

# WINDstärken

Information from the City of Cuxhaven and Siemens Gamesa Renewable Energy



Deliveries have begun

## Production in full swing at the nacelle factory

From Cuxhaven to the offshore world:  
The first Siemens Gamesa wind turbines built in the new plant have been installed in Belgium's Rentel offshore wind farm in the North Sea. The plant sends out deliveries by ship on an almost weekly basis. This delivery was a genuine coup for the team, because the first nacelles arrived in March at the Ostend installation port just in time for installation.

From there, the installation ship Apollo takes the turbines and uses an onboard crane to move them onto the foundations – 34 kilometers off the coast of Zeebrugge in the North Sea.

"Our production is underway, but we're still in the startup phase," says Project Manager Carsten-Sünne Berendsen. "It will take a few months to complete the ramp-up."

Numerous optimizations are in progress on the four assembly lines – during ongoing production – that will bring all of the production stages up to speed, including additional machines, tools, and equipment for a perfectly coordinated material flow of the individual components. All 42 Rentel wind turbines will go online by the end of the year, supplying clean energy to 288,000 Belgian households.



Dear readers,

this issue of WINDstärken honors an event that is very special to me as Mayor of Cuxhaven: the official inauguration of the Siemens Gamesa

plant in Cuxhaven, an occasion filled with joy and optimism.

The company's arrival here has been the beginning of a new era for our coastal city: Many jobs have been and are still being created, and the job market is being revitalized.

At the same time, we're experiencing an economic breakthrough thanks to the German Offshore-Industry-Center Cuxhaven, which is drawing additional relocations and having a significant effect on the regional economy.

With its optimal port infrastructures, logistics services, and a wealth of production, installation, and service expertise, Cuxhaven has established its position on the market. This pioneering investment in Cuxhaven as the German Offshore-Industry-Center Cuxhaven could not have been implemented to such an extent without the tremendous support

of Cuxhaven authorities, the State of Lower Saxony, the federal government, and the EU. With Siemens Gamesa's establishment here, Cuxhaven is facing a tremendous new challenge. We look forward to collaborating with all the stakeholders to shape the future of the energy transition.

  
Dr. Ulrich Getsch,  
Mayor of Cuxhaven



### How Siemens Gamesa stays on top

#### Ready for the future

Having produced over two-thirds of all the offshore wind turbines installed worldwide, Siemens Gamesa has an impressive history of success. But the competition is heating up. This spring on Capital Market Day, management explained how the company can remain the market leader in the future.



Future-oriented strategy: Offshore CEO Andreas Nauen on Capital Market Day, which took place in the spring

There are three cornerstones in the corporate strategy L3AD2020 that will carry the company into the future. First, Siemens Gamesa will strive to offer the best technology for the levelized cost of energy. Second, the business model will be defined by agility in order to respond more quickly and less bureaucratically to customer demands. And the strategy's third element is the digitalization of products and their manufacture.

The plant in Cuxhaven has already set its course for the future: a uniform technology platform. The highly cost-efficient direct-drive wind turbine is produced here. To reduce costs, the modern production facility was built on the waterfront and is linked to the offshore supply chain via Ro/Ro logistics. The plant is also advanced in terms of digitalization: Robots are being deployed and flexible digital controller components are installed in the completed plant.



### Quality products from the coast

## Made in Cuxhaven

Pride shows on the faces of employees every time the gates of the Siemens Gamesa factory open and another new 400-ton behemoth rolls onto the cargo ship. And no wonder, because the work of many expert hands goes into the production of these high-tech wind turbines on the North Sea coast. Well over 400 people have found jobs with Siemens Gamesa: Counting local suppliers and service providers, the number comes to almost 800. Together they're convinced that offshore wind energy is making an essential contribution to the success of the energy transition, because working on the turbines leads to active climate protection.

"For months, we struggled with temporary arrangements and deficiencies: for example, in the matter of buildings and a factory cafeteria," says project manager Carsten-Sünke Berendsen.

"But everyone was motivated by our greater goal." But there's one area where the assorted team of electricians, mechanics, logistics specialists, and many other disciplines, refuses to compromise: quality. Only nacelles that have passed their 24-hour test run with no errors are delivered.

