

# WINDPOWERUPDATE



**NORDEX SERVICE**  
more transparent, quicker,  
more reliable

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**TOWER-DESIGN**  
120 meter-concrete/steel-  
hybrid tower

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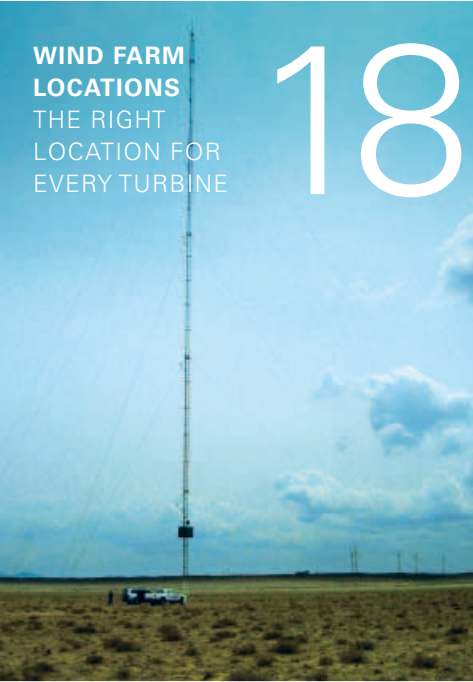
**PRODUCTION**  
The Nordex  
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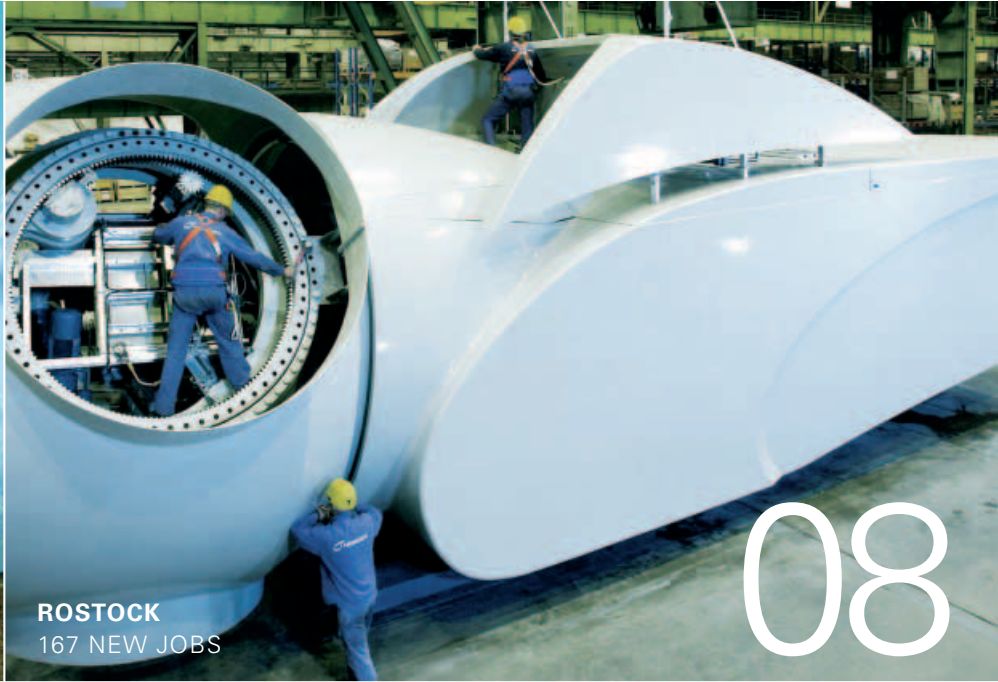
**WINDFARM TORTOSA**  
ONE OF 37 TURBINES  
OF THE 1.3 MW SERIES

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THE RIGHT LOCATION FOR EVERY TURBINE

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**ROSTOCK**  
167 NEW JOBS

08



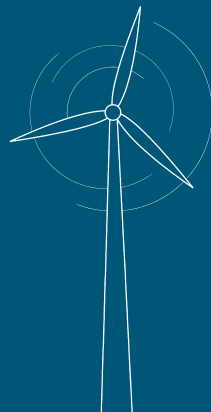
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**TOWER-DESIGN**  
CONCRETE/STEEL  
HYBRID TOWER



**MOBILE SOLUTION FOR TECHNICIANS**  
N-MOBILE

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# NORDEX PRODUCTPROGRAM

Type	Capacity	Regulation	Markets
<b>Nordex N60</b>	1.300 kW	Stall	Asia, Europe, Latin America
<b>Nordex S70, S77</b>	1.500 kW	Pitch	Europe, China
<b>Nordex N80</b>	2.500 kW	Pitch	Asia, Europe, Latin America
<b>Nordex N90</b>	2.300 kW	Pitch	Europe
<b>Nordex N90</b>	2.500 kW	Pitch	Europe, Asia



## EDITORIAL



Dear reader,

Over the past twenty years, a race for the largest turbine has emerged amongst the producers of wind power systems. Thus, installed capacity per turbine in Germany rose from 185 kilowatts in 1992 to over 1,700 kilowatts in 2005. The advantage of large turbines is that they are specifically cheaper relative to their cost of purchase as the costs do not rise by the same rate as output. During the same period of time, producers lowered their prices by around 50%. Basically, this has been one of the reasons for the success of our industry. If it were not for multi-megawatt turbines, wind power would not be as competitive with conventional electricity production as it has become today.

