

EP4 MARKET LAUNCH

Series production of EP4 components has begun

NEW TOWER DESIGN ___ ENERCON's "NG" hybrid towers offer benefits for production, logistics and installation

CONSTRUCTION SITE FOR TRAINING ___ ENERCON trains up installation teams at special premises in Gotha

FIRST E-101 WIND FARM IN CANADA ___ ENERCON has installed 77 E-101/3 MW WECs for the NRWF project



STANDARDS

- 03_EDITORIAL
- 04_VIEW
- 06_MAILBOX
- 19_DATES
- 21_ADRESSES

TABLE OF CONTENT

TITLE

8_ EP4 market launches

ENERCON has started production of the EP4 platform at several of its sites.

TECHNOLOGY

14_ New tower design

ENERCON's "Next Generation" hybrid towers allow for more efficient production and logistics processes and shorter assembly times.

TECHNICAL-LEXICON

16_ Installation device for EP4 generators

ENERCON uses lifting equipment developed by the company to install EP4 wind energy converters.

INTERNAL

17_ ENERCON apprentices stir up windy conditions

Wind tunnels have been created for the Energy, Education and Experience Centre (EEZ) in Aurich as part of a training project.

POLITICS

18_ Regions requiring grid expansion curb wind energy

Federal Network Agency puts forward plans for areas with reduced tendering volume.

20_ Integrated energy concept drives energy transition

The heating and transportation sectors in particular would benefit from the use of clean wind energy.

PRACTICE

22_ Training construction site

ENERCON is training up installation teams in a new area in Gotha.

24_ Offshore service job

Components were replaced on ENERCON's only nearshore WEC.

INTERNATIONAL

26_ First E-101 for Canada

ENERCON installed a total of 77 E-101/3 MW WECs in NRWF wind farm.

28_ Start of activities in Bolivia

ENERCON puts its first wind farm with 8 x E-82 E4 into operation.

30_ Expansion in Swiss Alps

ENERCON has enlarged Europe's highest wind farm with 3 E-92/2.35 MW WECs.

8

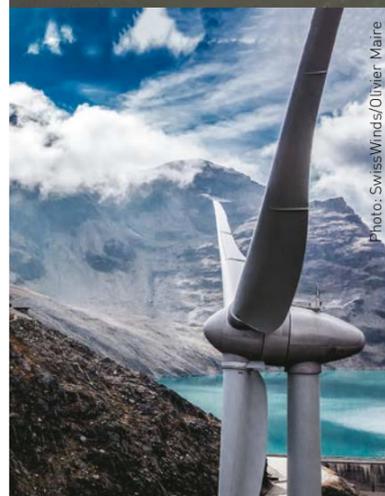


Photo: SwissWinds/Olivier Maire

30

ENERCON faces up to growing challenges



24

Dear customers, business partners and employees,

the onshore wind energy industry and ENERCON are faced with growing challenges. Our market environment is changing, competition is getting fiercer and political decisions have led to difficult framework conditions in key markets. New framework conditions have been imposed in Germany as a result of the tendering process being introduced, which has brought about a high level of uncertainty in this respect. Nobody is in a position to predict how expansion will develop in the next few years. What will come after the "dog race"? How will grid expansion develop? It is essential that we resolve these issues with our customers, associations and politicians so that we can plan carefully and reliably for 2018 onwards as well.

ENERCON is facing up to these challenges. Our objective is to remain competitive and secure jobs in our company in the long term. We are constantly striving for technology and quality leadership and want to supply our customers with the best-quality wind energy converters on the market. We will not abandon these principles in the future.

The foundation that we have is positive: ENERCON is a stable, well-established company with a sound financial basis and is independent in its decision-making. Thanks to our staff in Research & Development, Production, Service, Sales and other company divisions, we have outstanding expertise and decades of experience at our fingertips.

Together with our employees we will tackle the challenges facing us constructively. The personnel changes, implemented as a result of our Research & Development reorganisation which is clearly focussed on technology; gearing towards customer requirements; simplifying organisation and strengthening team spirit, are further points that will set the course for ENERCON's success to continue.

2016 is drawing to a close and thanks to the excellent work done over the past months we are able to report positive results: Our Installation and Service divisions have worked extremely hard, so that we are now heading towards the 3,900 MW mark in terms of installations. We have also begun series production of EP4 components and, in doing so, created the necessary conditions for the successful launch of our new 4 MW platform on the market (see cover topic). This is an acknowledgement of our efforts and assures us that our basis is sound even when faced with perpetual change. We would like to take this opportunity to thank all employees, customers and partners for their loyalty and cooperation, and wish you and your families a blessed Christmas season and a good start to the new year!

Hans-Dieter Kettwig
ENERCON Managing Director

Simon-Hermann Wobben
ENERCON Managing Director

18



Imprint **Publisher:** ENERCON GmbH, Dreekamp 5, D-26605 Aurich, Phone +49 (0) 49 41 927 0, Fax +49 (0) 49 41 927 109, www.enercon.de
Editorial office: Felix Rehwald **Design:** conception Kommunikationsagentur GmbH, Siegen **Printed by:** Druckerei Hachenburg GmbH, Hachenburg
Copyright: All photos, illustrations, texts, images, graphic representations, insofar as this is not expressly stated to the contrary, are the property of ENERCON GmbH and may not be reproduced, changed, transmitted or used otherwise without the prior written consent of ENERCON GmbH.
Frequency: The WINDBLATT is published four times a year. **Subscribe:** Phone +49 (0) 49 41 927 667 or www.enercon.de.
Cover page image: EP4 generator production at ENERCON production site Magdeburg.

Proud production team

ENERCON is well within schedule for the installation of the E-141 EP4 prototype. Work at the Coppanz site in Thuringia is progressing according to plan. The WEC is set to be put into operation and the first power to be fed into the grid in December 2016. The rotor blade factory KTA Kunststofftechnologie Aurich GmbH completed the first outer rotor blade set for ENERCON's new low-wind converter back at the end of October, even faster than was originally planned (pictured: the proud production team with blade number 2 following completion).

The production at KTA is carried out using a mould-based process. The inner blades of the two-part E-141 rotor blades are produced in ENERCON's winding centre for EP4 rotor blades in the Haren/Emsland blade plant. The KTA is currently preparing for the start of series production of the E-141 outer rotor blades. In the future, they will be manufactured on the same production line as the E-101 rotor blades. According to current plans, ENERCON will be installing up to 80 E-141 EP4 machines in 2017 (also see report p. 8 ff).



AURICH

Personnel changes in Management

ENERCON is reorganising its Management. The ENERCON Managing Director and Vice Chairwoman of the Board of the Aloys Wobben Stiftung, Nicole Fritsch-Nehring, is leaving the company at her own request in order to pursue a new professional challenge. Fritsch-Nehring resigned from her positions with effect from 31 October 2016 and will leave the company effective 31 December 2016. "We would like to thank Mrs Fritsch-Nehring for her many years of successful work and her commitment to our company, and wish her all the best for her future endeavours", says ENERCON Managing Director and Chairman of the Board, Hans-Dieter Kettwig.

As part of this personnel change, Hans-Dieter Kettwig will head ENERCON GmbH as Managing Director together with Simon-Hermann Wobben until further notice. Organisational changes have also been made in other divisions of the company. Reorganisation

of WRD technology and structure is a core issue. A technology steering committee headed by ENERCON Sales Director Stefan Lütkemeyer will assume leadership until further notice. This steering committee reports directly to the foundation's management board and will be geared towards meeting the challenges of the market and increasing ENERCON's power of innovation.

From the point of view of Management, the personnel change does not have any effect on ENERCON's position as technology and quality leader, which the company aims to further consolidate in the future. "Our Research and Development department is well equipped. Together with our employees, ENERCON will master the challenges ahead", affirms ENERCON Managing Director Hans-Dieter Kettwig. "Our commitment to offering our customers the best technology and most efficient WECs in the tried-and-tested ENERCON high quality will remain in the future."

HAMBURG

Successful trade fair and conference in Hamburg

The market launch of the EP4 platform and ENERCON's system solutions for renewable energies were the focus of ENERCON's appearance at the international wind energy trade fair Hamburg WindEnergy, and the WindEurope Summit 2016 conference taking place at the same time. Between 27 and 30 September, around 1,400 exhibitors from 34 nations presented their product innovations and services from the wind energy sector in Hamburg. The organisers counted around 35,000 trade visitors from around the world. The conference provided an extensive programme under the slogan "Making transition work" at the same time, with presentations given by around 300 experts on various current topics from the wind energy sector.

