

Gamesa



## GAMESA G114-2.0 MW

### GREATER ENERGY PRODUCED FROM LOW WIND SITES

As part of its ongoing commitment to technological solutions that guarantee maximum profit for its customers, Gamesa has launched the new G114-2.0 MW wind turbine.

With a new 114 meter rotor and 2.0 MW rated power, the Gamesa G114-2.0 MW is the new Class III model for the Gamesa G9X-2.0 MW platform, one of the most successful in the industry, having over 12 GW installed capacity and availability levels well above 98%.

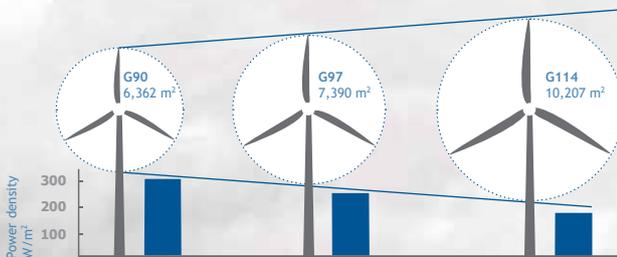
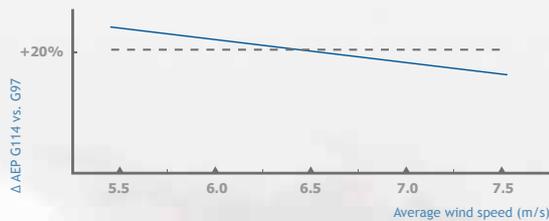
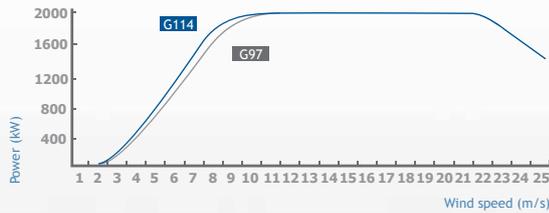
Available for quote in 2012, the low power density featured on this model sets a new industry standard for profitability in low-wind locations.

- ▶ MINIMUM POWER DENSITY
- ▶ IMPROVED CoE
- ▶ MAXIMUM PROFITABILITY

## MORE ENERGY PRODUCTION IN LOW-WIND LOCATIONS

The Gamesa G114-2.0 MW wind turbine inherits many of the technologies developed over 10 years with the Gamesa G9X-2.0 MW platform.

Now, with a new 114 m rotor, the Gamesa G114-2.0 MW has a 38% larger swept area than the Gamesa G97-2.0 MW and produces over 20% more energy annually. The new 55.5 m blade with state-of-the-art airfoil design ensures maximum energy production, reduced noise levels and a significantly lower Cost of Energy for Gamesa's Class III products.



### SPECIFICATIONS

#### General Details

Rated power	2.0 MW
Wind class	IIIA
Rotor diameter	114m
Swept area	10,207m <sup>2</sup>
Power density	195.94 W/m <sup>2</sup>
Control	Independent pitch and variable speed
Gearbox	3 stages
Generator	Doubly fed
Frequency	50 Hz / 60 Hz

#### Blades

Length	55.5 m
Airfoil	Gamesa

#### Towers

Height	93, 120, 140 m and site-specific
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# G126-2.5 MW

## Benchmark in return for low-wind sites

Gamesa maintains its unwavering commitment to continue developing the best technological solutions for its clients while reducing as much as possible the cost of energy of its products. One example is Gamesa's latest technological design unveiled for its 2.0-2.5 MW product line, the new G126-2.5 MW IIIA wind turbine. Intended for low-wind sites, this new model will provide clients with the most competitive class III product on the market in the 2 to 3 MW power capacity segment.

The new G126-2.5 MW IIIA wind turbine, with a new 126-meter rotor linked to a 2.5 MW generator, is a benchmark for return in the main onshore wind power market segment, which is among the most competitive.

The knowledge acquired through the launching of Gamesa's latest products has been a key factor in the evolution of this new model. Product development optimization, new wind turbine testing and validation procedures have been incorporated and time to market has been reduced.

With an extremely low power density, excellent capacity factor and reduced cost of energy, the G126-2.5 MW wind turbine has been met with a remarkable welcome in the sector and is destined to take its place as an industry leader alongside Gamesa's G114-2.0 MW wind turbine, which was awarded Windpower Monthly's gold medal in the "Best Onshore Wind Turbine up to 2.9 MW for 2014" category.

- ▶ PROVEN TECHNOLOGY
- ▶ 20-25% MORE ENERGY PRODUCTION\*
- ▶ EXCELLENT CAPACITY FACTOR AND REDUCED COST OF ENERGY
- ▶ OPTIMIZED FOR LOW-WIND SITES

\* Compared with G114-2.0 MW.



