

WINDPOWERUPDATE



MAINTENANCE:
Nordex Condition
Monitoring System

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FRANCE:
Nordex 50%
market share

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JAPAN:
The first
N80/2500 kW

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Cover photo: N90 Offshore in the Kattegat

Editorial



Dear readers,

since its foundation in 1985, Nordex has installed more than 2,300 turbines with a total output of 2 gigawatts. In doing so, we have succeeded in providing 4 million people across the globe with clean energy. The majority of these machines have been erected in Germany, but Nordex also has an outstanding position in the markets of France, Great Britain, Scandinavia and China.

In this issue of the Windpower Update we would like to inform you about a selection of our new wind park projects in Europe and the Far East. One particular highlight: the installation of a Nordex N90 Offshore unit in the Kattegat. With a rated capacity of 2,300 kW, to date the N90 Offshore is one of the most powerful turbines to be installed in the sea anywhere in the world. A further highlight: The start of the installation of the first megawatt wind farm in Latin America. On the peninsula Guajira in the north east of Colombia Nordex is going to install 15 Nordex N60/1300 kW turbines for its customer, Empresas Públicas de Medellín. As in other parts of the world, the demand for energy in South America also is increasing.

In order to fulfil our customers` demand for long lasting services and intelligent maintenance systems, it has also been possible since the beginning of this year to purchase our wind turbines with the Nordex Condition Monitoring System. The combination of continuous service, non-stop monitoring and control of the turbines and the use of a Condition Monitoring System ensures that the machines operate trouble-free.

I hope you enjoy reading this issue.

Carsten Pedersen

Nordex Product- Program

	Power Regulation	Generator Effect	Rotor Diameter
Nordex N43/600 kW	Stall	600/125 kW	43 m
Nordex N50/800 kW	Stall	800/200 kW	50 m
Nordex N60, N62/1300 kW	Stall	1,300/250 kW	60 or 62 m
Nordex S70, S77/1500 kW	Pitch	1,500 kW	70 or 77 m
Nordex N80/2500 kW	Pitch	2,500 kW	80 m
Nordex N90/2300 kW	Pitch	2,300 kW	90 m

“We will be focussing the higher power

Our editors talk to Thomas Richterich, CFO of Nordex AG.

Mr. Richterich, the worldwide growth forecasts for the wind energy market are excellent. Nordex is one of the top players in a lot of areas. The first half-year's figures would seem to point in a different direction. How do you assess the market setting?

It is true that the company's performance in 2003 was poorer than expected. This is true of the entire sector: a number of other suppliers in addition to Nordex also had to revise their projections downwards. But new order receipts from abroad show the increasing momentum in international markets. Precisely abroad, the medium-term forecast is clearly more positive again. Medium and long-term prospects remain good.

Since Spring 2003 a restructuring programme has been taking place at Nordex. Which measures are right at the top of the list of priorities?

Together with the major shareholder WestLB we are carrying out a restructuring programme to be finished in 2004/05 earliest. The return to profit territory has the top priority. We will achieve this by means of a clear focus and consistent implementation of the improvement measures we have defined. At the same time, we shall work specifically on the further optimisation of our products and services with a view to acquiring additional customers. With this in mind, for example we shall be holding many talks with existing and potential customers in the course of the coming weeks and months.



Thomas Richterich, CFO of Nordex AG.

Which concrete measures will you be taking? What will be different for customers?

We shall work to ensure that our resources are used in a clear and targeted manner so that we can invest more in those divisions of relevance to customers - Product Development, Project Management and Service. In the past, some processes at Nordex did not run optimally, meaning that they were not economical and not always to the full satisfaction of our customers. We shall be working hard on a quality and innovation offensive in order to achieve further marked improvements for our customers.

ing even more on range“

What does this mean for your internationalization strategy? What are your plans on the international front?

Nordex is outstandingly well positioned in the most important foreign markets, in Europe and in Asia. The company's early and consistent involvement in these markets was an extremely far-sighted entrepreneurial decision. Of course, we shall be staying with this strategy. Furthermore, we are considering looking for interesting partners in other markets in order to be able to react more flexibly to our customers' inquiries

Where will the focus lie as far as product development is concerned.

Nordex set new standards in the sector with the first 2.5 MW turbine in series production. In future too, Nordex will be concentrating on machines in the upper power range. It is our declared aim to concentrate even more on this segment than in the past.

Where do you see Nordex three years from now?

Nordex will maintain, and indeed improve on, its position as a technological leader. We still have a lot of work ahead of us, but Nordex has good products and a motivated and qualified team. I am convinced that we will be able to underpin our claim to a place among the top suppliers in the international wind-power market within the next few years.

