



DESIGNED TO PERFORM

GENERATION GAMMA – THE 2.5 MW EFFICIENCY CLASS



N90/2500
N100/2500
N117/2400

 **NORDEX**
We've got the power.

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NORDEX – A PROFILE

Dependable power plants for a clean environment

Economic prosperity, progress and environmental protection – for Nordex these go hand in hand. Since 1985, we have been developing increasingly effective wind turbines that help meet the growing global demand for energy while reducing the impact on the environment.

As an internationally expanding company, Nordex has a footprint in all the growth markets. Our factories in Germany, China and the United States serve the markets in the core regions of Europe, Asia and the Americas. We deliver tailor-made, all-round solutions to our customers – from planning a wind farm, through turnkey installation, to maintenance and service. The “Nordex Academy” provides high quality training to all our staff, guaranteeing superior expertise as a supplier of sophisticated products and services.

Our core competence is wind turbines in the power range up to 2.5 MW. In the Gamma Generation: Efficiency Class we offer different types of machines for each wind class using a common technical platform. Nordex customers can be sure they’ll have the most effective product for every location.

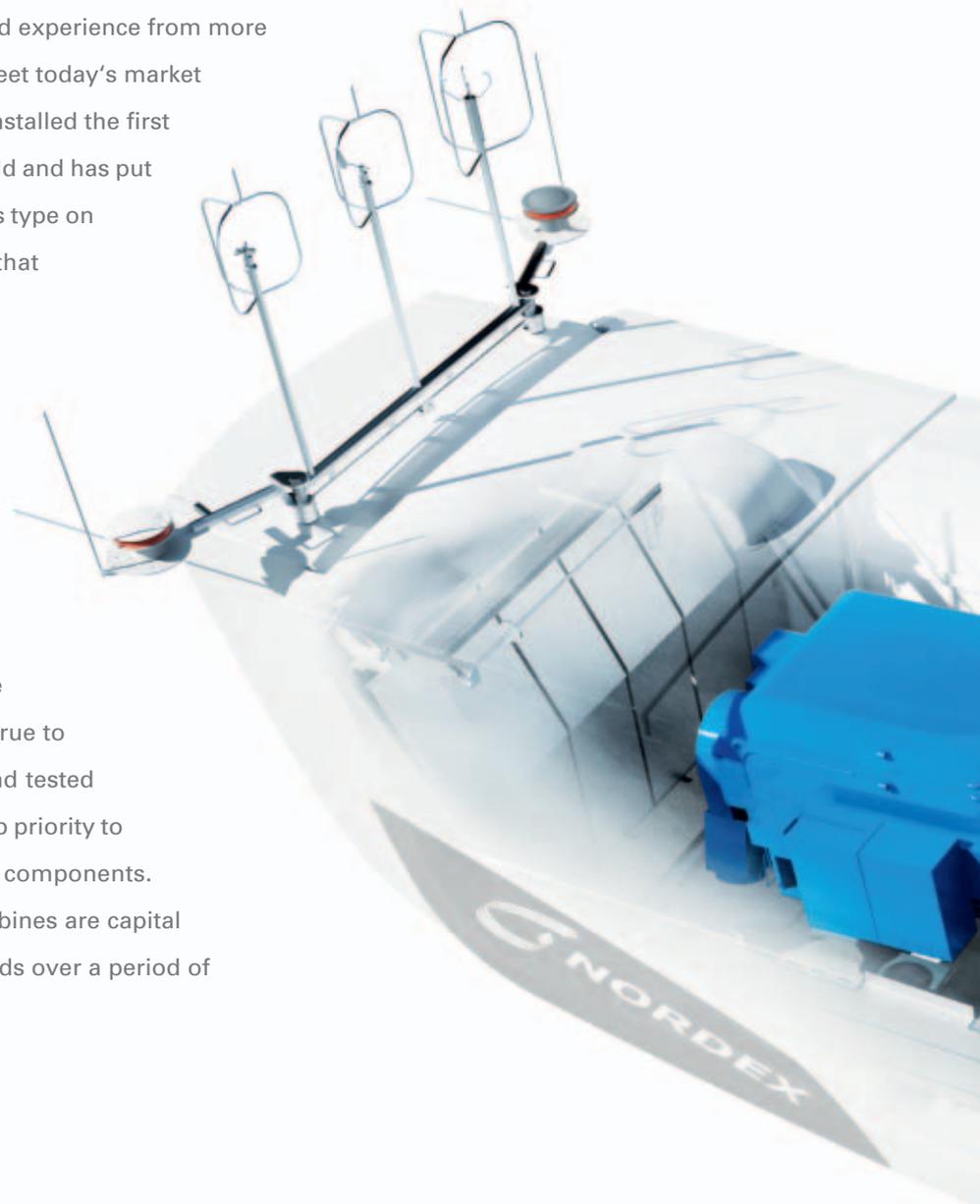


THE EFFICIENCY CLASS

Experience puts us one step ahead

The Efficiency Class combines the latest research and development with know-how and experience from more than a decade of operation to meet today's market requirements. In 2000, Nordex installed the first 2.5 MW series turbine in the world and has put more than 2,000 machines of this type on grid since then. When we say that our turbines offer high quality, mature technology and dependable performance even in extreme locations, we know what we're talking about.

Nordex continues to develop the Efficiency Class. Yet we remain true to proven principles, using tried and tested series engineering and giving top priority to the dependability of all system components. We ensure that Nordex wind turbines are capital goods that generate reliable yields over a period of at least 20 years.



➤ *The Efficiency Class combines proven, reliable technology with enhanced performance.*

The Nordex Efficiency Class

sets the highest standards for

- yield
- grid code compliance
- quality



YIELD

Maximum wind yield at any location

Our commitment to continuous development ensures that Nordex wind turbines offer a high level of technical availability of more than 97 percent, making it even more worthwhile to invest in a turbine of the Efficiency Class.

The perfect machine for every type of wind

With its N90/2500, N100/2500 and N117/2400 turbines the Efficiency Class achieves the maximum yield at every site. Nordex offers the N90/2500 for regions with strong winds and the N100/2500 for areas with moderate wind conditions. The N117/2400 has been specially designed for locations with light winds and with a rotor diameter of 117 metres it is the largest turbine in its power class.

Smart options