It thus comes as no surprise to learn that customer demand is particularly strong for megawatt turbines, i. e. in the 1,500–2,500 kW class. According to BTM Consult, demand for these turbines has risen by around 50% p. a. over the past five years, while the market as a whole has grown by only around 12% each year. However, this trend stagnated for the first time in 2005 in the developed countries, providing clear proof in our view that large industrial customers are now focusing more on system reliability and availability rather than merely concentrating on price per kilowatt as they used to.

Utilities and international power station operators seek high and regular energy yields over the service life of their assets. In other words, averting the risk of a production shortfall is considered to be more important than the advantages of greater output in the case of systems which have left prototype status. Nordex has prepared well for this trend. In 2000, we assembled what at that stage was the world's largest turbine. Since then, around 300 N80/N90 (2,500 kW) turbines have been assembled around the world. Only few other turbines in this output class have proven their merits to the same extent as this model. In this issue of WindpowerUpdate we have a special focus on our latest projects and developments of the N80 and N90.

I wish you much enjoyment with this new issue of WindpowerUpdate.

A handwritten signature in blue ink, appearing to read 'Carsten Pedersen'. The signature is fluid and cursive, with a large initial 'C'.

Carsten Pedersen



Thomas Richterich, CEO of Nordex AG

## INTERVIEW WITH: THOMAS RICHTERICH "AT THE END OF 2008, WE WILL HAVE SALES OF A GOOD BILLION EUROS"

**Mr. Richterich, there has been a steady rise in global demand for wind turbines for a year now. What effect is this boom having on Nordex?**

In spring 2006, we raised our sales forecast for this year to more than EUR 460 million. At the same time, we announced that we want to grow by 50 % per year in the next two years, meaning that we will have sales of a good billion euros by the end of 2008. Of course, we won't achieve the one billion threshold without spending on new staff and production facilities.

**Where exactly will you be investing?**

We want to optimize nacelle assembly activities at our Rostock facility and thus improve the overall

production flow. This will involve spending on new cranes, for example. In the short term, we also want to extend blade production in Rostock. In China, we will be setting up new production facilities. After opening the first rotor blade production facility for the 1.3 MW N60 in spring 2005, we are now looking for a second site, again for blade production but this time for our 1.5 MW turbines. At the moment, we are constructing an assembly hall in the north of China for our 1.5 MW turbine. All told, we're talking about a volume of around EUR 10 million which we will be spending in China this year. What comes after this depends on how business turns out.



**Qingdao:** China's first commercial wind farm with nordex turbines.

## DID YOU KNOW ...

... that on June 1, 2006 a fixed-price system for the remuneration of wind power came into effect in Ireland and guarantees operators a fee of up to 5.9 cents per kilowatt/hour?

... that the UK government published an energy review on July 13 in which it re-affirmed its goal of ensuring that at least 20 % of the electricity fed into the national grid comes from renewable sources in 2010?

... that Nordex completely redesigned its website including new content in May 2006?

... that Nordex's export quota rose to 81 % in the first half of 2006, with business in European countries outside Germany accounting for 77 % of business?

### **Does this mean that China is one of Nordex's growth markets?**

Yes, absolutely. However, we require partners in the individual provinces to ensure that we have a steady intake of orders. We want to forge additional joint ventures and also extend our production capacity, which we initially want to use only for the Chinese market. Later on, we could envisage exporting turbines and components from China. China has announced plans to establish around 30,000 MW of wind power output over the next 14 years. We would like to secure a share of at least ten percent of this.

### **Wind power business is also booming in the United States. When does Nordex expect to return to this market?**

All wind power experts agree that looking ahead over the next few years the United States will be one of the largest markets in the world regardless of whether the Production Tax Credit system is renewed beyond 2007 or not. We want a share of this market. However, we must first settle a patent issue with a competitor. There are two ways of doing this: Either we pay the patent holder a fee for every turbine which we deliver to the United States or we make minor technical modifications to the generator to get round the patent. Currently we are preparing both solutions. We are working on a prototype with technical modifications allowing us to avert patent disputes. Ultimately, however, it's a question of what our customers want. That said, we will only opt for an economically viable solution.

### **What customers have you set your sights on in the United States?**

We are definitely seeking a master contract with a handful of investors over a period of years. This will involve pooling several projects of several hundreds of MW. We are in no hurry to sign such a contract either this year or next. At the moment, we are selling every turbine which we can produce even outside the US market. Still, we would like to have such a contract for 2008 and 2009 as a basis for part of our production.

### **Going forward, does it make sense for Nordex to establish its own production facility in the United States?**

Yes, that would be the next step. US assembly at least would be a good way to minimize transport costs and reduce currency exposure. We would do this in the form of a low-cost investment as we assume that there are enough large sites to be had in the United States. However, as I said, we want to do this step by step.

## NORDEX CREATING NEW JOBS IN ROSTOCK

### 167 NEW JOBS ESTABLISHED

#### 60% more traineeships

The contribution made by the wind power industry to the national economy is frequently viewed only in terms of reliable energy supplies and environmental protection. Indeed, there can be no question that it has achieved impressive results in these areas. Thus, renewable energy now contributes more than 10% to German electricity supplies, with wind power accounting for the largest share of this (4.3%). At the same time, the use of electricity made from wind, water and sun avoids carbon dioxide emissions of around 60 million tons each year.

Yet, our industry is also making a growing contribution to gross domestic product and employment. In 2005, the renewable energies industry generated sales of EUR 16.4 billion. At around EUR 9 billion, the construction of energy production systems constituted the lion's share of this. The industry employs around 157,000 people, with this figure rising. The most important segment is once again wind power with 64,000 employees.

This year, Nordex has already created 167 new jobs in Rostock. At the moment, the Group has around 680 people working at its two sites in the city, 32% more than at the end of 2005. At the same time, the number of trainees at Nordex has also risen. "Just a few days ago, ten young school-leavers commenced their traineeships at our Company," says CEO Thomas Richterich. As a result, Nordex has almost 30 traineeships at its Rostock site.