ENERCON is pleased with the outcome of both events. "Our exhibition booth attracted a lot of visitors, we conducted conversations with customers, business partners and interested parties from all over the world, and we were able to conclude several agreements over the course of the trade fair", says ENERCON Managing Director Hans-Dieter Kettwig. According to Kettwig, the cooperation with the conference which ran in parallel was a "good addition" to the trade fair programme: "The specialist presentations and discussions with senior politicians and decision-makers enhance the status of Hamburg even further as an important meeting point for the wind industry – a fact confirmed by many customers. From our point of view, it is essential that we develop this partnership and intensify it further." At the conference opening, Kettwig took part in a panel discussion on the topics of energy transition and framework conditions of the wind energy sector. He pointed out the necessity of an intelligent inter-connection between flexible energy generators, consumers and the infrastructure including storage solutions in the context of the further restructuring of the energy system towards renewables. "If we, the renewables, claim to be system-relevant, then we have to be able to deliver as well. We must demonstrate that we are able to offer closed systems", emphasised Kettwig. One of ENERCON's presentations at

the conference dealt specifically with this topic. The storage solutions were introduced on the basis of the ENERCON Smart Container. ENERCON's system solutions were also presented at the trade fair booth. Visitors were able to discover just how far ENERCON's commitment to energy logistics and energy storage has progressed using a variety of multimedia resources. Not least the VIP visitors who ENERCON were glad to welcome to the booth were suitably impressed. These included the EU Commissioner for the Energy Union, Maroš Šefčovic; Hamburg's Senator for Economics, Frank Horch; Hamburg's Senator for Environment and Energy, Jens Kerstan; Hamburg's construction state councillor, Andreas Riekhoff; and the State Secretary in the North Rhine-Westphalia Ministry for Climate Protection and Environment, Peter Knitsch.



EU Commissioner for the Energy Union, Maroš Šefčovic, with ENERCON Managing Director Hans-Dieter Kettwig at the ENERCON trade fair booth.



WindEurope CEO Giles Dickson (r.) and Simon Müller from the International Energy Agency (IEA) at the panel discussion.



Tour of the generator production facilities in Magdeburg-Rothensee.

MAGDEBURG

Intensive exchange at ENERCON Forum in Magdeburg

In order to exchange views with its customers, financial partners and business partners on important issues concerning the onshore wind energy sector and current company developments, ENERCON invited them to take part in the traditional Forum once again. This year, it took place between 15 and 17 November in Magdeburg. Around 350 guests attended. ENERCON Managing Director, Hans-Dieter Kettwig, is pleased with the outcome: "We are delighted that so many of our partners took up our invitation and were able to see for themselves the stable position that ENERCON is in, and how our company is set to tackle the upcoming challenges. We engaged in an intensive and very open dialogue. We are therefore confident that we will be able to master any new challenges that face us together with our partners."

The issues discussed included the current market situation in Germany and abroad, the effects of the tendering system planned for Germany on further onshore wind energy development, and various aspects of the energy transition. ENERCON organised panel discussions with participants including Hermann Albers, President of the German Wind Energy Association (BWE); Giles Dickson, CEO of the European Wind Energy Association WindEurope and Simon Müller from the International Energy Agency (IEA). Beforehand, Prof. Claudia Dalbert, Minister of the Environment for Saxony-Anhalt, and Mayor of Magdeburg Lutz Trümper, gave a welcome address to the plenum. They reiterated the importance of onshore wind energy for a successful energy transition and in boosting the regional economy.

In this context, Hans-Dieter Kettwig and ENERCON Sales Director Stefan Lütkemeyer presented ENERCON's development to date,

plans and further ideas concerning system solutions for renewable energies. Leading experts from various R&D departments such as Arno Hildebrand, Alfred Beekmann, Christoph Hessel, Andree Altmikus, Alexander Hoffmann, Katharina Roloff and Meike Müller held talks on the topics of energy storage and grid support, sound and acoustics, rotor blade development, wind farm planning and optimisation, solutions for cold climate sites and ENERCON's EP4 and EP3 platform. "We got the impression that particularly questions on the new Renewable Energy Sources Act and the effects, and ENERCON's answer to this 'WECs plus system solutions', found fertile ground in uncertain times", says Kettwig.

The personnel changes in ENERCON's Management proved to be only of marginal interest. "Our partners know that the continuity and stability of our company development will remain with the new set-up", says Hans-Dieter Kettwig. "Numerous discussions confirmed to us that we can still rely on the confidence of our partners – isolated media reports from the past weeks based on unfounded speculation will not change that fact."

The guests were also very interested in the guided tours of the production facilities in Magdeburg-Rothensee and SKET offered by ENERCON. They were given the chance to look behind the scenes of the production of rotor blades, generators and steel towers and were able to hear exactly how the final assembly of the WEC components is carried out. A particular highlight was the production of components for ENERCON's new EP4 platform.

HAMBURG

ENERCON's "E-Ship 1" awarded innovation prize

ENERCON's cargo ship "E-Ship 1" has been presented with an innovation prize by the International Windship Association (IWSA). The IWSA, a non-profit organisation promoting wind-based, environmentally friendly drive systems for commercial shipping, awarded the "Wind Propulsion Innovation Award 2016" to the special transporter for components of ENERCON WECs, driven by four Flettner rotors, in the category "Innovation". In addition, ENERCON, as shipowner, received the award in the category "Technology End-User".

The "Wind Propulsion Award" was presented for the first time this year. The prize is awarded by the IWSA to acknowledge ground-

breaking projects and technological innovations in the area of wind propulsion for commercial shipping. The overriding objective of the IWSA is to work towards reducing fuel consumption and minimising damage to the climate caused by emissions from commercial shipping.

Over 40 candidates were nominated for the "Wind Propulsion Award 2016". The awards were presented at the beginning of September as part of the SMM (Shipbuilding, Machinery & Marine Technology) trade fair in Hamburg. With over 2,100 exhibitors and 50,000 visitors, the SMM is one of the leading international trade fairs in the maritime industry.

Series production of EP4 components launched

DURING THE PROTOTYPE STAGE FOR THE NEW EP4 PLATFORM, ENERCON LAID THE FOUNDATIONS FOR THE SERIES PRODUCTION OF EP4 COMPONENTS IN PRODUCTION. THIS HAS ALREADY GOT OFF TO A SUCCESSFUL START IN SEVERAL LOCATIONS.





150

EP4 machines in 2017

Production of E-126 EP4 outer rotor blades in Magdeburg-Rothensee.

ENERCON's new EP4 platform has been very well received on the market. And customer demand, both for the E-126 EP4 for moderate locations and the low wind turbine E-141 EP4, is exceptionally positive. ENERCON is planning up to 150 EP4 machines for 2017. This would mean that the number of "old" E-126 models with 6 and 7.5 MW would already be far exceeded in the year of the market launch – ENERCON has installed a total of 95 WECs from this series since production began in 2007.

Production is well prepared for this ambitious series production start: The foundations were laid for the production of EP4 components during the prototype stage at several locations in Germany and series production launched. "Our production facilities are well equipped for

this challenge", says ENERCON Production Director Simon-Hermann Wobben. "We have made significant investments in our local sites in the last months and switched production over to EP4. We got off to a smooth start. Nothing can prevent the EP4 platform from being successfully launched on the market."

In line with the ENERCON principle that work should be distributed among the existing production sites in equal measure, ENERCON plants in Aurich, Magdeburg and Haren/Emsland have all been entrusted with the production of EP4 components. "ENERCON is therefore helping to set up its national production plants for the future and secure numerous jobs in Germany", says Simon-Hermann Wobben.



Winding centre for EP4 inner rotor blades at Haren/Emsland site.



Final assembly of EP4 rotor in Magdeburg-Rothensee.

"We got off to a smooth start. Nothing can prevent the EP4 platform from being successfully launched on the market."

ENERCON Managing Director Simon-Hermann Wobben

EP4 rotor blade

The EP4 rotor blades, split into two parts, are produced in Haren and Magdeburg, and will soon be produced in Aurich. "Thanks to the segmented design of the EP4 blades, the work can be effectively divided between different sites", says Jost Backhaus, Managing Director for ENERCON Rotor Blade Production. ENERCON has opened a new winding centre in Haren for this purpose, where the identically constructed inner blades of the E-126 EP4 and E-141 EP4 are manufactured. They are produced using a winding technique where glass-fibre non-woven fabric is soaked in a resin-hardener mixture and then wrapped around a revolving positive core. In the next step, the aerodynamic casing that gives the blade segment its distinct profile is glued onto the hardened tubular structure. The segment is then finished and the surface coated. The EP4 inner blades are produced, assembled and finished at the Haren plant. "Haren delivers these components to the construction site turnkey", explains Jost Backhaus. In the weeks following the start of production, the production facilities AERO Ems GmbH and Harener Komponentenfertigung GmbH have already manufactured over 30 EP4 inner blades.

The EP4 outer rotor blades are manufactured at the Magdeburg-Rothensee and Aurich sites. The E-126 EP4 outer rotor blades are also built at the Rothensee site, where they are produced using the

conventional half-shell technique. One main mould is currently available and another will be put into operation in 2017.

As ENERCON is expecting a considerably higher number of units for the E-141 EP4, series production of the outer rotor blades is set to be carried out in the blade plant KTA Kunststofftechnologie Aurich GmbH, which was designed for high output. The KTA production team built the rotor blade set for the E-141 prototype (see p. 4f). ENERCON is currently setting up series production in its most modern blade plant to start at the beginning of 2017.

