

STANDARDS

- 03_ EDITORIAL
- 04_ VIEW
- 06_ MAILBOX
- 07_ ADRESSES
- 09_ DATES
- 19_ INTERNAL

TABLE OF CONTENTS

<p>TITLE</p> <p>10_ ENERCON system solutions As a system supplier for renewable energies, ENERCON supplies added-value solutions for wind farms.</p> <p>TECHNOLOGY</p> <p>16_ Battery storage system in operation ENERCON starts test program for smart container in the Húsahagi wind farm, Faroe Islands.</p> <p>TECHNICAL LEXICON</p> <p>18_ Impact Absorption Layer ENERCON has developed a durable erosion protection system for its rotor blades.</p> <p>POLITICS</p> <p>20_ Before adoption of the 2016 Renewable Energy Sources Act Call-for-tender system results in a serious downturn for onshore wind energy.</p> <p>22_ Renewables under pressure Absurd specifications lead to increasing costs.</p>	<p>PRACTICE</p> <p>24_ First repowering in Bavaria ENERCON erected 2 x E-115/3 MW in Kraftisried in place of two old turbines.</p> <p>26_ Clean energy from the heap ENERCON has erected an E-115/3 MW at former colliery site in Dinslaken Lohberg/NRW.</p> <p>INTERNATIONAL</p> <p>28_ 2,000 MW installed ENERCON reaches important milestones in the NRW/Ontario project in Canada.</p> <p>30_ Large-scale project successfully on the grid ENERCON has installed 67 x E-92/2.35 MW in the Federal State of Bahia, Brazil.</p>
---	---

10



22



30

Going that extra mile for climate protection and the energy turnaround!



Dear clients, business partners and employees,

The energy turnaround is forging ahead – but we must continue to work towards ensuring that our domestic wind industry is not left behind! After all, wind energy is the last home-grown renewables industry which continues to perform well in the export market and can rely on a strong domestic market. Manufacturers and suppliers need this domestic market, because no industry can rely on exports alone in the long term. As it enters the home straight, it is evident from the latest EEG amendment that a sensible long-term view is, after all, winning the day, albeit with an appreciable detrimental impact on the onshore wind energy sector. The cumulative effect of degression levels on wind projects in 2017 and 2018 in particular will be the final nail in the coffin for more than a few projects, particularly at inland sites – whether because of the EEG or because of the tendering process. Since this is a most unwelcome prospect, we will do everything in our power to fight back through innovation, so that we can continue to work alongside you in achieving the energy turnaround in Germany and the EU.

The federal states and the German Wind Energy Association (BWE) have provided us with especially valuable support. In talks between the Federation and the states, they strongly advocated the view that on-shore wind should not be downgraded to the bargain basement of the energy turnaround through the introduction of a complicated formula, but should instead be awarded a tendering corridor with transparency for those making the calculations. ENERCON too has made a stand here, and, in the course of many campaigns fought before the state chancelleries, in the regions and not least also in Berlin, has insisted that our sector should not simply be wiped out in the interests of achieving the questionable goal of preventing the energy turnaround from proceeding with excessive haste. We stood shoulder to shoulder with you, leaving them in no doubt that we will fight back and not simply take this retrogressive development on board. We would like to take this opportunity to express our sincere appreciation for your support.

It is still difficult to come to terms with the fact that the Paris climate resolutions – a genuine turning point after the inauspicious portents that preceded them – appear to have been more or less consigned to oblivion. The climate objectives are such that it will be essential to make an upward adjustment of the renewables targets to more than 60 % by 2025. The satisfying dynamics of expanding renewable energies should not be seen as a problem. Adhering to an expansion corridor of 45 % until 2025 is a top priority. We must all work together to ensure that the energy turnaround proceeds with the tailwind which this historic project deserves! For at times such as these, we can all appreciate how important reliability is in uncertain times. And renewables too can play their part in this.

Hans-Dieter Kettwig
ENERCON Managing Director

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: ENERCON – system provider for renewable energies.



Protest against planned Renewable Energy Sources Act reform

ENERCON employees took part in the "5 to 12" one-minute warning initiated throughout Germany by the renewable energy associations to save the energy transition at several locations in Germany at the end of May. More than 1,000 employees and Company Management took part in the central ENERCON demonstration in Aurich (see photo) in order to protest against the Federal government's plans to initiate a tendering system to reform the Renewable Energy Sources Act (EEG).

With the one-minute warning and a demonstration in Berlin's government district at the beginning of June, the sector called on the government to make a clear commitment to the energy transition and continued expansion of renewable energies. According to the warning, the planned tendering system particularly threatens onshore wind energy. It would drastically limit continued expansion in the further development of the onshore wind energy sector representing thousands of future-proof jobs, local value creation and progress would be endangered. In addition, the energy transition and climate protection in Germany would suffer a significant setback.

Auxiliary constables accompany ENERCON heavy goods transport

ENERCON is now calling in auxiliary constables to accompany large-volume and heavy goods transport in Lower Saxony. The specially trained transport escorts replace regular police officers who were required for that task until now. The basis for the new regulation is a pilot project by Lower Saxony's Ministry of the Interior and Sports which should relieve the police in Lower Saxony of the constantly increasing large-volume and heavy goods transport.

The auxiliary constables appointed to accompany transport are given special powers: As police assistants, they may intervene in road traffic and for example stop and direct vehicles. This is usually not permitted for private transport escorts. Road users must follow the instructions of auxiliary constables; otherwise, they run the risk of a fine and points in the central index of traffic offenders in Flensburg.

The new transport escorts on duty can be recognised by their yellow jackets with retro-reflective stripes and the writing "Hilfspolizei" (auxiliary

police) on the back. Their vehicles are characterised by magnetic plates and the writing "Hilfspolizei" (auxiliary police). They use a signalling disc to control traffic.

ENERCON welcomes Lower Saxony's pilot project. The Federal State is playing a leading role in Germany with this practical regulation. In the past, there were regular delays with scheduled transport due to the lack of available police officers. Auxiliary constables offer important relief equally for police and the economy here: The police can deal with higher-priority tasks, and ENERCON can start its transport on time and thus avoid additional costs due to disruptions. "We are particularly pleased that Lower Saxony has implemented the pilot project pragmatically and practically within a short timeframe", says Hendrik van Hettinga, Head of Supply Chain Management at ENERCON Logistic GmbH. "We very much hope that other Federal States take this solution as an example".



ENERCON heavy goods transport accompanied by auxiliary constables.



AURICH

ENERCON welcomes over 100 young people at the Future Day

More than 100 young people were informed about training occupations and activities at ENERCON at this year's Future Day at the end of April. As part of a guided tour through various of the company's Production and Administration departments, they learnt about the training occupations of metal worker, master precision machinist, warehouse logistics specialist, industrial business management assistant, office management assistant, electronics technician for machines and drive systems, IT specialist for system integration and IT specialist for application development.

In addition to information about the professions, ENERCON's trainers for young people had prepared small tasks to give them a practical insight into typical activities for each profession. Even a guided tour through ENERCON's visitor centre in the EEZ (Energy, Education and Discovery Centre) was on the agenda. It went down very well with the 9 to 15 year-old participants. "We are very satisfied with the feedback", says Nicole Nanninga, training manager at ENERCON. "The young people were very interested. And who knows? Perhaps we can welcome some of them to our company soon as new apprentices."

ENERCON places great importance on training its own skilled workforce. "It is important for the future of our company, in particular considering the shortage of skilled workers and the demographic development", affirms Klaus Peters, Chief Production Manager at ENERCON who was involved in the event. Currently, ENERCON offers apprenticeships in more than 20 professions. Each year, between 80 and 100 new apprentices are hired at the Ostfriesland site alone. ENERCON currently employs 217 apprentices in Ostfriesland.

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 Guachipelín, 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. ,Sti
Ulugöl Plaza
Küçükbakkalköy Mah. Vedat Günyol Cad. No: 20 Kat: 8
TR-34750 Ataşehir - İstanbul, 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

HANOVER

Trade fair presence in Hanover with new booth design

ENERCON was present at this year's Hanover trade fair with a new exhibition concept and a fair stand with a new design. The spotlight was on the new E-141 EP4 wind energy converter that was presented in a multimedia showroom with scale models as well as augmented reality applications. Visitors were able to look at the inside of the models using iPads and for example reproduce the rotation of the moving WEC components. One half of an E-115 generator exhibited at the main stand as an original exhibit offered an idea of the dimensions of the main components.

In addition to the completely redesigned main stand and the second stand at the simultaneous "Job & Career" job fair, ENERCON was also represented at the "Tec2You" recruitment initiative for the first time this year. Interested students were offered comprehensive information on the subject of training at ENERCON.

