The Building of an Offshore Wind Farm

alpha ventus

EWE e·on VATTENFALL

→ Three wind turbines of the first German offshore wind farm. A REpower 5M stands in the foreground, with two M5000s from AREVA Multibrid in the background. The completed wind farm comprises six turbines of each type. //

Foreword → With the commissioning of alpha ventus, a pioneering project is brought to a close, setting a milestone for the further expansion of wind power.

alpha ventus was the first offshore wind farm to be constructed under open sea conditions: far out in the North Sea, 60 kilometres from the coast of the mainland, in 30-metre deep water and in the midst of extreme winds, weather and tides. As leading European energy providers, we are proud to have taken this important step together.

The Federal Government has declared a target of 30 percent of all energy production should come from renewable energies by 2020. We are aware of the responsibility – but also the great challenges – associated with this goal. In order to achieve this target proportion of the energy mix, we need to utilise the entire spectrum of renewable energies. Yet, offshore wind energy in particular possesses the potential in Germany to provide a considerable and environmentally-friendly amount of Germany's energy needs.

The Federal Government has put into place the legal basis for just such an expansion of wind power. There were and are many questions to be answered. Not the least of which is how to meet the challenges of the weather conditions and extreme water depths when erecting offshore turbines at German sites. The development of uniform permit standards and environmental and safety regulations has just begun. The same is true for the offshore infrastructure which is still under construction in Germany. In order to gather essential experience in all these areas, EWE, E.ON and Vattenfall put this pioneering project of alpha ventus in motion. In itself, a unique cooperation that further underscores the special significance of alpha ventus.

After all the permits for the offshore test field were on hand, alpha ventus was erected between the summer of 2008 and autumn 2009. The twelve wind turbines of alpha ventus provide clean, offshore power, which will make an important contribution to our future energy supply. alpha ventus is a groundbreaking pilot project for offshore technology in Germany, one that will provide us with fundamental knowledge for the still open questions facing the realisation of future offshore projects in Germany.

alpha ventus has taken the first concrete step towards the use of offshore wind in Germany. The next few years will reveal its potential. Several hundred megawatts of capacity are already planned for further offshore projects in the North and Baltic Seas. Additional wind farms, which EWE, Vattenfall and E.ON are planning or already have under construction, will contribute significantly to a secure and sustainable energy supply for Europe in the future.

Dr. Werner Brinker,
CEO of EWE AG

Dr. Wulf Bernotat,
CEO of E.ON AG

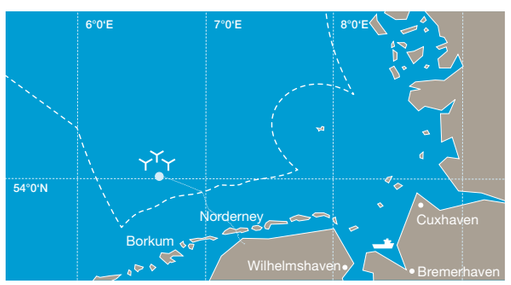
Tuomo J. Hatakka,
CEO of Vattenfall Europe AG

01 → alpha ventus

alpha ventus → 45 kilometres north of the island of Borkum, twelve rotors are turning in a wind power project of pioneering character. Since the end of 2009, alpha ventus, the first German wind farm to be erected under true offshore conditions, has been standing in the middle of the North Sea.

What does "offshore" really mean? It is a step further out into the open sea and into greater water depths. It is this step into unknown territory from which the challenges to the emerging offshore industry in Germany have come. This pioneering project was realised by the corporations of EWE, E.ON and Vattenfall through a joint consortium, the Deutsche Offshore-Testfeld und Infrastrukturgesellschaft, or DOTI. The planning and construction of the wind farm created new challenges for the entire project team on a nearly daily basis. Despite a narrow time frame and partially difficult weather conditions as well as the high demands placed on the available construction ships, only three years passed between the starting signal for the wind farm's construction and the erecting of the twelve wind turbines in November 2009.

alpha ventus has become the starting signal for the further development of offshore wind power. Its construction and operation is providing valuable knowledge for future offshore wind farms off the coast of Germany.



Location of the wind farm

When compared to future offshore projects, with an average of up to 80 wind turbines, alpha ventus is a relatively modest undertaking. Nevertheless, the scale of this pilot project is unrivalled up to now. With an installed capacity of five megawatts each, the wind turbines alone are some of the largest in the world to be used in offshore conditions. The power they produce, with the help of an offshore transformer station specifically constructed for the wind farm, will be transferred to the mainland over Norderney via an approximately 60 kilometre-long submarine cable. The amount of power alpha ventus generates is enough to meet the needs of up to 50,000 households; an impressive number, which illustrates the productivity of modern wind power turbines. Or put another way, the larger the surface with which the rotor of a wind turbine can capture the wind, the more energy it can gather. In the case of alpha ventus, the rotors have a diameter of either 116 metres or 123 metres and capture the wind over an area of around one and a half times the size of a football pitch. Accordingly, the remaining components are also on a larger scale: To their respective wing tips, the wind turbines rise to a height of either 148 or 155 metres over the North Sea and are almost as tall as the Cologne Cathedral. Under the water's surface, the structures continue another 28 metres to the seabed, where they are anchored to the bottom by piles up to 50 metres long. This is how the just under 1,000 ton weight of the turbines, as well as the three-storey offshore transformer station, defies the extreme open sea conditions.

Large swells and wave heights of several metres are not uncommon during certain times of the year at the alpha ventus site, where wind speeds reach an average of 36 km/h (force 5). This makes the construction, as well as subsequent maintenance, of an offshore wind farm disproportionately more difficult than a wind farm erected near the coast or on land. Unlike a wind farm on land, construction teams and service technicians can only reach alpha ventus by ship or by air via helicopter. Wind and weather limit the time available for construction and maintenance work and necessitate the most exact planning and logistic flexibility for any actions carried out onsite. What makes it worth the effort? →

→ A view of the rotor blade assembly from the offshore transformer station.

alpha ventus →

The difficult weather conditions, which make work complicated for workers and technicians, deliver a considerable advantage at the same time: Compared to sites on land, higher wind speeds and steady wind conditions prevail in the North Sea. According to the measured data for onsite wind speeds, it is possible to calculate that alpha ventus can produce around 3,800 hours of power per year under full load. That is approximately 50 percent more than a comparable wind farm on land.

alpha ventus contributes almost 230 million kilowatt hours per year to an environmentally-friendly power supply. In the process, the wind power has a long way to go before it arrives at the German power grid. The power is generated in the enclosed generators of the wind turbines around 90 metres above the sea's surface. From there, the electric power flows first through the cabling within the wind farm to its southern edge where the heart of alpha ventus can be found: the offshore transformer station. This houses the transformer and all electrical and technical systems. The helicopter, which brings the service teams to alpha ventus, lands here as well. Furthermore, the transformer station serves as a logistical base and can provide shelter in case of emergency.

Four cable lines run from the wind turbines to the offshore transformer station where they are connected to the transformer. The current is stepped up to a voltage of 30,000 volts to 110,000 volts and then transported to the mainland. Buried in the seabed, a 60-kilometre long submarine cable as thick as a person's arm carries the electricity over the island of Norderney to the northern coast of Germany.