Says Richterich: "We attach key importance to training for school-leavers as well as employees. In particular, we cannot find sufficient qualified people in the labor market for our production activities. To address this problem, Nordex has launched a training program in conjunction with the labor agency in Rostock. Theoretical and practical training will take up to 24 weeks and specifically covers the requirements for working at Nordex. At this stage, 53 people are taking part in the program, at the conclusion of which they are to be employed in the rotor production or turbine assembly departments at Nordex. "We expect to retain a large percentage of the participants as we are able to determine the content of the training program ourselves," says Richterich.



**Works visit by Minister-President Dr Harald Ringstorff** in Rostock on 2 August 2006. In his briefcase the notification of a 2 million Euro grant, with which the regional government is supporting the planned 11 million investment at the Rostock facility. The region also intends to support Nordex as far as possible with permits for on and off-shore projects.

The new jobs have been created in the wake of the sharp rise in demand for Nordex wind turbines. In the first six months of 2006 alone, order receipts surged by 150 % to EUR 400 million. This prompted Nordex to raise its sales target for 2006 to over EUR 460 million in April, 50 % more than it achieved in 2005. This is equivalent to annual production of around 500 megawatts. In Rostock, Nordex is well on the way to achieving this goal, having produced around 280 megawatts between January and June. The volume of rotor blade production has also doubled, with even larger rotor types being assembled.

Says Richterich: "We expect this growth to continue over the next few years. Between now and 2008, we want our business volume to grow by around 50 % per year." In this connection, the Company will be satisfying European demand mostly from Rostock.



**280 megawatt have been produced** between January and June.

# MOBILE SOLUTION FOR TECHNICIANS

## NORDEX SERVICE – MORE TRANSPARENT, QUICKER, MORE RELIABLE

### **The goal is to achieve enhanced efficiency and greater customer satisfaction**

Nordex currently services over 2,200 wind turbines all around the world. The fleet of turbines looked after by Thorsten Kramer, who is managing director and head of Service at Nordex, is growing by the week. Nordex is now fitting out its service staff with the latest electronic equipment to render customer service swifter and more reliable for operators. The system is known as “n-Mobile”.

“Looking ahead over the next few years, n-Mobile will be a constant companion for our staff out on the field. Using this system, we will be able to substantially simplify the search for disruptions, remedy these, document our activities and keep our customers informed of all services provided quickly and reliably,” says Kramer, describing the advantages of n-Mobile. n-Mobile is the electronic information system which all Nordex technicians all around the world will be able to use to access the Internet on a wireless basis via 3G or GPS communications. It forms the hub for all service activities and documentation.

Immediately upon receiving an error alert from a turbine, the dispatcher at the regional center sends the service technician an assignment electronically

via the terminal fitted to his service vehicle. The misunderstandings liable to arise in telephone calls are thus avoided as the information required is precise and the assignments are clearly worded.

While on the job at the wind farm, the technician is able to gain a real-time view of the inventories of stocks available at the wind farm service point. If the spare part required is in stock, he can fetch it without any further ado. At the same time, this inventory call-down is documented in n-Mobile, which triggers an order for fresh stocks of this part so that the inventories at the service points are automatically replenished. If the necessary part is not in stock, n-Mobile can automatically order it from the central warehouse in Rostock. Head office dispatches the requisite parts to the wind farm within 24 hours.

When the job has been completed, the technician sends a report back to Nordex by e-mail at the press of a button for documentation and billing purposes before leaving the site. The customer also receives a clearly structured report by e-mail or fax in what is a key contribution to greater transparency.

The heart of the system is the Nordex Service Management System (SMS), to which n-Mobile is linked. The SMS is an extensive database which has been

fed with the technical data on all of Nordex's wind turbines and is constantly updated by n-Mobile. In addition to the type of turbine, age, location and production, this also stores the history of each individual turbine. In this way, all activities performed by the technicians, diagnostics, repairs, the time required and the number of spare parts used are recorded, thus producing a detailed profile for each turbine. The advantage of this is that each technician is able to gain a complete and transparent rundown on what he needs to know about the turbine even if he has not previously worked on it. Nordex also uses this data for quality management. Details of wear and tear in material and the consumption of spare parts possibly indicative of system shortcomings are passed on to the engineering department.

"We have now networked all service technicians and regional centers using n-Mobile." Paperless communication keeps our backs free for operative activities and allows us to inform our customers of what we are doing with minimum delay. In addition to the new logistic service infrastructure with 50 service points and the central service depot in Rostock in Germany – a model that Nordex will be implementing also in other European markets – we have thus reached a new milestone in our efforts to ensure high turbine availability for our customers via swift turn-around times," explains Thorsten Kramer.



n-mobile offers a real-time view of the inventories of stocks available at the service point.



#### Interview with

**Dr. Klaus-Jürgen Beel**, an independent operator of wind turbines and a Nordex customer for over ten years.

## CUSTOMER INTERVIEW

### “NORDEX IS THE RIGHT PARTNER FOR ME”

#### **Dr. Beel, for how long have you been operating wind turbines?**

I initiated the construction of the only and last industrially produced wind turbine in Eastern Germany in October 1989 in Wüstrow in Fischland on the Baltic coast. Our company, VEB Holzhandel Rostock, required alternative energy to dry wood as we were not permitted to generate thermal energy from electricity, gas or heating oil, while lignite and ash were not suitable for use with wood. In 1992, I was able to acquire this turbine privately as it was no longer required for the wood business.