It was hands-on: ENERCON apprentices and their trainers showed more than 1,100 young people the handle for equipping PCBs with electronic components and soldering and for processing metal workpieces – typical activities in the electrical engineering and metal working professions on which ENERCON focuses its training.

"It went down very well with all the participants", says ENERCON's training manager, Nicole Nanninga.

In addition, ENERCON presented its expertise and services in the field of energy logistics in the common "Integrated Energy Plaza" exhibition area. Networking of energy generation, transmission, distribution and storage in the energy system of the future was one of the central themes of the world's largest industrial trade fair this year. Furthermore, there was a varied series of talks at ENERCON's main stand as in previous years. This year, for example Michael Strobel, ENERCON's Director of Technology & Innovation gave a talk on technological innovations and ENERCON's managing director Hans-Dieter Kettwig one on corporate development.

"All in all, it was a successful trade fair presence for us", says ENERCON's Head of Sales, Stefan Lütkemeyer. "The new booth design and the EP4 showroom went down very well; the visitor numbers, especially on our main days of Wednesday and Thursday, were good and the discussions with our customers positive. We were able to conclude some deals during the week." According to the trade fair organisers' figures, more than 190,000 visitors attended the Hanover trade fair this year including over 50,000 from abroad.



Afflux at the presentation by ENERCON's managing director Hans-Dieter Kettwig.



ENERCON showroom with augmented reality application.



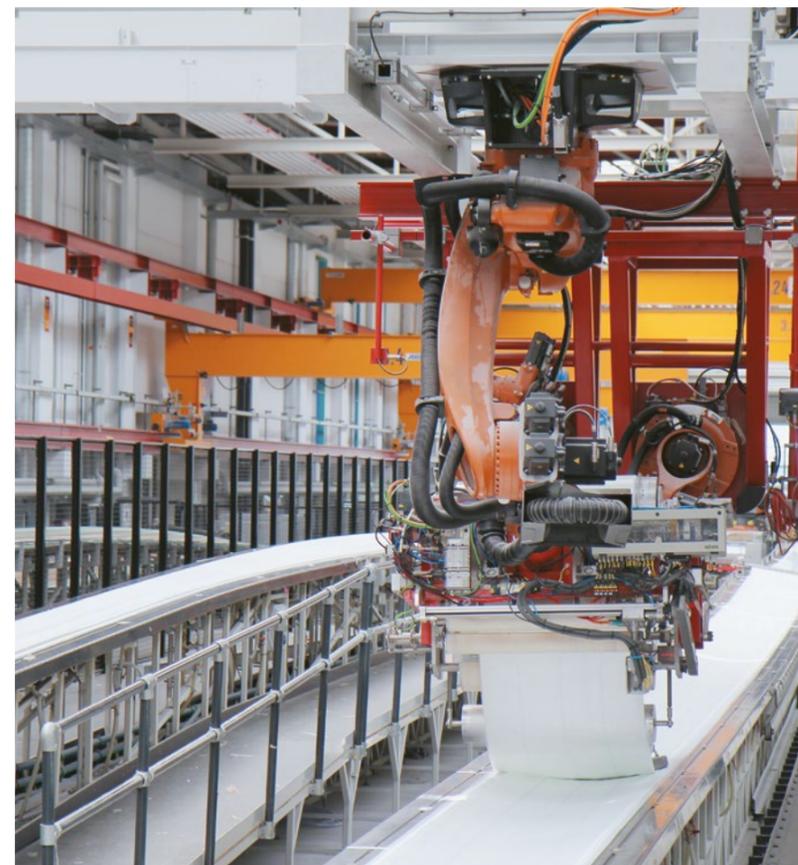
Lower Saxony's Prime Minister Stephan Weil (right) and ENERCON's managing director Hans-Dieter Kettwig in front of the real-life exhibit.



ENERCON's presence at the "Tec2You" recruitment initiative went down very well with the visitors.

AURICH

Positioning robot at ENERCON blade manufacturing in series production



ENERCON now uses a positioning robot in series production for manufacturing E-101 rotor blades in the KTA blade factory in Aurich. When manufacturing the so-called spar booms, the machine cuts and positions the glass fibre non-woven fabric in the mould completely automatically prior to infusion with a resin-hardener mixture. Until now, laying the glass material involved staff-intensive manual work. The spar boom manufactured from GRP is the "backbone" of the rotor blade and is used to stabilise it. It is later incorporated into the half shells on the pressure and suction faces in the manufacturing process.

The non-woven fabric webs required for positioning in the mould are initially wound from supplied large rolls, cut and wound up again onto special transport drums in a rerolling and cutting machine upstream from the robot. The positioning robot grasps them and rolls out the webs of between 11 and 45 metres in length depending on the layer, positioning them precisely in the mould. These work steps are repeated until 45 layers are arranged on top of each other in the mould. The robot takes around three hours for the entire process.

Besides increased efficiency, using the positioning robot offers considerable advantages for product quality since process automation guarantees always consistently high quality. The risk of technical errors and related time-intensive rework is almost excluded. The robot was developed by automation specialists wi2 technologies in close collaboration with ENERCON. "The positioning robot is a further example of successful partial automation of our production process", says KTA's managing director Jost Backhaus. Robots are already used in ENERCON's blade production to work on the blade connection and the blade surface as well as for the coating in the finish. "Our approach is to primarily develop for the fields of automation solutions where the greatest benefits can be achieved in terms of increased efficiency, time and cost savings as well as improved quality, occupational health and safety and health protection." The positioning robot also has a further argument: It can also be used without difficulty in the production of other blade types – for instance, the outer rotor blade of the E-141 EP4 that the KTA will prepare itself to produce from the summer.