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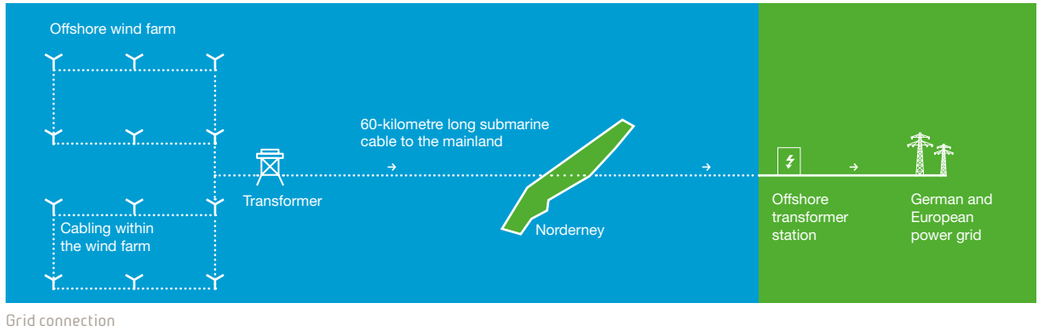

Grid connection

01 → Helicopter on the offshore transformer station // 02 → Preparation of the cabling within the wind farm, July 2008 // 03 → Delivery of the submarine cable for grid connection, Wilhelmshaven, July 2008 // 04/05 → The completed offshore transformer station on site, September 2008 // 06 → A view of the control room monitors // 07 → Helicopter transfer from offshore transformer station //

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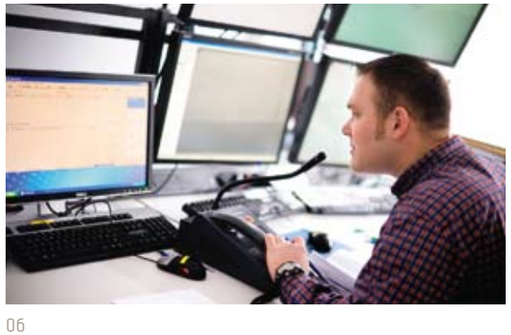

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02 → Wind power from the open seas

Wind power from the open seas → Only a strong breeze, or wind force 3, is needed to drive the more than 100-ton heavy rotors of the wind turbines of alpha ventus.

Already at a wind speed of 12.6 km/h (wind force 3), the wind turbines are able to generate power – thanks to the same principle which allows aeroplanes to fly. Because the rotor blades are shaped aerodynamically, like the aerofoils of an aeroplane, this allows their cambered profile to generate lift in the wind stream in exactly the same manner. Only the force produced does not lift a plane but rather sets the rotors turning.

When the rotor begins to turn, an entire chain of processes is set in motion; culminating in the production of environmentally-friendly electric power. First the rotor, via a shaft, powers a generator, which is concealed in the nacelle of the wind turbine. The principle is similar to that of a gigantic dynamo: The shaft ends in a coil of copper wire, which is entirely encircled by a magnet. When the rotor turns, the shaft rotates, causing the coil to rotate which allows the magnetic field to generate electricity in the copper wire. At heart a simple principle, but one taken to the highest technological level in a modern wind power turbine.

Also thanks to state-of-the-art turbines, the significance of wind power has steadily risen since their commercial introduction at the end of the 1980s. Already today, wind turbines lead the way in renewable energy sources. Well over 20,000 wind power turbines already dot the German countryside. Around seven percent of our energy consumption is met by power that was obtained from the wind.

The EC Commission, in a draft of a directive for the advancement of renewable energies, has stated the goal of covering 20 percent of the energy demand from renewable energies by 2020 and, at the same time, to decrease the amount of greenhouse gases released by 20 percent. According to the "Integrated Energy and Climate Programme" (IEKP), the German Federal Government will actually increase its contribution to power generation from renewable energies to 30 percent by then. In the face of this goal, clean wind power is an essential component of the energy mix of the future.

Wind farms have become commonplace in Germany, with most of the best locations having already been developed. Therefore, the further expansion of wind power is relying on two complementary strategies: repowering, meaning the replacement of smaller turbines with more modern and more powerful turbines, and offshore: wind power from the sea. Over the oceans, the wind conditions are more constant than those over land, where natural obstacles such as hills or forests and the various structures can create vortexes or even stop the flow of air. The open seas possess another advantage, sufficient available area in which to construct wind farms such as alpha ventus, and even much larger offshore projects. Thus, offshore wind power has an excellent potential to take over a considerable part of the environmentally-friendly power supply in Germany in the future.

Although the expanse of the North Sea can give the impression that a wind farm can be constructed at any location offshore, that is not the case. Just as on land, strict construction restraints are imposed at sea as well. Today, the North Sea, as well as the Baltic Sea, is already an intensively utilised economic area. Sand dredging areas, communication cables, restricted military areas, shipping lanes and protected areas must be taken into consideration when selecting a site. The Federal Maritime and Hydrographic Agency (BSH), which issues permits for planned offshore wind farms for large parts of the North and Baltic Seas, approves them only when the marine environment will not be endangered and the safety of maritime traffic will not be affected. →

Left → Rotor blades shortly before the last "heavy lift", the "star lift". In this situation, the weight of approx. 100 tonnes is less important than that the wind conditions are almost absolutely still in order to assemble the rotor blades. //

In the case of alpha ventus, the Niedersächsisches Wattenmeer National Park (Lower Saxony Tidelands National Park) had an influence on the location of the wind farm. In contrast to other European countries such as Great Britain or the Netherlands, where wind turbines already stand in shallow coastal waters, the protection of Germany's tidelands requires a very wide area off the coast. Around 60 kilometres lies between alpha ventus and the mainland of Lower Saxony. This long distance and the consequent water depths of approximately 30 metres make the construction and operation of an offshore wind farm challenging. alpha ventus is the very first open seas wind farm of its kind worldwide.

The protection of the environment therefore played an important role during site selection. The same is true for the construction and operation. Even when an offshore wind farm like alpha ventus can not be seen from the coast and does not disturb anyone, it still represents an encroachment into the marine environment. How can the inevitable construction noise be reduced to a minimum? How does the fauna react to the new and artificial structures in the middle of their environment? How are their hunting grounds and migration routes affected? How great is the sonic influence of the rotors in the water of the North Sea? An entire series of accompanying research projects have been devoted to these questions. Advanced by the Federal Ministry for the Environment and coordinated by the project administrator, Jülich, these projects were carried out in the alpha ventus wind farm. Moreover, three research stations in the North and Baltic Seas collectively deliver important findings. One of these is FINO 1. It lies in the immediate vicinity of the alpha ventus site and, since 2003, has already been collecting the very data and figures which support the weather and yield forecasts for the wind farm.

The sea, while offering extraordinary conditions, has its own demands. Thus, the turbines must also meet extraordinary technical standards. The extreme wind and weather conditions on the open seas require robust and powerful rotors, bearings and drive transmissions. The great water depths necessitate the use of massive foundations and special foundation structures. And because the wind turbines are not always accessible by ship due to weather conditions, they require additional "extras" – such as so-called winch-down platforms on the roof of every nacelle, onto which maintenance personnel can be winched down from a helicopter.

Taken together, an offshore wind farm does not offer simple conditions in which to work. The requirements for work safety are accordingly stringent: Every person from a ship or helicopter that comes in contact with a wind turbine must be proven to be healthy and fit and receives countless training courses about work safety and survival on the open seas. For alpha ventus and for the first time in Germany, a comprehensive work and safety concept was developed, which establishes in detail the code of behaviour, responsibilities and work procedures for the wind farm. Potential, hazardous scenarios have already been taken into consideration during the construction of the farm. Even the wind turbines are protected from danger through the use of modern technology. For example, the turbines automatically turn off when wind speeds are higher than 90 km/h (force 10).

Thus secured, a wind farm should produce power for around 20 years. Some day, when the first offshore wind farm reaches the end of its operational life and is being disassembled, wind farms could have long become commonplace for us.

