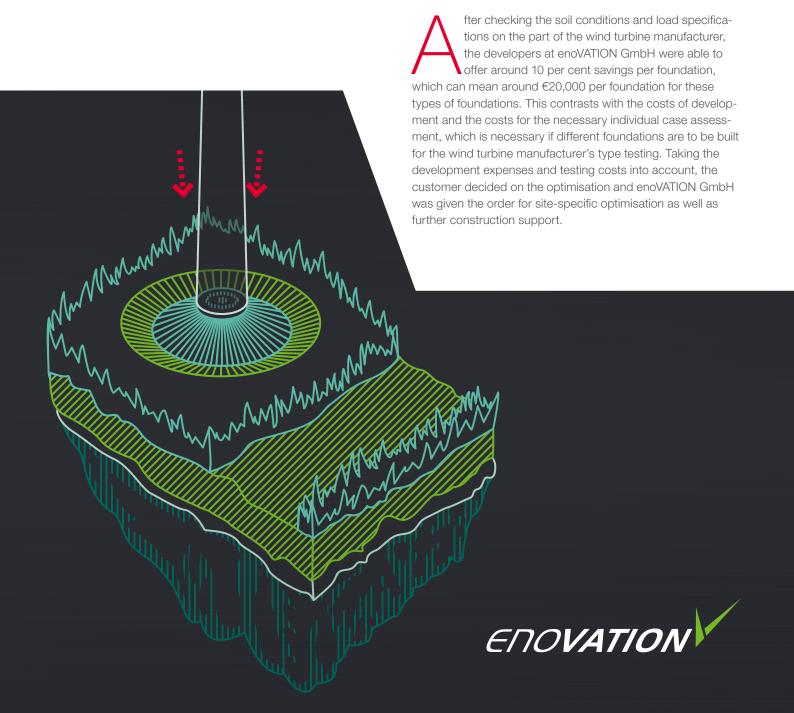
approx. 100 km from Stockholm, in December to expand the team in the areas of wind turbine sales, project purchasing, location optimisation and service.

In the long term, services such as wind turbine inspections, dismantling and repowering as well as multibrand service will be set up.

Construction of an eno wind turbine in Blombacka.

Optimised foundations for Milow WP

In autumn 2018, enoVATION GmbH received a request for site-specific optimisation of three foundations at the Milow wind farm, Mecklenburg-Western Pomerania. These are foundations for a Vestas V126 at a hub height of 137 m.



During the detailed development process further savings potential was leveraged, so that in the end the finished foundation design managed to use a good 15 per cent less concrete and almost 20 per cent less steel compared to the standard variant. The savings per foundation built once again significantly exceeded the previous estimate. In addition, the three foundations in question could be executed immediately, which made it possible to optimise material procurement and the construction process. Another decisive advantage of using the same design was simplification of the test procedure. Thanks to its experience in the area of component certification, enoVA-TION was able to obtain type testing from TÜV for the now optimised foundation. As a result, this considerably reduced the project-specific testing effort for the individual case test so that despite the additional expenses for type testing, the bottom line was that the overall testing costs in the Milow project were low. The foundations were completed, and the expected savings were realised during the construction phase without any issues. The wind farm went into operation in 2019. Both the customer and enoVATION are already working on further projects in which this foundation is to be used. This type testing for the optimised foundation can now be fully exploited. The project's testing expense is now no different than when using the manufacturer's foundation.

Pictures of the construction site at the Milow wind farm.







enoVATION expands service offering

enoVATION GmbH from Rerik, known as a development service provider for wind turbine technology, is expanding its range of services by adding measurement and testing services.

In most development projects, in addition to engineering and design work, validating development results is an essential part of the task. This means that in addition to the design, the focus is often also on measuring the results. In projects where existing problems need to be solved through troubleshooting, a metrological assessment of turbines or turbine parts is usually even a prerequisite for further work.

To address this need, enoVATION GmbH has built up extensive expertise in the inspection of wind turbines and their components over time and deploys state-of-the-art measurement and testing technology. It makes sense to also offer these competencies freely on the market to customers such as operators and project planners. "This means that in addition to a sole testing service provider, our customers also have an experienced consultant with manufacturing expertise at hand who is also able to offer solutions to any problems that may arise," explains Stefan Bockholt, Managing Director of enoVATION GmbH. "In future, in addition to our development services, we will therefore offer testing services such as

- / vibration monitoring (CMS)
- / gear and bearing endoscopy
- / blade angle checks
- / network measurements
- / grounding and lightning protection tests
- / DGUV-V3 tests.

In addition, we can combine these services as desired up to and including comprehensive tests of wind turbines, e.g. after commissioning or extended service life," Bockholt continues.

As a result, enoVATION GmbH continues to evolve into a service provider that can offer all engineering services from the initial idea to testing during operation.

www.eno-vation.com

Become part of a green future



Then the renewable energy sector is the place to be.

– 2 –

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WORK FROM HOME

(unexpectedly). No problem. _ 7

We support environmentally friendly train travel with

MONTHLY TICKET SUBSIDIES.

- 8 -

To work even more sustainably in the future, many of our pool vehicles are already **ELECTRIC.**

- 9 -

Tail wind is always good. Why not be supported in later life by our

COMPANY PENSION SCHEME

and regular massages?

– 10

To keep you up to date, eno often gives you the opportunity to refresh your knowledge in

SEMINARS etc.

_ 11 _

Knowledge is worth a lot to us, we help you financially if you want to **STUDY.**

_ 12 _

If the housing market does not offer anything quickly enough, we are willing to provide you with temporary **LIVING SPACE.**

-13

We not only look forward to the future with pleasure, but also enjoy the here and now through fun **COMPANY EVENTS.**

Wind*Energy Hamburg

Success with wind

Events

Postock Wind Rostock Wind Rosto