BrazilWindpower

(Rio de Janeiro/Brazil)
30 August – 1 September 2016
www.brazilwindpower.com

Colloque National Eolien

(Paris/France)
13 – 14 September 2016
www.colloque-national-eolien.fr

WindEnergy

(Hamburg/Germany)
27 – 30 September 2016
www.windenergyhamburg.com

Renewables Marketplace

(Liverpool/UK)
12 – 13 October 2016
www.renewableuk.com

ENERGIA

(Tampere/Finland)
25 – 27 October 2016
www.energiamessut.fi

Vind

(Stockholm/Sweden)
26 – 27 October 2016
www.vindkraftsbranschen.se/wind2016

CanWea

(Calgary/Canada)
1 – 3 November 2016
windenergyevent.ca/canwea-2016

KeyWind

(Rimini/Italy)
8 – 11 November 2016
<http://en.keyenergy.it>

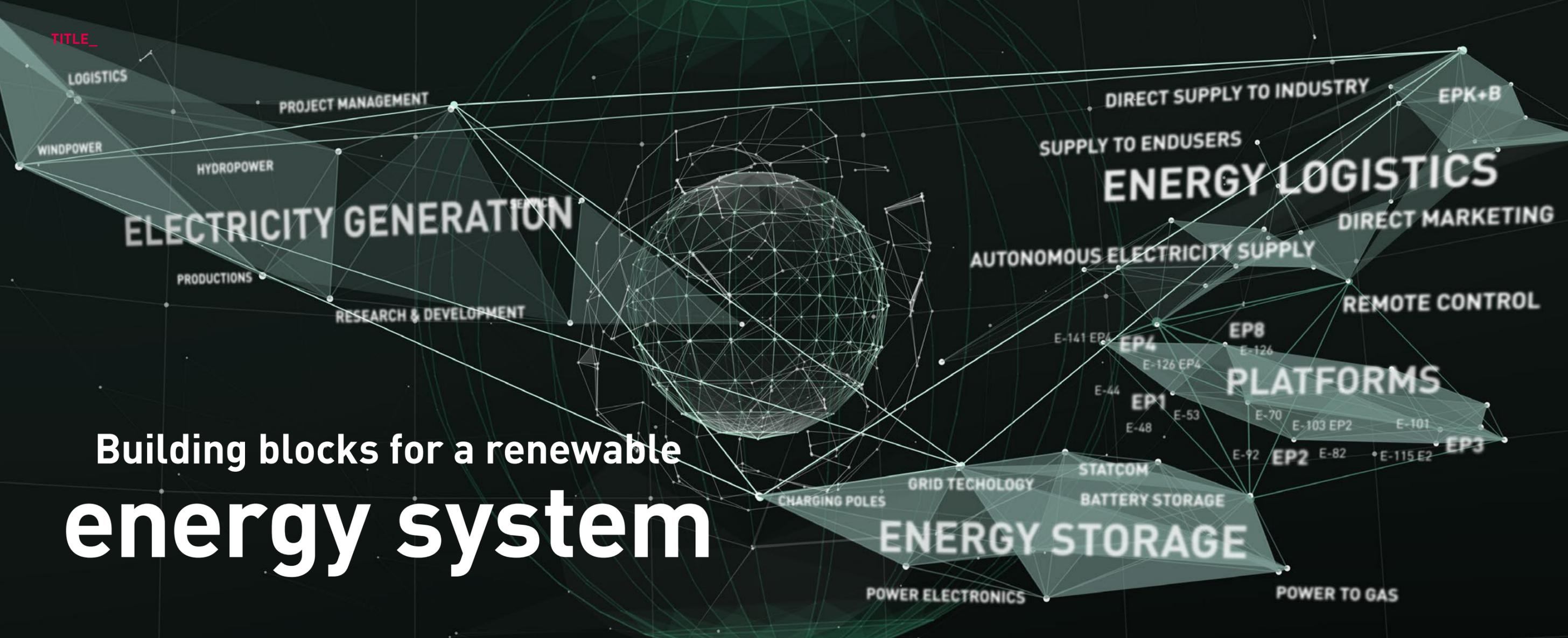
Windaba

(Cape Town/South Africa)
2 – 4 November 2016
www.windaba.co.za

EuroTier

(Hanover/Germany)
15 – 18 November 2016
www.eurotier.com

TITLE_



Building blocks for a renewable energy system

IN AN ENERGY SYSTEM BASED ON RENEWABLES, INTELLIGENT NETWORKING OF FLEXIBLE ELECTRICITY PRODUCERS AND CONSUMERS AS WELL AS THE INFRASTRUCTURE IS BECOMING INCREASINGLY IMPORTANT. AS A SYSTEM SUPPLIER FOR RENEWABLE ENERGIES, ENERCON SUPPLIES ADDED-VALUE SOLUTIONS FOR WIND FARMS. IN ADDITION, ENERCON IS DEEPLY INVOLVED WITH THE SUBJECT OF PILOT PROJECTS AND RESEARCH PROJECTS.

The energy transition is progressing inexorably with the development of renewable energies. The share of renewables in Germany's gross power supply was already 30.1 percent in 2015 according to figures from the German Association of Energy and Water Industries (BDEW). Wind, sun, biomass, water and geothermal energy are thus now the largest energy source well ahead of lignite (23.8 percent). Onshore wind energy remains the most important renewable power source (12.2 percent). With 79.3 billion kilowatt hours, power generation from onshore wind energy converters in 2015 climbed to a record level. Together, renewables climbed to 195.9 billion kilowatt hours last year. They were able to set a new record in the early summer of 2016. At 11.00 a.m. on 8th May, their share in electricity production was around 87 percent according to Agora Energiewende's statistics. A look at the figures shows that a full renewable power supply is moving within reach in Germany.

With an increasing share of fluctuating renewables, especially onshore wind energy, in electricity production, there is a clear need for the players of the new energy system to coordinate more closely with each other. The claim of renewables is that it guarantees security of supply and grid

stability on its own without being dependent on fossil backup solutions. "The challenges they face are intelligent networking of power generation and consumption taking account of grid expansion and improvement as well as storage", says Jens Winkler, Head of Energy Management at ENERCON. At the Hanover trade fair, the keyword for this was "integrated energy", integrated energy systems, which was at the same time a central motto of the world's largest industrial fair this year.

As a system supplier for renewable energies, ENERCON already offers its customers extensive products and services for this. In addition, ENERCON is involved in various pilot projects and research projects in order to develop further innovative building blocks for a renewable energy system to maturity.

Power generation building block
ENERCON's core business area is the development, manufacture and erection of wind energy converters. ENERCON's products are technologically and qualitatively superior worldwide. They are characterised by the direct drive concept developed by ENERCON. The ENERCON annular generator is used to transform mechanical energy into

electrical energy. Output, voltage and frequency vary with the speed and are converted for output to the grid via a DC link and an ENERCON inverter. The generators and inverters developed for ENERCON WECs are also used in hydropower plants and solar parks.

Grid integration building block
ENERCON's wind energy converters are already equipped with an intelligent grid feed system as standard. ENERCON's WECs with the ENERCON SCADA system can thus be easily integrated into all transmission and distribution networks. The components that are essential for the network are the modular inverter system and the wind farm controller for controlling the entire wind farm according to the grid operator's specifications. To ensure that the generated power is properly fed, voltage, current and frequency are continually recorded and transmitted to the WEC control system. Yield-optimised wind farm operation is even guaranteed in grids with heavily fluctuating voltage or frequency. In the event of grid faults, e.g. short circuits or overfrequencies, the wind farm and the individual wind energy converters react in accordance with the grid operator's requirements. The parameters for this reaction can be configured for specific grids and projects.

ENERCON WECs have FACTS properties (FACTS is the abbreviation for Flexible AC Transmission Systems). The term generally refers to systems based on power electronics that are suitable for contributing to maintaining and improving grid stability. In ENERCON WECs, the functionality is contained in the modular inverters. Today, wind farms can thus provide certain system services that are essential for grid stability and security of supply.

In "normal" grid operation, ENERCON's feed-in concept allows a highly dynamic provision of reactive power from WECs and wind farm controllers. This is used by the grid operator as a contribution to the voltage control at the wind farm's network connection point. If the WECs are equipped with the STATCOM option, this contribution is even completely possible irrespective of the wind, even during a WEC standstill.

In the event of a grid fault, e.g. a short circuit on an overhead line, "riding through grid faults", e.g. continued operation of the WECs without disconnecting from the grid, is required worldwide nowadays. During a grid fault, the control system in ENERCON WECs supports the grid in less than 30ms by feeding in the appropriate reactive current. A WEC can ride through such fault situations for up to 5 seconds without being subjected to exceptional mechanical stress. This pays off in terms of the service life depending on the frequency of grid faults. The most recent FACTS technology developed by ENERCON offers for example the further feature of supplying an asymmetrical reactive current in the event of asymmetrical grid faults.

STATCOM modules developed by ENERCON can also be installed separately, for example in order to strengthen weak network regions to avoid cost-intensive network expansion. An example of this is the STATCOM unit that ENERCON has installed at its GZO foundry in Georgsheil/East Frisia. Operation of the electric smelting furnaces draws a lot of power from the relatively weak distribution grid, meaning that the voltage would drop too much without STATCOM support.

The alternative to improving the grid infrastructure would have been routing new high voltage lines to the factory; however, this would have meant very high investments costs and was therefore out of the question.

In addition, ENERCON WECs can contribute to stabilising frequency with the power frequency control (in the event of an overfrequency or under-frequency in the grid). This was demonstrated in practice by R&D projects and currently also leads to the pre-qualification of pools of wind farms in other countries as the balancing power provider.

With the "inertia emulation" option, ENERCON WECs are finally in a position to make a contribution to the grid's ready reserve. In the event of a sudden imbalance between production and consumption, e.g. due to a power plant failure, the first frequency stabilisation was inherently achieved by conventional power plants until now. They are equipped with large turbines and generators with heavy rotating masses that store kinetic energy. This ready reserve is immediately made available to the grid in the event of a drop in frequency so that an excessively quick change in frequency is counteracted.

"The closer we come to a full power supply based on inverters, the more urgent the subject of frequency control by wind energy converters also becomes for grid operators", says Eckard Quitmann, Head of the Sales-Grid Integration department at ENERCON. With "inertia emulation", ENERCON WECs manage the very quick frequency control to a certain extent: The kinetic energy stored in the rotor and generator is used to provide the grid with more power in the short term as would be made available based on the predominant wind conditions. "The example shows that we are technologically prepared for issues regarding which system services an energy system requires that is based on energy generation by wind energy converters", says Quitmann.

Energy logistics building block

In addition to the power generation and power feed technology, ENERCON also provides its customers with extensive energy logistics services. As part of the optional EPK+E service package – an additional module in the tried-and-tested ENERCON EPK service package – it is all about further developing the value-added chain for energy logistics until the decentralised match-up of production and consumption. The virtual power plant is the main control instrument for this.

The background to ENERCON's commitment in this area is that the legislator is encouraging ever stronger commitment from the operators to finding a profitable market for the electricity they generate themselves. Since the 2014 Renewable Energy Sources Act came into force, direct marketing applies to new WECs. When the remuneration system will switch to tendering from 2017 and competition is introduced between bidders for the erection of wind farms – if not before – profits obtained by means of energy-related logistics will be crucial to site success.