Did you know that...

- during the 30 day reliability run the average technical availability of the nine N80/2500kw turbines at the Nerefco wind farm in Rotterdam came to 99.73 percent and the wind farm produced 2.6 million kWh of electricity during this period?
- you can download our annual reports, presentations, brochures as well as many other folders from our web page www.nordex-online.com?
- according to the German VDEW (Verband der Elektrizitätswirtschaft), approx. 8% of the total power consumption in Germany in 2002 derived from renewable energy sources (2001: 6.5%)? In this connection, wind energy came in second with a power supply of 38%, right after hydro power which in Germany accounts for about half of the power production from renewable energies?

The Nordex Condition Monitoring System

The Condition Monitoring System is an overall, secure solution for avoiding unforeseen downtimes resulting from component wear. The system supports the high level of availability of the turbines and troublefree operation.

Since the beginning of 2003 Nordex AG has been offering tried and tested condition monitoring systems for all wind turbines. The interplay of continuous service, the monitoring and control of the turbines and the use of a condition monitoring system gives an even greater guarantee than in the past that the machines will operate trouble-free.

Hitherto the availability of the wind plants manufactured by the Nordex Group was achieved on the basis of the world-wide, round-the-clock accessibility of all machines, 24-hour remote monitoring and care, as well as rapid-reaction service. The automatic solution offered by a condition monitoring system represents an additional instrument within the framework of service and maintenance. Like an "attentive ear", the system is connected to all wearing components, such as the gearbox, bearing and generator, and provides the information on their condition required for decision-making. In this way, unforeseen downtimes caused by wear or damage to components can be considerably reduced in the future.

Condition Monitoring System

A condition monitoring system is an early-warning system which automatically supplies information on the condition of sensitive components subject to wear on a continuous basis. In the course of years of operation of the turbines wear may occur on the interlocking and moving mechanical parts of components without being noticed. The gearbox, bearings and generator are particularly susceptible to this "pitting". Undetected faults here may result in costly damage. A condition monitoring system keeps the customer constantly informed about the condition of the mechanical parts in the components in real time. In this way, the system warns in good time before damage can be caused. The advantage: maintenance

is no longer performed as a reaction to a fault, but actively, in advance of a breakdown, as it is possible to plan these operations ahead of time. Spare parts, components, cranes and vehicles can be ordered and made ready in good time in order to replace the worn-out parts before the damage finally occurs, all this on a just-in-time basis. This condition-oriented repair and maintenance avoids unforeseen downtimes caused by component wear, shortens on-site maintenance work and prevents any follow up damage. In addition to this, the date of possible replacement of a component can be scheduled in such a way that it falls at a time of year when winds are lighter. This reduces yield losses to a minimum.

The principle of condition monitoring systems is based on the recording of acoustic frequencies created by the rotational and friction forces of the gearwheels within the components during operation. Vibration sensors with three measuring points on the generator, two measuring points on the main bearing and three to four measuring points on the gearbox continuously record these vibration levels. To do so, first of all an individual reference range, a so-called fingerprint, is determined for each turbine and each component. This acoustic fingerprint of the gearbox, the bearing and the generator is created over a period of three months in normal operation in the wind park. The values recorded are stored in a black box as reference values. During subsequent operation of the turbines the actual values measured are automatically transmitted online to the condition monitoring system and here automatically compared with the reference range round the clock, seven days a week. If the actual acoustic data differ from the reference range, accurate information can be obtained on the basis of experience collected over years on the degree of wear, the expected service life of the components and their timely replacement.



The Nordex Condition Monitoring System: The perfect combination of practical experience and the latest technology for reliable maintenance.

From repair on the basis of condition to repair geared to dependability

All the values and data in the condition monitoring system of each individual wind turbine are evaluated in a database in the central Nordex remote monitoring system. Further levels make it possible to evaluate data relating to, among other elements, vibration diagnosis, frequency analysis, envelope and order spectra. All values are archived as histories at Nordex. They are used both for documentation

vis-à-vis customers and as evidence for insurance companies. In providing this service Nordex goes beyond the minimum requirements of the insurance business. In addition to data on individual turbines, in future it will be possible to evaluate empirical values for individual turbine types and product families. This gives Nordex a continuous increase in know-how on the different power classes, which at the same time paves the way for a longterm maintenance system geared to dependability.

Producing electricity at sea

Nordex N90 Offshore in the Kattegat

Electricity for 1,500 households.