Many good wind locations are in regions with extreme temperatures. To capitalise on the potential of these locations, Nordex offers the machines in the Efficiency Class with a hot-climate package or an anti-icing system. Turbines in the hot-climate design have an extended operating range and are available for outside temperatures up to 45 degrees Celsius. The anti-icing system is an innovative Nordex component that heats the rotor blades, freeing them from icing and preventing new ice from forming. These two options make operation of the turbines even more profitable for our customers.

➤ *The Nordex Efficiency Class also includes a 141-metre hybrid tower*

Service – simple, fast and safe

Thanks to the service-friendly design of the turbines, Nordex has reduced maintenance time to the minimum. Service can be carried out under a closed roof regardless of weather conditions. Continuous work surfaces with sufficient space and light support fast and safe servicing. All components are directly accessible and can be easily, safely and inexpensively maintained with the aid of the internal crane. In addition, reliable turbine operation is supported by low-maintenance and maintenance-free components.

Round-the-clock performance checks

To ensure maximum availability, Nordex keeps a constant eye on its customers' wind turbines. In the event of any divergence from normal operation, Nordex Remote Monitoring immediately intervenes. In addition, the optional Condition Monitoring System checks the state of wear-critical components, reducing downtime through a programme of preventive maintenance.

High in the sky for a better yield

Wind conditions differ from region to region and wind quality usually improves in line with altitude. To maximise potential, Nordex offers the machines in the Efficiency Class on modular tubular steel towers or on hybrid towers with heights ranging from 65 to 141 metres.



GRID CODE COMPLIANCE

Active support for every grid

The turbines in the Efficiency Class are characterised by excellent control capabilities for maintaining the voltage and stabilising the frequency of the public grid. They meet all the requirements for the German system service bonus (known as the SDL-Bonus).* Their fault-ride-through capability enables them to bridge effortlessly any dips in voltage. The Nordex wind farm management system allows the grid operator to directly control the rated and reactive power of the wind farm in the grid.

With these features, the turbines are certified for the grids of the most demanding international markets. They can also be adapted to new and complex connection requirements ensuring seamless integration into the local grid.

Always striving to progress

Our aim is to offer the best power quality on the market. Nordex intensively tests grid connection technology, both in the field and on the test bench. This is why our wind turbines have long been recognised for quality and dependability of supply equal to or better than those of conventional power plants.

* The requirements for the SDL bonus are regulated in Germany in the System Service Ordinance (SDLWindV). They are among the strictest grid guidelines in Europe.