01 → A stiff breeze // **02/04** → Preparing for a "star lift" // **03** → Cross section of an offshore nacelle // **05** → The research platform, FINO 1, at the northwest edge of the construction site // **06** → Getting a lift – and technician is flown up to the turbine during calibration operations. //

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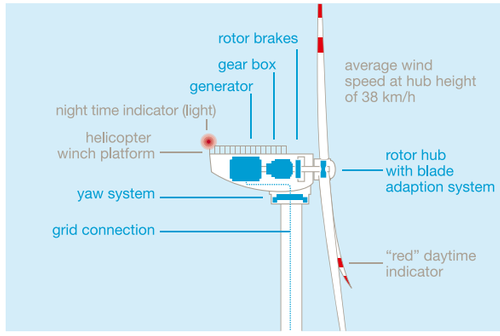

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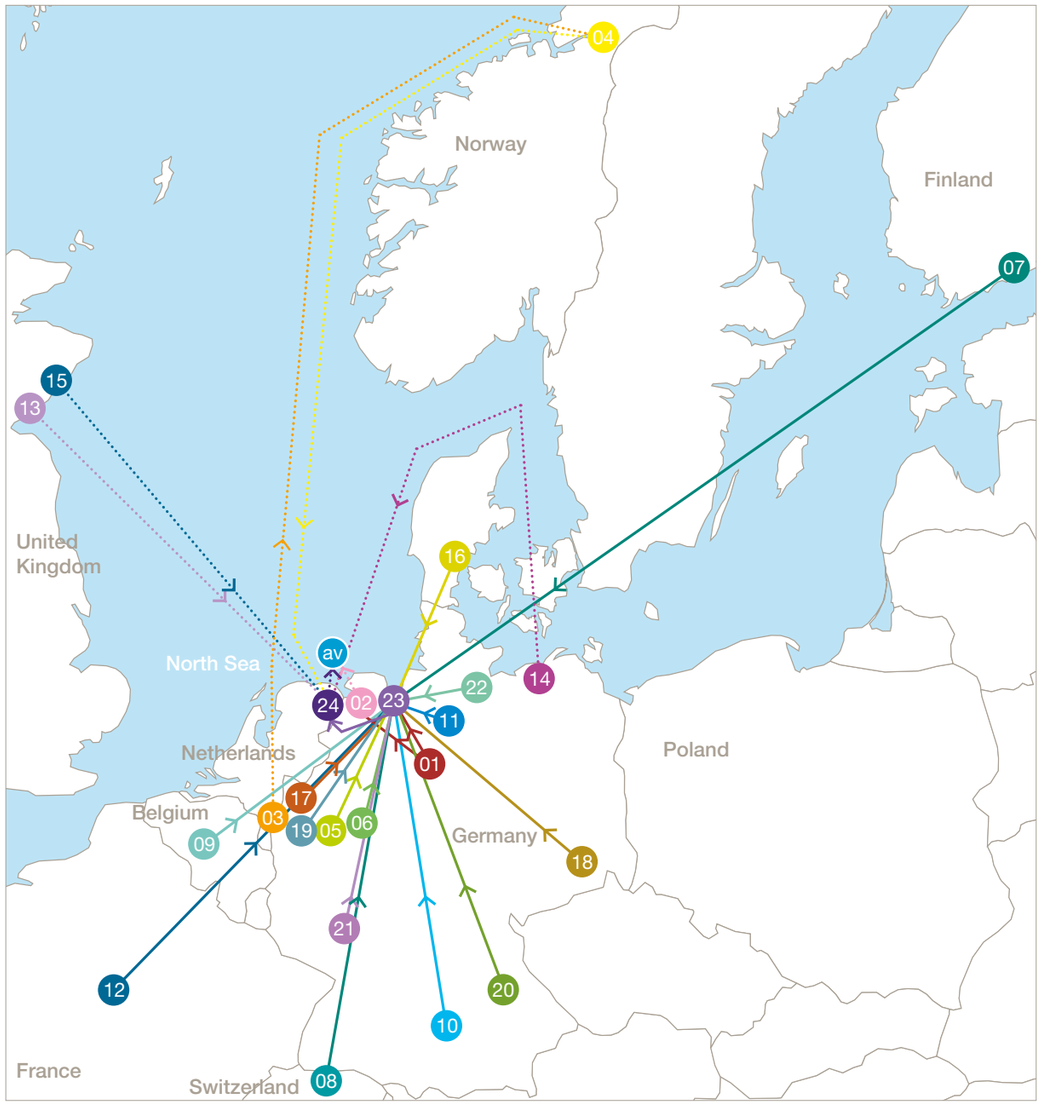
03→ A wind farm emerges

Logistics schedule →



Logistics of a wind farm: The map shows various production locations and delivery routes for the components.

01 → The tower components for the wind turbines were manufactured in Bremen, Germany.

02 → The jacket structure for the offshore transformer station was constructed in Wilhelmshaven, Germany. Afterwards, the final assembly of the entire topside was carried out. The jacket and topside were then installed directly onsite at alpha ventus.

03 → The duct components for the tripod foundations were milled and formed in the Dutch city of Roermond.

04 → The tripods were assembled in Verdal, Norway and afterwards shipped back to Germany.

05 → The nacelles and lower decks for six of the twelve wind turbines were produced in Krefeld, Germany.

06 → The hubs of six of the twelve turbines were produced in Mülheim an der Ruhr, Germany.

07 → The generators were manufactured in Helsinki, Finland.

08 → The converters for six of the twelve turbines were made in Baden, Switzerland.

09 → The transformers for the AREVA Multibrid M5000 came from the Belgium city of Mechlin.

10 → The drive transmission for the M5000 wind turbines were produced in Augsburg, Germany.

11 → The fabrication of the rotor blades for this turbine type was carried out in Stade, Germany.

12 → The hollow shafts for the M5000 were manufactured in Joinville, France.

13 → The jacket foundations for the REpower 5M were produced in Methil, Scotland.

14 → The fabrication of the piles for the REpower turbine foundations was carried out in Rostock, Germany.

15 → The necessary templates for positioning the jacket foundations were produced in Montrose, Scotland.

16 → The rotor blades for the REpower 5M were manufactured in the Danish city of Kolding and in Bremerhaven, Germany (23).

17 → The drive transmissions for the REpower turbines came from Voerde, Germany.

18 → The production of the hollow shafts and rotor shafts for the REpower 5M was carried out in Dresden, Germany.

19 → The converters for the REpower turbines were produced in Kempen, Germany.

20 → The transformers for the REpower 5M were manufactured in Regensburg, Germany.

21 → The UPS systems for the REpower turbines were produced in Reinheim-Georgenhausen, Germany.

22 → The fire extinguishing systems for the REpower 5M come from Bad Oldesloe, Germany.

23 → Each turbine component for the wind turbine nacelles were preassembled in Bremerhaven and afterwards transported to the base harbour of Eemshaven in the Netherlands.

24 → From Eemshaven, all preassembled wind turbines were shipped to their location offshore and subsequently erected with the help of a so-called jack-up rig.

A wind farm emerges →

The story of the alpha ventus offshore wind farm begins the same as all offshore wind farms, namely, on land. The individual components of the wind turbines were manufactured and preassembled as much as possible at countless sites throughout Europe – a task of European dimensions. For example, the steel tripod foundations, on which six of the twelve wind turbines stand, were welded in Verdal, Norway. The steel sheets required for this work came from Germany and were formed into tubular elements in the Netherlands. Six further foundations, called „jackets" were manufactured in Scotland. Because both types of foundations – tripods as well as jackets – with a height of almost 50 metres and weighing several hundred tons were entirely too large as a whole to be transported over land, the assembly of each took place directly „on the quay". From here they were taken by transport ship to Eemshaven and then to the wind farm.

On the open sea 45 kilometres from Borkum, the various components came together, one after the other, in order to assemble the wind turbines. After the foundations were anchored to the seabed, the tower segments, nacelles and rotors were shipped to the construction site, and the turbines sprouted from the ocean surface up to a rotor blade tip height of approx. 150 metres: First the tower segments were installed successively on the foundations and subsequently capped at 90 metres with a nacelle weighing several hundred tons. Then the entire preassembled rotor was mounted on the nacelle in one go. Lastly, the turbines were connected to the cabling within the farm.

The construction of the transformer station took a similar form. Also here, massive jacket foundation structures, with the help of a floating crane, were carried to sea, secured to the North Sea seabed with piles of about 40 metres in length and connected to the actual platform, the "topside".