With a rated capacity of 2,300 kW, the N90 Offshore is one of the most powerful turbines to be installed in sea anywhere in the world.



45 meter rotor blades capture the wind.

At the beginning of May 2003, Nordex installed an offshore turbine of the N90 series off the Danish port of Frederikshavn in the Kattegat. With a rated capacity of 2,300 kW, the N90 Offshore is one of the most powerful turbines to be installed in the sea anywhere in the world. Until today, most of the machines operating in European coastal waters have a maximum output of 2 MW.

With this project Nordex has reached a major milestone in the development, installation and practical testing of wind turbines at sea. Nordex will be using the operation of this N90 to thoroughly test and monitor all the components used in the machine, as well as the overall performance of the turbine under realistic maritime weather conditions. The experience and results obtained here will make a key contribution to the development of future, even more powerful offshore turbines by Nordex.

Just as with onshore projects, the economic efficiency of an offshore project depends on the costs per kilowatt hour of wind energy generated. However, the one-off expenditure for underwater foundations, installation in the open sea and laying cables, as well as running costs for operation and maintenance, are higher. The output of the wind turbines operating at sea thus plays a crucial role in the economy calculation. Only the energy yield resulting from a high rated capacity and availability, a good power curve and a long turbine service life can produce a calculable and economic ratio in relation to the higher costs incurred at sea.

Thanks to the 90-metre rotor, the N90 Offshore version is able to produce optimal yields – a bonus at the Kattegat location with its average annual wind speed of 7.8 m/s. The expected calculated annual energy yield is approx. 7 GWh. This makes it possible to supply approx. 1,500 four person households with clean wind power from the sea.

The machine is designed to be resistant to waves and is effectively protected against longterm corrosion. This ensures that the components have a long operating life and reduces costly offshore maintenance to a minimum. As an example of this, the nacelle, among other parts, is protected against corrosion and an active dehumidification protection system has been installed to counter the effects of the aggressive salt in the air. The dehumidification facilities and humidity gauge in the tower, nacelle and hub ensure that humidity is constantly kept below 50 per cent.

In addition, the turbine is equipped with a breakdown crane which makes it possible to erect a "power crane", developed by Nordex, on the nacelle, if necessary. The power crane is able to replace the gearbox, generator, transformer, shaft, hub or rotor blades without the assistance of an external crane. This means that the costly use of an offshore crane for maintenance work is not necessary. For service and maintenance work the offshore machine has a helicopter hoist platform. This makes it possible for maintenance staff to be placed on and taken off the machine by helicopter.



The completed rotor ready for erection.

Operation of the N90 turbine in the Kattegat is being remote-monitored and controlled by the Nordex service center in Give, Denmark. For this the Nordex Control 2 SCADA system is used, which supports the remote control of the turbine, its adjustment and the monitoring, visualization and archiving of the data and operating modes. The integrated "Nordex Condition Monitoring" early-warning system makes it possible to recognize any signs of wear in the components at an early stage.

Strong position in France

Every other Wind Turbine comes from Nordex

Nordex dominates the French Wind Turbine Market with approx. 50% of the installed MW in 2002. Since the beginning of the year, Nordex has installed another 28 MW of wind energy in France, reconfirming its position as the leading wind turbine manufacturer in France.

In February, when the strong wind Tramontane blew from the north-west, the Nordex team installed eight wind turbines in Rivesaltes. The customer Hydelec has delivered the access roads, the foundations and the electrical works, and the Nordex supply of the turbines (four N43/800 kW and four N60/1300 kW) is the first Nordex wind farm in the French department of Pyrénées-Orientales. The site has already been visited by many people from the area and the surrounding departments where Nordex last year erected seven N60/1300 kW at Fitou and ten N43/600 kW at Tuchan near Perpignan.

The very first N80/2500 kW wind turbines for the French market were installed in March 2003 at Bouin situated 30 km south of Nantes in Normandy. At this site, Nordex erected eight of these giant wind turbines on 60-metre tubular towers. The project was a turnkey project and included access routes, foundations and grid connection. Later this summer, Nordex will among other projects in France erect another two N80/2500 kW wind turbines at the refinery at Dunkerque.

Together with these projects Nordex has achieved a leading role in France, a major growth market. Of the approx. 183 megawatts so far installed in France, Nordex alone has contributed 86.35 MW.



Wind Farm Tuchan.



Wind Farm "Avignonet" – 10 wind turbines N50/800kW south of Toulouse.