➤ *Nordex makes sure that the machines in the Efficiency Class always comply with the latest grid requirements.*



QUALITY

Top-quality engineering – simply routine for us

Thanks to their sophisticated design, the wind turbines in the Efficiency Class are certified quality products. From the earliest development phase Nordex engineers check the stress levels of materials and components using advanced computer-aided calculation routines. These are followed by extensive testing in the Nordex Test Centre and in the field.

Extreme testing of hardware and software

In the Nordex Test Centre our engineers inspect the components and systems of the prototypes under simulated wind and weather conditions. By subjecting them to stress exceeding the usual specifications, such as extreme climate and vibration tests, Nordex ensures that they meet all quality criteria and that a high-quality and technically mature product goes into series production.

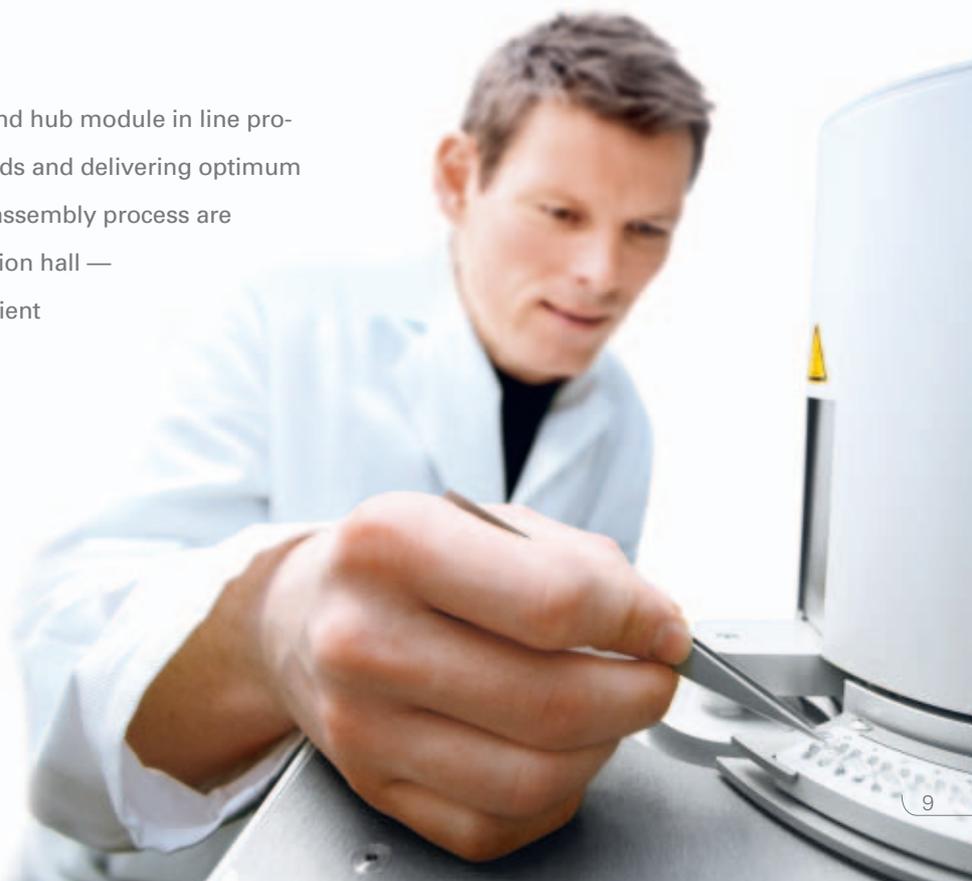
Quality-assured rotor blades

Nordex sets especially high standards when it comes to the materials used for our rotor blades, which can be up to 58 meters in length. Automated production processes, monitored by the latest measuring and testing methods, guarantee that each rotor blade works reliably.

Highest industry standards

Nordex manufactures the nacelle and hub module in line production, setting the highest standards and delivering optimum product quality. Many steps in the assembly process are performed in the protected production hall — a key prerequisite for the most efficient installation of turbines at the wind farm.

➤ *An eye for detail: in the laboratory Nordex checks the materials for the rotor blade.*





SOLUTION FOR STRONG WIND

Dependable yields in rough climates

Wind locations with rough climates require mature, robust technology. The IEC-1-certified N90/2500 has been specifically designed for these conditions. For any strong wind site, it is the first choice for its price/performance ratio.