The construction of the wind farm was a daunting logistical task. An entire fleet of vessels was necessary at sea in order to ship alpha ventus, piece by piece, to its final location and then merge the parts into a whole when onsite. In the meantime, two dozen ships crisscrossed the wind farm – from small, fast rescue boats, route safety ships, tugboats, cable layers and small Remotely Operated Vehicles up to gigantic pontoons and floating cranes: A lot of work for the offshore coordinators, who were active around the clock in order to control construction site traffic. During peak periods, several hundred people were in action at the same time at the alpha ventus construction site.

These people installed rotor blades at dizzying heights, laid cabling on the seabed, welded gigantic steel structures, established tight time schedules and stuck to them, devised comprehensive proposals and, often under extreme time pressures, came to the right decisions. Added to this is a multitude of professionals in participating authorising bodies and agencies, in the Federal Ministry of the Environment and on the side of research. They have all contributed to the success of the alpha ventus offshore wind farm with their hard work.

The construction work in overview →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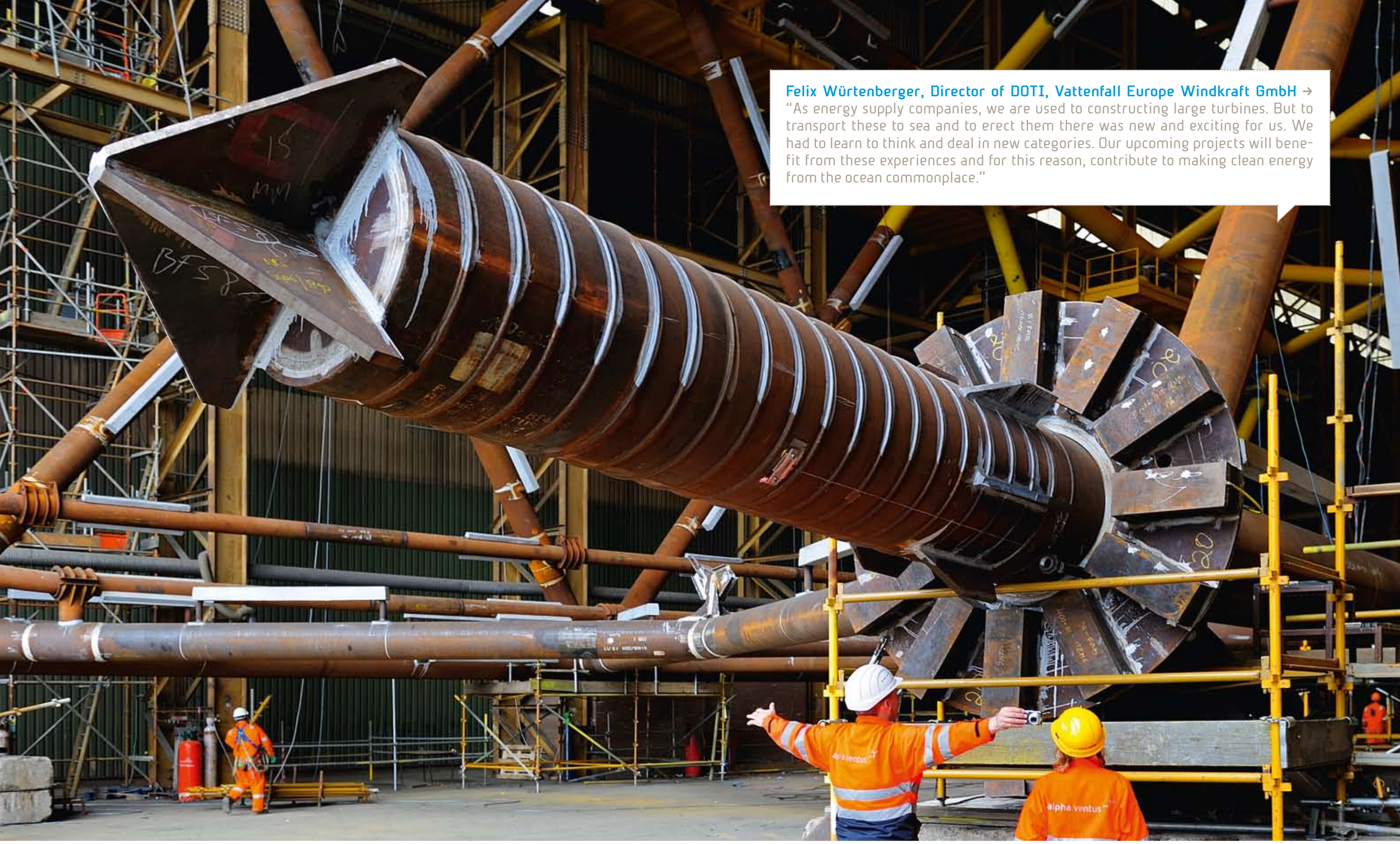
August 2007 → Beginning of construction work on the cable route // **Summer/Autumn 2008 →** Laying of submarine cable (01) → Preparation for grid connection // **September 2008 →** Installation of offshore transformer platform (02) // **Spring-Autumn 2009 →** Connection of the submarine cable → Transformer station is brought online → Installation of six AREVA Multibrid M5000 turbines (03/04) → Calibration and trial operations begin, first grid feed-in → Installation of six Repower 5M turbines (05/06) → Cable work within the wind farm // **November 2009 →** Completion of wind farm → Continuation of calibration and trial operations // **April 2010 →** Official inauguration //

