NETHERLANDS: Europoort with 9 x N80.

EMISSION TRADING: Nordex supports customers.

CHINA: Is the sleeping giant waking up?

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WINDPOWERUPDATE is published by Nordex AG, Bornbarch 2, 22848 Norderstedt, Germany
Tel: +49 40 50 09 8-100, Fax: +49 40 50 09 8-101
Editorial office: Marketing & PR Department
Layout: Heuer & Sachse, Hamburg, Germany
Edition no. 18
Issues: 8,000
Cover photo: Windpark Gut Losten with 5 x N90
Dear readers,

In this issue too, we would once again like to provide you with information about our ongoing projects. One particularly gratifying development from our point of view is our successful entry into the Estonian market. With a total of eight turbines of the 2.3 MW class installed, the Pakri wind farm is the largest one to date with N90 turbines. One special highlight: Pakri is a joint project within the framework of the Kyoto Protocol. This project involves the sale of certificates for the avoidance of 500,000 tons of CO₂ emissions to the state of Finland. This makes it one of the first projects to be partially financed by means of emission trading.

CO₂ certificate trading, which is due to start within the EU on January 1, 2005 and also permits projects outside Europe, could create additional demand in other countries. In China, for example. As a cosignatory to the Kyoto Agreement, China has to reduce its emissions itself from 2008 at the latest. Above all in emerging markets such as China emission trading will be available as an additional source of finance in the coming years. With the current Pakri project and the Jepirachi Park, completed in February 2004, Nordex has already implemented two projects within the framework of the climate protection convention and, together with specialist partners, is able to support its customers in an advisory capacity with regard to financing.

I hope you enjoy reading this issue.

Carsten Pedersen

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Dr. Müller, you had a varied and interesting job with the management consultants Roland Berger. What made you join Nordex?

I am very pleased to be a permanent part of the Nordex team. I have already been working on the restructuring program at Nordex for a year now as an “outsider”. Although there have been ups and downs – as there are everywhere – during my work I never had any serious doubts that the company would be able to master the challenge. Otherwise it would not have made any sense to accept the duties and responsibilities of a member of the Management Board here. There were many factors that contributed to my deciding to join Nordex. The high level of commitment on the part of staff and management, the good positioning in major growth markets and in the MW class, as well as the attractive market setting, all point to the good inherent value of the company. Our international core markets will be booming in the coming years.

How do you rate the progress of restructuring?

What has been achieved so far is a respectable result. Just one year after the start of the implementation phase we have put approx. 80% of the planned measures into practice. This means in effect that some 1,200 improvements have been made. But more important than this figure is the effect on earnings of restructuring, which has already reached a measurable level. In the 3rd quarter of 2003/04 we were able to radically cut back our operating loss compared to the previous year. This positive development can be seen above all in the reduction of the cost-of-materials ratio from 90% to 79% and in the marked improvement in other operating costs. This puts us in a better position than originally planned and means that we have been able to significantly improve our earning position in contrast to the trend in the sector. The completion of restructuring at the end of the year will lay the foundation stone for continued improvement in earnings performance.

Where will the focus of future measures lie?

Of course, we have to manage the remainder of the program on schedule. This means that the remaining 20% has to be implemented by the end of December. Here the focuses will be on the further reduction of cost of materials and the implementation of technical measures. In addition to this, it is important that we stick to the newly defined business processes in order to ensure that these measures are effective in the long term. The prerequisites for this have been created in the form of the wide-ranging training activities which have been held over the past few months. Every member of staff is therefore called upon to “live” the new processes in his day-to-day work. After all, our aim is to return to profit territory next year.
Guarantor of Quality”

What targets have you set for Nordex?

Apart from the implementation of all restructuring measures by the end of 2004, the focus of attention will be on increasing our efficiency. This includes the strengthening of project organization in the company, greater integration of suppliers in the value-added process – for example in the form of the new rolling-demand process – the further development of our service concept and the further improvement of our products. We have made good progress precisely in the optimization of our turbines. This is reflected in the positive trend in the availability of our N80 after the introduction of the so-called “October package”. Here, numerous detail solutions were included in the products to increase the availability of our multi-megawatt turbines. But there is still much to be done. For Nordex it is crucial that we constantly develop our mainstays, the N80 and N90, and further improve them as efficient and reliable machines in the upper power class. We intend to enhance Nordex as a guarantor of quality. This will create the conditions for continuing to be one of the leaders in this high-performance class.

Your motto?