Nordex has already connected the N90/2500 to the grid hundreds of times in Europe, Asia and North America.

➤ *The N90/2500 is the most frequently installed turbine in the Efficiency Class and has proven itself around the globe.*



FACTS AND FIGURES

N90/2500 IEC I

Operating data

Rated power	2,500 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s

Rotor

Diameter	90 m
Swept area	6,362 m ²
Operating range rotational speed	10.3 - 18.1 rpm
Rated rotational speed	16.1 rpm
Tip speed	75 m/s
Speed control	Variable via microprocessor
Overspeed control	Pitch angle

Gearbox

Construction	Combined spur/planetary gear or differential gearbox
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Generator

Construction	Double-fed asynchronous generator
Cooling system	Liquid/air cooling
Voltage	660 V
Grid frequency	50/60 Hz

Control

Control centre	PLC controlled
Grid connection	Via IGBT converter
Distance control	Remote controlled surveillance system

Brake system

Main brake	Pitch angle
Secondary brake	Disk brake

Lightning protection Fully compliant with EN 62305

Tower

Construction	Tubular steel tower
Rotor hub height/Certification	65 m/IEC 1a 80 m/IEC 1a



SOLUTION FOR MODERATE WIND *Profitable at varied locations*

For projects with moderate wind speeds Nordex offers the N100/2500 turbine. The N100/2500 is one of the machines with the highest yield at IEC 2 locations. For even more efficiency Nordex has raised the cut-out wind speed from 20 to 25 m/s.

Thanks to their robust technology, the N100/2500 is ideal for wind farms in the widely different climatic conditions prevailing around the world.

➤ *The N100/2500 is one of the highest yielding machines at IEC 2 locations.*



FACTS AND FIGURES

N100/2500 IEC II

Operating data

Rated power	2,500 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s

Rotor

Diameter	99.8 m
Swept area	7,823 m ²
Operating range rotational speed	9.6 - 16.8 rpm
Rated rotational speed	14.9 rpm
Tip speed	77 m/s
Speed control	Variable via microprocessor
Overspeed control	Pitch angle

Gearbox

Construction	Combined spur/planetary gear or differential gearbox
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Generator

Construction	Double-fed asynchronous generator
Cooling system	Liquid/air cooling
Voltage	660 V
Grid frequency	50/60 Hz

Control

Control centre	PLC controlled
Grid connection	Via IGBT converter
Distance control	Remote controlled surveillance system

Brake system

Main brake	Pitch angle
Secondary brake	Disk brake

Lightning protection

Fully compliant with EN 62305

Tower

Construction	Tubular steel tower
Rotor hub height/Certification	75 m/IEC 2a 80 m/IEC 2a 100 m/IEC 2a



SOLUTION FOR LIGHT WIND

Maximum economic efficiency

To make IEC 3 locations economically viable, project operators need a turbine that can exploit even low winds to the maximum. With a rotor sweep of 10,715 square metres, the N117/2400 is the IEC 3 turbine with the highest yield in its category. The maximum acoustic power level is 105 decibels, which means that the machine can be installed nearer to residential areas and that a wind farm can be optimally laid out in the available space.

With a capacity factor of 40 percent, the N117/2400 is the most profitable solution for low wind locations.

➤ *The 117-metre diameter rotor makes the N117/2400 the best solution for low wind sites.*



FACTS AND FIGURES

N117/2400 IEC III

Operating data

Rated power	2,400 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	20 m/s

Rotor

Diameter	116,8 m
Swept area	10,715 m ²
Operating range rotational speed	7.5 - 13.2 rpm
Rated rotational speed	11.8 rpm
Tip speed	72 m/s
Speed control	Variable via microprocessor
Overspeed control	Pitch angle

Gearbox

Construction	Combined spur/planetary gear or differential gearbox
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Generator

Construction	Double-fed asynchronous generator
Cooling system	Liquid/air cooling
Voltage	660 V
Grid frequency	50/60 Hz

Control

Control centre	PLC controlled
Grid connection	Via IGBT converter
Distance control	Remote controlled surveillance system

Brake system

Main brake	Pitch angle
Secondary brake	Disk brake

Lightning protection

Fully compliant with EN 62305

Tower

Construction	Tubular steel tower, Hybrid tower (141 m)
Rotor hub height/Certification	91 m/IEC 3a, DIBt2
	120 m/IEC 3a, DIBt2
	141 m/IEC 3a, DIBt2

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