ENERCON offers customers in the EPK+E direct marketing of their energy quantities to the electricity exchange. In addition, individual marketing solutions such as direct supply of major industrial consumers with power from a wind farm are also possible. ENERCON shows how this works in practice with the operation of its GZO foundry that obtains energy directly from an E-101 nearby. Further marketing options include regional community-owned electricity tariffs. In addition, marketing solutions for WECs that fall out with the Renewable Energy Sources Act once the 20-year period expires are also being developed. "Even their potential in terms of energy economy can be exploited so that old turbines can continue to operate at sites where repowering is not possible", Jens Winkler says.

ENERCON also offers a green electricity tariff for WEC self-supply as part of the EPK+E. Involvement of the consumer side and management of energy storage systems including marketing stored energy quantities will be added in the future. It is possible to match up supply and demand at regional level through flexible control of major consumers, e.g. factories or cold stores whose production and operation can occur at different times, as well as incorporation of energy storage systems. "By managing all of the energy-related logistical processes, we are creating a controllable virtual power plant that can guarantee both supply and stability of the energy system", according to Winkler.

Quadra Energy GmbH, a 100% ENERCON subsidiary with its headquarters in Düsseldorf that has many years of experience and expertise in energy trading and assisting consumers to obtain the best possible energy deal, is responsible for energy logistics business segment. This means that Quadra is very familiar with dealing with the flexible nature of fluctuations in power consumption and availability, and can achieve

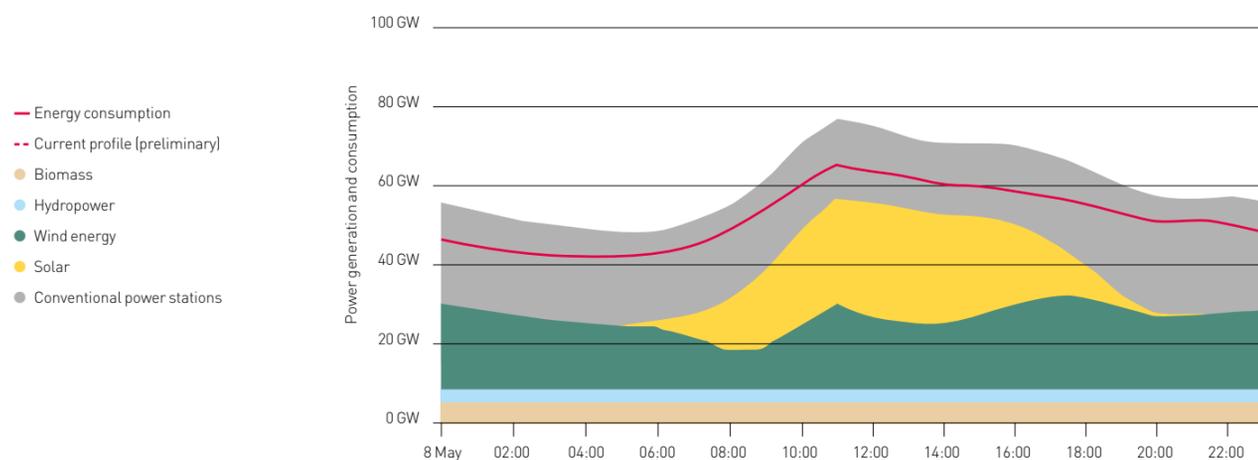


Model region for energy turnaround: Feldheim/Brandenburg with ENERCON wind farm (left) and RRKW, Germany's largest battery storage system (above).



Power generation and consumption

AGORA Energiewende 3 June 2016, 12:10 a.m.



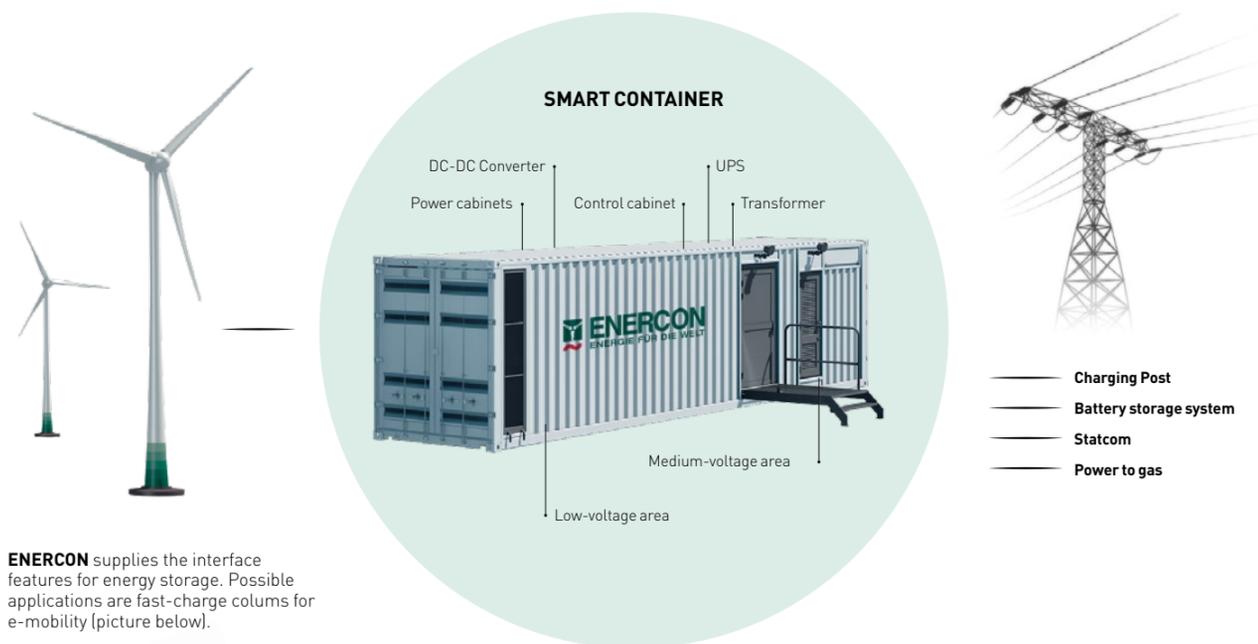
optimum savings and profits respectively for a range of customers and accommodate renewable energy quantities profitably in a rapidly changing electricity market.

Electricity storage building block

Energy storage systems in the future are an essential building block in the renewable energy system. They can contribute to renewable energy generated at a lower price not being discarded at stages at which the grid cannot absorb it for capacity reasons but being fed in with a time delay, especially in the short term for the time being, if the grid demand increases again or supply on the production side falls. "It is ecologically and economically crazy to allow environmentally friendly energy generated at a lower price to go up in smoke in high-wind phases – and providing environmentally-harmful and expensive fossil reserve power stations for times in which the wind does not blow and the sun does not shine", says Joachim Stilla, Division Manager of Innovation Strategy

and System Architecture as well as Program Manager for Storage Systems at ENERCON. "With the help of storage systems, renewables can take on more responsibility for the system on their own."

ENERCON demonstrates a possible application of storage systems that is beneficial to the system together with its project partner Energiequelle at the Feldheim/Brandenburg regional back-up power plant (RRKW), Germany's largest battery storage system. Any discrepancy between the demand for and production of energy leads to a change in the grid frequency. The large number of producers and consumers ensures that this is mainly averaged out. However, control power is always also required. Various staggered products are defined and are traded – designated as primary, secondary and tertiary reserves in chronological order. Primary balancing power is produced in Feldheim with the help of the energy stored in the batteries. The battery storage system has an installed power of 10 MW and a capacity of 10.79 MWh.



ENERCON supplies the interface features for energy storage. Possible applications are fast-charge columns for e-mobility (picture below).

ENERCON supplied the complex power electronics for the pilot project, including the controls for the inverter used for charging and discharging and for the grid connection. A very similar technology with a smaller output and energy quantity is also used in a further storage system pilot project on the Faroe Islands. The battery storage system will charge and discharge so that it consolidates the wind farm's infeed power within the short term (see also report, p. 16). The technology is housed on the Faroe Islands in a 40-foot container, the ENERCON smart container that ENERCON is currently developing as a standard product for storage applications.

The smart container is the interface between the memory module and the power grid that is responsible for storing electricity energy in the memory modules, withdrawing the energy as well as feeding it into the grid. "With the smart container, various storage applications can be implemented on the customer side in the future", Joachim Stilla says. Besides battery storage systems, possible applications include electrolysers for power-to-gas solutions and fast-charge columns with a charging power for electric mobility of considerably more than 50 kW.



"Overall, the subject of fast-charge columns has a significant potential", Joachim Stilla says. "There is still no manufacturer-independent nationwide infrastructure for fast charging in Germany. If e-mobility should pick up, quick-charging points must first be installed and above all significantly reduce the duration of the recharging process. This is a promising perspective for renewables and the deployment of ENERCON know-how in power electronics."