The Nordex credo: “We’ve got the power”: We have shown that we are able to successfully implement an extensive program of improvements in products, services and processes and in doing so have once again proved our efficiency.

Did you know that …

… more than 30% of the Nordex Group’s new business this year has been received from Portuguese customers? Experts expect installed capacity to double to 600 MW in Portugal in 2004, rising to as much as 3,750 MW by 2010.

… in China all signs regarding wind energy are pointing to growth? The government is aiming to increase installed capacity five-fold to 3,000 MW by 2010. Invitations have been called for public tenders for large-scale projects comprising roughly 2,000 MW for construction over the next few years.

… Nordex has already received two orders triggered by the climate protection policy set out by the United Nations in the Kyoto Protocol? Trade in CO2 certificates will commence in 2005 within the European Union. This may give rise to an additional source of income for emerging markets in Eastern Europe and Asia as savings achieved abroad can also be included in trading.
Quality offensive for wind turbines

**Nordex conducts Risk Analysis on Turbine Development**

Nordex has subjected its N80 turbines to a thorough check and in doing so laid the foundation stone for a quality offensive for its multi-mega-watt turbines. All components, modules, processes and the overall design of Nordex N80 turbines were subjected to a general check on the basis of a Failure Mode and Effects Analysis (FMEA). The FMEA method, which was introduced in the aviation and aerospace industry in the sixties and has been successfully used in the automobile industry for several years, subjects product development to a risk analysis. The aim at Nordex was to make a general check of the safety of turbines and to optimize the availability and quality of the components in a systematic process.

For the performance of the Failure Mode and Effects Analysis it was important from the outset for Nordex to include aspects and problems in connection with the insurance industry. With this in mind, Nordex was able to acquire the Allianz Technologiezentrum (Munich) as a partner for performing the FMEA. Headed by AZT, a tightly organized team comprising Nordex staff responsible for certification, operational management, service and product management analyzed the N80 machines with regard to potential failures in damage scenarios, risks and need for improvement. Subsequently, the team defined the measures required for improvement. Today, all these measures have already been included in the development and optimization of Nordex turbines.

The principle of the FMEA analysis

Before conducting the FMEA, Nordex first broke the “wind turbine” system into seven basic function groups on the basis of a structural analysis: structure, azimuth system, control, electricity supply, sensor system, pitch system and drive train. In the next step the function groups were divided into 45 individual subsystems. For example, the pitch system was broken down into the components rotor blade, blade bolts, blade bearing, yaw ring, pitch gear, etc. These subgroups were subsequently divided again into 10 subsystems and subjected to a structured failure analysis.

The actual FMEA was performed in two steps per subgroup. First possible failures were drawn up on the basis of damage scenarios for the subsystems and their effects and causes recorded and classified with regard to risk. The second step comprised the definition of measures to remedy the failures.

The example of the “slip ring” can be used to illustrate the procedure. Nordex made a detailed documentation of the function and requirements of the subsystems of the slip ring – “rotary transmission leadthrough”, “sliding contacts”, “cables” and “flange”. One possible failure might, for example, be a short circuit, with the consequence that no signal or power is transmitted. The team drew up several conceivable possibilities as causes for the failure: “moisture”, “mechanical failure of the slip ring finger”, “structural failures or material and production failures”. Nordex subsequently assessed the risk of these potential failures under three aspects:

- the probability of the failure occurring
- the importance of the failure for the customer and the turbine
- the possibility of discovering the failure

Here, each potential cause of the failure was individually evaluated on a scale on the basis of these three aspects. At Nordex we decided on a scale of 1–10: 1 (low), 10 (high). Subsequently, these values of the three groups were multiplied by each other. The result produced the risk potential number (RPN) for this concrete failure. The higher the risk assessed under one of the aspects, the higher was the subsequent RPN. Nordex immediately initiated remedy measures for all possible causes of failures with a RPN value of greater than 100 as well as for all failures the
importance of which for the customer was classified with a risk of 9 or 10. Possible causes of fire, for example, were always evaluated with a high RPN of 9–10. The example of the slip ring produced the failure cause of “moisture”, with an RPN of 144: the incidence of the cause was assessed as low (4), the importance as high (9), but its discovery as low (4). Multiplying 4 x 9 x 9 resulted in an RPN of 144. This figure was compared with the damage experience of the “Allianz Zentrum für Technologie” and checked for plausibility. Subsequently, a decision was taken as to which measures can be put in place to prevent this failure cause from occurring again. In the case of “water penetration” the team decided on the following solutions: increasing IP protection, making it possible to improve ventilation of the hub or retrofitting a machine with a spinner to channel the condensation water to flow out in a regulated way, thus avoiding water penetration.