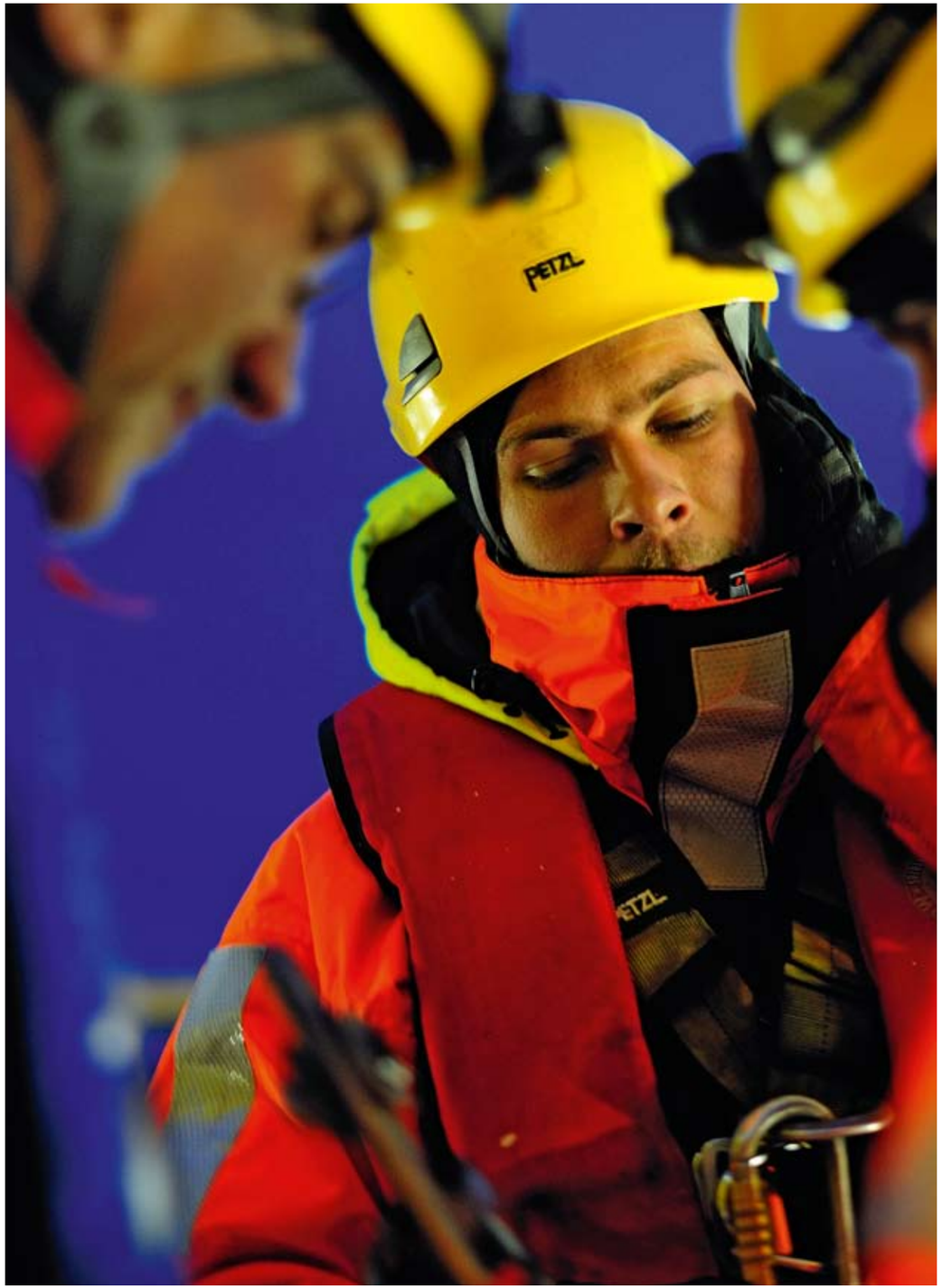


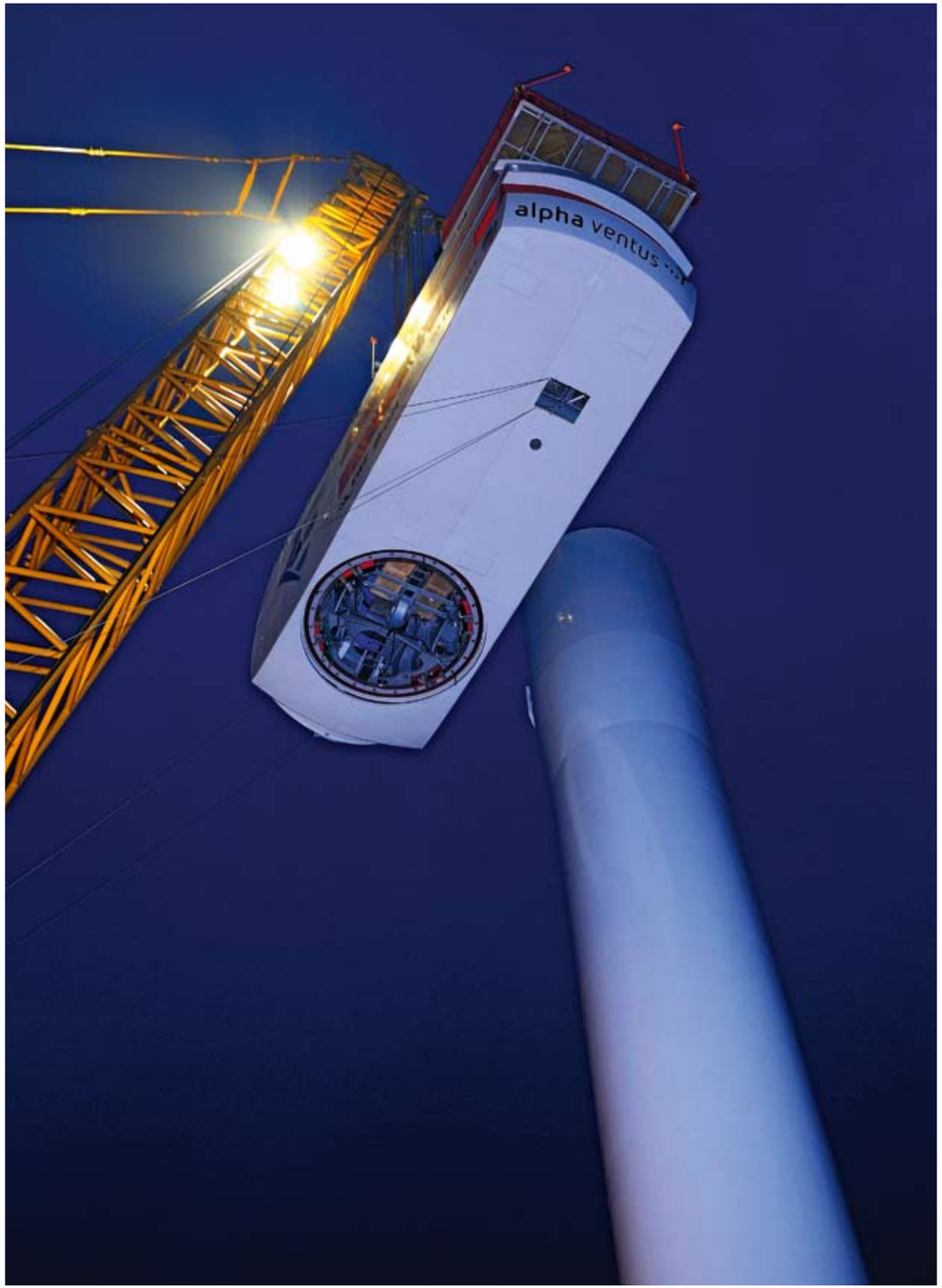
Felix Würtenberger, Director of DOTI, Vattenfall Europe Windkraft GmbH →
"As energy supply companies, we are used to constructing large turbines. But to transport these to sea and to erect them there was new and exciting for us. We had to learn to think and deal in new categories. Our upcoming projects will benefit from these experiences and for this reason, contribute to making clean energy from the ocean commonplace."

→ The jacket foundations (here in assembly) are later positioned on foundation piles that have already been fixed in the sea floor. //

→ Final preparation before the placing the first tower segments on a jacket foundation. //

→ Thialf, the world's largest floating platform, places a "jacket" for a REpower 5M. //