Business developers, employment agencies, and personnel departments worked hand in hand to put together a highly qualified and motivated team. There were special selection procedures, intensive training courses, and integration activities for all occupational groups. The company deliberately solicited talented women. The results are remarkable: The diverse teams are pooling all their skills to produce quality made in Cuxhaven.



### How Cuxhaven benefits

## A city flourishes

Seaport – North Sea resort – small metropolis at the mouth of the Elbe River: Cuxhaven has many faces. But now the city is changing dynamically and establishing itself as a permanent fixture in the offshore wind industry.

The establishment of the Siemens Gamesa nacelle plant has unleashed "many positive domino effects," according to Markus Heinig. As CEO of Unternehmensverband Cuxhaven Elbe-Weser-Dreieck e. V. (UVC), Cuxhaven's business association, he sees "significant economic effects for the region that primarily benefit the construction and housing industry, retail trade, port industries, skilled crafts and trades, hotels and restaurants, and a variety of service industries." Companies are expecting to see an increase in consumerism. "The annual total purchasing power will grow by 20 million, or possibly even 30 million Euros in the coming years," predicts Heinig.

The upward trend is already being felt. "Incoming orders for skilled crafts are increasing," says Yana Arbeiter, CEO of Kreishandwerkerschaft Elbe-Weser, the district craftspeople's association. "In the Cuxhaven and Land Hadeln areas, we already saw

an increase of 3 percent in 2017 compared to the previous year." DEHOGA Chairman Kristian Kamp reports more than 3.7 million hotel stays and attributes the 1.5 percent annual increase to two factors: "The greater share of business guests in our hotel business and the offshore industry as a factor specific to our location mean that there is greater capacity utilization in our businesses even during the winter months." Tourism in Cuxhaven has also picked up over the past few years. The wind industry and vacationers are not incompatible, because improvements in the infrastructure and the location's image, along with positive signals sent by the knowledge and technology sector, make the city and surrounding countryside more attractive to tourists and residents. "Our booming tourist trade and the creation of the German Offshore-Industry-Center Cuxhaven complement one another perfectly, and are clearly separated spatially," emphasizes UVC CEO Heinig. The former decline in population has already stabilized and the qualification level of the workforce has improved. The rate of unemployment in the Cuxhaven district has dropped by almost one percent, and even 1.2 percent in the city.



fish boulevard



city's shopping area



beach promenade



Drone inspection and repair robots

# Latest technologies for rotor blade maintenance



Flying eye: Siemens Gamesa tests automated rotor blade inspections

Rotor blades are among the most stressed components in a wind power plant. Regular inspections are required to keep the blades operating reliably for their lifecycle of 25 years. Siemens Gamesa has recently begun using automated drones whose camera images are evaluated by state-of-the-art computer programs.

The primary goal of almost all innovations in the wind industry is to reduce operating costs. Computers can support experts more quickly and accurately than humans. Until now, technicians have been required to regularly inspect all sections of rotor blades offshore while working under uncomfortable conditions suspended from a cable.

## Premiere of innovative storage in Hamburg

# Hot rocks store power

For about three years, Siemens Gamesa Renewable Energy has been researching power storage using hot rocks at a testing facility in Hamburg. The findings are now being converted into a powerful project on a larger scale. Construction of the Future Energy System (FES) – the first thermal energy storage for wind energy using gravel as a storage medium – began in December on the site of aluminum manufacturer TRIMET Aluminium SE in Hamburg-Altenwerder. The system heats roughly 1,000 tons of rock fill to approximately 600 degrees, which keeps about 30 MWh of electric energy at the ready.

The heat is re-converted to electricity via a steam turbine. A generator rated at 1.5 MW produces energy for up to 24 hours, during which time it can supply power to an estimated 1,500 German households or charge about 50 electric cars.

Siemens Gamesa’s partner in the energy industry is HAMBURG ENERGIE GmbH, which is testing the storage medium on the energy markets. With the start of construction a few weeks ago, Siemens Gamesa reached an important milestone in the development of a key technology for the energy transition.

In times of sunny weather and high wind conditions, renewable energies are available in large amounts, and the in-feed often exceeds grid capacities. Storage systems act as a buffer. This new development, supported by the German Federal Ministry for Economic Affairs and Energy, offers an especially economical storage solution: Excess wind energy is converted to heat and stored in rock fill that is protected with an insulated cover. When more electricity is needed, a steam turbine converts the heat energy back into electricity.