"The biggest challenge will be using the same line production process to build two different blades", says Jost Backhaus. The E-141 outer rotor blades will be produced on the same line as the E-101 blades. The production process may be similar – both blades are produced using the half-shell technique – but the process times are different, as are the materials and equipment required for each blade type. "We therefore have to make our line production even more flexible", says Backhaus. The main aim here is to ensure that the manufacturing and logistics processes in the plant are controlled and displayed effectively according to the blade type. Different components have to be delivered to the work positions in the same production cycle and the respective sub-processes have to be carried out efficiently to keep within the specified cycle.

In order to ensure a smooth transition between the E-141 and E-101 production, the KTA set up a type of "pit lane" for the mould vehicles which transport the blade moulds from work station to work station inside the plant. The moulds required for the specific blade type are fitted out in this preparation area away from the production line, without affecting the production cycle. The prepared mould is then fed into the production cycle, and as soon as the empty mould reaches the first work station, the employees start the production process by layering up the mould.

EP4 generator

ENERCON has chosen Magdeburg to be the production site for the EP4 generators. They are wound at the Windgeneratorenfertigung Magdeburg GmbH in Rothensee. Investments in new plant equipment were also necessary at this ENERCON plant in order to adapt the production processes to the new components, Managing Director Daniel Burek says. The plant can handle a capacity of approximately 350 EP4 generators every year.

According to Daniel Burek, the stacking equipment for handling the segment plates during production of the stator support ring had to be adjusted, for instance. A total of 39,000 single plates are handled during this work process. The winding station is also new. Here, the copper windings are laid in the stator support ring manually, formed and then fixed in place. Around 9 tonnes of copper strands are formed into bundles during this step.

Adjustments had to be made due to factors such as the size differences: The 52-tonne EP4 stator support ring has a diameter of 8.75 metres while the E-115 stator, which will continue to be produced in Magdeburg, weighs 36 tonnes and has a diameter of 6 m. Another difference is that 12 systems are wound from both sides on the EP4 compared to 6 systems on one side on the E-115.



Assembly of the stator support of an EP4 generator at RoAn in Magdeburg-Rothensee.

Modifications also had to be made to the crane systems, internal transport and lifting equipment and work platforms to accommodate the larger dimensions and weights of the EP4 components. The impregnation plant and powder booth were also enhanced for EP4 production. This is where the fabricated stators and rotors are provided with an insulation coating to protect them against corrosion. The components are impregnated with liquid resin and then powder-coated with epoxy resin. This production step has been altered for the EP4. The stator and rotor are impregnated and coated in subcomponents rather than all at once, due to the optimised transportation in segments. "The changeover to EP4 was well organised in advance", reports Daniel Burek. "The production start-up went without a hitch."

EP4 generator assembly

The final assembly of the produced EP4 generators is carried out at the Rothenseer Anlagenbau GmbH in Magdeburg (RoAn). RoAn also assembles the hub, the yaw carrier unit and the EP4 roof unit. "We didn't have to change much for the start of EP4 production", says RoAn Managing Director Dr Dirk Hofmann. "We merely had to make it possible to use our conventional method to create a new product."

Following the definition of the manufacturing process workflow and the creation of BOMs, work plans, installation instructions and inspection instructions, the layout in Logistics and Production was modified. The devices and test equipment required for assembling the EP4 components were constructed and procured and the corresponding risk assessments created. A workshop was also held prior to the actual production start-up to gather suggestions on possible ways to streamline and economise the workflows. "We gathered around 50 suggestions for improvement", reports Dirk Hofmann. Staff training was another important part of the preparations. It is safe to say that the changeover to EP4 went according to plan at RoAn as well.

EP4 main carrier unit

The EP4 platform main carrier unit is assembled in Aurich at Mechanic Anlagenbau GmbH. This subcomponent including attachments and

electrical installations is the top part of the divided EP4 machine carrier, which is joined together with the yaw carrier unit pre-assembled in Magdeburg at RoAn at the construction site. Dividing the manufacture of these components between two plants is a new approach. Mechanic mounts the rectifier platform on the main carrier with the electric components and cabling installed, carries out a functional test and packs the assembled subcomponent in weather-proof packaging for shipping to the installation site.

The crane capacities in the production halls at Mechanic had been increased for EP4 production. The hall layout had also been changed to make room for the new series, and the necessary assembly and test equipment procured. "We also introduced shift work for the EP4 production, hired more staff and provided the staff with intensive training", says Production Manager André Hollander. After all, the EP4 considerably increases the complexity of the production process at Mechanic: On top of this most recent ENERCON development, the plant will continue to assemble the main components for the E-70, E-82, E-92 and smaller WEC series in the sub-megawatt class.

EP4 nacelle casing

Another new feature of the EP4 platform is the nacelle casing. It is designed with optimised segmentation for easier transport to the installation site in standard containers. The sandblasted aluminium plates are manufactured at Maschinen- und Anlagenbau Magdeburg GmbH (MAM). For this purpose the production line for the E-126 inner steel blade spoilers was stripped down and the hall refurbished, reports Technical Manager Mike Müller. MAM expanded the existing compressor system and then installed a new blast room for the EP4 nacelle casing. It also had to set up work stations for the nacelle casing, build extraction systems for them and develop a staging area for transport containers.

The production processes themselves are not hugely different from those used for the nacelle casings of other ENERCON series. "The main difference is that there are now more casing elements to be manufactured", explains the Technical Manager. "Innovations include the

transport frames for container loading and the weekly production including sandblasting, fitting out and packaging 85 casing elements."

EP4 blade connection unit

ENERCON has designed a new blade connection unit to connect the rotor blades to the hub on the EP4 wind energy converters. It consists of a pitch system to which hub adapter and blade adapter are fastened. The blade connection unit is pre-assembled at the ENERCON factory and is shipped to the installation site in fully functional condition.

SKET GmbH in Magdeburg is responsible for producing the EP4 blade connection unit. "As a main supplier of ENERCON, SKET was already involved in the prototype production of EP4 components from the beginning", says SKET Managing Director Dirk Pollak. "The ongoing pre-series production was used to optimise the production process further, particularly in terms of cost."

Aside from the blade connection unit, SKET is also involved in the production of the EP4 in many other ways. For example, it manufactures the support pin, works on mechanical processing of almost all of the cast components and helps to further develop corrosion protection and quality control and reduce costs together with ENERCON's research and development and other ENERCON suppliers and plants.

EP4 E-module

Elektric Schaltanlagenfertigung GmbH in Aurich produces all E-modules for WECs in the EP4 platform series. The plant has been collaborating closely with ENERCON's development engineers since the development phase in order to guarantee a standardised EP4 E-module design which optimises production. "There is no doubt that the cooperation has paid off", says Elektric Managing Director Ulrich Neundlinger. "We have simplified the routing of the cables and can therefore connect up the cables on the E-module more quickly. We also took lots of ergonomic aspects into account during development. This means that on the whole, the module can be produced very easily. As a result of this, we were able to start up production much more quickly than with other new assemblies."

The E-module produced at Elektric always has the same structure, both for the E-126 EP4 and the E-141 EP4. It consists of two levels: a lower level in which two transformer units are built and an upper level where two converter units are installed with a total of 18 converters. These inverters, which are also produced in series at Elektric, convert the electricity generated by the EP4 into alternating current that conforms to grid requirements.

The production process is the same as that which has been used for the ENERCON E-modules to date: Suppliers send the steel construction frames to the factory at Elektric as needed. Here, all electrical components including converters, control cabinet, transformers, switchgear and the UPS, are installed and tested according to the specified production cycle. The completed E-module is then shrink-wrapped in transport protection film and made available for delivery. One detail has been changed on the underside of the steel frame which appears



Final assembly of EP4 hub in Magdeburg-Rothensee (Top image).
Assembly of the EP4 E-module at Elektric in Aurich (Image underneath).
Functional test of EP4 main carrier unit at Mechanic in Aurich (Bottom image).

insignificant but has an effect on the logistical handling: It has "corner castings" – the standard fastening system for 20-foot containers, which allow an E-module loaded for lorry transportation, for example, to slot into the corresponding attachment points on container trailers. Lashing straps for securing cargo are therefore not required.

Further optimisation of EP4 production

ENERCON Production Director Simon-Hermann Wobben is pleased with the progress of the EP4 series production launch. "Considering the complexity of the EP4 platform production and how many different ENERCON production facilities are involved in manufacturing this high-tech product, it is particularly gratifying to see how well all the different parts are coming together", says Wobben. But ENERCON will not be resting on its laurels. "We aim to build the highest-quality WEC on the market", says Wobben. "Alongside research and development, our Production has a special responsibility here. We are therefore constantly working on ways to optimise our production further." According to Wobben, the key factors here are maintaining the highest quality standards in all areas; innovative production processes using partial automation and modern machines designed to meet the special ENERCON requirements; and, "above all, qualified, motivated and committed employees". //

New tower design brings efficiency benefits

ENERCON'S "NEXT GENERATION" HYBRID TOWERS HAVE BEEN DESIGNED TO IMPROVE THE EFFICIENCY OF PRODUCTION AND LOGISTICS AND REDUCE ASSEMBLY TIMES AT THE CONSTRUCTION SITE. THE FIRST NG TOWERS HAVE ALREADY BEEN INSTALLED, WITH OTHERS TO FOLLOW IN THE SPRING FOR WIND ENERGY CONVERTERS IN THE EP4 PLATFORM SERIES.