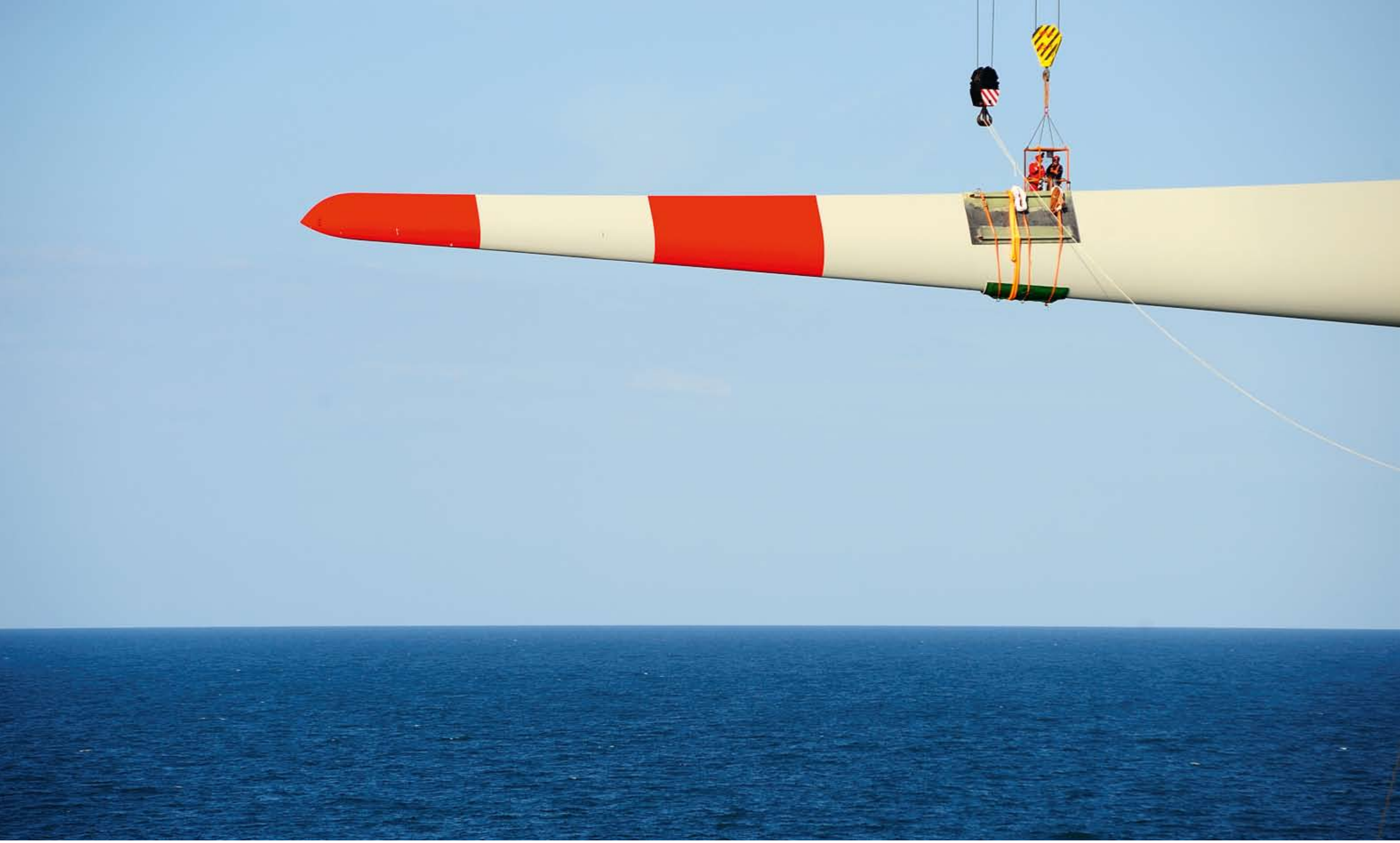




→ Night work at sea: The rare calm must be taken advantage of in order to install the nacelle of a REpower machine. //

→ The journey of a wind turbine to the construction site starts in Bremerhaven and continues via Eemshaven. Here, the transfer of a nacelle and rotor blades of a REpower turbine can be seen. //

Dr. Claus Burkhardt, Director of DOTI, EWE AG → "The corporate commitment and investment in the coastal region are extremely important for our company. The coastline and the North Sea have been shaping the region for centuries. We are proud to add a new chapter to this history."

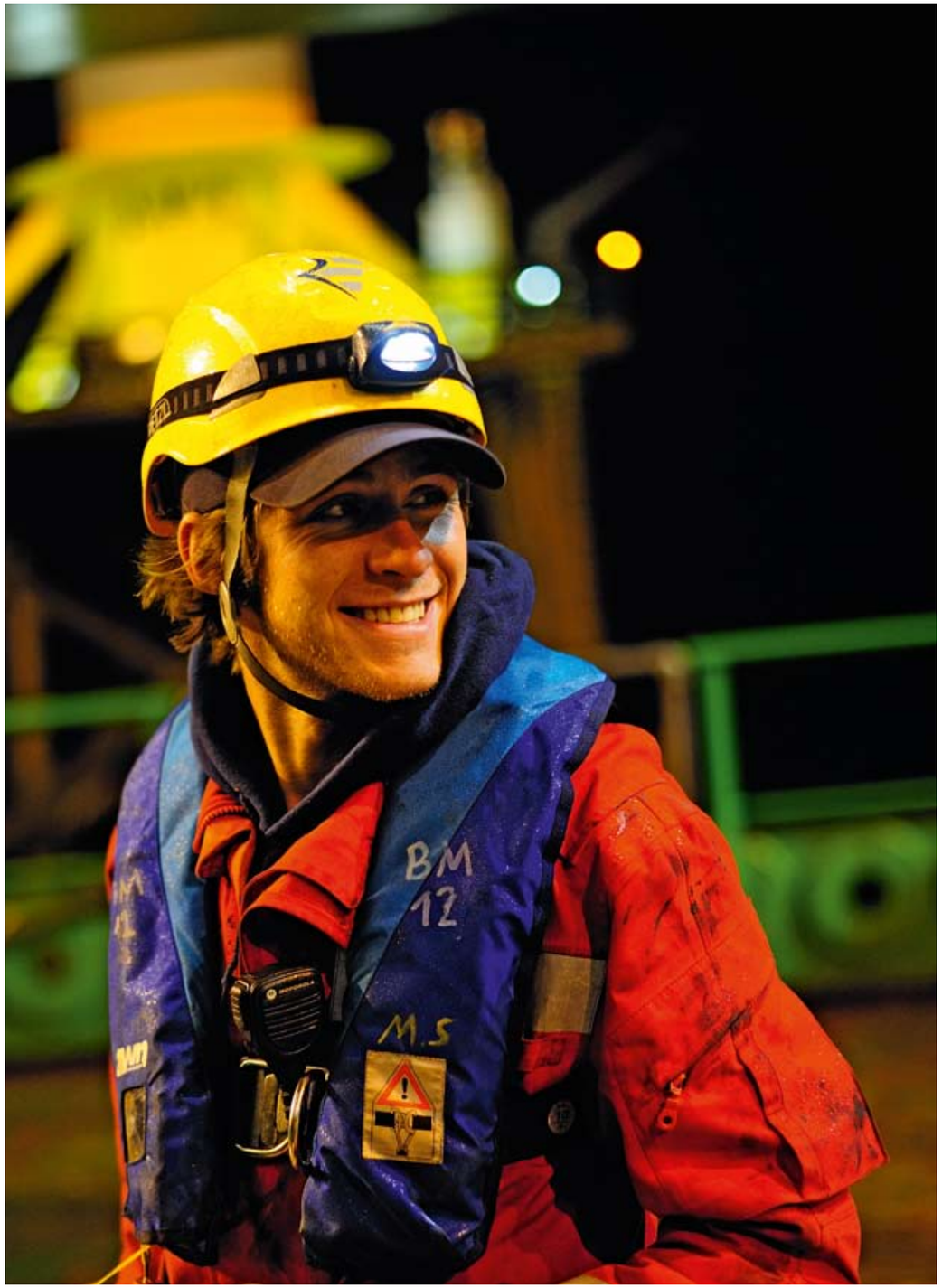


→ The wing "tip" of a REpower shortly before the "star lift". Once installed, the tip cuts through the air at over 300 km/h under full load, as fast as a Formula 1 race car. //