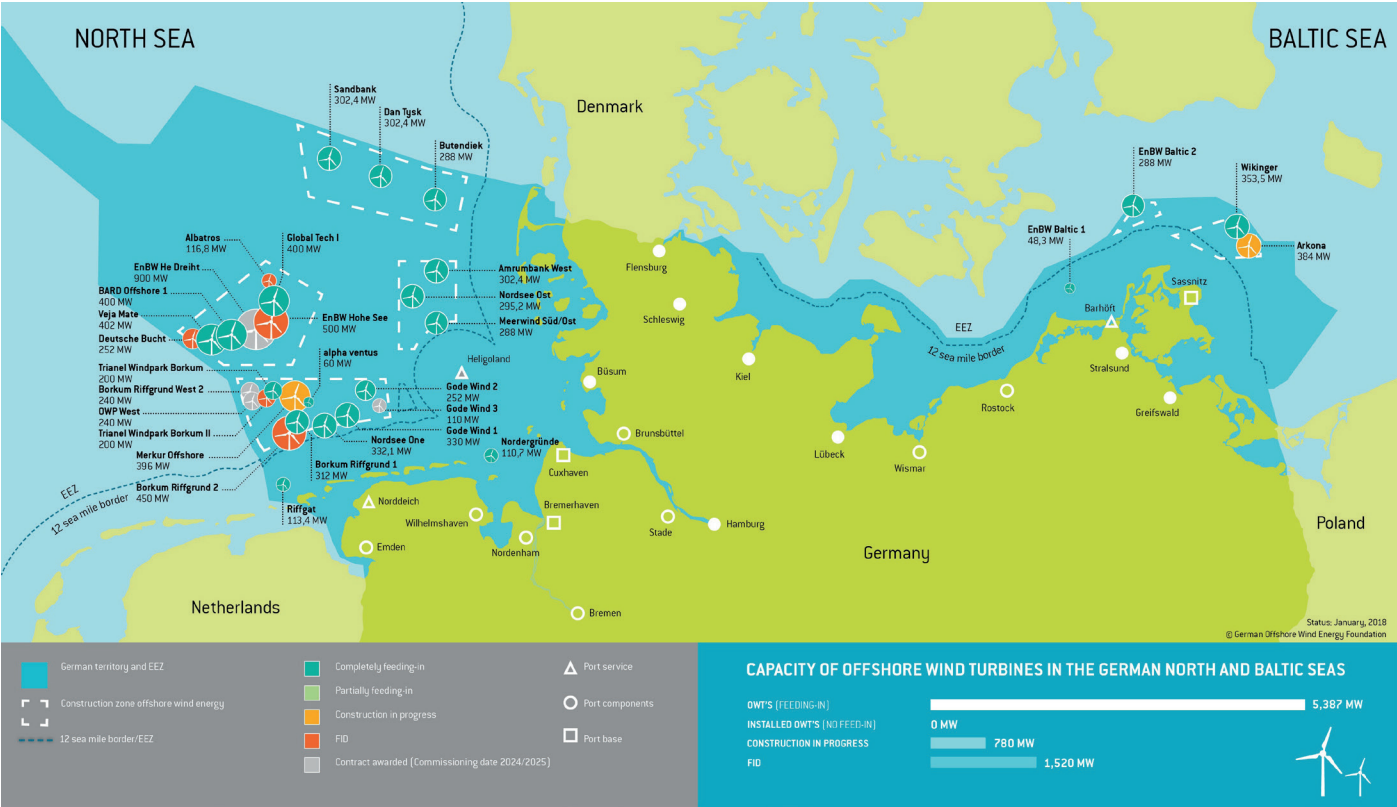
At Siemens Gamesa, this job will soon be taken over by automated camera drones. The drones follow a precisely defined course along all three blades of the turbines while taking high-resolution pictures of the surface. Smart software also helps analyze any damage: A computer program analyzes the images with millimeter precision while at the same time learning to evaluate damage more and more accurately.

Soon there will also be a machine to help with surface repairs. “Rope robotics” is the procedure by which a compact robot suspended from the hub rappels down to the damaged area. Its automated arm is equipped with grinding, spatula, and painting tools.