Energy supplier building block

Private end-customers should also benefit from attractive green electricity tariffs in a renewable energy system. ENERCON is therefore also active as an energy supplier and offers its employees at all its sites in Germany 100 % green electricity from ENERCON wind energy converters and German hydropower at favourable conditions. ENERCON operates its own wind energy converters for this purpose. In addition, the factories at the ENERCON production sites in East Frisia and Magdeburg are also supplied with green power.

In addition, ENERCON holds a 40 percent of shares in utilities in Aurich and is going to become more committed to this co-operation in the private end-customer business. The recently founded utility is applying for electricity and gas networks in the urban area of Aurich in the reallocation of network concessions. The purpose of ENERCON's share is to set up together with the local authority a complete green local utility, push ahead with decentralised renewable energy supply at ENERCON's company headquarters and thus become a model for comparable projects in other regions.

Research projects building block

In accordance with its company strategy geared towards technology and innovation leadership, ENERCON is involved in numerous research projects dealing with the subject of "integrated energy" or with partial aspects of optimised integration of renewables in the energy system of the future.

An example of this is the enera research project where ENERCON takes part in the Federal Ministry of Economics' SINTEG funding program



together with the Oldenburg utility company EWE and 73 further partners from the economy, science and politics. Enea's aim is to make the energy system in the North-West of Germany future-compatible with the use of intelligent technology, reduce the cost of conventional grid expansion and avoid costs for consumers. Smart grids with power electronics and storage systems, smart markets and an intelligent communication infrastructure for networking all players play an essential role in this.

ENERCON is also involved in leading research partnerships on an international level. The "R2 Wind" research project for the provision of balancing energy by wind energy converters together with the wind farm operator WindVision, the energy trader Eneco Energy Trade and the transmission network operator ELIA was successfully completed recently. The Estinnes wind farm in Belgium demonstrated with eleven E-126/7.5 MW and 6 MW turbines that it was technically possible for wind energy converters to provide balancing power. During the two-month project phase, Estinnes wind farm was part of ELIA's secondary reserve and provided the grid with up to 10 MW of negative balancing power as and when necessary. Furthermore, technical and market-related issues were raised which will have to be resolved if wind farms are to be able to participate commercially in the balancing energy market.

The subject of grid integration also concerns cooperation between ENERCON and IREQ, the research institute of the Canadian utility Hydro Québec. At the end of last year, both partners signed a framework agreement initially designed for five years. IREQ is a worldwide leader in the field of electrical grids, modelling and simulation. Through this cooperation, the partners want to pool their strengths and use research projects to further optimise the grid integration of wind energy.

There are also various pilot projects in the fields of grid integration, networking with other renewables as well as storage in which ENERCON has gathered important experience with the technology used and the procedures applied and uses these for further development. An example of this is the cutting-edge hybrid power plant from the ENERCON wind farm and pump storage system on the Canary Islands of El Hierro (see 1/2016 WB report) as well as the above-mentioned storage system project on the Faroe Islands. It not only provides important insights into application of the storage technology in practice. "It is at the same time a model project for the high penetration of electricity networks with volatile inverter-based sources", Eckard Quitmann says. "It can already be seen on a small scale on the Faroe islands which challenges the networks must meet with the further development of renewables and an increasingly high penetration of inverters in the future." //

Storage system installed in the Húsahagi wind farm

ENERCON IS STARTING ITS TEST PROGRAM ON SMART CONTAINER FOR POWER CONVERSION AND CONTROL ON THE FAROE ISLANDS. THE CONNECTED BATTERY STORAGE SYSTEM SHOULD CONSOLIDATE THE INFEED POWER OF THE INSTALLED E-44 WIND ENERGY CONVERTERS.

ENERCON has installed and commissioned a battery storage system in the Húsahagi wind farm on the Faroe Islands. The pilot project implemented together with the utility company SEV and the battery manufacturer SAFT should consolidate the infeed power of the installed wind energy converters (13 x ENERCON E-44/900 KW) and thus substantially contribute to the stand-alone system's stability.

The site acceptance test for the components installed in standard containers in the wind farm has already been successfully completed. Final testing is currently underway to check the system's behaviour in different wind conditions. After the test run has been completed, the storage system will be activated for standard operation.

The 2.3 MW battery storage system should even out rises and falls in the power supply obtained from wind energy converters. By balancing out

abrupt rises and falls by storage or withdrawal, a more constant infeed power is achieved and this increases network stability. This also prevents situations from arising whereby the grid operator restricts the feed-in capacity when a high-wind phase coincides with low energy demand.

ENERCON delivered its self-developed 2.3 MW smart container for power conversion and control for the pilot project. This interface between the wind energy converter, the memory module and the power grid contains ENERCON's tried and tested inverter technology as well as the components for controlling the power electronics. It is responsible for storing the electrical energy generated by the wind energy converters in the memory modules, withdrawing the energy as well as feeding the power into the grid. Two battery containers by the French battery manufacturer Saft are used as the storage system. The lithium-ion batteries have a continual discharging power of 2.46 MW and a capacity of 707 kWh.

Modular structure: The storage system in the Húsahagi wind farm consists of an ENERCON smart container (front right) and two battery containers.

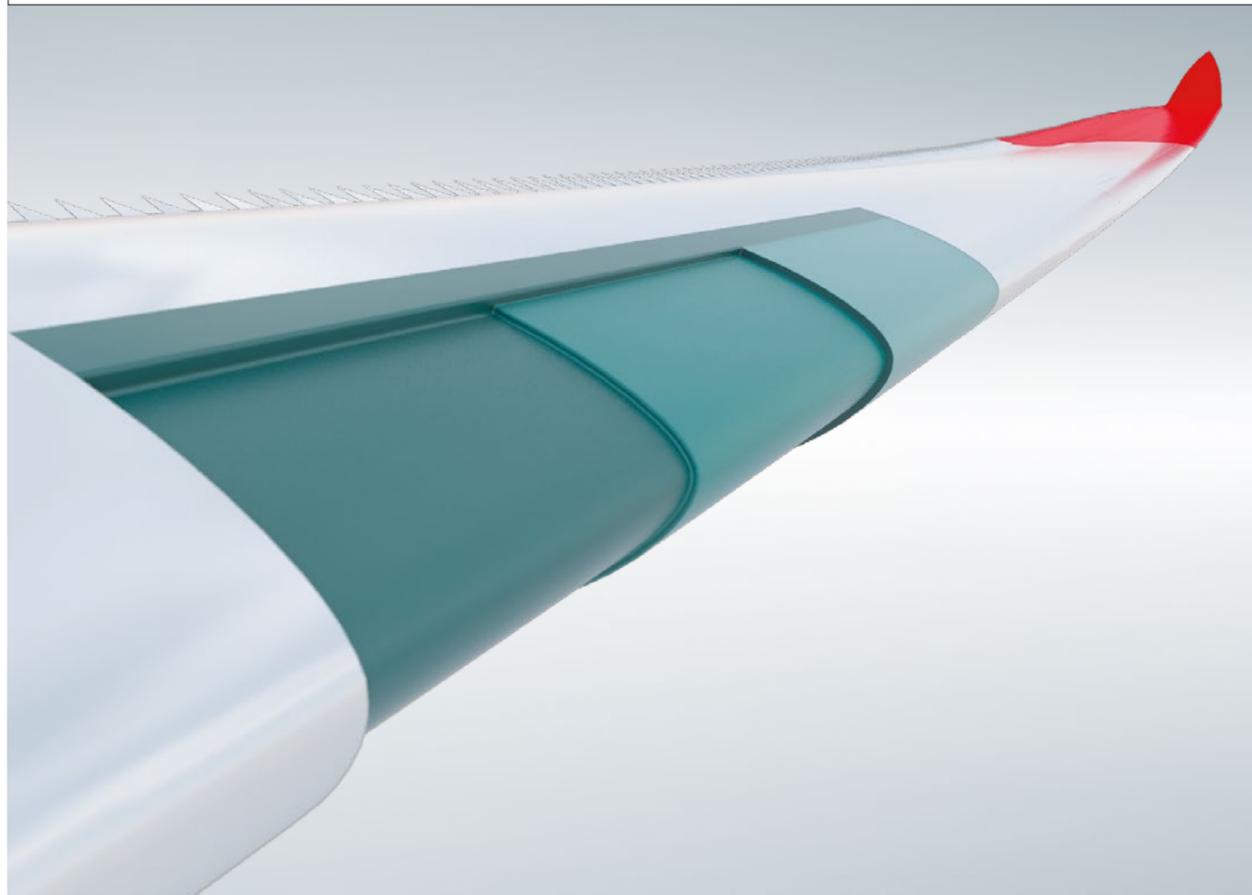
ENERCON's expertise in the field of energy storage lies in the provision and control of interface features for connecting the storage system to the grid. The smart container is currently being developed by ENERCON into a standard product with which different storage systems can be produced by the customer in the future. In addition to battery storage systems, possible applications include for example electrolyzers for power-to-gas solutions and high-speed charging columns for electric mobility. //



Storage system in the Húsahagi wind farm, Faroe Islands.