According to the FMEA method, it is possible to make settings to remedy potential failures with regard to the implementation of measures only on the “probability of occurrence” and “discovery of causes”. For example, components can be designed differently or new suppliers selected in order to minimize the likelihood of the failure occurring. The likelihood of the failure being discovered, in turn, can be increased by specific service and maintenance checks. However, the “importance” of the potential failure for the turbine and the customer cannot be changed – but it can be corrected by taking the right measures.

As the example of the slip ring shows, Nordex has subjected every component of the N80 turbine to an FMEA analysis and developed a plan of action. For instance, Nordex has deduced numerous steps for the avoidance and reduction of failure sources from the FMEA method, especially for service, bought-in parts, technology and development of the machines. This makes it possible, as of now, for Nordex Service to look for certain sources of failures using scheduled visual checks during maintenance work, extend maintenance reports, make random checks in the form of advance and post-maintenance, optimize work processes and train service staff with specific tasks in mind. In the case of bought-in parts, in future the consequence will be supplier audits and stricter control of incoming goods. Likewise, a well-planned measure comprises numerous changes in the design as well as the installation of a Condition Monitoring System, which Nordex has been offering since 2003. And, last but not least, new stress measurements, calculations and specifications for the machines have been put in place.

Quality offensive: All components, modules, processes and the overall design of Nordex N80 turbines were subjected to a general check
Safety from the very beginning:

Sensitive Measuring Technology prevents Fires in Nordex Wind Turbines

Dependable yields thanks to reliable operation and a high degree of availability, top quality and pioneering technology are what customers quite rightly expect of a wind turbine. At especially sensitive locations, such as in the grounds of the Nerefo oil refinery in Rotterdam, aspects relating to the safety technology of wind turbines are also at the forefront of considerations. These include primarily preventive measures aimed at avoiding the outbreak of fires at great heights. In addition to lightning conductors in the blades and on the housing, automatic fire alarm and extinguishing systems play an increasingly important role in preventive fire protection. Nordex AG has taken up this challenge with a fire-protection concept for its machines.

Statistically, a fire in the housing of a wind turbine is extremely unlikely under normal operating conditions. Lightning conductors and the Faraday feature of the nacelle housing prevent a lightning flash from entering the interior of the machine. In addition to this, regular inspection and maintenance of sensitive components and round-the-clock accessibility of all Nordex systems by the 24-hour remote monitoring and remote service system reduce the risk of a fire starting in the interior of a turbine.

In spite of this, Nordex has developed a fire-protection concept for its turbines for special applications. For the Nerefo wind park, for example, that has been built in the grounds of the oil refinery in Rotterdam. In addition to the standard three fire extinguishers supplied for acute manual fire-fighting, Nordex also equips its powerful machines, such as the Nordex N80 and the Nordex N90 with an additional automatic fire alarm system and an extinguishing system when required. For Rotterdam therefore, a system is being used which was designed for extinguishing burning objects in enclosed, smaller spaces and which in the past was used in particular in the engine rooms of ships.

The actual fire-extinguishing system consists principally of an extinguishing-agent unit, an automatic activation button with electrical activation, plus nozzles and control valves. Any fire breaking out is fought
using a mixture of foam and water. In addition to this, the system can also draw on a carbon dioxide (CO₂) solution to combat fires. Here, the extinguishing effect is based on the suffocation principle, or the suppression of oxygen. Both systems work completely independently of each other.

The extinguishing system, whether it is carbon dioxide or a foam/water mixture, is automatically activated using a pneumatic system. As soon as the temperature in the nacelle rises above 79 °C, the rubber device breaks and the extinguishing process is set in motion. Above the collection vat for gearbox oil, the rotor brake and the wind-tracking system the limit is 123 °C. The fire-extinguishing system can also be activated manually by pressing a button at the foot of the turbine tower.

Nordex has chosen the CO₂-based extinguishing system for those switch cabinets located in the nacelle instead of at the base of the machine. The carbon dioxide capsule is attached outside of the cabinet inside the nacelle – but there is no danger to human life due to the small quantity of gas used. Hoses transport the gas on to two nozzles inside the switch cabinet and ensure that the gas, which removes oxygen from the atmosphere, is evenly distributed in the one cubic meter of space.