When ENERCON developed its new EP4 platform, it recognised the important contribution which the use of a high proportion of identical parts and standard components could make to optimising production and logistics and shortening construction times on site. When one considers that wind energy converters are constantly increasing in size and that, in markets like Germany, there is a trend towards installing them at challenging sites deep in the hinterland, then the importance of these objectives becomes all the more apparent. The systematic implementation of the platform concept down to component level is ENERCON's answer to the challenges represented by these developments in the market. ENERCON has designed its 'Next Generation' towers to meet the needs of our times.

The most striking new feature of the NG towers is their use of a combination of conical and cylindrical segments. ENERCON's earlier hybrid towers were conical throughout, with just the top steel sections being cylindrical in shape. Moreover, the new NG tower segments have been standardised, and can be used for different tower versions with a range of hub heights: something akin to a modular system has been designed, which uses a combination of different numbers of cylindrical and conical segments depending on the hub height. This makes it possible to reduce development times considerably for new tower versions. Furthermore, the tower diameter is restricted to 10 m at the foundation. This means that it is sufficient to halve the concrete segments, rather than dividing them into three as used to be the practice.

"We can achieve cost benefits in production because of the higher proportion of identical parts", explains Arno Hildebrand, project manager for the NG tower at ENERCON's research and development division WRD. "It is easier to manufacture the segments in the factory. The components for different tower versions can be manufactured on one and the same production line. Fewer formworks and less space are required; even warehousing is made easier. And because the concrete has to be made to predefined specifications, there is a guaranteed option of manufacturing the towers anywhere in the world." There are also benefits when it comes to logistics, because transportation is made easier and cheaper thanks to the absence of the large one-third segments.

"With fewer concrete segments to join together, the shorter assembly times on site make for added efficiency benefits", continues Hildebrand. Another advantage is that thanks to the new shape,

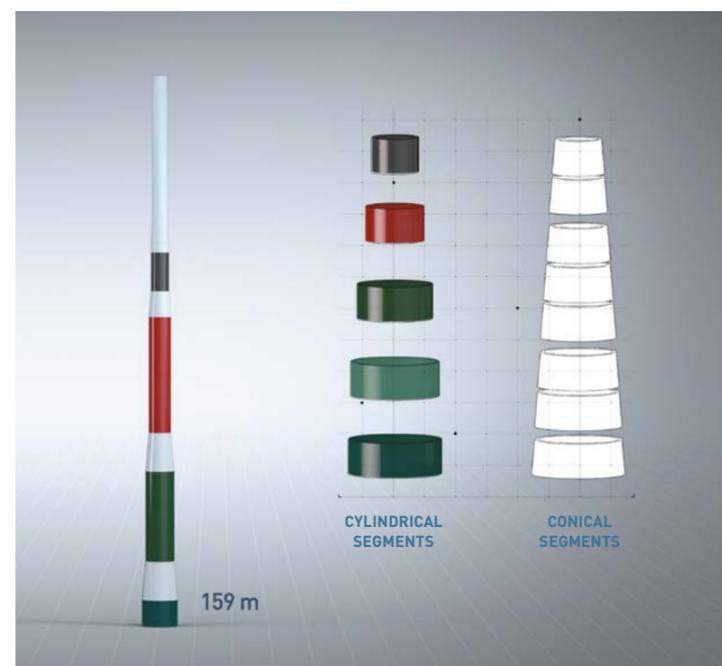
New NG tower
with 159 m hub height
for the E-141 EP4.

ENERCON's tower crane can be positioned more efficiently alongside the wind energy converter during construction. Because it takes up less room, this special crane technology has the edge over crawler and mobile cranes, especially at sites with challenging conditions.

The top steel sections of the NG towers are cylindrical throughout. "This means that all of the mounting parts are identical", explains Hildebrand. It is only the steel element which connects the steel and concrete segments which is conical in the new EP4 towers; because of its base diameter of 5.0 m, it is delivered to the construction site in three longitudinal segments for ease of transportation.

These steel segments are joined together by a special union fitting, which is then filled with quick-setting grout. A bolted version without concrete is available as an alternative for use at sites with cold climates. Once the individual concrete segments have been installed, they are tensioned together using prestressing tendons which run down the internal wall of the tower from the top section right down into the tensioning basement. "This also provides maintenance benefits, as the service technicians have an unobstructed view of the prestressing tendons when they are carrying out their inspections", explains Hildebrand.

The first hybrid towers to be designed using the new NG concept were built for E-115 projects in Schleswig-Holstein. For instance, there



One of the first projects to use the new NG tower: the Fücht wind farm in Schleswig-Holstein, with eight E-115/3 MW converters (92 m hub height).

"The standardised segments allow us to be more efficient on the construction site, especially in terms of building the concrete tower."

Sascha Köhn, project manager at ENERCON
Project & Logistics Management

are a total of seven E-115/3 MW converters with 92 m hub heights in operation at the Schnatebüller Koog wind farm near Niebüll. Five E-115/3 MW converters with the same type of tower were installed in the neighbouring wind farm of Leckeng. Another eight turbines of the same design were installed at the Fücht/Helse wind farm near Marne. And in addition to these, the same type of tower has also been erected in other farms.

Experiences made at the construction sites have fulfilled the expectations of those behind the NG concept. "Compared with the similar hybrid towers for the E-101 with a hub height of 99 m, which lay at the heart of their predecessors' design, the NG towers were quicker to build", says Sascha Köhn, project manager at ENERCON Project & Logistics Management for the E-115 wind farms with 92 m hub heights in Schleswig-Holstein. His conclusion? "The standardised segments allow us to be more efficient on the construction site, especially in terms of building the concrete tower."

The first NG tower for the EP4 platform will follow in the spring of 2017: a hybrid tower with a hub height of 159 m. It will be available for both the E-126 EP4 and the E-141 EP4. //

Special installation device for EP4 generators

SPECIAL LIFTING DEVICES DEVELOPED BY ENERCON ARE USED TO INSTALL THE NEW EP4 PLATFORM GENERATORS. THEY ARE TAILORED TO THE UNIQUE DESIGN OF THE ENERCON COMPONENTS.



Un order to be able to make more flexible use of the crane technology when installing EP4 platform wind energy converters, ENERCON's EP4 installation concept allows for separate installation of the stator and rotor. Thanks to the reduced weights on the individual hoists ENERCON is able to use smaller installation cranes. These are available in large quantities in most installation regions and also cost much less than large cranes. Installing the stator and rotor separately, however, means that special lifting and installation equipment is required: the "generator rotor installation device". ENERCON also uses this device for other WEC series. It was redesigned and adapted for the EP4 generators by the ENERCON company SKET in Magdeburg.

The device ensures that the generator rotor can be arranged with millimetre precision in the already installed generator stator using the installation crane. The biggest challenge involved in this installation step at up to 159 m hub height is the fact that there is no leeway for

crane operators and technicians. The air gap between the generator rotor and stator is only a few millimetres wide, and the 58-tonne generator rotor only has to catch slightly for irreparable damage to be caused.

The generator rotor is therefore bolted to a lifting device on the ground, which the crane lifts. The lifting device is movably connected to an auxiliary axle pin via a high-precision linear guide. Both parts are bolted so that they cannot move during lifting. At hub height the crane slews the load towards the WEC machine house and the auxiliary axle pin is bolted to the WEC support pin. The lifting device is hydraulically unbolted. Thanks to the 5° inclination on the axle pin, the unlocked lifting device with the generator rotor slides into the generator stator via the linear guide with millimetre precision. Finally, the bolt connections between the auxiliary axle pin and the support pin and the lifting device and the generator rotor are undone. The crane operator can then move away the installation aid and lower it. //

ENERCON apprentices ensure windy conditions

AURICH

WIND TUNNELS WERE CONSTRUCTED FOR THE CENTRE FOR NATURE AND TECHNOLOGY IN AURICH AS PART OF A CROSS-COMPANY TRAINING PROJECT. THEY ARE USED FOR SCIENTIFIC EXPERIMENTS WITH SCHOOL CLASSES.

No matter how much operators and owners wish it was the case, ENERCON has no influence on the wind. Whether wind is blowing, its strength and direction are all determined by nature, and wind energy converters have to adapt to this at every site. In the course of a cross-company training project, however, it is ENERCON's apprentices who have been creating windy conditions: They constructed several wind tunnels for the Centre for Nature and Technology (znt). In the future, they will be used in the Energy, Education and Experience Centre (EEZ) in Aurich for scientific experiments with school classes.