Nordex in France

Location	Type	Quantity	MW
Baie de la Somme	N29/250	1	0,25
Donzère	N43/600	5	3,00
Lastours	N43/600	3	1,80
Tuchan I	N43/600	5	3,00
Tuchan II	N43/600	10	6,00
Cap Corse, Ersa	N43/600	13	7,80
Cap Corse, Rogliano	N43/600	7	4,20
Rivesaltes	N43/600	4	2,40
Avignonet	N50/800	10	8,00
Merdelou	N60/1300	6	7,80
Fontanelle	N60/1300	6	7,80
Fitou	N60/1300	7	9,10
Rivesaltes	N60/1300	4	5,20
Bouin	N80/2500	8	20,00
Total		89	86,35

Nordex at the Danish coast

Ebeltoft Waterfront: Fewer Turbines, more Power

Four giant N60/1300 kW wind turbines have replaced 18 old 55 kW turbines along the ferry port of Ebeltoft, Denmark.

Among the many repowering projects that Nordex installed last year in Denmark, the project executed at the waterfront at Ebeltoft is one of the most remarkable due to the site location – the ferry port of Ebeltoft – and the scarcity of manoeuvre space

during the installation of the turbines. The skilled Nordex team managed to erect the four wind turbines in less than 5 days. In the following, we take a closer look at the installation of these four king size machines.



N60 in Ebeltoft: nearly touching the water.



1 The old wind turbines and foundations have been removed from the pier, and the pier is now broadened for the larger Nordex turbines. The new foundations are pile foundations on the ocean bed. The cables have been laid down in the pier.



2 It is early morning, and the truck backs on the pier with the tower bottom section.



3 The tower bottom section is made ready to be installed.



4 The tower top section is being installed.



5 The nacelle is lifted to the top of the tower. From the photo it appears that the crane is too broad for the pier road. Each time the crane should start installing a new turbine on a new turbine site, it had to be dismantled.



6 When installing the N60/1300 kW machine under normal conditions, the hub is installed together with the nacelle, and the blades are mounted individually to the hub. At Ebeltoft blades were mounted to the hub on shore. Thereafter, they were transported to the turbines at the pier.



7 The rotor section is mounted to the nacelle.



8 The turbines are now erected and the transformer stations have been mounted inside the towers.

Nordex assembling 15 Wind Turbines in Uckermark, Germany

Turbines with a large rotor for high energy yield.

More and more wind turbines are being assembled in non-coastal regions in Germany. Thus, with over 500 megawatt of new installed capacity, the German state of Brandenburg easily outstripped the coastal state of Schleswig-Holstein last year. The reason for this is that many coastal areas with strong wind conditions have already been occupied. Plus, new and larger turbines are rendering wind power an economically viable option in non-coastal areas.

A good example of this is the 15 wind turbines which Enertrag has now ordered from Nordex for assembly in two locations in Uckermark, Brandenburg, in a project worth around EUR 22.6 million. Each S77 turbine has a nominal output of 1,500 kilowatt. To ensure that this output is achieved in even

only medium wind conditions, the turbines have a large rotor with a sweep of 77 metres mounted on towers of 100 metres.

Nordex sees strong potential for further expansion in wind-power in non-coastal regions in Germany. "Whereas the coastal states of Schleswig-Holstein and Mecklenburg-West Pomerania already derive more than 20 percent of their electricity from clean wind power, other German states are still a long way from achieving the political goal of substantially boosting the share of green energies," explains Carsten Pedersen, COO sales and marketing at Nordex AG.

Another 45 Nordex Megawatt into the Grid

Three Nordex Wind Farms for Sachsen Fonds, Germany

Nordex has completed three wind farms on a turn-key basis for Sachsen Fonds. In a record time of only four months, the company connected a total of 30 large turbines to the electricity grid at the end of 2002.

Sachsen Fonds, a subsidiary of Landesbank Sachsen Girozentrale, has acquired the wind farms from Nordex for a total of EUR 48.5 million, including long-term technical management and maintenance of the wind farms.

Given the new challenges in connection with construction permits and finance for wind farms in Germany, Nordex considers the completion of this project to be a major success. The

largest of the three projects is the Uetze wind farm, located 30 km north-east of Hannover and comprising 21 S70/1500 kW turbines. Including the construction of access routes, work of the foundations, the transformer and the grid connection, this turnkey project had a total order value of around EUR 35 million. Nordex also installed a further nine turbines of the same model at the Reinsfeld and Hinzert-Pöler wind farms near Trier. These turnkey projects were valued at EUR 13.5 million.

Nordex asserting itself in southern Europe

25 Nordex Turbines for Portugal

In 2002 Nordex was third largest producer.