The foam/water mixture is used in the remainder of the nacelle. The extinguishing agent, water with an extinguishable anti-freeze agent and the foaming agent Extensid AFFF, is accommodated in separate containers inside the nacelle. The extinguishing agent is not mixed with the extinguishing water until the system is started up. This prevents demixing or chemical dissolution of the extinguishing agent. When the extinguishing system is activated a non-resistant aqueous film and a thick coating of foam are spread over the source of the fire by means of nozzles. The resulting cooling effect is crucial for successful extinguishing, especially for the generator and the hot gearbox oil. A total of 200 liters of water is available in the tank in the nacelle and 10 liters of water in the tank in the hood.

However, it may not be necessary to extinguish a fire. Three pneumatic sensors notify the service team of the heat level inside the nacelle via the remote monitoring of the Nordex Control 2 control system as soon as the temperature reaches just 68 °C. The turbine is automatically stopped. The advantage: in contrast to conventional smoke detectors, incorrect information resulting from dust being raised during braking, which might be interpreted as smoke, is ruled out. In order to be able to clearly process and display the large number of signals and information supplied by the sensors, control and regulating devices in the unit, the Nordex Control 2 visualization system makes a key contribution. For example, if a pneumatic sensor transmits an alarm signal, it is recorded by Nordex Control 2 and immediately transmitted to the remote monitoring service team. After a short analysis of all the turbine’s data, the team decides whether a fault can be repaired on site. If there really is a fire, the service personnel can extinguish it manually on site or activate the automatic extinguishing system before the heat limit is reached. However, a fire in the switch cabinet area of the nacelle is always automatically extinguished using carbon dioxide and the turbine shut down. In this case the report on the use of the extinguishing system is also transmitted direct to the Nordex remote monitoring team.

The fire alarm and extinguishing system built into Nordex turbines is not affected by external jolts, vibration and shocks. This prevents the system from being accidentally activated. Likewise, the correct functioning of the extinguishing system is also ensured in the case of extreme oil soiling and dust. And one further advantage: no electricity is used during standby. There is also the possibility of locating a CO₂-extinguishing unit in the hub.
Reducing downtimes

**Nordex Wind Turbines with reliability-oriented Maintenance in the Future**

**Structured error diagnosis, life cycle files and end-to-end information system for reducing down times**

Nordex has implemented reliability-oriented maintenance for all wind turbines which it has already constructed in Europe or will do so in the future. On this basis, it guarantees wind farm availability of 97%. Nordex customers are able to obtain this service in the premium and extended service packages with a term of up to 12 years thanks to the close ties between ongoing training of Nordex’s own staff, an end-to-end information system as well as a full-maintenance concept with condition-oriented maintenance.

One key element of the reliability-oriented maintenance system is the Service Management System, which Nordex will use in the future to document all error reports received from its turbines and product fleet in a database together with details of the procedures taken to remedy the fault. At the same time, life cycle files will be created for each individual turbine and product group comprising service activities, maintenance reports, down times, remedial times, disruptions, expert opinions as well as logs detailing new components. In this way, it is possible to track each turbine’s history and document the service activities taken in a manner which is transparent and understandable for the customer.

In addition to the straight recording of error messages, a data and knowledge management system with agent technology forms the core of active error avoidance. The intelligent evaluation routines incorporated in the IT system calculate logical links between the strain on components on the basis of the turbine status reports – e.g. wind speed, turbine speed or temperature. They then generate alerts sent by e-mail to the customer manager as soon as the turbines appear to be deviating from the required performance curves. This ensures swift and active intervention before below-average turbine response emerges.

In a further step, the weekly evaluation of frequently diagnosed disruptions within a turbine family make it possible to organize maintenance work on an active, systematic and product-group-oriented basis rather than merely in terms of time. To this end, possible causes of errors are remedied in good time before they affect all turbines of this type. Together with the Condition Monitoring System (CMS), which is used for actively monitoring the drive train, this approach avoids unwanted downtimes. The reason for this is that even modules and small electronic parts not monitored by CMS can be replaced prior to the disruption occurring during early or routine inspection work. All the results of the error analysis as well as the on-site service activities are incorporated in product engineering for the turbine family concerned. As well as this, regular training at the Nordex Service Academy makes sure that employees are able to exchange and regularly widen the knowledge gained from evaluating and remedying malfunctioning.