#### **What Nordex turbines do you operate?**

At Bentwisch near Rostock I operate the Nordex N52 prototype, which marked the first foray into the megawatt class back in 1995 – at my own 40 hectare plot of plowland. In 1988 I acquired two Nordex N54 1000 kW turbines and in 2002 a Nordex S77 with 1,500 kW. Last year, I set up three Nordex N90/2,300 kW turbines at Barkow near Altentreptow in Mecklenburg-West Pomerania together with an associate. Much to our joy, this location proved to be every bit as good as a coastal site.

#### **What do you think are the advantages offered by Nordex turbines?**

Nordex turbines are robust and the service is excellent. My insurance company confirmed that they have an “inconspicuous underwriting history” and my bank told me that Nordex’s guarantee services are characterized by a readiness to oblige and commercial fairness. I haven’t needed an engineering office, a financial intermediary or an external operator for the acquisition and assembly of the seven Nordex turbines over a period of ten years. What is more, I have always required almost full finance without any additional collateral.

#### **How do you assess the quality of Nordex’s services over the past few years?**

I have fundamental trust in the service team. I have never felt unfairly treated or ignored. Nordex offers the best possible service and I can always go away on holiday with peace of mind. Although the requirements have doubtless risen as a result of technological progress and the growing number of wind farms under management, I have not noticed any changes for the worse in the quality of service. And I know that Nordex invests a lot in training its service staff.



#### **Where do you see room for improvement in Nordex's service?**

I think it would be good for certain errors to be catalogued so that operators can remedy the errors themselves quickly on site – possibly with the assistance of remote data transmission using a mobile telephone. In this way, it would not be necessary for a service technician to be sent out to reset the master switch after a power failure, for example. Occasionally, something like this happens and as a result it would be possible to prevent disruptions lasting several hours. After all, time is money! I would also welcome greater technical support for the service staff. Together with the customer advisors and the remote communications team, they should be backed up by specialist engineers able to answer any queries which may arise. Customer advisors are not always aware of the latest turbine models, while service staff are sometimes left to their own devices and do not have any experts to consult for diagnostic purposes. The result is that they have to come to the site on repeated occasions if they have been unable to find the cause of the problem or remedy it. For this reason, I think that it would also be important to have the names of turbine specialists able to determine the cause of the problems more precisely.

#### **Are you satisfied with the turbine availability?**

I had cautiously assumed availability of 97 % but am in fact getting a substantially better rate of over 98 %. The lack of wind is more of a problem than technical failures. Yet, it is important to keep smiling and simply enjoy the beautiful summer.

#### **What would you advise other operators who are perhaps less satisfied with Nordex service to do?**

In some shops, you can read the sentence "If you are satisfied tell others; if you are not satisfied tell us". Every operator will find that Nordex is very receptive to all feedback. And I am convinced that Nordex takes this information seriously.

#### **How would you sum up the quality of Nordex's service?**

On a scale from 1 to 6, with 1 being the highest and 6 the lowest grade, I would give it a 2. Naturally enough, I can only speak for myself. I also don't know whether my repair costs and turbine availability are in line with the sector average. But to repeat, I consider Nordex to be the right partner for me and I have no intention of changing either the producer or the maintenance company.

## TOWER DESIGN

# CONCRETE/STEEL HYBRID TOWER AVAILABLE FOR THE NORDEX N90/2500 FOR THE FIRST TIME

### 120 meter hybrid tower developed by Nordex

Nordex is now offering concrete/steel hybrid towers for hub heights of 120 meters for the N90/2500 (LS) turbine, which has been specially developed for non-coastal regions. Previously, it used solely steel towers. "Given the sharp rise in steel prices, concrete has now become a relatively inexpensive alternative for keeping the production costs of towers manageable. For this reason, Nordex has developed a concrete/steel hybrid tower for its N90/2500," says Dr. Alexander Jakubowski, who is in charge of tower development at Nordex. Calculations have demonstrated that a hybrid solution offers substantial price advantages compared with steel tube, concrete or lattice towers for multi-megawatt turbines with large hub heights.

The 120 meter hybrid tower developed by Nordex comprises a concrete tube roughly 60 meters tall, which is assembled on top of the foundations using locally supplied cement and then prestressed. It carries the three sections of the modular tower assembly with a total length of a further 60 meters or so. As the concrete tube can be produced in different lengths, any hub height between 100 and 120 meters can be offered flexibly, thus ensuring an optimum turbine height to make the most of the prevailing conditions.

The hybrid tower also offers logistic advantages as the maximum heights normally applicable during transportation do not apply. With tower heights of 100 meters, the diameter of the lowest section is well in excess of four meters, thus exceeding the permissible maximum height on a low loader.

As with steel towers, the entry door allowing access to the turbine is located at the foot of the tower. The foot of the tower also holds the transformer and other key electrical components. The concrete tube replaces several sections of the steel tube tower, thus doing away with the need for screwed site joints and platforms, which require regular maintenance.

With installations using steel tubes, lattice towers and now also 120 meter concrete/steel hybrid towers, Nordex offers powerful wind turbines meeting the current requirements of wind farm operators particularly with respect to the increasing hub heights for efficient deployment in non-coastal regions.



Design of the 100 meter hybrid tower.



## LINKING THE SUPPLIER, PRODUCTION AND ASSEMBLY THE CENTRAL THREAD IN NORDEX QUALITY MANAGEMENT

### Quality assurance taken seriously

Nordex has been attaching particular importance to product quality for many years. Indeed, it has DIN ISO 9001 certification covering the planning, sourcing, construction and start-up of all electrical and automated systems as well as infrastructural activities related to wind power systems and wind farms. As a result, it has achieved an important goal but is certainly not resting on its laurels. Reflecting this, Nordex quality management is structured on a process-oriented basis and covers suppliers, production and assembly activities as well as the final construction of the wind power systems.