Nordex Energy Ibérica, a wholly owned subsidiary of Nordex AG, signed a contract worth around EUR 11.3 million for the turnkey assembly of the Vergao wind farm for the Portuguese developer GENERG Ventos de Proença-a-Nova. The project consists of ten N62/1300 kW turbines including all infrastructure activities. The wind farm is located at an altitude of 600 metres in the Vergao mountains in the Catelo Branco region.

Further, Nordex received an order comprising 15 N90/2300 kW turbines for the Chao Falcao wind farm for operator Enersis, Lisbon. The Chao Falcao wind farm will be located roughly 100 kilometers north of Lisbon close to the town of Fatima at an altitude of between 450 and 500 meters.

In force since January 2002, the Portuguese "clean-slate" law provides for a sliding-scale feed-in charge of 8.2 euro-cents per kW/h for the first 2,000 full-load hours. There are only two other countries in Europe stipulating a higher price. The act seeks to offer incentives for assembling wind farms in locations with less favourable wind conditions but close to the consumer. The advantage of this solution is that these regions in particular frequently possess well-developed electricity grids. At the same time, it is possible to avoid long and expensive transmission routes.

A total capacity of up to 7,000 MW is to be funded in this way. In taking this course, the Portuguese government is pursuing the EU goal of covering 39 percent of its electricity requirements from regenerative sources by 2010. At the same time, the University of Porto forecasts annual growth of 5 percent in demand for energy. It thus comes as no surprise that Portugal

is seen as having strong potential. DGE (Direcção Geral de Energia), the organization responsible for grid access, has granted permits for projects with a volume of some 3,500 MW. Nordex' customer GENERG, a 42.5-percent subsidiary of the Belgian utility Electrabel, expects project volumes of around 400 MW in the next four years. This points to enormous opportunities for growth in the light of the current situation. Roughly 67 MW of new wind capacity was added to the grid in 2002, with Nordex supplying around 13 percent of these wind turbines, making this company the third largest producer in Portugal last year.



N60 at the wind farm Cabeço Alto, Portugal.

ECN orders five Nordex Turbines

The Dutch research institute ECN (Energy Research Centre of the Netherlands) has ordered five N80/2500 kW wind turbines from Nordex for its new test field near Wieringermeer. The project including installation and maintenance for the first five years of operation is worth around EUR 11 million.

The five multimega-watt turbines are scheduled to go into operation towards the end of November this year. The necessary road access and preparations for grid connection have already been completed.

To date, Nordex has installed 65 of these turbines around the world, including nine in the Netherlands for a joint BP/ChevronTexaco wind farm. Together with the new ECN project, this confirms the quality of the Nordex products and its strong position in the megawatt class worldwide.

ECN will use the turbines for intensive testing in order to support research and development programs. In these programs items as wake efforts, control strategies, energy yield optimization and birds interaction will be addressed. In addition, the electricity produced will be fed into the public grid. Given an average wind speed of 7.6 m/s at an altitude of 80 metres, the five turbines will be able to produce roughly 32 million kWh of electricity each year, sufficient to cover the electricity requirements of approx. 8,000 households.



Wim Stam and Erik N. Nielsen (Nordex) signing the contract.

ECN is one of the leading international research institutes in the wind power segment and is committed to basic research in the interests of encouraging the widespread use of environment-friendly wind power. To this end it focusses on large turbines of manufacturers who are willing to cooperate in the research programs of ECN. This was one of the key reasons for its decision to order the N80/2500 kW.

Where the wind does not "sleep"

Nordex Turbines for Scotland

Crystal Rig Offers Strong Winds to a New Nordex N80 Wind Farm.

Towards the end of 2002, Nordex received a major order from Scotland. Fred Olsen Renewable Ltd. ordered a total of 20 Nordex N80/2500 kW wind turbines worth a total of EUR 37 million. Nordex will be handling the complete installation of the turbines as well as maintenance for the first five years.

The Crystal Rig wind farm is to be constructed close to the small Scottish town of Dunbar. The site is characterized by mean wind speeds of 9.3 m/s, thus offering ideal conditions for achieving optimum yields from the strong-wind turbines.

The fact that Nordex currently produces the world's largest series wind turbine was not the only reason for Fred Olsen Renewable Ltd. to select Nordex. "We were able to guarantee our customer optimum service for the turbines via our local after-sales office in Peebles," explains Claus Poulsen, Managing Director of Nordex UK, Manchester. To date, this platform has primarily been looking after the 24 Nordex N60/1300 kW turbines at the Bowbeat wind farm completed last year.