More durable erosion protection

ENERCON GUARANTEES A DURABILITY OF 30 YEARS OF OPERATION FOR THE ROTOR BLADES ON THE EP4 PLATFORM WIND ENERGY CONVERTERS. IN ORDER TO IMPROVE THE EROSION PROTECTION OF THESE HEAVILY-STRESSED COMPONENTS, ENERCON HAS DEVELOPED AN "IMPACT ABSORPTION LAYER" – A TYPE OF SHOCK ABSORBER INCORPORATED INTO THE LEADING EDGE.



Wind energy converter rotor blades are some of the most highly-stressed components. Wind flow and rotation affect enormous loads on the blade structure. The material is constantly exposed to weather conditions and sunlight. The blade surface erosion caused by dust particles and precipitation in the air is added to this. Dust and water particles are affected by the high blade speeds – the blade tips reach a speed of over 280 km/h – upon impacts such as sandpaper on the blade surface. This means that the protective coating on the surface will gradually become worn. The erosion protection on rotor blades with a conventional design must therefore be replaced after a certain period of time depending on the location and the stress.

In order to improve durability of the rotor blades for EP4 platform wind energy converters, ENERCON has therefore developed a particularly resistant erosion protection system together with a supplier.

A so-called "impact absorption layer" (IAL) is laminated onto the outside of the leading edge during EP4 blade production. The component is a type of shock absorber that is assembled from several layers of different materials.

The outer layer, a very erosion-resistant strong film, is used for protecting the surface. Below that, there is a rubber layer as a connecting element for the rotor blade's GRP material. The IAL prevents any particles incurring from damaging the surface and the EP4 rotor blades are therefore effectively protected from erosion over a long period. The protective effect was substantiated very impressively by high-pressure firing tests. The rotor blade protected with IAL was durably exposed to a 500 km/h water jet. No signs of damage could be identified, even after 26 hours. The technology will also be introduced successively in rotor blades on the other ENERCON platforms. //

AURICH

Internal graduation ceremony for 44 ENERCON apprentices

In honour of its former apprentices, ENERCON hosted an internal graduation ceremony at the EEZ (Energy, Education and Discovery Centre) in Aurich. A total of 44 young people successfully completed their apprenticeships with ENERCON companies in East Frisia in the first semester of 2016.



The following students were honoured: Lisa Schneider, Malte Friedrichs, Stefan Klöpping, Nina Bruns, Lukas Scherler, Janek Grotelüschen, Caroline Bünsow (Electronics technician for facility engineering); Artur Olgeiser, Niklas Weinlich, David Boes, Lars Vierkant, Marina Klaassen (IT systems technician); Angela Hinderks, Eric Gottfried, Kristina Bauer, Christina Meppen, Griet Ewen, Niklas Janssen, Julian Meyer (Industrial management assistant); Tobias de Vries, Alexander Mauer, Marcel Janssen, Timo Erdmann, Arne Bents, Nadine Bagehorn, Lena Lengert (Assistant for warehouse logistics); Matthias Noormann, Thorsten Löschen (Electronics technician for machinery and drive systems); André Ahrends, Jana Pahl (Logistics manager); Sönke Frerichs (Commercial driver); Sven Duderstadt (Logistics manager); Sabrina Fuhrmann, Hilko Heddinga, Lydia Hördt (Office clerk); Lena Trebesch, Duc Huu Nguyen (Bachelor of Arts in Business Administration); Dennis Freese (Bachelor of Science – Business Information Systems); Niels Giljan (Bachelor of Science – Business Information Systems); Sarah Pallasdiess (Technical product designer); Mike Schmidt, Tobias Buschmann, Fabio Reina, Renko Wibben (Process mechanic).

AURICH

ENERCON starts construction of customer centre

ENERCON has begun construction work on a customer centre at the Dreekamp site in Aurich. Employees in departments which are in direct contact with customers, e.g. Sales, Project Development, Project & Logistics Management and Energy Management, will work in the centre in the future.

Construction work includes extension and renovation of the old ENERCON research

and development building for office rooms as well as construction of a conference building including meeting rooms and a staff canteen with its own production kitchen. The construction work will create office workplaces for approx. 200 employees. Completion is planned for the first quarter of 2017. A grass strip and a biotope will be created as compensatory measures.



AURICH

ENERCON builds its own after-school care centre in Aurich

ENERCON is currently building its own after-school care centre at the Aurich site. The new building is being built in Aurich-Sandhorst opposite ENERCON's "KITA Wirbelwind" company kindergarten. In addition to a generous living and play area for the schoolchildren to be looked after, it also includes a work area for homework supervision, a library, a research and creative room, a kitchen with a connecting dining room, lavatories and staff rooms. Construction has already begun; the rooms will be ready for occupancy in the 1st quarter of 2017. Until then, the children in the already established after-school care centre group will be temporarily accommodated in other premises. The new care provision is intended for children of employees as well as parents from Aurich who do not work in the company. There is a total of 20 after-school care centre places intended for primary-school children in classes 1 to 4. Care begins at the end of school hours and lasts until 5 p.m. There are no holiday closures. In addition to an optimal support ratio, it also provides varied offerings in theme rooms, numerous activities, music and English lessons as well as healthy and wholesome nutrition.

BREMEN

ENERCON expands Bremen site

ENERCON expands its site in Bremen. As a result of expansion of the departments located there, an additional floor will be leased in the office building at Teerhof in the city centre in the third quarter of 2016. In addition to the 3rd, 4th and 5th floors, ENERCON is then also expanding its office spaces on the 1st floor.

ENERCON in Bremen has had its headquarters in Teerhof directly on the Weser since May 2013. In addition to employees from the Sales, Project & Logistics Management, Law and Project Development departments, the Research and Development department as well as the new research company "I4E Innovation for ENERCON" founded for forward-looking technology and innovation development are also partly located in Bremen.

Shackles placed on wind energy by the tendering process

BUNDESTAG DECISION ON EEG REFORM SCHEDULED FOR BEFORE THE SUMMER BREAK.

Even if the Bundestag has yet to hold a first reading which sets out the general framework for EEG 2016, agreements have already been reached in advance on large areas of what will be the most important legislation to govern wind power from 2017 on. Preliminary decisions have been agreed during a whole series of talks – between the chancellor's office and the Ministry of Economic Affairs, and between the Federation and the federal states – with the result that the Bundestag now finds itself under pressure not to expose these hard-won compromises to further scrutiny. The decision-makers will very soon have to vote on a bill which covers a wide range of issues – no easy undertaking.

Auction system design main issue

For months on end, the main bone of contention has concerned the No. 1 area of interest when it comes to designing the new auction system, namely the annual tendering volume. As long ago as last November, the so-called 'world formula' was raising concerns among wind converter manufacturers and suppliers. This complex set of figures was to be used to control the annual expansion of renewable energies so as to ensure that the 2025 target of a 45% share of renewables in gross electricity consumption was not exceeded. The variable factor in the formula was to be onshore wind. There was a desire to fix the annual tendering volume on the basis of the expansion of other renewables and

many other variables. On paper, it would even have been possible to have years when onshore wind was excluded altogether from the tendering process. The wind industry faced a serious body blow, because having a strong domestic market behind it had always been indispensable for its long-term future; it would guarantee innovation and, looking further ahead, secure the future of its sites at home in Germany. It was only thanks to the commendable efforts of the federal states at two Prime Ministers' Conferences that the formula was finally expunged from the legislative proposal.

Instead, a fixed tendering volume of 2,800 MW was determined for the years 2017 to 2019;

another 100 MW will be added from 2020. Compared with the 4,400 MW tendering volume which would be required to meet the expansion corridor of 2,500 MW (net) already set out in the current EEG, this would certainly be a significant reduction. If dynamic repowering also becomes a factor from 2020, then wind output in Germany will grow more slowly, the more turbines are replaced. Nonetheless, if this tendering volume were actually to become a reality, it would at least mean that we could plan on a reliable basis.