With its reliability-oriented maintenance, Nordex is going one step further than with conventional condition-oriented maintenance. Thanks to the active observation of turbines and the entire product fleet, it is able to ensure the availability of the equipment throughout the entire term of the contract.
More and more customers are ordering our large turbines. Some 70 per cent of new orders received in the course of this financial year have been for the Nordex N80/N90 series”, says a delighted Carsten Pedersen, Nordex Sales Director. The most recent example of this is an order from e.disnatur, a subsidiary of the utility E.DIS AG. Nordex will be installing a turnkey N80 wind farm for e.disnatur, with a capacity of 15 MW. Construction work is due to start in Schortewitz (Saxony-Anhalt) near Halle in August 2004. To begin with, Nordex will be setting up the necessary infrastructure, such as roads, foundations, the transformer and approx. 18 kilometres of cable. Start-up of the six large turbines, each with a capacity of 2,500 kW, is scheduled for December 2004.

All this was preceded by many years of planning. Some six years ago, the Nordex subsidiary NPV commenced work on developing the wind farm project. Says Pedersen: “This long planning phase is the result of the fact that about two years ago we changed our building application from smaller machines to the N80 in order to obtain the optimal energy yield from the area.” Measurements showed that the average wind speed at a tower height of 80 metres was 6.6 m/s. On this basis Nordex projects an annual energy yield of 24,000 megawatt hours for the wind farm. This is the equivalent of the electricity consumed by 6,000 4-person households and saves some 24,000 tonnes of CO₂ emissions per year.

Says Pedersen: “What makes this order particularly gratifying for me is the fact that we were able to sell the “Schortewitz” wind farm to a customer who already has experience with this series. This underlines the quality of our work and the performance of the machine”. At the beginning of 2004, e.disnatur took over the “Losten” N90 wind farm. The business partners are currently engaged in negotiations on further projects.

After the took over of five N90 e.disnatur has ordered further six N80.
The Dutch research institute ECN (Energy Research Centre of the Netherlands) is satisfied with the performance of its five N80/2500 kW wind turbines on their test site at the Wieringermeer. “Up to now the N80 turbines on our site show a good performance, and meet our expectations”, so Wim Stam, Managing Director of the test site organisation in a first interim result.

In spring 2004 Nordex installed the five multi-megawatt turbines, which have been handed over to the customer after 1,500 hours of operation. ECN uses the turbines for intensive testing in order to support research and development programs. In these programs items as wake effects, control strategies and energy yield optimization are being addressed. “The Nordex monitoring system works well and gives us useful information about the status and performance of the turbines. We have to analyse the accuracy of availability data and energy production. In general terms wind turbine manufacturers have the tendency to overestimate both types of data somewhat. Based on our results to date Nordex could be an exception”, says Stam.

Nordex also benefits from the results of these tests. All improvements and suggestions based on the research at ECN will be directly incorporated into the development of the N80/N90 product family. This interest in the R&D measurements and Nordex’ willingness to allow them under full guarantee were important reasons for ECN, to choose Nordex last year as its supplier from amongst six manufacturers.

In the meantime more than 100 turbines of the N80/N90 are installed worldwide.
A further nine N80s in operation in the Netherlands:

**Industrial Port of “Europoort” with 22.5 MW Wind Farm**

At the beginning of 2004, Siemens Nederland N.V. placed an order with Nordex to install the “Hartel III” wind farm with nine large Nordex N80/2500 kW turbines for the power utility Eneco Milieu B.V. Nordex installed the large machines in the summer having previously dismantled ten smaller turbines with a capacity of 500 kW each.

1. A final check of the anchor bolts. They are the connecting link between the foundation and the tower.

2. The steel tower segments are installed on top of each other and subsequently bolted together.

3. The nacelle and the hub – altogether 97 tons in weight.

4. ... are placed on the tower at a height of 80 meters.

5. A rotor blade with a length of 40 meters and a weight of 9.2 tons is mounted on the hub with millimeter precision.

6. Two of nine N80s. Hartel III supplies electricity for 8,000 households.
Renewables in Estonia

First major Order from the Baltic Region

Nordex has succeeded in penetrating the Estonian market with an order worth some EUR 20 million. The Estonian project development company Pakri Tuulepark, a 100% subsidiary of the Norwegian energy utility Vardar, has ordered eight large turbines of the type N90/2,300 kW from Nordex for the “Pakri” wind farm. This project was originally initiated by the Danish developer Global Green Energy. Nordex is to connect the turbines to the grid in Estonia on a turnkey basis by the end of December 2004. In addition to this, the wind farm is to be equipped with a mobile “power crane”. With the aid of this crane system all the main components of the machine can be replaced should this become necessary for service purposes.