The znt provides schools with an out-of-school teaching location. "From the very beginning,

the use of wind tunnels as test equipment was planned by the znt initiator, Erich Welschehold", says Educational Director Kai Leferink. They are intended to demonstrate to the pupils which forces the wind flow develops, how lift and downforce can be utilised and which effects the aerodynamic properties have. The wind tunnel experiments help to illustrate why a sailing boat sails, or why the rotor on a wind energy converter turns, for example.

As the wind tunnel design required was not available to buy, ENERCON stepped in. Experts from various departments first built a prototype based on the znt specifications. It was then recreated by the apprentices in

ENERCON's training workshops in the EEZ. The metalworking apprentices had the task of adapting and installing the axial fans and the housing parts from various suppliers. The electrotechnical apprentices then installed the electronic components and took care of the cabling and software adaptation. Three wind tunnels were produced in the EEZ in this way.

"The project went down very well with the apprentices", reports metalwork trainer Keno Claassen. "They had a lot of fun working on a concrete project like this, and when it was over they had a functional product which they can see being used for such a fantastic purpose", adds electrotechnical trainer Martin Cremer. //



Project team with finished wind tunnel, from left: Mario Hölscher, Sebastian Bley, Tim Helmerichs, Jannik Seelig, Patrick Walter, Dennis Jacobs.

Regions requiring grid expansion curb wind energy at top locations

THE FEDERAL NETWORK AGENCY HAS PRESENTED ITS PROPOSAL FOR THE DIVISION OF AREAS FOR A REDUCED TENDERING VOLUME. THE LIMITATIONS APPLY EXCLUSIVELY TO NORTH GERMANY.

Following the passage of the Renewable Energy Sources Act by the Bundestag, it is now clear that the Federal Government wants to put the dampers on wind energy expansion in North Germany, because grid expansion and wind expansion have not progressed at the same speed in the past. This represents a real break in the Renewable Energy Sources Act, as up until now the grid operators have been responsible for expanding the grid sufficiently to take up the new wind power coming into the system. Now this logic has been turned around and wind farm planners have been told to wait for the grid to be expanded.

In the future, only 58% of the average expansion from the past three years will be allowed in the newly defined "regions for grid expansion". The figure shows the regions planned for grid expansion: While the federal states Schleswig-Holstein, Lower Saxony and Hessen were named to start with, the current draft by the Federal Network Agency (BNetzA)

also shows the north of Mecklenburg-Western Pomerania to be affected alongside Schleswig-Holstein and the north of Lower Saxony. The wind energy development permitted has now been reduced to 902 MW compared to the average of 1,552 MW installed previously – a loss of 650 MW potential wind energy capacity per year. Of course, the Federal Network Agency can amend the Act in three years' time after checking the grid expansion status. However, if pressure is not put on the grid operators to make changes, then we can assume that grid capacity will still be underdeveloped three years from today. In that case, an extension of the curb on expansion is merely a formality.

Expansion reduced to 902 MW

The area for grid expansion defined in the Renewable Energy Sources Act 2017 is officially based on the data from the last system analysis in accordance with the Reserve Power Plant Ordinance and the data and analyses transferred for the period in three to five years. The transmission network operator prepares this system analysis every year by 30 March, and it is confirmed by the Federal Network Agency by 1 May. It considers individual grid situations which are particularly critical and relevant for design. The system analysis has two fundamental advantages compared to other information sources on grid bottlenecks: It looks to the

future and considers the effect of newly installed cables in the critical grid situations as relief for the grid.

What is not clear is how the 2016 system analyses carried out by the transmission network operators have led to the region on the draft provided being proposed. Some of the districts proposed have never been subject to wind energy limitations or reduced by expansion measures. The district of Emsland is one of these regions. Not only are there virtually no limitations here due to the ultra-high voltage line which transports electricity from Wilhelmshaven to the former Lingen power plant, but larger grid capacities will also be freed up at the latest when the Emsland nuclear power plant is shut down.

Freed up grid capacities not considered

Similar examples can be found in Bremen where significant grid capacity has been freed up due to the decommissioning of several coal-fired power plant units. There is no bottleneck here. According to the grid operator TenneT, the 380 kV west coast line in Schleswig-Holstein is set to be put into

operation in 2019, causing huge capacities to become available in the grid.

Furthermore, nowhere near all of the measures to ensure efficient utilisation of the grids have been put in place to date. There are, for example, technical approaches which could help reduce the forced limitations of WECs as part of feed-in management in the event of grid overload by up to 90%. For this, the On-Line Dynamic security assessment has to be used to automatically determine the best countermeasures and it has to be possible to restrict the output of the wind farm within a few minutes. Up until now, wind energy converters have only been limited if the equipment would be overloaded in the case of equipment or cable failure. As this overloading does not occur at all in most cases, a large amount of wind energy is throttled as a precautionary measure in order to conform with the system security principles. On-line DSA, on the other hand, can predict whether there is a sufficient time buffer available for the feed-in management intended to remedy overloading which has already occurred. It should therefore still be possible to guarantee system security. The feed-in management intervention period only serves to bridge the time until other grid measures have taken effect.

Setback for integrated energy

On top of this, in the new Renewable Energy Sources Act the Federal Government has prohibited a further possibility for using clean wind energy locally instead of feeding it into the grid: Up until now, wind turbine operators were able to supply industrial plants in the immediate vicinity of the WEC, or use a percentage of the energy generated for storage solutions. Electricity which could not be used was fed into the public grid, according to the Renewable Energy Sources Act. Unfortunately, and for reasons our industry cannot understand, these regional solutions are no longer permitted. Wind energy converters to which the call for tender applies are obligated to feed all of their electricity into the public grid. A setback on the path to achieving integrated energy, which we need to reach in order to be able to source all our power from renewables! We cannot help feeling that the renewables are still being used as a scapegoat for failed grid policies in Germany, despite the fact that the positive onshore development was clear to anyone who wanted to see it – including the grid operators. The reaction is simply too late and there is still no pressure being put on the grid operators in Germany! //

LAMMA

(Peterborough/UK)
18 – 19 January 2017
www.lammashow.com

EnergyNowExpo

(Telford/UK)
8 – 9 February 2017
www.energynowexpo.co.uk

WindExpo

(Tokyo/Japan)
1 – 3 March 2017
www.windexpo.jp/en/

Hannover Messe

(Hanover/Germany)
24 – 28 April 2017
www.hannovermesse.de

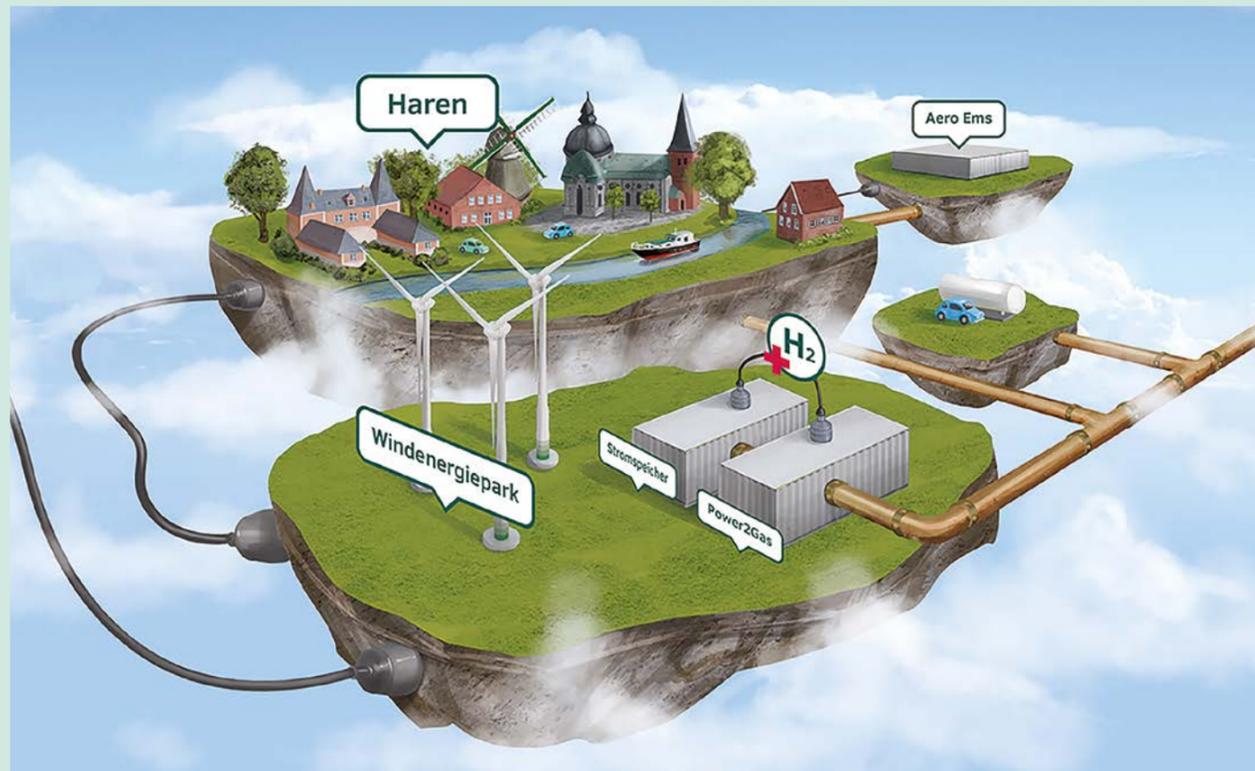
ICCI

(Istanbul/Turkey)
3 – 5 May 2017
www.icci.com.tr



Integrated energy – a path to energy transition for heating and transportation

IN OUR ESTIMATION, TENDERING SYSTEMS ACROSS GERMANY AND THE EU ARE CURBING THE ALLEGEDLY TOO FAST EXPANSION OF RENEWABLE ENERGIES, DESPITE THE FACT THAT THE USE OF CLEAN WIND ENERGY IS URGENTLY NEEDED IN OTHER AREAS.