The simple principle behind this storage concept combines proven components in an innovative configuration.

For the process of converting electricity into hot air steam, it uses heating elements and fans from mass production. The same applies to the re-conversion: A standard steam turbine operated by a highly dynamic Siemens steam boiler generates electricity at the end of the process chain. The plant will be commissioned in 2019.



Responsible for 4.7 of the 5.4 GW of installed power, the majority of Germany's offshore wind turbines are in the North Sea

## Offshore power for a clean future

# The North and Baltic Seas drive the energy transition

It's full steam ahead for the energy transition: In 2017 the amount of power produced by German offshore wind turbines rose to an impressive 18.3 terawatt hours. That's the equivalent to the power requirements of 5.2 million German households. With a power output of almost 5.4 GW, offshore wind turbines are contributing more and more to Germany's security of supply.

The offshore industry is also playing a significant role in the German economy: According to the latest figures from the BMWi (German Federal Ministry for Eco-

nomic Affairs and Energy), some 27,200 employees are working in the offshore wind industry, generating an annual revenue of about two billion euros. That's roughly 40 percent of all employees working in the offshore wind industry throughout Europe. The development of offshore wind energy is thus both creating jobs and driving the energy transition. Nevertheless, forecasts for the German market are subdued. It's true that the first auction for projects in the North and Baltic Seas in 2017 resulted in three subsidy-free bids:

This was the operators' way of signaling that the projects would be able to manage without public funding as early as 2023/24. But experts believe that the EEG 2017 (Renewable Energy Sources Act 2017) will curtail the expansion of offshore wind energy, especially as of 2020. That's why they joined with the coastal states and unions to launch the second Cuxhaven Appeal in September 2017, which calls for an expansion of at least 20 GW by 2030 and 30 GW by 2035. After all, the wind parks on its doorstep are an important economic factor for this city at the mouth of the Elbe River.

## MILESTONES

### 2018

- Delivery of first nacelles manufactured in Cuxhaven
- Turbine installation at the offshore wind farm Rentel
- Official inauguration of the Cuxhaven plant
- Further suppliers establish facilities on site
- Expansion of digital manufacturing
- Shore connection system at RoRo ramp
- EnBW Albatros turbine installation

### 2019

- First grid connections with Offshore Transformer Module (OTM) instead of large substations
- 71 turbines commissioned at EnBW Hohe See
- Turbine delivery to large UK offshore projects
- Preparation for serial production of 8-megawatts-version of Siemens Gamesa's large direct-drive offshore-turbine

### 2020

- Delivery of SG 8.0-167 to first projects in the Netherlands, Denmark and the United Kingdom
- Operational voltage of the park grid of 66kV instead of 33kV in the interconnection cables between the turbines becomes new standard
- New foundation concepts applied to contribute to cost out in capital expenses



# Plant engineering bound for success 1,000 wind turbines

Siemens Gamesa’s direct-drive offshore wind turbines are continuing their journey to success. Since the company announced its eight MW model with a rotor diameter of 167 meters, orders have been pouring in for projects in Denmark and the United Kingdom, currently adding up to 1,000 plants to the order books. The Arkona Becken wind power plant in the Baltic Sea, the Rentel wind farm in Belgium, and the British Walney extension have already been supplied. The Beatrice project, also in Great Britain, will be followed by two more German wind farms.



Successful model: SG 8.0-167 DD

No. of plants	Wind turbine type	Projekt name	Country
2018			
60	SWT-6.0-154	Arkona Becken	D
42	SWT-7.0-154	Rentel	BE
47	SWT-7.0-154	Walney ext. East	UK
84	SWT-7.0-154	Beatrice	UK
71	SWT-7.0-154	Hohe See	D
2019			
16	SWT-7.0-154	Albatross	D
174	SWT-7.0-154	Hornsea ONE	UK
102	SWT-7.0-154	East Anglia I	UK
2020			
94	SG 8.0-167 DD	Borssele I + II	NL
41	SG 8.0-167 DD	Vesterhav Sud / Nord	DK
74	SG 8.0-167 DD	Kriegers Flak	DK
2021			
165	SG 8.0-167 DD	Hornsea TWO	UK