With suppliers spread around the world, stable and continuous quality processes in conjunction with components suppliers are of crucial importance for Nordex. Nordex follows the same principles with external suppliers and also its own production facilities. A high level of quality in both the production process and with respect to the sub-products is assured on the basis of defined personal self-control routines on the part of production staff backed up by random checks. Any deviations are documented in error reports and indicate potential for improvements, which can be implemented by taking specific action.

For example, quality control of inbound goods: If during the examination of inbound goods they are found to exhibit any deviations from Nordex's specifications, these are specifically documented. If the error is not tolerable the component is not installed. Each error is automatically forwarded to Construction as input. Measures are then agreed upon with Product Engineering aimed at avoiding such deviations in the future. "We trace the products and components used in our systems a long way back, look closely at the upstream suppliers and also track the origin of the material. We require fault-free material for our systems. That is why our quality management activities not only define the mutual flow of information but also stipulate the exact data required for detailed instructions for each step of the process and define the action to be taken in the event of any non-compliance," says Gerhard Höher, head of quality management at Nordex. The Nordex change committee meets in regular intervals to discuss proposals for possible changes and adopts improvements. In addition, a check is performed to determine whether the details of the proposals have reached the right people and have also been implemented.

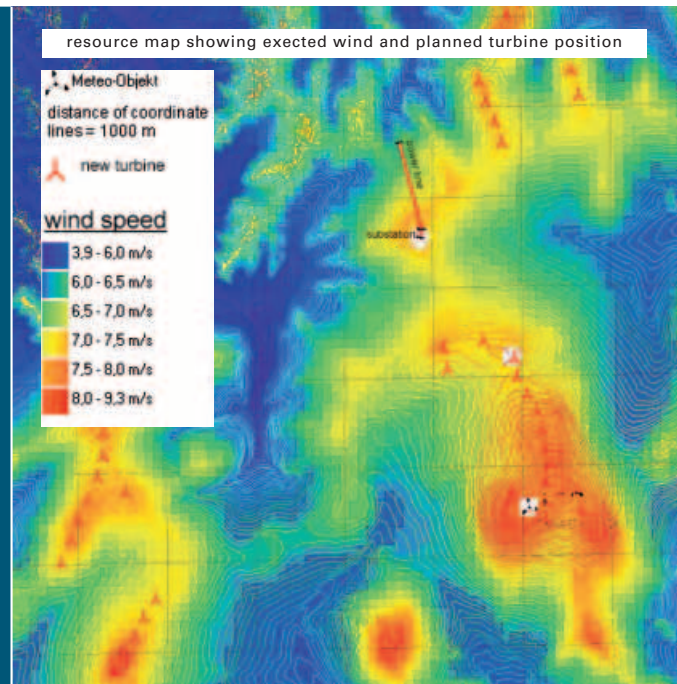


Over the past few years, Nordex has done much to improve quality management in the production process and, to this end, has defined in detail the on-the-floor processes. Thus, for example, each production employee must document the steps taken on a real time basis, i.e. immediately after performing them, and then confirm them upon completion. To make sure that this documentation is not merely filed away never to be seen again, Quality Management regularly reviews the entries in the lists by reference to the name stamps, date and time and also takes random samples during production. Nordex employees attend special courses at the Company's own academy in Rostock, where they are able to learn and master the necessary activities. At the same time, detailed process and activity instructions clearly document each step of the production sequence, thus ensuring that the turbines delivered exhibit very few flaws, if at all. The same principle is also applied to rotor blade production. The result is 100% reliability in rotor blade production processes. This ensures, for example, that the right layers are inserted in the right places with just the right amount of overlapping. A further advantage is that the blades undergo examination by Nordex experts authorized by Germanische Lloyd. This ensures that any faults in workmanship can be avoided. Each individual rotor blade is examined from the inside and outside prior to delivery and receives a certificate confirming this.

Finally, quality control is implemented during system assembly in the form of ancillary checks at the building site with documentation of results. Nordex site and project managers oversee all assembly activities on the field. On the basis of precise lists, detailed checks, which also take account of site safety considerations, are performed. The Nordex Academy also conducts safety training courses to ensure that the construction teams have all the knowledge required in this important area when they work at the construction site. The systems are not cleared until an intensive examination of the technical facilities has been completed. Any irregularities or deviations are recorded in non-conformity reports, the results of which are plowed back into the ongoing improvement process. "In this way, we are able to guarantee that our customers receive truly fault-free systems," explains Höher .

Digital elevation model

## WIND TURBINE LOCATION THE RIGHT LOCATION FOR EVERY TURBINE



### Finding the best wind turbine location

Planning a wind farm entails a great deal of work. The aim is to calculate the most efficient turbine from an economic point of view and the best location for each individual turbine within the wind farm. Geological formations, vegetation and buildings may influence local wind conditions. At the same time, shadowing, acoustics and turbulence place additional restrictions on the scope for the placement of turbines. Only optimum configuration allows wind farm losses caused by shadowing effects to be reduced to a minimum, thus ensuring that the wind farm operates as efficiently as possible.

Backed by the experience which it has gained around the world in the technical planning of wind farm systems, Nordex helps its customers to determine the most suitable turbine and to position it to maximum effect within the wind farm. In this connection, Nordex also examines the wind farm layouts and yield calculations prepared by the customer to ensure the best possible site configuration. All customers regardless of whether they are located in France, Germany or China benefit from these free micrositing services.