The wind farm is located on the Paldiski Peninsula on the Gulf of Finland. The projected annual yield of the wind farm after precautionary discounts is expected to be 56,000 MWh. This corresponds to around one per cent of national electricity consumption. This yield projection is based on intensive wind measurements, which after 42 months showed an average wind speed of 8.0 m/s at a hub height of 80 metres.

The Pakri wind farm is implemented as a joint implementation project under the Kyoto Protocol which foresees the sale of 500,000 tonnes of reduced greenhouse gas emissions to the Finnish Republic. Wind farm operator Vardar will be receiving EUR 2.9 million from Finland for this avoidance. It is among the very first wind power projects of its kind in the world where the income from the sales of carbon credits guarantees the economic feasibility of the project. Overall, the project will result in the avoidance of emissions totaling 1,300,000 tonnes of CO2. Furthermore, the project is supported by the 5th Framework Programme of the European Commission, which promotes, among other projects, the deployment of large scale wind turbines in areas with poor infrastructure.

“With this reference project we will be creating a good starting base for further Nordex projects in the region. By 2010, the Estonian government plans to cover 5.1 per cent of electricity consumption using renewable sources”, explains Carsten Pedersen, Sales Director of Nordex AG.
In March 1998, 55 nations under the aegis of the United Nations jointly resolved to reduce the output of greenhouse gases in an attempt to protect the global climate. Within the so-called obligation period between 2008 and 2012, emissions of carbon dioxide in particular are to be cut to at least 5 percent below 1990 levels. Preliminary progress in this direction will be evident as early as in 2005. At the same time, emissions are to be reduced at minimum expense. If, for example, a country is able to achieve its reduction targets outside its own borders, this also counts towards the targets. At the same time, countries exceeding their targets, can sell this excess volume of emissions in the form of CO2 certificates to other parties. The idea underlying this is the realization that climate protection transcends national borders. For this purpose, the CO2 reduction measures must be certified by an officially acknowledged body.

This vision has partially already been implemented as CO2 trading has now begun. One reason for this is the environmental policies being pursued by the European Union, which is also one of the signatories of the Kyoto Protocol. In fact, Europe has set itself even more ambitious targets than the international community of states. The EU of 15 wants to cut its emissions by a total of 8 percent by 2012, while Germany is seeking a reduction of as much as 21 percent. In order to achieve this goal, official CO2 trading will be commencing in Europe on January 1, 2005. The main target will be conventional power stations, which in Germany alone account for 66 percent of total CO2 emissions.

Also outside Western Europe emissions trading is starting. Thus, in April 2000 the World Bank in conjunction with 17 companies and six governments established the “Prototype Carbon Fund” to finance climate protection projects in developing countries. An example of how this works in practice is a project which Nordex AG has implemented in Colombia. The German wind turbine manufacturer installed a wind farm comprising 15 megawatt turbines for regional utility Empresas Publicas de Medellin (EPM). In the wake of the liberalization of the electricity market, electricity prices in Colombia were so low that it would not have been possible to finance the wind farm solely from the operator’s regular income. It was only CO2 trading with the World Bank that made the project commercially viable. A baseline study determined that the wind farm would avoid roughly 1,168,000 tons of CO2 emissions over its useful life of 21 years compared with a conventional power station. As a result, EPM was able to sell the reduction of 800,000 tons of CO2 to the World Bank’s Prototype Carbon Fund for a sum of USD 3.24 million.

Germany is also preparing for emission trading, with the KfW Banking Group to set up a climate protection fund, which will be acquiring emission certificates in trust and then selling them in quotas to companies in Germany and other EU nations. The idea is to create a portfolio which will give the participating companies an inexpensive means of making smaller contributions to climate protection. All in all, KfW is seeking a total fund volume of EUR 50 million.

Many potential wind farm operators are not familiar with the possibilities and offerings under existing rules or are not aware of the procedures to be adopted, thus shying away from the approval-granting process. However, in doing so they are ignoring business potential which can also be harnessed in the interests of climate protection. For this reason, Nordex is working with experienced partners such as TÜV Süd, the first German certification body for climate protection projects, and organizing contacts with the corresponding networks. Thus, CO2 trading is becoming an increasingly important instrument for Nordex as a means of assisting customers in securing the necessary finance for wind farms.
With an installed capacity of more than 380 GW and 1,900 TWh generated electricity in 2003, China is the second-largest electricity producer in the world after the USA. Increasing industrialization, the spread of electricity to rural areas, growing urbanization and a rising standard of living mean that electricity consumption by the 1.3 billion inhabitants of China is growing at a rapid pace. Since 2000 electricity consumption has been increasing by 8 to 15 per cent annually and further average growth of more than 5 per cent per annum is expected until 2020. If the economic upswing continues, energy requirements will increase by more than 200 per cent over the coming years.