Roetra Vente



Roetra Mare

## Rolling logistics concept Excellent connections to Ostend

The ramp in front of the Siemens Gamesa plant has stood the test. Since March, the special ship Roetra Vente has been regularly docking there to pick up nacelles for Belgium’s Rentel offshore wind farm in Ostend. Everything’s based on a modern logistics concept. Heavy transport via trucks and loading by crane are largely a thing of the past. Instead, the 400-ton giants are rolled almost effortlessly out of the plant and onto the ship, for increased safety and about a 20 percent reduction in logistics costs. Excellent connections are guaranteed by the „roll-on/roll-off“ process and two special freighters. The Roetra Vente can carry eight nacelles per voyage. The second ship, the Roetra Mare, can hold three complete wind turbine towers or 12 blades.



REBO Terminal, Ostende

# Interview Dr. Ursula Prall “Only a few projects succeed without funding”

Dr. Ursula Prall has been Chair of the German OFFSHORE WIND ENERGY Foundation for one year now. She started at a turbulent time for the offshore industry, since just a little earlier, in April 2017, the first auction for offshore wind farms in Germany had closed with zero-cent bids. Bidders were thus opting to manage without any public funding for electricity from offshore wind farms, which they will be feeding into the grid from 2024/25. The industry is now reviewing the results of the second auction and is already preparing for the third round. In the future, bidders will no longer go to auctions with fully developed offshore wind farm plans in place, but will bid on projects that are being developed using public funds. WINDstärken talked with Ursula Prall about the opportunities and risks.



Dr. Ursula Prall, Chair of the German OFFSHORE WIND ENERGY Foundation (Photo: Enno Kapitza)

**WINDstärken:** Dr. Prall, what is your view of the results of the offshore auction that has just ended?

“This round once again saw a zero-cent bid accepted. Even so, the average figure for the awarded bids was a more realistic 4.66 cents per kilowatt hour. This value highlights the decline in costs, but also makes it clear that only a few projects can succeed without funding.

It is gratifying to see the acceptance of bids for almost 750 megawatts (MW) in the Baltic. These projects should be constructed by as early as 2021/22, and will help cushion the impact of the lull we have experienced for the past two years.

## Sucess by qualification

“With this new arrival, we’re signaling a good development for the labor market in the region. Strong demand for qualified workers offers people a chance to escape from unemployment. Nearly 380 qualification measures have been carried out since April 2016.

As part of the Cuxhaven appeal, we called for the volume under development to be expanded to at least 20 GW by 2030 and 30 GW by 2035. We maintain this requirement because it’s justified by how costs are developing. As a result of this auction, grid connection systems representing more than 700 MW remain unused: a settlement must be reached as soon as possible to give access to these transmission capacities – via the special tenders provided for in the Coalition Agreement for offshore wind power, for example. An important effect of this round is the end to the transitional regime: the fate of projects that remain unawarded is now sealed. “

**WINDstärken:** Starting from the third round of auctions, the public sector will take over the role of project developer: what sort of response did this change of model receive in the industry?

“Ambivalent. This change excludes an entire sector – the project developers – from offshore wind energy. Another particularly problematic aspect is the exclusion by law of projects at a greater distance from the shore (from distance class 3) and those that had not reached a sufficient stage of development by the time the changes were put in place. In both cases, it means a loss of value for investments in the tens of millions of euros, with no compensation whatsoever. This has led to a strong sense of unease, and the situation is currently being reviewed under constitutional law.

The law built up a system of incentives over a period of 15 years, and then abruptly dismantled it again in 2017.”

**WINDstärken:** What opportunities and risks does centralized offshore wind farm development by Germany’s Federal Maritime and Hydrographic Agency (BSH) present?

“Under the central model, zones that are tendered in a specific sequence are selected and provisionally explored. The successful bidder still has to undertake the actual project development process itself. This procedure provides the opportunity for an orderly development of the zone – in terms of both time and place – and of implementing the project swiftly in line with the grid connection. As I see it, potential problems lie less in the new roles of the authorities and the BSH, than in the way the quantity structure is currently organized. Because the path for development is too narrow, industrial development of the offshore sector will come to a standstill, and climate protection with it.”

**WINDstärken:** What is your long-term forecast: will the new distribution of roles lead to a reduction in the cost of offshore wind power in the future, or would it have been better to leave the task of project development to the operators?