Storage systems are to be added to 16 x E-141 EP4 turbines in the community-owned wind farm Fehndorf-Lindloh planned for Emsland in Lower Saxony. This will bring the region a huge step towards sourcing all of its energy from renewables.

The Federal Government aims to achieve a 45 % share of renewables in power generation by 2025. A higher share would be possible. However, expansion has been curbed by the introduction of tenders with rather low volumes. The wrong move, in our opinion. The transportation and heating sectors in particular still have a lot of homework to do, and onshore wind energy could prove helpful here.

Renewable energies do take up a share of 13 % of the power supply in the heating sector, but in the transportation sector the share is a mere 5.3 %. The share in transportation dropped to this level following a minor boom in renewables a decade ago brought about by biofuels, which, however, died down very quickly.

The electricity sector could help

The electricity sector alone exceeded the expansion targets and achieved a share of as much as 33 % of the gross power consumption in 2015, putting it in a position to do the homework for the other sectors too. "Together with customers we are planning a whole series of projects to implement the integrated energy concept locally in the regions", explains Jens Winkler, Head of the Energy Management Department at ENERCON. "For example, at the Fehndorf-Lindloh wind farm in Emsland we could use a 2 MW battery storage system to increase the share of self-supplied quarter-hours in the location from 45% to 68 %, and generate hydrogen for the mobility or heating sector with 4 MW power output at the same time."

According to Jens Winkler, project concepts such as this one would bring many more advantages for the expansion of wind energy: A reliable level of consumption at the local level by electric cars, power-to-gas and power-to-X applications also ensures a reduction in grid load as a result of new wind farms. "The argument that grid power still has to be available is invalid, as the P2X technology only works when power is available locally. Otherwise the gas grid cuts in – not the power grid."

The governing coalition has taken a step backwards with the 2017 Renewable Energy Sources Act: Where it used to be possible for companies to supply production facilities with wind energy from WECs installed

on their premises, this will no longer be permitted in the future for WECs which won the tender. They are obligated to feed all of their power into the public grid. The wind energy may only be used for alternative applications at times when the electricity trading price is negative, or if feed-in management is activated. The rules which have been established by politics are dubious to say the least. It obstructs innovations in the decentralised optimisation of consumptions, grid use and intelligent networks, and all of that in the digital age!

Concept for integrated energy necessary

Not much of a consolation given that, contrary to what the commotion in politics and amongst the general public surrounding the excess wind energy in the allegedly overflowing grid would have us believe, the energy exchange (EEX) in Leipzig only reported a few hours of negative electricity prices in recent years: Following an isolated record of 621 hours of negative electricity prices in 2013, the number of hours decreased to 61 in 2014 and 118 in 2015. Pushers of the integrated energy concept are not able to make any major advances with feed-in management power either, seeing as the proportion of "switched-off" power generation in Lower Saxony was just 2 % of the total generated, and in Mecklenburg-West Pomerania only 1.38 %, according to the Federal Network Agency (BNetzA). Schleswig-Holstein was the only state which had to limit around 20 % of its wind energy generation.

In the time remaining before the Bundestag elections in September 2017, the Federal Ministry for the Economy wants to develop a concept to further implement integrated energy. The high burden placed on electricity due to cost allocations and levies will present a huge challenge here. Failure to transfer these costs appropriately to the mobility and heating sectors will make it difficult for the clean renewable energy to be accepted for use in electric cars, heat pumps, etc., even though the entire industry in Germany is finally on the way to achieving electro-mobility. In our opinion, politics is missing a group which looks forward to put together a summary of the situation in Germany. Countless opportunities are ignored despite the fact that many of them could already be implemented. //

Germany

ENERCON GmbH
Dreekamp 5 · 26605 Aurich
Phone +49 49 41 927 0 · Fax +49 49 41 927 669
E-mail: vertrieb@enercon.de

Argentina

ENERCON Argentina SRL
Juramento 2089 – of. 309 · C1428DNG Buenos Aires
Phone / Fax +54 11 47 888 686
E-mail: fernando.petrucci@enercon.de

Austria

ENERCON GmbH Austrian branch
Resselstraße 16 · 2120 Wolkersdorf
Phone +43 22 45 82 828 · Fax +43 22 45 82 838
E-mail: office@enercon.at

Asia-Pacific

ENERCON GmbH
Dreekamp 5 · 26605 Aurich, Germany
Phone +49 4941 927-0 · Fax 4941 927 -669
E-mail: Sales-Asia@enercon.de [Asia],
Sales-Pacific@enercon.de
(New Zealand, Australia, Pacific States)

Belgium / Luxemburg

ENERCON Services Belgium BVBA
Heldenplein 7A · 3945 Ham
Phone +32 11 340 170 · Fax +32 11 340 179
E-mail: sales.belux@enercon.de

Brazil

Wobben Windpower Ltda.
Av. Fernando Stecca nº 100 · Distrito Industrial CEP
18087450 Sorocaba · São Paulo
Phone +55 15 21 011 700 · Fax +55 15 21 011 701
E-mail: wwp@wobben.com.br

Canada

ENERCON Canada Inc.
700, rue de La Gauchetière ouest · Bureau 1200
H3B 5M2 Montréal, Québec
Phone +1 514 363 72 66 · +1 87 77 082 101 (toll free)
E-mail: info.canada@enercon.de

Costa Rica

ENERCON Service Costa Rica
Edificio Latitud Norte · 400mts norte Construplaza
10203 Guachipelin, Escazú
San José, Costa Rica
Phone +506 40 33 14 10
Sales.CentralAmerica@enercon.de

Eastern Europe / Baltic States

ENERCON GmbH
August-Bebel-Damm 24-30 · 39126 Magdeburg
Phone +49 391 24 460 236 · Fax +49 391 24 460 231
E-mail: sales.international@enercon.de

Finland

ENERCON Services Finland Oy
Fredrikinkatu 61 · 00100 Helsinki, Finland
Phone +358 9 75 99 12 02
E-mail: Laura.Kokkala@enercon.de

France

ENERCON GmbH
ZI N°2 · Impasse du Pré Bernot · 60880 Le Meux
Phone +33 344 836 720 · Fax + 33 344 836 729
E-mail: info-france@enercon.de

Greece

ENERCON GmbH Office Athens
49A Doukissis Plakentias Ave · 152 34 Chalandri
Athens/Greece
Phone +30 210 68 38 490 · Fax +30 210 68 38 489
E-mail: sales.hellas@enercon.de

Italy

ENERCON GmbH Italia
Via Carlo Veneziani, 58 · 00148 Rome
Phone +39 06 91 97 71 23 · Fax +39 06 91 97 71 99
E-mail: sales.italy@enercon.de

Ireland

ENERCON Windfarm Services Ireland Lt.
Unit 14, Northwood House,
Northwood Business Campus
Santry, County Dublin, Ireland
Phone +353 1 89 34 020 · Fax +353 1 86 24 151
E-mail: sales.ireland@enercon.de

Latin America

ENERCON GmbH
Dreekamp 5 · 26605 Aurich
Phone +49 49 41 927 684 · Fax +49 49 41 927 669
E-mail: sales.international@enercon.de

The Netherlands

ENERCON GmbH – Dutch Branch
Voltastraat 19 · 8013 PM Zwolle
Phone +31 38 46 96 010 · Fax +31 38 42 28 010
E-mail: info-netherlands@enercon.de

Poland

ENERCON Poland
ul. Polska 30
PL 60-595 Poznan
Phone +48 618 45 37 30 · Fax +48 618 45 37 39
E-mail: sales.poland@enercon.de

Portugal

ENERCON GmbH Sales Portugal
Parque Empresarial de Lanheses · Lugar de Segadas
4925 424 Lanheses · Viana do Castelo
Phone +351 258 803 500 · Fax +351 258 803 509
E-mail: sales.portugal@enercon.de

Spain

ENERCON GmbH Sucursal en España
Ronda de Auguste y Louis Lumière 23 · Edificio 21 A
Parque Tecnológico · 46980 Paterna (Valencia)
Phone +34 961 824 556 · Fax +34 961 828 143
E-mail: enercon.spain@enercon.de

Sweden

ENERCON GmbH - Sweden
Arlövsvägen 9 · 211 24 Malmö
Phone +46 40 143 580 · Fax +46 40 222 420
E-mail: scandinavia@enercon.de

Turkey

ENERCON
Rüzgar Enerji Santrali Kurulum Hizmetleri Ltd. , Şti
Ulugöl Plaza
Küçükbakkalköy Mah. Vedat Günyol Cad. No: 20 Kat: 8
TR-34750 Ata ehir - Istanbul, Turkey
Phone: +90 216 569 7417
Fax: +90 216 569 7427
E-mail: sales.turkey@enercon.de

United Kingdom

ENERCON GmbH
24 St. John's Road
EH12 6 NZ Edinburgh (United Kingdom)
Phone +44 131 31 40 150 · Fax +44 131 31 40 152
E-Mail: sales.uk@enercon.de

ENERCON training construction site is up and running

ENERCON WILL NOW BE TRAINING UP INSTALLATION TEAMS IN A SPECIALLY BUILT TEACHING AREA IN THE GOTHA TRAINING CENTER. USING ORIGINAL COMPONENTS, INSTALLATION TECHNICIANS WILL GET TO KNOW THE TYPICAL PROCEDURES IN PLACE ON ENERCON CONSTRUCTION SITES.