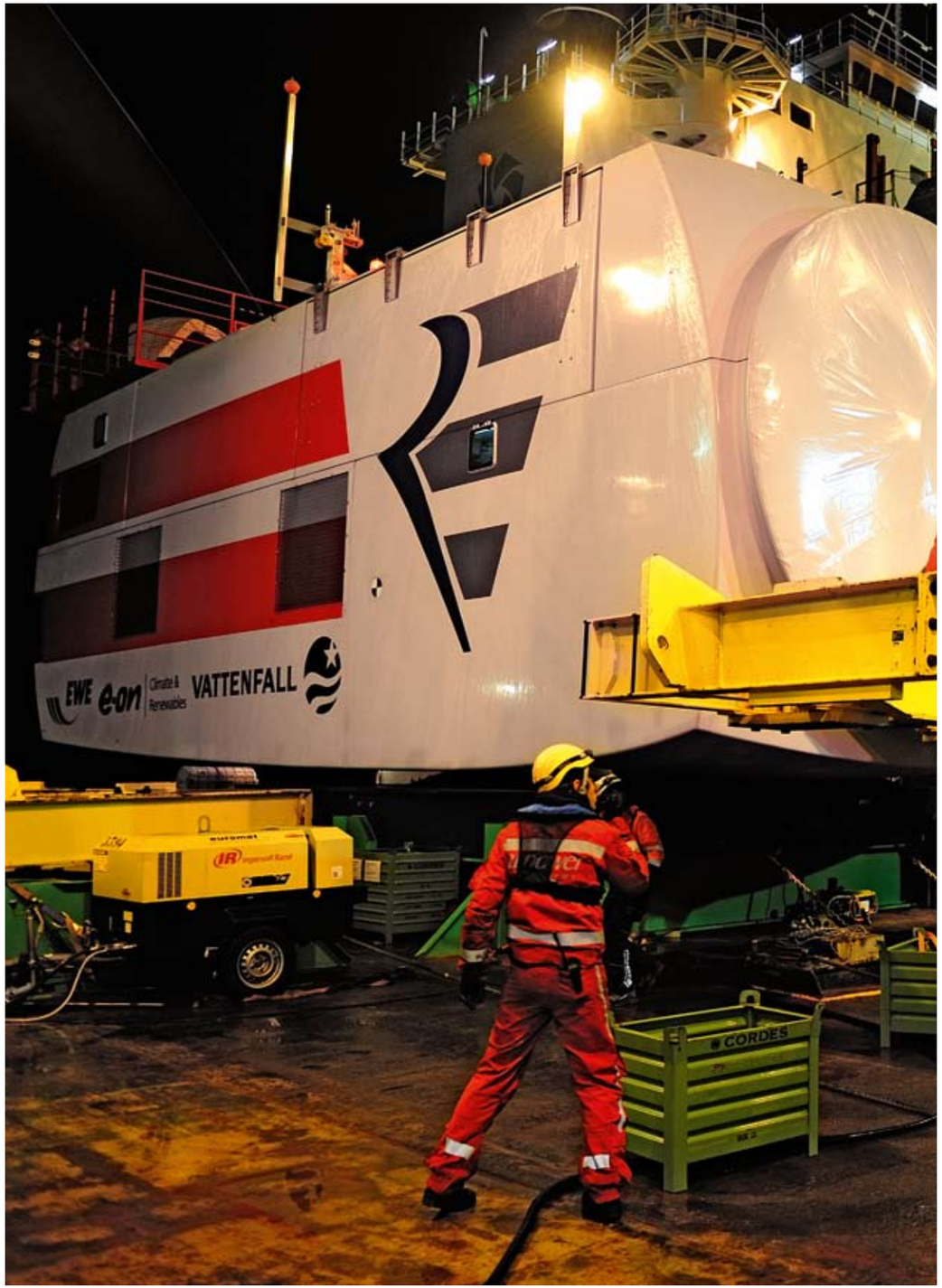
→ Waiting for the weather to improve. //

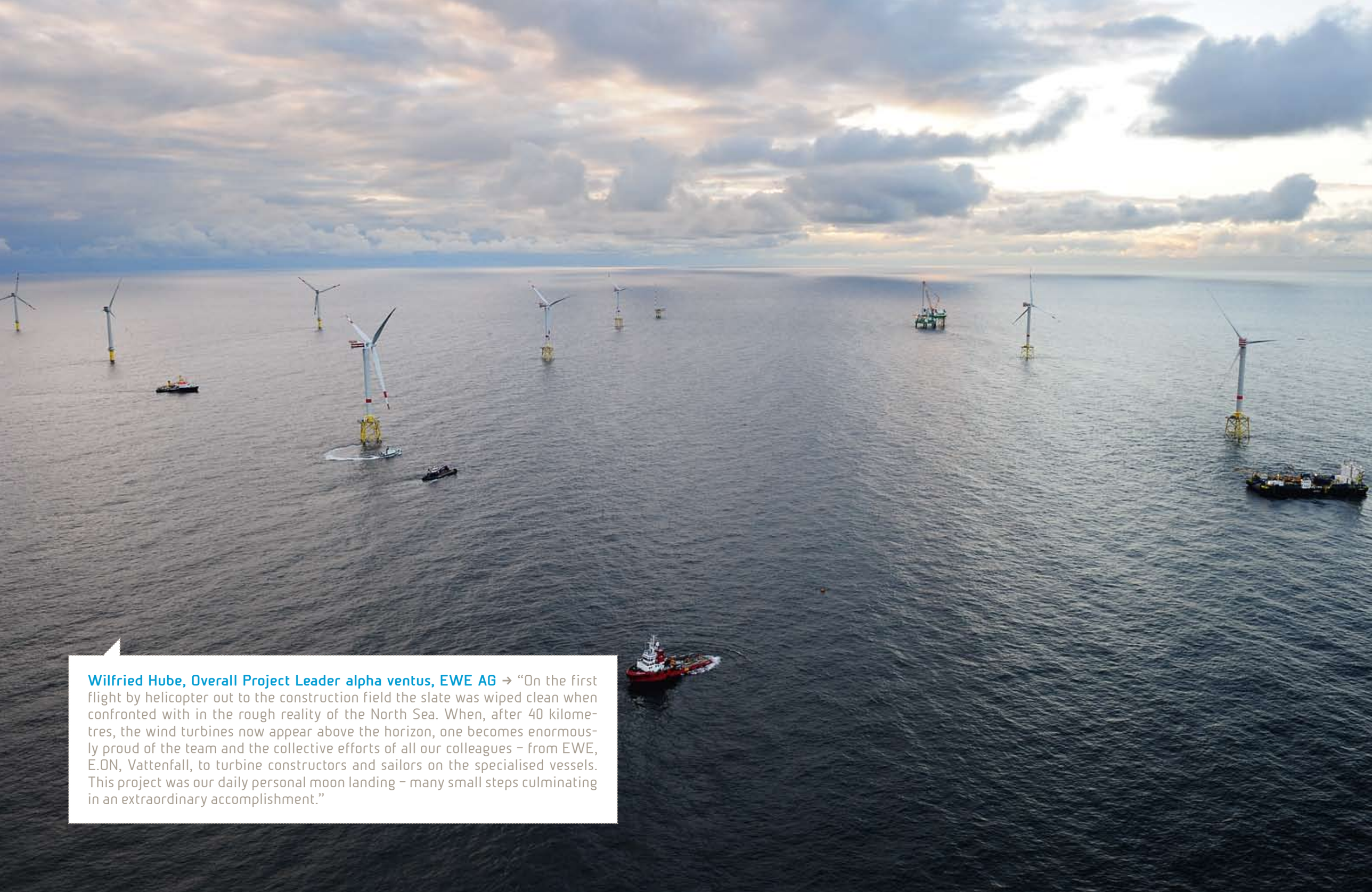
Ralf Lamsbach, Director of DOTI, E.ON Climate & Renewables Central Europe GmbH → "The first time at sea it became clear that here, for the first time in Germany, the offshore would meet the wind power industry. And everything under the management of three energy supply companies. It was a true international meeting of industries at sea and an entirely new frontier for all involved parties. Now, it is time to put our collective experience to work and to transform offshore wind power into an industrial standard."

→ A view from Thialf of the jacket foundation for a REpower turbine. Later, only the upper third of the yellow-painted part of the foundation will be visible above water. //



→ Everything is ready for the installation of a nacelle. //





Wilfried Hube, Overall Project Leader alpha ventus, EWE AG → "On the first flight by helicopter out to the construction field the slate was wiped clean when confronted with in the rough reality of the North Sea. When, after 40 kilometres, the wind turbines now appear above the horizon, one becomes enormously proud of the team and the collective efforts of all our colleagues – from EWE, E.ON, Vattenfall, to turbine constructors and sailors on the specialised vessels. This project was our daily personal moon landing – many small steps culminating in an extraordinary accomplishment."

04→ alpha ventus reference project

alpha ventus reference project → alpha ventus is a pioneering project. Never before has a wind farm been constructed under similar conditions on the open seas.