Like here in Kings Mountain,
Ireland, 20 N80 will be installed
at Crystal Rig.

Nordex builds Colombia's first Wind Farm

The Colombian utility Empresas Públicas de Medellín (EPM) has ordered 15 N60/1300 kW turbines from Nordex AG to go on grid on the Caribbean coast in December 2003.

The order is worth approx. EUR 17 million and includes installation of the machines as well as maintenance and technical operation for one year. During this period, Nordex will train the EPM engineers who will subsequently take over these tasks.

The work started on the Guajira peninsula in the north east of the country in May 2003, and in October Nordex will be erecting the units on site. The "Jepirachi" project will then be the country's first wind park to be connected to the grid. The name of the wind farm, "Jepirachi", is a word from the language of the Wayuu Indians living there and means "north-east wind".

The location is ideal from a climatic point of view. At a height of 50 metres, the average wind speed is around 10 m/s. In addition to this, wind distribution is constantly good, ensuring a high annual yield. These figures are the result of measurements made by EPM jointly with GTZ (Gesellschaft für Technische Zusammenarbeit) within the framework of the TERNA (Technical Expertise for Renewable Energy Application) wind energy program.

The energy market in Colombia, which has been deregulated since 1995, is characterized by a low price level. This is because all power plants with a capacity of more than 20 megawatts feeding into the national grid have to sell their energy via the electricity exchange. For this reason, the government recognition

of the wind park as a "technical innovation project" was crucial. This makes it possible for EPM to count the investment costs towards the pre-tax profit. In addition to this, EPM is currently negotiating with the World Bank's Prototype Carbon Fund for a certificate trade for the CO₂ saving. Reimbursement for 800,000 tons of CO₂ emissions avoided comes to approx. USD 3,200,000.

The composition of the existing power plant network also promises to provide support. At present, some two thirds of national energy output in Colombia comes from hydro power plants. But longer periods of drought have resulted in repeated supply bottlenecks. This is why politicians are increasingly supporting a broader energy mix in the grid. Up to now, this comprised principally fossil fuels, such as pit coal, oil and an increasing amount of natural gas. "Against this backdrop, we expect good follow up business for wind parks in Colombia", says Carsten Pedersen, COO Sales and Marketing at Nordex. And it looks as if Nordex has found a good business partner for this in EPM. Approx. 16 per cent of the national electricity capacity is supplied by EPM.



15 Nordex N60 will be installed on the peninsula Guajira.

The Chinese Lunar New Year began with the completion of the Yingkou Wind Farm

Yingkou Windpower Co. has recently completed another extension of their wind park on the Liaodong Peninsula. Just before the Chinese Lunar New Year on February 1, 2003, the commissioning of the 17 x N43 /600 kW turbines was completed successfully.

The signing of the contract for Xi'an Nordex Wind Turbine Company's (XNC) first N43/600 kW prototype three years ago made Yingkou Windpower Co. one of the very first to invest into locally produced wind turbines, by now one of XNC's most important business partners, and today the wind park in Yingkou ranks among the biggest in China. It is also currently the biggest wind park of Nordex in China with an accumulated capacity of 23.2 MW.



The finishing touch – painting the eyes of the dragon.

The contract for the latest wind park extension by 10.2 MW was won by XNC in March 2002. In addition to the relatively short terms of delivery, the biggest challenge turned out to be the client's requirement to use local suppliers – 50 to 85 % of the main components of the wind turbines – including blades, yaw system, controller, generator and gear box. Working closely together with Chinese suppliers and supported by Nordex resources, XNC was able to fulfill this task and manufactured all turbines in their factory in Xi'an.

The delivery of the turbines to the site started mid October 2002, and by the end of December 2002 the experienced personnel of the customer had completed the installation of all turbines successfully.

The Yingkou wind farm.

Having manufactured more than 30 N43 turbines together with local suppliers, XNC has gathered valuable experience and is now in a strong position to compete successfully in the Chinese market.

"Many see local suppliers only as a tool to reduce the price of a product and are therefore pushing hard to get fully locally produced wind turbines in China" says Hans von Schaper, General Manager of XNC. "But by selecting a mix of local and imported components we have been able to develop a reliable N43 turbine that sells for a very competitive price." Since the beginning of this year, many new local projects have been started as China has authorized the provincial authorities to approve such wind parks, a positive and promising outlook for the coming years.