The first step in micrositing involves assessing the location by reference to topographical maps, satellite images and, if necessary, by physically examining the site. This data is used to create a computer model with digital elevation models as well as a roughness description which can include obstacles, trees, reliefs, roads and existing wind turbines. In a second step, the potential yield of the wind farm is measured by applying wind data collected by weather stations or taking measurements at the site covering a period of at least one year. The main wind direction, the annual average wind speed and turbulence are calculated. Using the information available on the landscape, roughness and meteorological conditions, the prevailing conditions can be determined with great precision. On the basis of this data, it is possible to select the appropriate turbine type, the tower height and optimum wind farm layout by means of computer calculations which incorporate all site data, zoning requirements and the turbine parameters. Measurements taken from reference equipment may also enhance the precision of the evaluation. In addition to standard wind farm calculation programs, Nordex also uses modern flow simulation models to derive exact measurements even in complex topographical conditions. This produces a realistic yield model for the entire wind farm.



↑ **The potential yield of a windfarm** is measured by applying data by taking measurements.

## SPAIN

# 6,340 TONS OF MATERIALS TRANSPORTED ACROSS EUROPE

### Windfarm Tortosa

37 Nordex N62 with 48.1 MW installed capacity.

#### Logistics models for wind farms

In spring 2006, Nordex constructed a wind farm comprising 37 N62 turbines in the coastal mountain range close to the town of Tortosa about 200 kilometers south of Barcelona. This was the largest project which Nordex had completed for the Spanish market to date and posed considerable logistic challenges. Almost 6,340 tons comprising towers, machine houses, rotor blades and related equipment had to be transported from one end of Europe to the other by water and road to avoid any disruptions to construction work as well as unnecessary storage times at the site so that the wind farm could be completed on schedule.



“We sourced the 37 sets of rotor blades from Ponnerrada in the North West of Spain, while the towers came from Denmark and the machine houses were produced in Rostock,” says Andreas Petzold, head of logistics at Nordex. At first glance, this was a project like any other. However, Nordex decided not to transport the turbines and components solely in a few large deliveries by ship.

In order to avoid filling the construction site in Tortosa with machinery all at once, a system was devised to ensure just-in-time delivery of the components required. “The assembly of an N62 with the three tower sections, three rotor blades and the nacelle takes one day. We faced the task of getting the 37 turbines to the site on a just-in-time basis over a period of three months, while not losing control of the costs and additionally avoiding any interruptions to assembly at the site or at least being able to react to any threatened delays,” Petzold explains.

The tower sections were carried by ship from Denmark via the English Channel, the Bay of Biscay and through the Straits of Gibraltar to a fishing port around 25 kilometers away from Tortosa with access to the necessary mobile crane capacity. At the same time, the machine houses were transported one after the other on heavy-duty trucks from the Rostock factory to Spain. With their compact form, a transportation

The nacelles had to complete the final 16 kilometers on dirt roads with inclinations of up to 16 %.



width of exactly 300 cm and the relatively light weight of the nacelles, namely around 50 tons each, it was possible to use semi-trailers which did not require any police accompaniment in France, for example. The 111 29-meter blades were transported by road over a distance of 1,400 kilometers from Ponferrada to Tortosa. One new element of the logistics, however, was the use of a commission stock warehouse in Germany for the ancillary equipment. "With this project, we had our suppliers deliver four large components for the N62 turbine, the three blade extenders, the cast-iron stall hub, the switch boards and the tower screws and other equipment, directly to a commission stock warehouse for the first time. Here, one tarpaulin trailer per turbine was loaded with the necessary 18 tons of components and dispatched in a precisely timed sequence over a period of three months to ensure that the rotor blades from Spain, the nacelle from Rostock and the main components arrived in Tortosa at the same time," says Till Ehlers, who held operative responsibility for the project, describing the advantages of this network-type logistics solution.

The construction staff at the site were particularly required to coordinate their weekly construction schedules with the logistics center in Norderstedt on a binding basis to ensure that the dispatches were triggered exactly in time with requirements. Yet, there was another obstacle to overcome at the site: After

traveling 1,800 kilometers as "standard heavy loads," the nacelles had to complete the final 16 kilometers of their journey on dirt roads with inclinations of up to 16%. This was impossible for trucks designed for long-distance hauls on motorways. Accordingly, a special tractor was available on site for this short yet extremely difficult route to bring the turbines safely and reliably to their final destinations at the wind farm.

Summing up, Petzold has this to say: "We were able to complete the project in time and on budget. Accordingly, the model proved itself. There were delays with only two of the 37 road hauls, these being for weather-related reasons. In particular, the commissioned trailers of ancillary parts, which were used as mobile storage directly at the base, cut costs at the site considerably. With this structured logistics solution, we will be able to guarantee customers on-schedule completion for projects with similar volumes anywhere in Europe. In China, where our production facilities for turbines and rotor blades are located far apart, such a model is also an option."

## UK NORDEX SCORING AGAIN IN THE UNITED KINGDOM



### New contracts worth EUR 91 million already achieved in 2006

Nordex UK has since received the ninth new contract for this year from the United Kingdom. The Company will now be supplying wind turbines with an output of some 90 megawatts to this country. The latest project concerns extensions to the "Crystal Rig" wind farm with the addition of five N80/2500 kW turbines in a contract worth EUR 10 million.

In 2003, Nordex had constructed 20 N80 turbines close to the small Scottish town of Dunbar. With an installed capacity of 50 megawatts, "Crystal Rig" is one of the largest wind farms in operation in the United Kingdom. "In my view, the fact that Fred Olsen Renewables has opted for Nordex again testifies to the confidence which it has in our technology," says Carsten Pedersen, COO Sales and Marketing at Nordex AG.