Tightened degression

Much more drastic are the plans concerning less generous degression levels for wind energy converters during the transitional period between feed-in tariffs and the introduction of tendering from 2017. While EEG 2016 allowed for a flexible ceiling in this area, with expansion-dependent degression of up to 1.2% per quarter, the proponents of the current EEG proposal have had a major rethink: a figure of 1.2% on 1 April is to be followed just two months later by a one-off cut of 5%, followed in turn on 1 October 2017

by a figure of 2.4%. With expansion of 3,600 MW per annum, we would continue to see this 2.4% being applied quarterly, resulting in total degression for 2017 and 2018 of more than 18%. "A huge deficit for contracts which have already been concluded under the terms of EEG 2016!", declares ENERCON's managing director Hans-Dieter Kettwig. "Clearly, there is a desire to force projects out of the transitional ruling and into tendering at all costs." A legal opinion from the University of Dresden raised constitutional concerns about the way in which conditions for wind converters were being altered retrospectively for the transitional period. We can now anticipate a race for the tape, with all the negative repercussions for grid load and network expansion that will entail.

Hidden cuts in a different guise can also be found in Art. 51 of the new law, which governs the nuts and bolts of the six-hour rule; since 1 January 2016, this has no longer guaranteed any remuneration to wind energy converters of 3 MW installed output or above if the trading price is negative for more than six hours

in succession. The Electricity Market Act alleviated the situation considerably for wind turbine operators in terms of lost revenue by deeming electricity prices to be negative only if this applied to both the day-ahead and the intraday markets. In the latter, volumes of energy are traded for the following day, so this at least offers a certain amount of scope for predicting the market. A study of this precise issue revealed that taking both markets into consideration when determining the duration of negative energy prices would alleviate the situation substantially. It remains to be seen why the law-makers have now set aside the provisions of the Electricity Market Act and determined that the spot market on the Paris stock exchange is to be the sole criterion used.

No de minimis rule

In our opinion, the much vaunted plurality of stakeholders has also been squeezed out of the law by the new ruling. The de minimis rule, which was created by the EU Commission explicitly to suit the market in Germany, which is dominated by medium-sized enterprises, is not currently used to any positive effect in the law. An exemption clause for citizens' energy companies merely allows them to join the tendering process at an earlier stage. This is of no genuine advantage for them – after all, the tariff at which a bid is considered realistic only becomes evident later on in the course of the project. These are choppy waters then, towards which the previously robust medium-sized onshore wind energy sector is now steering! But ENERCON will face up to the challenge regardless, and be on hand to offer assistance with issues such as the implementation of grid expansion zones, storage system ideas, green regions, green grids, etc. Challenges can also be turned into opportunities! That, at least, is the route we intend to take. //



Photo: BLE/Alte Schmidt

Strong ENERCON presence at the „Energiewende retten“-demonstration beginning of June in Berlin.

The energy turnaround – now just a white elephant which we pursue against our better judgment?

RENEWABLE ENERGIES COME UNDER PRESSURE FROM POLITICIANS AND THE PUBLIC.

Whilst biogas was the first form of renewable energy to be brought up short by the debate on costs, the scenario which sees the brakes being slammed on onshore wind generation, which actually cuts the cost of the energy turnaround, is apparently no longer being ruled out. The latest argument against further expansion? Wind farms which are not feeding power into the grid to their full extent, or have not been connected up in the first place because of a lack of grid capacity, have supposedly driven compensation

for lost electricity earnings to absurd heights. With no end to this trend in sight!

However, this charge brought against renewable energies fails to take into consideration the fact that conventional power stations show no signs at all of restricting to a minimum the amount of electricity they feed into the grid when wind and solar conditions are good, thereby giving renewables the priority to which they are legally entitled. Thus a study by the Energy Brainpool (commissioned

by Greenpeace) found no evidence that the Brokdorf nuclear power plant in Schleswig-Holstein and the Moordorf coal-fired power station in Hamburg reduced their output to the minimum threshold during periods of high winds with a large degree of feed-in management. Instead, Brokdorf in particular was sometimes to be found feeding high levels of power into the grid, even when there was maximum regulation of renewable energies. Possible reasons for this may admittedly include technical restrictions or the need to



Clear message to politicians.

Photo: BEE/Ala Schmitt



Approx. 1,500 ENERCON employees took part in the demonstration in Berlin. They demanded continuation of the energy turnaround and a safe perspective for jobs in the sector.

provide system services or ensure a secure supply of power. But it is also true that the current regulatory framework offers power plants no incentive to adjust production in response to problems such as grid congestion.

No incentive

The purely market-led operation of installations in the electricity system also extends to pumped-storage plants which are part of the network: the existing pumped-storage plants in Germany, Austria and Switzerland have a combined output of some 10 gigawatts, and operate purely in response to the market. By rigorously modifying their mode of operation to provide support for grid operation through redispatch measures, however, the pumped-storage plants could be used to relieve pressure on the grid.

The grid operator '50 Hertz' recently proposed a genuine blow for freedom on the issue of grid disconnections: if conventional plants were also included in the feed-in management system and were consistently regulated as far as possible by the network operators in the control zone, then the number of grid-related disconnections of wind energy converters would be reduced to a fraction of what they currently are. And at the same time, the priority which should, by law, be given to renewable energies would come one step closer to realisation.

Moreover, the sector has long been pointing out that pressure on the grid could be relieved effectively by using the electricity locally for

other purposes, rather than feeding it into the grid. 'Energy sector coupling' would encompass areas such as on-site heat pumps, but also regional electromobility strategies, and hydrogen and methane conversion. But the federal government was keen to turn a blind eye to this in the EEG, and determined that renewables plants participating in the tendering process would have to feed 100 % of their power into the public grid. This is a nonsensical regulation which will ensure that at times of grid congestion, almost fully remunerated electricity will be left unused. Permission to deploy the power elsewhere instead of feeding it into the grid at times of disconnection would be enormously helpful and would also breathe new life into sector coupling, to which much lip service is paid. Quite apart from this, the ruling also ensures that it is much more difficult for industrial enterprises to be self-sufficient by generating their own power with wind energy converters.

Reduction of installation

As things stand, the federal government plans to redress the situation in the face of the growing number of grid disconnections in the thriving onshore sector by choking expansion over the next few years. The tendering volume in the so-called 'grid expansion regions' is in future to be capped at 58 % of the expansion seen in the last three years. The Federal Grid Agency will determine the precise location of these regions following the adoption of EEG 2016. But it is already clear today that states such as Schleswig-Holstein, which have been conscientiously doing their bit for grid expansion

in recent years, will feel the full impact on their doorstep of this throttling of the energy turnaround. Thus the ruling will provide no incentive for anyone else to make a special effort to expand their grid rapidly in the future. But if shackles are to be placed on previous front-runners of wind energy expansion such as Lower Saxony and Schleswig-Holstein for an unspecified period, it may very well prove difficult in a few years' time to fill the tendering corridor with projects. We are calling – as we have done in the past – for an open approach to grid planning and an intelligent level of cooperation between the network agencies. Stakeholders in renewable energies must be given a seat at the table when it comes to defining grid zones, because among other things, we know where the expansions are and have all the necessary data to hand. Moreover, as manufacturers and operators of onshore wind energy converters, we very much hope that the connection to the grid of fixed offshore projects, which is currently an unpredictable variable, will not give rise to further negative discussions and decisions vis-à-vis the expansion of onshore renewables, because at the moment we have three different systems raring to go. We need some clarity! Politicians are therefore urged to encourage the grid operators commissioned with extending the electricity infrastructure to make rapid progress. For instance, Tennet & Co. has no disincentive to delay its project, as they face no penalties for dragging their feet. Living by the motto, "Slow and steady gets there in the end" means that everyone else just has to drum their fingers and count the cost. This cannot be allowed to continue. //

First repowering in Bavaria completed

ENERCON HAS INSTALLED 2 X E-115/3MW AT KRAFTISRIED IN PLACE OF TWO OLD PFLEIDERER WECS.



Usually, the preparations for installing new wind energy converters are less complex than for the "WildKraft" project at Kraftisried in Bavaria. Before ENERCON could start installing 2 x E-115/3 MW on the Haarberg in the Ostallgäu/Schwaben district, space had to be created. Only a maximum of 11 WECs on the high ridge are approved; therefore, two of the legacy systems had to initially differ.

According to the Allgäu utility company (AÜW), which is involved in the owner association, it was the first dismantling of WECs in Bavaria using explosives. In addition, the project is the first renewal of already erected WECs in the Free State.

"Repowering" was not only required by the operating permit. There were also no more spare parts for the faulty eleven-year-old Pfeleiderer WECs. According to AÜW's managing director Michael Lucke, they were a "technical total loss".