ENERCON has opened up a training construction site for installation and service technicians at its Training Center (ETC) in Gotha, Thuringia. In the special area, installation teams are trained up to face the challenges involved in installing ENERCON WECs. To help with this, original components from an E-115 WEC including the machine house, hub and generator are available, as well as segments of a hybrid tower. Under the direction of ENERCON instructors, the participants assemble these components and then dismantle them again in training courses lasting between three and four weeks. The programme can vary depending on the WEC model.

"The aim of the new training facility is to familiarise the trainee installation teams with the typical processes and operations on an

ENERCON construction site, and to teach them the proper construction site set-up in compliance with all applicable health and safety regulations", explains Dirk Peter Brandt, Head of the Gotha Training Department. "We want to use it to optimise the processes on our construction sites and make them more efficient. That's why we have created an authentic construction site environment for the training courses." The work is carried out with equipment from the standard installation containers used by ENERCON installation teams, and two installation cranes.

Using the installation documentation, the work procedure instructions and the instructions for safe use as a starting point, the instructors pass on theoretical and above all practical knowledge to the course-



Practice installation:
Under the guidance of ENERCON instructors, trainee installation technicians are taught the procedures and actions involved in installing an ENERCON WEC.



participants to help them in their future work at ENERCON. "In the tower installation area the assembly of divided segments is taught, for example", explains Dirk Peter Brandt. The participants also practice how to place the segments on top of one another on a practice foundation. A custom-made precast concrete tower with three precast concrete rings is provided for this purpose. "In the WEC installation area we train the participants on how to pre-assemble the WEC components and how to install the assembly on a practice tower", adds Brandt. The training courses include the operation of the tools and equipment required and the filling out of documents for documentation purposes. The participants receive a certificate from ENERCON on completion of the course.

Employees from external service providers are also trained up on the training construction site alongside the teams of ENERCON employees. The ETC plans to conduct 25 installation trainings per year covering concrete tower and WEC. In accordance with the new construction site training programme, in future the teams will always receive training on the latest product series. The practice tower for WEC installation is therefore designed in such a way that machine houses from the EP4 platform or other WEC types can also be installed on it later.

The opening of the training construction site in the ETC is, however, just the first step. ENERCON is currently preparing to set up further training areas in Brazil and France. "Training construction sites in other countries may follow", Brandt says. //

Unusual service assignment on the water

A COMPONENT REPLACEMENT WAS REQUIRED ON ENERCON'S ONLY NEARSHORE WEC, AN E-112/4.5 MW WHICH HAS BEEN IN SERVICE IN THE EMS RIVER NEAR EMDEN SINCE 2005. DUE TO THE UNUSUAL SITE CONDITIONS, THIS WAS A SERVICE TASK WHICH PRESENTED UNIQUE CHALLENGES.

ENERCON wind energy converter sites are usually designed so that they can be quickly and easily accessed with the crane technology required in case of a bigger service job. For this reason, the access road and crane platforms are kept unobstructed at all times during the operating life. But for one component replacement on an E-112 close to Emden, ENERCON was not able to build on this basis: This WEC is ENERCON's only nearshore wind turbine. It is not installed on land, but has its foundation in the tide transition zone of the river Ems. After analysing the various crane and logistics options, a decision was made to access from the sea, turning the otherwise routine procedure into a complex undertaking.

The service work was required due to a defect on the yaw bearing. This bearing is the rotatable connection between the machine house and the tower. It ensures that the nacelle can be positioned in the direction of the wind. In order to carry out the replacement, the machine house has to be disassembled, including the hub and blade assembly and generator. "The E-112 nearshore cannot be reached by crane from land", says Project Manager Alexander Ermshaus from ENERCON Project & Logistics Management. "We were forced to resort to the same procedure we used to install the WEC in 2005." In order to make the best use of the opportunity, ENERCON decided to replace the rotor blades as well.

ENERCON's own large crane (a CC 9800 which is usually used for the installation of the E-126/7.5 MW) was loaded onto a work pontoon in the port of Emden and towed to the WEC site in the Ems. Construction measures first had to be taken in the water south of the E-112.

Following the opening of a stone training wall, a berth was dredged and mooring posts put in place so that the pontoon could be positioned securely in front of the WEC. Throughout the entire project the work pontoon was exposed to the changing tides. Every installation load case and every crane lifting operation had to be planned in detail beforehand, demanding different ballasting of the floating work platform for each load case and fixed work processes taking the construction site-specific health and safety rules into account.

The service work itself started with the removal of the rotor blade and hub assembly, the generator and the machine house with the CC 9800. They were then set down on the work pontoon. The machine house was placed on a yaw frame to carry out the bearing replacement. The rotor blades were also replaced on the pontoon. The dismantled blades were transported away "just in time" by a barge over the port of Emden, and the new rotor blade set delivered. Then the components were installed again in reverse order – always depending on the tide, wind conditions and the waves. The overhauled E-112 nearshore was finally put into operation again in mid-September.

"A lot of planning had to be done in advance in various specialist disciplines in order to carry out the update", says Alexander Ermshaus. "We have the excellent and constructive cooperation between the authorities, partners and ENERCON specialist departments to thank for the fact that the preparations for this complex nearshore work were completed relatively quickly, and that the work itself was a success." //



Work pontoon with crane and disassembled E-112 components.

Reinstallation of the rotor blade and hub assembly on the E-112 nearshore.



ENERCON E-112 NEARSHORE

The E-112/4.5 MW nearshore in Emden is the only ENERCON WEC which is not on land. It was installed in 2004/2005 in the Ems River, several metres from the dike. At the time, ENERCON was looking into the possibility of entering into the offshore business with the E-112. The nearshore project was intended, amongst other things, to help gather experience in this area. Complications which arose in the course of another nearshore pilot project in the mudflat by Wilhelmshaven meant that a stop had to be put to these efforts. The ENERCON Management then made the decision not to further pursue the nearshore/offshore topic and to concentrate all energies on the onshore business. The E-112 nearshore in Emden is operated by utility EWE from Oldenburg and maintained by ENERCON Service.



ENERCON installs first E-101 wind farm in Canada

AT A HUB HEIGHT OF 124 METRES, THE 77 X 3 MW TURBINES IN THE NIAGARA REGION WIND FARM (NRWF) ARE SOME OF THE HIGHEST WIND ENERGY CONVERTERS IN THE WHOLE OF NORTH AMERICA.



ENERCON has put the first wind farm with E-101 wind energy converters outside of Europe into operation in Canada. A total of 77 x E-101/3.05 MW have been installed in the past months for the Niagara Region Wind Farm (NRWF) in the province of Ontario. The wind farm power output of this large-scale project is 230 megawatts. At the end of October the mains supply was connected.

The ENERCON project is located in the West Lincoln district of the town of Wainfleet in Haldimand County. At a hub height of 124 metres, the E-101 WECs are the highest in the whole of North America. The wind farm has a feed-in tariff contract with the grid operator of the

province IESO, running over 20 years. It is operated by ENERCON, the Six Nations of the Grand River Development Corporation and the partner Boralex.

The entire project had a very short implementation time. It was given the go-ahead in May 2015 and the wind farm was put into operation just 16 months later – a remarkably short realisation time in view of the size of the project. And made all the more remarkable given that the project presented several challenges in terms of installation and logistics.

The project stretches over six municipalities with a surface area of 750 square kilometres. These distances had to be taken into account when planning the access road, delivery to the construction site and the project-internal logistics. In addition, the installation had to take place outside of the winter months. As these factors eliminated the possibility of a just-in time delivery, ENERCON set up a central storage facility in a former quarry close by. All of the required components were first transported to the temporary storage facility where quality and completeness checks were carried out. The components were then delivered to the respective WEC locations as required. "This system allowed us to considerably speed up installation", says Michael Weidemann, Executive Vice President ENERCON Canada Inc.