In contrast to offshore nations such as Great Britain or Norway, Germany is standing on the threshold of development of its own offshore industry. Of course important steps have already been made, and one can observe how alpha ventus and its successors are breathing new life into the economies of Germany's coastal regions. The first specialised vessels are leaving the shipyards while assembly halls are being constructed on the coasts. A new branch of industry is emerging.

alpha ventus can be regarded as a endurance test for a new generation of wind power turbines on the open seas. One goal is to prove the technological and economical feasibility of offshore technology, particularly far from the coastline. The knowledge and experience obtained from this project is not only concerned with technology, but also with the entire process: from authorisation procedures and environmental audits, to safety concepts, tendering procedures, the logistics employed and various construction stages up to the individual maintenance jobs and the particulars of operations. The experience obtained from the wind farm, and the experience to be acquired in the future, is an essential source of knowledge for the offshore wind industry in Germany.

Not without reason did the enterprise start with the name "Offshore-Testfeld Borkum-West" (Offshore Test Field Borkum West). The Federal Maritime and Hydrographic Agency (BSH) played a special role in this regard. Because "Borkum West" – today, alpha ventus – was also in reality the first offshore wind farm to receive official approval from the agency. Since then, the BSH has issued countless permits for further offshore projects in the North and Baltic Seas. Standards for authorisation procedures have meanwhile been established – partially as a component of the research projects involved in alpha ventus – and are already being evaluated and further developed. Even here, pioneering work was accomplished.

As a collective platform for stakeholders from politics, economy and research, the "Stiftung Offshore- Windenergie" (Offshore Wind Energy Foundation) has also participated in the alpha ventus project from the beginning. With support from the Federal Ministry of the Environment, the foundation was able to acquire, already in 2005, the legal clearance for the site and continues to lead the project today. Through its countless actions, the foundation furthered the advancement of environment and climate protection by bringing about an increased utilisation and investigation of offshore wind power.

Important discoveries are expected from multiple accompanying research projects dedicated to the first German offshore wind farm of alpha ventus. Consolidated under the umbrella of the RAVE Initiative (Research at Alpha Ventus), they are being aided by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) with around 50 million Euros in total. Many different aspects of the wind farm are being put under scrutiny and analysed – from the impact on the marine ecosystem up to the development of an entirely new wind farm control system.

RAVE comprises the scientific activities of the turbine manufacturers and multiple research institutions. Higher scientific coordination for the initiative has been taken over by the Fraunhofer-Institut für Windenergie und Energiesystemtechnik IWES (Fraunhofer Institute for Wind Power and Energy System Technology), while Jülich, the project administrator, coordinates research proposals, and the German Wind Institute (DEWI) coordinates the monitoring programmes. In turn, the Federal Maritime and Hydrographic Agency (BSH) has equipped the wind farm with extensive monitoring technology. That is how alpha ventus has become not only a wind farm, but a gigantic, open air laboratory as well, making alpha ventus possibly the most researched and monitored offshore wind farm ever. →

alpha ventus timeline →

1999/2001	→ Application for construction of "Wind Farm Borkum-West" by PROKON Nord GmbH
2001	→ Permit granted by the Federal Maritime and Hydrographic Agency (BSH)
2005	→ Formation of Offshore Wind Energy Foundation, rights of use sold to the Foundation by PROKON Nord GmbH
06/2006	→ Establishment of DOTI to construct wind farm
12/2006	→ Lease agreement signed between DOTI and Offshore Wind Energy Foundation
End of 2006	→ Federal government's "Infrastructure Planning Acceleration Act"
06/2007	→ Contract signed with Multibrid Entwicklungsgesellschaft mbH (which has operated under the name Multibrid GmbH since December 2007) as general contractor for construction and erecting of six M5000 wind turbines
07/2007	→ Order placed with AREVA to supply the transformers for the transformer station
08/2007	→ Beginning work on the cable route
10/2007	→ Contract signed with AREVA for the supply of the transformer station
12/2007	→ Order placed for the offshore transformer station and cable work within the wind farm with the consortium Bilfinger Berger, Hochtief Construction and WeserWind and Norddeutsche Seekabelwerke
09/2008	→ Construction of the offshore transformer platform
11/2008	→ Contract signed with REpower Systems AG to deliver six REpower 5M turbines
07/2009	→ Construction of the first wind turbine is complete
08/2009	→ Calibration and trial operations begin → First grid feed-in
11/2009	→ Completion of wind farm → Continuation of calibration and trial operations
04/2010	→ Official inauguration

alpha ventus has paved the way for future offshore wind farms in Germany. It has even made the issue of "wind power" – whether on land or on the open seas – more of a European-wide matter than ever before. This is not only proven by the countless European sites where turbine components for alpha ventus were manufactured. It also reveals a glimpse of future projects of the corporations which made alpha ventus a reality. EWE, E.ON and Vattenfall have invested heavily in the further expansion of wind power.

EWE is one of the pioneers of wind power in Germany. Already in 1989, EWE AG constructed the largest wind farm in Germany at that time. Since then, the Oldenburger energy corporation has come to operate wind power turbines with a total output of around 130 megawatts and, consequently, has increased its commitment to this sector – on land, in coastal areas and at sea. In particular, EWE sees offshore technology as a future issue with excellent innovation and growth potential. The experience and know-how gathered from alpha ventus will be incorporated into the company's next offshore project: Starting in 2011, EWE, together with its partners, will erect the marine wind farm RIFFGAT 15 kilometres from the North Sea island of Borkum. At the end of 2012, 30 multi-megawatt class wind power turbines will stand in an area similar in size to 850 football pitches and produce enough power to meet the needs of around 100,000 households. With this project, EWE AG is making another important contribution to the use of offshore wind power in Germany.

From 2007 to 2011, E.ON is investing a total of 8 billion Euros in the expansion of renewable energies. This clearly shows the significance the company attaches to the future of renewable energies. The expansion of offshore wind power is of strategic importance in this future. Today, E.ON is already operating five offshore wind farms in the North and Baltic Seas with a total installed output of almost 300 MW. Further farms are being erected. However, that is just the beginning: E.ON, together with its partners, is involved in constructing the world's largest offshore wind farm, the "London Array", in the Thames Estuary. After completion, it will deliver 1,000 megawatts of power and cover the electricity needs of around 750,000 households. Through its involvement with alpha ventus, the company has obtained valuable experience and know-how for the particular challenges facing the further expansion of offshore wind operations in Germany. E.ON is planning four more German offshore projects in the North and Baltic Seas, from which the project of Amrumbank West, with up to 80 turbines, is in the advanced stages of planning.

Vattenfall already operates wind farms in seven European countries, meeting the energy needs of 500,000 households with the electricity they generate. When it comes to offshore wind power, Vattenfall is one of the leading companies in Europe. Currently, Vattenfall is planning or constructing eight wind farms in six European countries. In 2010, Vattenfall expects to bring the offshore wind farm "Thanet", located east of the County of Kent, online. With an output of 300 megawatts, Thanet is the largest offshore wind farm in the world to date. In Germany, Vattenfall is planning the project "Dan Tysk". This will be a wind farm in which 80 offshore wind turbines will be erected during the first construction phase, 69 kilometres northwest of the island of Sylt.

These are only a few examples from many projects that underscore the excellent potential offshore wind power has for Europe. Over the next few years, what began with alpha ventus can thus make a significant contribution on the way to a carbon-neutral energy supply in Germany as well.

→ A view of the completed offshore wind farm and transformer station.

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Links

EWE AG
→ **www.ewe.de**

E.ON Climate & Renewables Central Europe GmbH
→ **www.eon.com**

Vattenfall Europe Windkraft GmbH
→ **www.vattenfall.de**

Research at alpha ventus
→ **www.rave-offshore.de**

Offshore Wind Energy Foundation
→ **www.offshore-stiftung.de**

German Wind Energy Association
→ **www.wind-energie.de**

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
→ **www.bmu.de and www.erneuerbare-energien.de**

Federal Maritime and Hydrographic Agency
→ **www.bsh.de**

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