And the wind farm developer is in good company. This year alone, two other Nordex customers – including UK utility Npower – have opted for this turbine. Generally speaking, what was decisive was the robust design of the turbine, which is certified for strong-wind sites. In the past few months, Nordex has received orders for 22 of its N80 turbines from the United Kingdom to join the 30 units already in operation there.

Including the projects under construction, Nordex UK has to date installed roughly 230 megawatts worth around EUR 200 million. The Company is also providing maintenance services for most of these turbines. Explains Pedersen: "Our customers often attach key importance to OEM service, which is why we want to further extend our service in the UK. In fact, we are currently holding negotiations with a number of customers on new projects."

The United Kingdom is one of Nordex's most important markets on account of the strong projected growth. Experts assume that new installation of the industry will expand in 2006 by around 40% to some 600 megawatts. Contrary to original assumptions, demand is focusing on onshore turbines.

#### UK PROJEKTS UNDER CONSTRUCTION:

<b>Amish Moore</b>	3 x N60 (1.300 kW)
<b>Earlsburn</b>	15 x N80 (2.500 kW)
<b>Burger Hill</b>	2 x N80 (2.500 kW)
<b>Crystal Rig 2</b>	5 x N80 (2.500 kW)
<b>Braich Ddu</b>	3 x N60 (1.300 kW)
<b>High Sharpley</b>	2 x N60 (1.300 kW)
<b>High Pow</b>	3 x N60 (1.300 kW)
<b>Wharrels Hill</b>	8 x N60 (1.300 kW)
<b>Graig</b>	4 x N80 (2.500 kW)

## IRELAND

# NORDEX SUPPLYING MULTI-MEGAWATT TURBINES TO IRELAND

### **Contract worth a total of around EUR 20 million.**

Nordex AG has received its largest order to date from Ireland. In a contract worth around EUR 20 million, it will be supplying a total of nine N90/2500 turbines to County Limerick in July 2007. The customer is the SWS (South Western Services) Group, whose Natural Resources division is a leader in renewable energy development in Ireland. In addition to CHP stations, biomass and waste-to-energy systems, the Group is also concentrating on wind farms.

The nine multi-megawatt Nordex turbines are to be deployed at the Knockawarriga wind farm, where they will generate sufficient energy to cover the requirements of 18,000 households. On an elevated plateau near Newcastle West, with average wind speeds of greater than 8 m/s prevail at a tower height of 75 meters, ideal conditions for the 90-meter rotors fitted to the turbines.

Nordex had previously assembled wind farms in Ireland in 2003 and 2004 including ten N80/2500 turbines. To date, it has installed around 250 N80/N90 turbines around the world, making this series one of the most exhaustively proven systems of its class.

The Republic of Ireland has extensive plans for encouraging the use of renewable energies, which are to contribute 13.2% to total electricity production by 2010. As part of these efforts, the installed wind turbine capacity is to roughly double to around 1,000 mega-watts. To achieve this, a new feed-in remuneration system for electricity produced from renewable sources came into effect as recently as in June 2006. Under these new arrangements, wind farm operators will receive a fixed rate of up to 5.9 euro-cents per kilowatt/hour for a period of 15 years. As early as in March, the Commission for Energy Regulation offered 1,000 megawatts of new grid capacity under the Gate 2 renewable connection process.





## ITALY

### NORDEX AWARDED FURTHER MAJOR CONTRACT IN ITALY

#### **Contract worth EUR 47 million for wind farm in Sicily**

Nordex AG has been awarded a contract for the construction of the Vicari wind farm. In the initial construction phase, the wind farm will comprise 15 N90/ 2500 turbines. The project is worth around EUR 47 million. In addition to supplying the turbines, Nordex is also responsible for constructing the access routes, the foundations, the cabling and the substation. A further three turbines of the same kind are currently still in the permission-granting phase. Including this option, the contract will have a total value of around EUR 55 million. "The second major project received by Nordex Italia within a short space of time underscores the importance which the high-growth Italian market has for our business," explains Nordex CEO Thomas Richterich.

The customer and later operator of the wind farm is ERG CESA Eolica, a joint venture forged by Italian energy Group ERG and the Spanish CESA Group. Start of production of the turbines on a range of hills (700 meter) near Palermo is to commence in August 2007. With a tower height of 80 meters, the 15 turbines will yield up to 100 gigawatt/hours, sufficient to cover the requirements of around 33,000 households.

# CHINA

## NORDEX EXTENDING LOCAL PRODUCTION

### New rotor blade production

Nordex AG is continuing to invest in extensions to its production capacity. Currently the company is building a rotor blade production facility worth around EUR 20 million in Dongying, in the east of the People's Republic of China. Thanks to the direct access to the sea port, this location is ideally suited for the shipment of large components and the import of commodities. Initially, Nordex will be producing rotor blades for turbines in the 1.5 megawatt (MW) class. These blades measure up to 37.5 meters in length and weigh around 5.8 tons each.

Together with two regional utilities, Nordex started work on building assembly facilities for 1.5 MW turbines in the spring. The Company is also preparing similar partnerships in other provinces, which will then source their rotor blades from the Dongying facility. Series production is to be ramped up as early as in January 2007, with output in the first year of operation planned to comprise 225 blades for 75 turbines (110 MW).

With an area of 8,400 square meters, the facility in Dongying will reach full output in the late summer of 2007. Assuming that everything goes ahead as planned, capacity is to be doubled again provided that this is justified by demand. With a total area of 90,000 square meters, there is sufficient space for this. During this phase, output could then be increased to around 400 MW. The total investment budget for the site stands at EUR 20 million, with around EUR 10 million earmarked for the first phase.