“We still need to adapt to the way the roles have been distributed, but this factor will not determine whether costs go up or down. Costs will be determined by technological advances by the manufacturers – which first need a large enough market volume. Larger project zones could further contribute to a reduction in costs, and will certainly be discussed as the work of zone development planning proceeds. The key success factor will be a political will to make use of offshore wind energy.”



About 200 people have been retrained in the fields of industrial electronics, metal, and building and property security.

Dagmar Froelich, Chair of the Management Board, Stade State Employment Agency

Roughly another 80 people have earned supplemental qualifications in CNC milling and logistics, plus there are also the interns for the Siemens Gamesa plant from the Cuxhaven Job Center. The Stadeland Employment Agency and the Job Center have invested some EUR 6 million so far in continuing training.”



# A joint trade show appearance by strong partners



The Ministry of the Economy of the State of Lower Saxony, Seaports of Niedersachsen GmbH, and the Cuxhaven German Offshore Industry Center will be presenting together for the first time this year at "WindEnergy Hamburg 2018."

Their booth measures an expansive 200 m<sup>2</sup> and is located in Hall B6. The Siemens Gamesa booth is right next door. The offshore sector in Lower Saxony and Cuxhaven is thus also highlighting the strength of its partnership by appearing as neighbors at the trade show.

## PEOPLE & OPINIONS

### How offshore wind parks will survive without subsidies by 2023 ...

The first German offshore auction in April 2017 ended with a bang: Ørsted (then Dong Energy) and EnBW, two major providers, immediately submitted subsidy-free bids. WINDstärken asked the Ørsted CEO and the head of Siemens Gamesa Offshore how economic projects can succeed in five to six years without subsidies.



**Volker Malmen,**  
CEO of Ørsted in Germany:

"Ørsted has built more offshore wind capacity worldwide than any other company, so we were able to call on our years of experience when preparing for the auctions. We've been developing, building, and operating offshore wind parks for 25 years. Over the course of more than twenty wind-projects that we have built in the meantime, tremendous progress has been made in terms of cost reductions, innovations, and technological development. Like the manufacturers of plants and other subsystems, we as builders and operators have always been able to benefit from this progress, in part because of the trusting collaboration with our suppliers. Together we have reduced costs by 60 percent over the past few years. This trend is continuing since we are far from having exploited all the cost reduction potential.

Naturally, bidding on projects that will go online in 2024 also involves forecasts for the

energy market. However, our expectations of price development are rather conservative. We've anticipated only a moderate increase even in the CO<sub>2</sub> price, which affects the price of electricity. Our bid at the 2017 and 2018 auctions was based on a detailed calculation. Ultimately we have set important milestones in the young history of our industry with our subsidy-free winning bids."



**Andreas Nauen, CEO Offshore at**  
**Siemens Gamesa Renewable Energy:**

"Our industry has already experienced a dynamic learning curve in terms of cost reduction. It took conventional power plant technology 50 years or more to become highly efficient. Offshore wind is moving faster: Things really got going in Germany in 2011 with the inauguration of Baltic 1. The technology for unsubsidized offshore wind power plants will go online in six years. The wind power plant itself has about a 30 percent effect on a project's cost of energy.

The course is now set: Our industrialized production will pay off in just a few years. Little by little, we're improving the performance and efficiency of the turbines, while digitalization enables us to derive maximum power from almost any wind situation.

We're also getting better and better at building plants: Our offshore installation time is now down to only 24 hours per turbine. Improved service concepts are another cost reduction factor. We're using digital plant monitoring and special ships for technicians to further reduce plant downtime.

We also need to produce less expensive foundations and towers. One way we're working on this is our Danish research project Nisum Bredning, where we're simply casting the transition pieces out of concrete. Their extreme weight absorbs vibration and even saves on steel for the towers.

I'm confident that we'll be able to meet the challenge of subsidy-free projects because all disciplines are working on it together: logistics providers, foundation and tower manufacturers, shipping companies, submarine cable manufacturers, colleagues at Siemens Energy Management with state-of-the-art grid technologies, and Siemens Gamesa as the leading supplier of offshore wind turbines. And, of course, the operators – our customers – with whom we've covered a lot of territory since Baltic 1."