Apart from that, economic reasons spoke in favour of replacing the old turbines with modern ENERCON WECs. While both Pfeleiderer turbines with a nominal power of 1.5 MW each generated around 2.5 million kWh, the annual energy yield expected from both E-115s according to AÜW is 13 million kWh – more than five times as much and therefore a significant increase in efficiency.

The E-115s were erected on hybrid towers with a hub height of 149 metres. They were commissioned at the beginning of the year. Half of shares in the owner association are designed for community investments BioEnergie Allgäu (BEA), a merger of AÜW, Allgäuer Kraftwerke (AKW, Allgäu's power plants) and Kempten's special purpose association for waste management (ZAK), holds 45 percent. Wilpoldsrieder Dorfentwicklungs GmbH holds the remaining 5 percent. //



Dismantling of old WECs (above) and installation of foundation and tower of new E-115 at the Kraftisried site.



New ENERCON E-115 at the Kraftisried site.

Clean energy from the heap

ENERCON HAS ERECTED AN E-115/3 MW ON THE FORMER COLLIERY SITE IN DINSLAKEN LOHBERG, NORTH RHINE-WESTPHALIA. IT IS PART OF THE LARGEST CONTIGUOUS CO₂-NEUTRAL AREA IN EUROPE.

There are only a few wind energy sites in Germany that symbolise the revolutionary restructuring of the energy system from fossil fuel to renewables as clearly as Dinslaken Lohberg. The heap in the Ruhr area (North Rhine-Westphalia) is part of the Lohberg mine that produced hard coal until it was decommissioned in 2005. ENERCON recently erected an E-115/3 MW with a hub height of 135 m directly on the mining heap.

It was officially inaugurated at the end of April. The E-115 is operated by Windkraft Lohberg GmbH, a co-operation between the utility company RWE, the power plant operator Steag, the mining group RAG and the Dinslaken utilities. It wants to make the former colliery site the largest contiguous CO₂-neutral area in Europa and thus take account of the energy transition on the Lower Rhine.

Energy will be obtained exclusively from renewable resources on the site in the future. For this, a combined heat and power plant operated with biomethane was erected as well as ENERCON's E-115 wind energy converter as a "local landmark of the ecologically responsible and low-consumption energy era", according to the operators. Its expected annual energy yield is 9 million kilowatt hours. That is enough clean energy to supply 3,000 households in

the town of Dinslaken and saves 6,330 tons of CO₂ per year compared to conventional power generation.

Due to the particular soil conditions, the E-115s were set up with the help of vibro-replacement. Since only limited space was available on the heap, ENERCON used its tower crane for installation. Special equipment was also required for WEC assembly. The rotor blades were transported onto the heap with a self-propelled vehicle and the mobile Alpine transport frame. A hairpin bend on the access road made transport with standard blade transporters impossible.

The exposed site – the ground level at the installation site is 110 m above sea level while the environment lies consistently only 25 to 30 m above sea level – is the reason why the E-115's tower base is produced in blue shading instead of ENERCON's typical green at the customer's request. Only a few WECs have been erected in this colour variant until now. But there could be more soon. There are other wind energy projects in the planning stage at heap sites in the region. A remarkable side effect of the energy transition: The legacies of the fossil energy era in North Rhine-Westphalia are being developed into renewables to the site's advantage. //



ENERCON used its tower crane to install the E-115 on the Lohberg heap.



Erected ENERCON E-115 at the Lohberg heap site.



ENERCON Projekt Niagara
in Ontario/Canada with 77 x E-101/3.05 MW.

ENERCON installs 2,000 MW in Canada

THE IMPORTANT MILESTONE WAS REACHED WITH THE INSTALLATION OF THE NIAGARA PROJECT IN ONTARIO. THERE ARE ALSO GOOD FUTURE PROSPECTS FOR ENERCON IN THE NORTH AMERICAN MARKET.

Good reason to celebrate for ENERCON in Canada: Installation there reached the important 2,000 MW mark at the beginning of May. The 2,000th megawatt was installed with the erection of the Niagara Region Wind Farm (NRWF) in Ontario province.

ENERCON is currently erecting a total of 77 x E-101/3 MW for the major project (230 MW wind farm power) in the West Lincoln district of the town of Wainfleet in Haldimand County. The 2,000 MW mark was surpassed with the installation of the 35th machine.

ENERCON has already been active in Canada since 2001. The first wind energy converter, an E-40/600 kW, was erected for the Lundbreck wind energy project in Alberta province. It is still in operation.

Today, ENERCON's installation balance covers a total of 889 wind energy converters and Canada is one of ENERCON's most important international key markets. ENERCON currently holds a 18 percent market share in the Canadian wind energy market and is one of the country's largest WEC manufacturers.

There are good future prospects for ENERCON in Canada. Canada recorded the third largest growth of all wind energy markets worldwide in the last three years after Brazil and China. The market prospects are good with development targets of 4,000 MW by 2030 in Alberta province, 1,600 MW by 2030 in Saskatchewan province and a number of new long-term renewable energy plans on a provincial level that almost all include wind energy. The outlook shows 1,000 to 1,500 MW of onshore wind power to be installed each year for the next four years.

An advantage for ENERCON is the new EP4 converter platform on which the E-126 EP4/4.2 MW to be introduced into series production shortly and the new E-141 EP4/4.2 MW low wind turbine currently in the prototype phase are based. Customer interest in EP4 platform machines is high in Canada. The EP4 will offer new opportunities and help to gain further market shares. //

Large scale project in Brazil now online

ENERCON INSTALLS 67 × E-92/2.35 MW WIND TURBINES FOR BRENNAND ENERGIA IN BAHIA. LARGE-SCALE PROJECT COMPRISES FIVE INDIVIDUAL WIND FARMS WHICH WON THE BID AT THE 2013 AUCTIONS.

For ENERCON, this was a successful first. Despite considerable challenges during the construction phase, ENERCON's first wind project with a total of 67 × E-92/2.3 MW wind turbines went successfully online in the state of Bahia, Brazil. Outstanding project management and a satisfied customer now put ENERCON in a favourable position for follow-up projects in Bahia – one of the country's most important regions for onshore wind energy. "Our accomplishment has put us in an advantageous position for future projects," confirms Rafael Justi, Senior Sales Manager at ENERCON's Brazilian subsidiary, Wobben Windpower.

The E-92 machines were installed on 98 metre (hub height) hybrid towers for ENERCON's customer, Brennand Energia. Located in Sento Sé city in Northeast Brazil, the giant project has an aggregate capacity of 157.45 MW and is subdivided into five wind farms: Baraunas I, Mussambe, Morro Branco, Baraunas II and Banda de Couro. The first three wind farms won bidding in Brazil's Energy Reserve Auction in August 2013 and the other two at the A-5 Auction in December 2013. A total annual energy yield of 494 gigawatt hours was sold in the two auctions.

The schedule for installing and commissioning the turbines was tight. And there were other hurdles that had to be dealt with – mountainous terrain, adverse weather conditions and the entire logistics of this

titanic project. There were weeks where more than 100 heavy load vehicles transporting precast concrete tower segments from ENERCON's new tower production facility in Juazeiro were arriving at the sites. However, all these obstacles were masterfully overcome.

The 66,000 square metre large production site in Juazeiro started up operations at the beginning of 2015 to supply components to projects in Bahia. Rotor blades were manufactured at the plant in Pecém, in the state of Ceará and the generators and the machine houses originated from the factories in Sorocaba in the state of São Paulo. The first three wind farms were commissioned in December 2015 and the other two partial projects followed in March 2016.

So far, Brennand Energia is extremely pleased with their experience with ENERCON – so much so that they have already started jointly planning other wind farms in the region. As of the first quarter 2016, ENERCON had already installed 1,198 MW in Brazil which corresponds to a market share of 14 percent putting ENERCON in third place in the Brazilian market. "Competition in the Brazilian market is fierce and demands local content," explains Rafael Justi. "On the other hand, Brazil is also a promising market. Since it is an emerging economy, Brazil will be requiring a lot of energy and wind energy along with hydropower are the most competitive forms of energy. In the long term, two to three gigawatts are expected to be installed every year." //

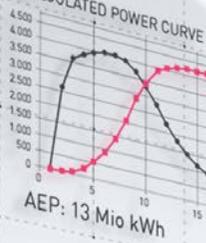


ENERCON E-92 in Sento Sé region
in Bahia, Brazil.

129 m
HUB HEIGHT

159 m
HUB HEIGHT

CALCULATED POWER CURVE



SOUND POWER LEVEL



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



Ø 141 m
ROTOR DIAMETER

IEC IIIA