Design of the rotor blade production facility in Dongying.

## EAST ASIA

### 60 HZ VERSION OF THE N90 TURBINES

#### **Delivery contract received for 21 MW/valued at around EUR 14 million**

Nordex AG has been awarded a contract for the construction of a wind farm from East Asia. It will be building a total of nine units of the model N90/2500 in 2007 in conjunction with a local business partner. The contract for the delivery of turbines and rotor blades has a value of around EUR 14 million. The business partner of Nordex will be supplying the towers, foundations and also servicing the wind farm.

The wind farm will be generating up to 40,000 MWh of clean energy a year, sufficient to cover the electricity requirements of some 10,000 households. On account of the rough weather conditions, Nordex will be fitting the turbines out with special lightning conductors: Each rotor blade will have an aluminum tip

as well as other receptors spread over the blade. A further technical feature is the fact that Nordex will be producing a 60 Hz version of the N90 turbines for the first time in view of the grid frequency required in this region. This frequency is only used in parts of Japan, Taiwan, Korea and the United States.

“This project is an important reference for markets in the East Asia, where we have so far primarily been building smaller turbines. At the same time, it marks a return to closer collaboration with our partner, with whom we have been working since 1994,” explains Carsten Pederson, COO Sales and Marketing at Nordex AG. To date, around 270 Nordex turbines are in operation in the East Asia.

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## IRELAND

### GRID FEED-IN TARIFF FOR ELECTRICITY

The Republic of Ireland has extensive plans to widen the use of renewable energies: As a result, the share of this source of energy is to grow to 13.2% in 2010. As part of these efforts, installed wind turbine capacity is to roughly double to around 1,000 megawatts. To achieve this, a new feed-in tariff system for electricity produced from renewable sources came into effect in June

2006. Under these new arrangements, wind farm operators will receive a fixed rate of up to 5.9 euro-cents per kilowatt/hour for a period of 15 years. Back in March, the regulatory authority invited tenders for the provision of 1,000 megawatts of new grid capacity for “green” energy.

## FRANCE

### GRID FEED-IN LEGISLATION AMENDED

The existing grid feed-in legislation in France is being amended to remove the provision which lowers the rates applicable as soon as a capacity of at least 1,500 MW has been installed on a nation-wide level. The offshore tariff is to rise to 13 euro-cents but will

remain unchanged at 8.2 euro-cents for non-coastal regions. All in all, the government has confirmed its ambitious goal of placing at least 5,000 MW in the national grid by 2010 (end of 2005: 775 MW). ¥

**N80/N90 CURRENTLY UNDER CONSTRUCTION (As of August 15, 2006):**

Quantity	Customer/Project	Country	Type	expected Commissioning	Turn-Key Project (TK)/ Turbines only (TO)
8	S. Freita	Portugal	N90/2300	2006	TK
8	S. Freita	Portugal	N90/2300	2006	TK
3	Rusova	Czechia	N80/2500	2006	TO
8	Cast	France	N80/2500	2006	TO
5	Baucaire	France	N90/2300	2006	TK
5	Courcelles	France	N90/2300	2006	TK
5	Oise Lihus	France	N90/2300	2006	TK
5	Les trois Muids	France	N90/2300	2006	TK
5	Oise Hétoimesnil	France	N90/2300	2006	TK
5	Noyers Saint Martin	France	N90/2300	2006	TK
5	Les Pénages	France	N90/2300	2006	TK
5	Les Mardeaux	France	N90/2300	2006	TK
5	Brachy	France	N90/2300	2006	TK
1	Gamlen	Germany	N90/2300	2006	TO
1	Gamlen	Germany	N90/2300	2006	TO
15	Earlsburn	UK	N80/2500	2006	TK
2	Burger Hill	UK	N80/2500	2006	TK
2	Bad Iburg	Germany	N90/2300	2006	TO
4	Champ Besnard	France	N90/2500	2006	TK
4	Les Hauts de Melleray	France	N90/2500	2006	TK
7	Gebhardshain	Germany	N90/2300	2006	TO
5	Saint Aubin sur Aire	France	N90/2300	2006	TK
4	Saint Aubin sur Aire 2	France	N90/2300	2006	TK
6	Plestan	France	N90/2300	2006	TO
4	Le Haut Court	France	N90/2500	2006	TK
5	Breteuil	France	N90/2300	2006	TK
5	Fo.-Linden/Eckerweiler	Germany	N90/2300	2006	TK
5	Le Bernard	France	N90/2500	2006	TK
5	Benet	France	N90/2500	2006	TK
4	La Butte Saint Liphard	France	N90/2500	2006	TK
5	Wimmelburg	Germany	N90/2300	2006	TO
9	Gotsu	Japan	N90/2500	2006	TO
5	Amélocourt	France	N90/2300	2007	TK
5	Chrystal Rig Extension	UK	N80/2500	2007	TO
9	Knockawarriga	IRL	N90/2500	2007	TO
4	Haut Traits	France	N90/2500	2007	TK
4	Petit Caux	France	N90/2500	2007	TK
4	Craig	UK	N80/2500	2007	TO
2	Distrdam	NL	N80/2500	2007	TO
18	Vicari	Italy	N90/2500	2007	TK
<b>Total 216</b>					

**NUMBER OF INSTALLED WIND TURBINES** since 1985: 2,811 • Total installed capacity: 2,931.25 MW

Type	Control	Number
2,3-2,5 MW	pitch	295
1,5 MW	pitch	407
1,3 MW	stall	662
Sub-MW	stall	1451



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