Including this extension, Nordex now has 34 turbines in operation in Yingkou: 30 sets of the N43/600 kW, most of them assembled by XNC, and 4 sets of the N60/1300 kW, which since their installation in 2000 are still the only megawatt turbines in all of China. The wind farm is a demonstration of the success of wind power in the region. Because of its large size as well as the megawatt turbines, the Yingkou wind farm attracts a constant flow of visitors, including local and international customers of Nordex.



N80 crosses Europe's borders

First N80 in Japan

**Ryuyo-Cho Windfarm: The 60 Hz Nordex N80/2500 kW.
One of the most powerful wind turbines in Japan.**

R yuyo-Cho wind farm proudly presents one of the largest turbines installed in Japan to date: A modified N80 wind turbine on a 60-metre tubular tower.

Even in the Land of
the Rising Sun the sun
goes down...
but the winds keep
blowing.

The electrical grid in Japan is divided into two zones; 50 and 60 Hz. Ryuyo-Cho wind farm, situated approximately 200 km southwest of Tokyo, Japan, is located in the 60 Hz area, and therefore the transmission and control system of the N80 were adapted



The nacelle has now been installed...

the construction of the foundations commenced in Japan. The shipment of the Nordex components (the turbine and the tower) was effected end of November 2002.

After the sea freight from Germany, the wind turbine and the tower had to be loaded onto smaller barges to be able to dock into the small port of Ryuyo-Cho. As the turbine could not be shipped to its final destination in one set, it had to be dismantled again after the factory test, as no part was allowed to exceed 45 tonnes. When installing the wind turbine, smaller cranes than usual were used so the nacelle and the drive train were installed in two steps.



accordingly. Upon request of the local electricity company, the output of the turbine was reduced to 1,900 kW.

In March 2002, the municipality of Ryuyo-Cho entrusted Nordex' Japanese partner, Ishikawajima-Harima Heavy Industries (IHI) with an EPC contract (Engineering, Procurement and Construction), comprising site surveys, site planning, civil works, electrical installation, power line construction, remote monitoring systems, delivery, construction and commissioning.

The design for this modified turbine was finished by Nordex last year in the beginning of April, and soon after, the production of the turbine started. In the meantime, ten thousand kilometres to the east,



... and thereafter the drivetrain is mounted.

Wind Energy in Japan

Nordex Partner IHI completed the Wind Farm Minami Osumi 1

10 Nordex N60 turbines have been connected to the Japanese grid, and another 10 turbines for the extension phase of the project have been shipped.

Nordex and its Japanese partner, Ishikawajima-Harima Heavy Industries (IHI), have completed the wind farm Minami Osumi 1 for the customer Kyushu Electric Power on schedule at the end of February 2003. In this first construction phase ten N60/1300 kW were connected to the grid. The farm is situated at the southern end of the island of Kyushu at an altitude of 420 to 520 metres. An average annual wind speed of 7.2 m/s has been measured on the site.

In total, the wind farm will comprise 20 N60 turbines. Nordex has also supplied the second section comprising further ten N60/1300 kW turbines scheduled to be installed later this year. With a rated capacity of 26 megawatts, the Minami Osumi project will then be one of the largest wind farms in Japan.



View from the Minami Osumi 2 site to the Minami Osumi 1 wind turbines.

Lack of energy

Tokyo extends use of Wind Energy

Capacity of 3.000 MW by 2010.

Japan has a supply problem. In the summer months of July and August the energy industry fears "blackouts" in the electricity grid. But necessity is the mother of invention: since mid-June, Tokyo Electric Power has been broadcasting a up-to-the-minute power forecast on television. Some industrial customers have already changed their production plans and manufacture more at night or on the weekends, when the demand for electricity is low.

The background: several atomic power stations have been taken off the grid for safety reasons. In addition to this, the deregulation of the electricity market has only been partially implemented in Nippon. The market is controlled by ten regional

suppliers. Exchanging loads between the east and west coast is only possible to a limited extent. Japan is the only country in the world to have two electricity grids with different frequencies (50 and 60 hertz). And the capacity of the frequency converters has reached its limit.

So it's not surprising that the government is now supporting the development of domestic sources of energy. But here Japan does not have a lot to offer. Wind energy is one exception. As a major step in this direction, Tokyo is now also planning to facilitate the development of wind park projects on public land and to lift a ban to this effect.

Above all the power-plant industry has argued in favour of being able to make use of the plentiful wind locations in the mountains and on the coasts. Although the installed capacity has increased from a mere 3 to 500 megawatts since 1990, compared to Europe and the USA Japan is still a developing country in terms of wind energy. Now Tokyo is planning to extend capacity to some 3,000 megawatts by 2010.