Due to the ground quality, 45 deep foundations were required. Local content requirements in Ontario also meant that ENERCON had to install a temporary segment production facility for the production of the concrete segments near Port Weller in St. Catharines. This production facility in the vicinity of the wind farm development did, however, help to solve another logistics problem: ENERCON's Canadian concrete tower factory in Matane/Québec could not be used – firstly, due to the local content requirements for production, and secondly because the transport distance would have been too long and therefore too costly.

The factory buildings rented on Lake Ontario for the project plant are part of a former shipyard. ENERCON converted them to meet the production requirements and fitted them out with the necessary equipment. In order to ensure consistent temperatures for production in the winter months (which is important for curing the concrete segments), a heated tent was installed on the site together with a purpose-built crane for transporting the components. There was space inside the tent for 44 tower segments to be cured under controlled temperature conditions.

With the NRWF project, ENERCON is helping to reduce CO₂ emissions in Ontario, says Michael Weidemann. On top of this, the wind farm is an essential contribution to the plan to replace the coal-based energy production in the province with renewable energy. Weidemann is particularly pleased about the jobs created in the region as a result of the project: 700 direct and indirect jobs were established for the project setup. In addition, at least 45 long-term jobs have been created for the 20-year service life of the wind farm directly at the service point. //

ENERCON NRWF project in Ontario/Canada with 77 x E-101/3.05 MW.

Qollpana II wind farm with
8 x ENERCON E-82 E4.



ENERCON's first wind farm in Bolivia up and running

THE QOLLPANA II WIND ENERGY PROJECT (8 X E-82 E4) KICK-STARTS ENERCON'S ACTIVITIES IN THE SOUTH AMERICAN COUNTRY. FOLLOW-UP PROJECTS ARE ALREADY BEING PLANNED.

ENERCON has put its first wind farm in Bolivia into operation. At the start of September, a total of 8 x E-82 E4 with a nominal power of 3 MW each were successfully connected to the grid as part of the Qollpana II project. The site is close to the city of Cochabamba in the East Andes and boasts excellent wind conditions (wind class IEC Ia). The wind farm (power output 24 MW) is predicted to generate an annual energy yield of approximately 82 gigawatt hours.

The eight E-82 wind turbines were installed on steel towers and have a hub height of 78 m. The operator is the utility company Corani S.A. The ENERCON turbines were a welcome addition to the first wind farm in the country. In 2013, two Goldwind WTG 77/1.5 MW were installed at the site. The energy from the two WECs was fed into a local distribution grid to begin with. A transmission substation was also built as part of the wind farm expansion so that the WECs from both subprojects are now connected to the country's transmission network.

ENERCON and Corani have come to a cooperation agreement for the next five years concerning the service for the WECs. The WECs are operated under ENERCON's EPK maintenance cycle, but the service personnel are not provided by ENERCON. Instead, they are provided by the operator and trained and supervised by ENERCON. The local service technicians receive basic training and recurring training once a year.

The inauguration of Qollpana II was celebrated at the start of September with a huge event at the wind farm. Bolivia's President Evo Morales, the Energy Minister and the German Ambassador took part in the ceremony, as well as other guests from politics, business and administration and ENERCON representatives. Members of the community were also invited to the site to learn more about the expansion of the wind farm and the topic of wind energy. More than 1,000 visitors took advantage of this offer. "The event was very impressive", says Carla Tapia, Senior Sales Manager for Latin America in ENERCON Sales. "The project is viewed as a huge success on the whole. The Bolivians are very proud of it."

For ENERCON, the project represents the start of its activities in the South American market. Further projects are already being planned. In addition, a second expansion of 51 MW is planned for the wind farm, which ENERCON will apply for again. Bolivia aims to install a total wind energy capacity of 500 MW across the country by 2020. //



Windy location: The Qollpana II wind farm is in the East Andes.

Expansion for Europe's highest wind farm

ENERCON HAS EXPANDED EUROPE'S HIGHEST WIND FARM IN THE SWISS HIGH ALPS WITH THE ADDITION OF 3 X E-92/2.35 MW. THE COMPLEX PROJECT IS A MILESTONE FOR WIND ENERGY IN THE CONFEDERATION.

Growth for Europe's highest wind farm: ENERCON has installed 3 x E-92/2.35 MW on the Nufenen Pass in the Swiss canton of Valais at a height of approximately 2,500 metres. They complement the E-70/2.3 MW which ENERCON installed there as a pilot WEC in 2011 and increase the wind farm power output to a total of 9.35 MW. The expansion means that the wind farm's expected annual energy yield will be increased to around 10 million kilowatt-hours, which amounts to the power consumption of approximately 2,850 Swiss households. At the end of September the operator Gries Wind AG celebrated the inauguration of the entire wind farm.

The Swiss Federal Councillor and Energy Minister, Doris Leuthard, also attended the event. According to the Minister, the wind farm is a "flagship project for energy transition". She praised the commitment of those responsible and emphasised the importance of the project for the region. All of the speakers were in agreement that the expansion represents a milestone for wind energy in Switzerland and the renewable energies in the canton Valais.

The inauguration of the high alpine wind energy showcase project took place at the same time as the Swiss parliament consented to the first package of measures of the Energy Strategy 2050. It is intended to initiate energy transition in Switzerland and to seal its withdrawal from nuclear energy. The share of renewables is to be accelerated and the share of fossil fuels reduced due to an increase in energy efficiency.

The Swiss Wind Energy Association, Suisse Éole, reports a currently installed wind energy capacity of 74.9 MW in the confederation with 37 large WECs. They produce an average annual energy yield of approx. 128 gigawatt hours in total. The Association describes wind energy as an "indispensable element of a safe, clean and home-grown power supply" for Switzerland. It is the "ideal" complement to hydropower and solar energy, as two thirds of wind power is produced in the winter half-year – the time of year in Switzerland when energy consumption is particularly high and solar energy and hydropower do not produce a lot of energy.

Suisse Éole views further expansion of wind energy in Switzerland to 120 wind farms with 800 WECs by 2050 as realistic. This would cover between 7 and 10 percent of Swiss energy needs. The Association

believes significantly higher figures are possible in regions with particularly favourable conditions.

"These targets can only be met if the approval processes are sped up", says Tanja Pintschovius, Country Sales Manager Switzerland in ENERCON Sales. Time and time again, projects which have already been planned and approved politically at the local and regional level are blocked by objections from individuals and associations. The clarification procedures are very lengthy. "Not one new WEC was installed in Switzerland in 2014 or 2015. We are therefore appealing to politics to see to it that the responsible offices cooperate better so that approval processes are simplified and thus sped up."

According to Pintschovius, the population accept the idea of further expansion of wind energy, as shown in surveys. Many of the projects planned are backed by a large majority at the local level. "Carefully planned projects are supported by the population at large", confirms Suisse Éole. This was also the case with the Gries wind farm, which had the backing of residents and local politics: Town meetings unanimously approved and supported the project.

The conditions of the high alpine location – around 2,500 metres above sea level and directly next to the Griessee reservoir – presented special challenges for transport, logistics and installation. Thanks to close cooperation with the Swiss crane and transport service providers, the tight construction window could be optimally used. For example, special equipment was required for the delivery of the components. The transport route led from Germany through the Gotthard tunnel to Airolo in Ticino, and from there to Valais via the Nufenen pass.

Tower sections, machine components and rotor blades were transported the last few winding kilometres on special self-propelled vehicles. The rotor blades were mounted on an Alpine transport frame which allowed the long components to be raised up to 60 degrees to drive around the hairpin curves. The installation teams were under a lot of time pressure when installing the WECs: In the high Alps the first snowfall can be expected as early as late summer. The installations thus had to be completed before the long-lasting bad weather phase set in. //



Gries wind farm in the Swiss canton of Valais with 3 x E-92 and 1 x E-70.

Photo: SwissWinds / Olivier Maire

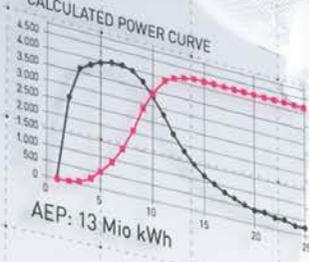


Logistical feat: Special equipment and careful planning were necessary to deliver the components to the installation site. The first meetings with SwissWinds, ENERCON Project Management and the internal Site Logistics took place back in 2014, so that a detailed installation strategy could be developed.

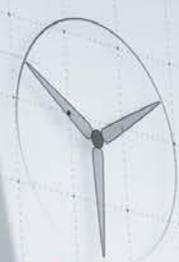
129 m
HUB HEIGHT

159 m
HUB HEIGHT

CALCULATED POWER CURVE



SOUND POWER LEVEL



Ø 141 m
ROTORDIAMETER

IEC IIIA

E-141 EP4 / 4,200 kW

INTELLIGENT ADVANCEMENT OF THE ENERCON PLATFORM STRATEGY

- + High efficient low wind turbine
- + New generator design for maximum quietness
- + Largest onshore rotor blade for maximum yield
- + Expedient hub heights