In spite of the massive amount of electricity generated, today China already suffers from periodic energy shortages. In the first quarter of 2004, 26 of the 31 provinces, regions and independent cities suffered power cuts. The reason: in China everything depends on coal as a source of energy. The power plants cannot get enough coal to satisfy the hunger for energy of a nation of billions undergoing an economic miracle. Some 75 per cent of energy in China is obtained from coal, while hydroelectricity accounts for 15 per cent and oil as a supplement in thermal power plants represents some 7 per cent. Furthermore, eight nuclear power plants with a total output of 8000 MW have been built in the past 20 years – accounting for 2 per cent of annual production. The use of renewable energy sources, such as solar power, geothermal heat and wind energy, has also started, albeit still on a small scale. The installed capacity of wind turbines, for example, stood at some 570 MW in 2003.

Because the coal-fired power plants work with an average efficiency level of just 30 per cent, more than 500 million tons of coal are burnt every year. The consequence: after the USA, China is today already the second-largest producer of the environmentally harmful substance carbon dioxide. In 2002, energy-related CO₂ emissions in China alone amounted to some 3.4 billion tons. This corresponds to approx. 13 per cent of global CO₂ emissions. Today, many Chinese cities are already covered by a thick layer of smog and many of the population suffer from respiratory diseases. In the big cities around 50,000 people die prematurely from the consequences of air pollution - and these figures are increasing.

In order to keep up with the demand for electricity, Beijing plans to extend power plant capacity to more than 500 GW by 2010: this is to be done by modernizing old and inefficient plants and building new nuclear power plants, for example. However, the country wishes to meet an increasing share of the demand for energy in the form of renewables.

The onshore wind resources of this huge country offer immense potential for use on a large technical scale. Experts talk of a figure of 250 GW capacity. This corresponds to about six times today’s global installed capacity. The Chinese wind power association estimates that potential capacity is as much as twice as high since the potential of 250 GW is based on wind resources at an altitude of 10 metres whereas modern wind turbines are erected on towers of at least 50 metres. The best regions for wind are in the steppe and desert areas in the West and North of the country, as well as in the coastal regions.

In the mid-nineties Beijing decided to use wind power as an additional source of energy. The aim of the first step in the Cheng-Fengi (“Ride the Wind”) program was to install around 1,000 MW by the end of 2000. Parallel to this, the People’s Republic opened up the electricity sector for foreign capital. Since then it has been permitted to make direct investments of foreign capital in power generation. This has also encouraged Nordex to become involved in China. As early as 1998, for instance, Nordex set up a joint venture in Xi’an. Together with the mechanical engineering company Xi’an Aero Engine Co., since this time Nordex has been producing 600 kW wind turbines for the Chinese market. However, the hope-for progress of the “Ride-the-Wind” program failed to fulfil the expectations of the whole sector. Ultimately it was the lack of transparency of approval procedures, slow decision-making processes and an unclear price policy that led to the slow and annually fluctuating pace of development. Nor have they yet got any closer to the new targets set for the subsequent, now ongoing five-year plan (2001–2005), which provides for installation of 1,200 MW by 2005. A mere 570 MW of wind energy capacity had been installed by the end of 2003. 240 MW of new installations are expected for the current year. According to the 11th five-year plan, a total of 3,000 MW of capacity are due to be connected to the grid in 2010.
In the past, most of the wind projects were financed by foreign governments as well as by organizations such as the World Bank or the Kreditanstalt für Wiederaufbau (Reconstruction Loan Corporation) (KfW). In terms of installed capacity the provinces of Liaoning on the Eastern coast, with more than 110 MW, and Xi’an in the North West, with more than 90 MW, lead the field. A further 160 MW are installed in Inner Mongolia and on the South coast. Hitherto smaller stall-controlled turbines with a capacity of up to 600 kW were used here. As of recently, more and more projects involving machines with a capacity larger than 1,000 kW have also been erected.