In Japan there are 28 national parks covering 5.4 per cent of the country's land area. Approximately 70 per cent of the country consists of mountains. The wind potential of the 30,000 kilometres of coastline could meet 10 per cent of the national energy demand.

Worldwide Installations

Country	Installed Wind Turbines										
	N27/150	N27/250	N29/250	N43/600	S46/600 S46/750	N50/800	N54/1000	N60/1300 N62/1300	S70/1500 S77/1500	N80/2500	N90/2300
Egypt	0	0	0	105	0	0	0	0	0	0	0
Australia	1	0	3	0	0	0	0	0	0	0	0
Belarus	0	0	1	0	0	0	0	0	0	0	0
China	0	16	16	137	0	12	0	16	0	0	0
Denmark	21	10	0	35	0	59	0	54	0	0	2
Germany	97	24	76	110	51	21	160	346	259	19	1
Finland	0	0	0	0	0	0	0	3	0	0	0
France	0	0	1	47	0	10	0	23	0	8	0
Greece	0	0	1	37	0	8	0	0	0	0	0
UK	0	0	0	3	0	6	0	28	0	2	0
India	79	6	178	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	10	0
Israel	0	1	0	0	0	0	0	0	0	0	0
Italy	0	0	0	0	0	2	0	0	0	0	0
Japan	2	0	4	7	0	3	0	21	0	1	0
Canada	0	0	0	0	0	0	0	20	0	0	0
Lettland	0	0	0	0	0	0	7	0	0	0	0
Luxembourg	0	0	0	0	0	0	2	0	0	0	0
Holland	0	0	0	4	0	6	0	0	0	9	0
Norway	0	0	0	0	0	0	0	0	0	16	0
Austria	1	0	5	0	0	0	0	0	0	0	0
Poland	0	0	1	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	3	0	22	0	0	0
Russia	0	0	3	0	0	0	0	0	0	0	0
Sweden	0	0	0	1	0	0	0	0	0	0	0
Spain	0	0	0	25	0	0	0	15	0	0	0
Syria	1	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	1	0	0	0	0	0	0	0	0
Uruguay	1	0	0	0	0	0	0	0	0	0	0
USA	0	0	1	1	0	0	10	12	0	0	0
Total	203	57	291	512	51	130	179	560	255	65	3
Capacity (MW)	30,45	14,25	72,75	307,20	33,00	104,00	179,00	728,00	388,50	162,50	6,90

Total Installed Wind Turbines: 2310

Total Installed Capacity (MW): 2026,55

Last update of this page: July 22, 2003

Nordex breaks the sound barrier of 2,000 MW installed capacity

MIn installing one N90 turbine and four S70s, in May 2003 Nordex broke the sound barrier of 2,000 megawatts total capacity of its wind turbines installed worldwide. Since being founded in 1985, the company has erected a total of just under 2,300 turbines from the North Cape to North Africa, from the interior of Mongolia to the Rocky Mountains in Canada. With a

total capacity of 2007 megawatts, today these machines can today theoretically provide four million people with clean wind power.

The basis for this growth and success on the market is the company's successful internationalization and the wide range of products in the megawatt class. When the 1000th Nordex turbine was delivered in 1999, the total capacity was just one

third of today's output: 550 MW. This illustrates that the main driver of growth in recent years has been the increasing demand for large turbines in the megawatt class. In the past financial year, the Nordex Group earned approx. 77 per cent of its revenues exclusively with turbines of the type S70/S77 with 1.5 MW and the Nordex N80/2.5 MW and Nordex N90/2.3, which went into series production in

2000 and 2001, respectively.

The jubilee unit with which the 2000-MW mark was crossed is the N90 – the latest offspring of the Nordex product family. With 2,300 kW, the turbine offers a high installed electrical output measured in terms of the space required. Thanks to its 90-metre rotor diameter, the N90 reaches its full rated output even at low wind speeds.

Nordex collects prizes

At this year's Business-to-Business Awards organized by the German Communication Association (Deutscher Kommunikationsverband), Nordex climbed the victors' podium twice: the company won silver for its Annual Report and bronze for its advertising campaign. This competition rewards successful marketing communication for products "needing explanation". "The target group is not the final consumers, but decision-makers and a specialist public in companies", announced the prestigious jury in justifying its decision. Competition for the awards was tough, as can be seen



Silver and bronze for successful marketing communication.

from the other award-winners: neck-and-neck with Nordex this time, for example, were BMW, Dresdner Bank, Lufthansa and Siemens.



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