With production costs for electricity generated from coal standing at less than 3.5 eurocent/kWh, the commercial use of wind energy has hitherto not been competitive without government support. Although work is in progress on a German bill comparable to the Renewable Energies Act, this is unlikely to be completed before 2006. Until then, remuneration for wind-generated energy will be individually negotiated between the suppliers, power utilities and the price adjustment board.

The erection of the first commercial wind farm marks a turning point and heralds the beginning of a new era in the use of wind energy. In the province of Shandong Nordex has erected the Qingdao wind farm for its Chinese partner Qingdao Dongyi Industrial Corporation, a business development company for the Laoshan zone. At the same time it is the first wind farm consisting almost exclusively of megawatt turbines. 12 x 1.3 MW turbines are in operation here. In this connection, the Qingdao Dongyi Industrial Corporation has concluded a purchase agreement with a lifetime of ten years with the Shandong Electric Power Company. The commercial financing makes this project a model to follow in China. DEG (Deutsche Investitions- und Entwicklungsgesellschaft mbH) is participating in the financing with a loan of EUR 10 mn. This company, a member of the KfW Group, grants loans for investments to private companies in developing and reforming countries in order to promote the extension of private-sector structures. Several large wind farms with capacities of around 100 MW each are planned for the coming years in Rudong, Huilai and Tongyu, as well as in Hui-tengxile. However, due to the low purchase prices these projects are only profitable with megawatt turbines, which make electricity production prices lower than is the case with smaller machines. The only obstacle left is the local infrastructure, where there is a shortage of crane capacities, for example. But the size of these projects increasingly solves this problem, because with 100 MW farms the creation of a project-related infrastructure, i.e. the acquisition of an efficient crane from Europe, is economically viable. The same applies for the obligation to ensure a local added value of currently 70 per cent. With large projects this is not only commercially realistic, it is also logical in order to avoid high transport costs and take advantage of the often more favourable purchase prices locally. Nevertheless, many years of experience in the country are an advantage as the quality and reliability of possible local partners varies greatly and thus constitutes a high risk for foreign investors. This is why Nordex initially made an intensive quality check before selecting its partner for extending the added value for MW turbines. And, finally, erection of the turbines is not the end of the story. Many projects in emerging markets have failed because they were not properly maintained afterwards. For this reason Nordex has equipped the wind farms it has installed to date with their own service stations and given the staff intensive training in Germany. Concentrating efforts on the North East and the Eastern South coast when developing the service network also proved advantageous.

Turning point:
Qingdao is China’s first commercial wind farm.
Head of Nordex Supervisory Board Dr. Eberhard Freiherr von Perfall accompanied Foreign German Minister Fischer on a trip to Asia

"In Asia a superlative market for wind energy may come into being in the medium to long term if the right overall conditions are created today", said Eberhard von Perfall, head of the Supervisory Board of turbine manufacturer Nordex AG. Von Perfall was a member of the German trade delegation that accompanied Foreign Minister Joschka Fischer on his journey to Asia (13.–23. July 2004). In addition to upholding political contacts, the Ministry of Foreign Affairs also planned to support partnerships in the field of energy and the environment on this 10-day tour.

For Nordex, the countries China and India have priority. The company has been active in these two countries for years and wishes to further intensify its work there in the future. Says von Perfall: “In view of the regressing business climate for wind energy in Germany we have to further increase our exports, which currently account for 60 per cent of overall business. The focus here is on Western Europe and Asia. We also have a good starting base for this in China in the form of our joint venture with the Chinese company Xi’an Aero Engine since 1998. As our next step we are planning to intensify our local added value for larger machines. In India we are looking to give new impetus to business in the form of revitalizing our license partnerships with local suppliers”.

The members of the economic delegation to Asia. Dr. Eberhard Freiherr von Perfall (8th from the right)
Now that the government of South Korea has raised the rates for electricity produced from regenerative sources from 3 to 8 cents, a new market is emerging here as well. The official goal is to install a total of 2,500 MW by 2010. Nordex has placed tenders for around 200 MW and entered into a master contract with industrial group Daewoo so that it is in a position to handle turn-key products locally.

On August 1, 2004 the amended Renewable Energies Act came into effect. This new legislation has created incentive to boost the efficiency of ecologically friendly power stations and thus resulted in a viable compromise for society as a whole. Whereas the remuneration payable for offshore installations in particular will be higher than before, particularly weak locations (less than 60% of the reference yield) will no longer be covered by the Renewable Energies Act.
We are represented with offices and subsidiaries worldwide.