GLOBAL TECHNOLOGY  
EVERLASTING ENERGY

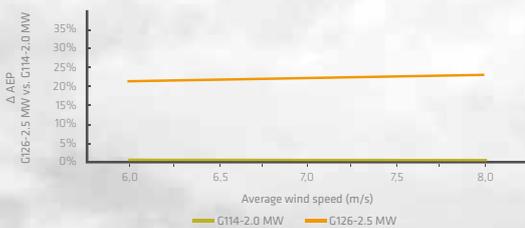
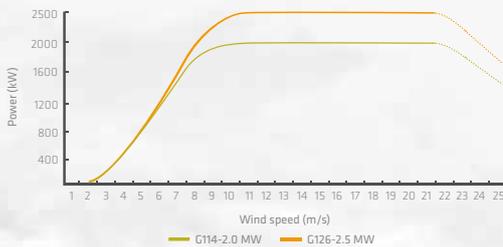
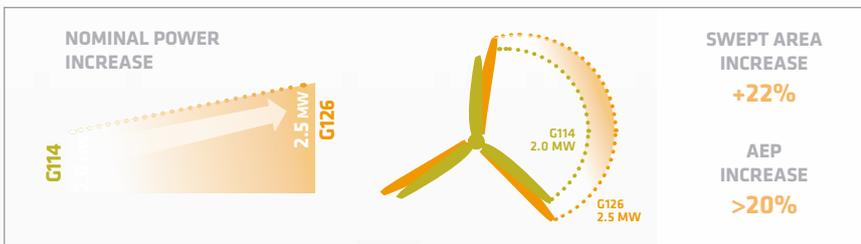


## NEW MODEL G126-2.5 MW IIIA

Gamesa harnessed the experience acquired through the design and installation of more than 18,000 MW from Gamesa's high performance 2.0-2.5 MW platform to develop this new model, capable of generating even more power at low-wind sites while remaining as competitive as existing, smaller-rotor models. The company's most recently developed turbines thus emerge through this approach: G114-2.0 MW IIA/IIIA, G114-2.5 MW IIA, and now G126-2.5 MW IIIA.

Following the evolutionary model of the 2.0-2.5 platform, and minimizing the risk associated with new technologies, the G126-2.5 MW is equipped with a 62 meter blade based on the 56-meter variant already delivering maximum production at lower noise and comprehensively validated for G114 turbines. Based on the same principle, the electrical system incorporated in the G126 is common for all 2.5 MW models across Gamesa's 2.0-2.5 MW platform.

Boasting a 20% increase in power production compared to the G114-2.0 MW model, the G126-2.5 MW wind turbine rounds off Gamesa's offering for Class III sites. With this new addition, this platform reaffirms itself as the market's most versatile, with seven different rotors, tower heights from 55 to 125 meters, and environmental options enabling installation at even the most complex sites.



SPECIFICATIONS			
<b>General Details</b>			
Rated power	2.5 MW	Control	Pitch and variable speed
Wind class	IIIA	Gearbox	3 stages
Rotor diameter	126 m	Generator	Doubly fed
Swept area	12,469 m <sup>2</sup>	Frequency	50Hz / 60 Hz
Power density	200.50 W/m <sup>2</sup>		
<b>Blades</b>			
Length	62 m		
Airfoil	Gamesa		
<b>Towers</b>			
Height	84, 102 m and site specific		

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GE Power & Water  
Renewable Energy

SMARTER AND  
MORE POWERFUL

# GE's 2.75-120



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Since entering the wind industry in 2002, GE Power & Water's Renewable Energy business has invested more than \$2 billion in next generation wind turbines. Whether at the turbine, plant, or grid level, GE continues to focus on providing more value for our customers. Through the use of advanced analytics, GE's Renewable Energy business is redefining the future of wind power, delivering on proven performance, availability and reliability. With the integration of big data and the industrial internet, the company is helping to manage the variability of wind to provide smooth, predictable power. Our current product portfolio includes wind turbines with rated capacities ranging from 1.6 MW to 3.2 MW and support services ranging from development assistance to site planning, operation and maintenance.

For more information visit our website:  
[www.ge.com/wind](http://www.ge.com/wind)

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SOFTWARE COE

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CONTROLS

PITCH

## GE's 2.75-120 ... a Brilliant Machine

How do you define brilliance? GE is redefining the future of wind power by integrating the Industrial Internet with GE's industry leading power conversion technology, enabling "grid friendly" integration of wind farms around the globe. By helping to manage the variability of wind, GE is working to provide smooth, predictable wind power to the world regardless of what Mother Nature throws its way.

- **Increased output** – less downtime through turbine to turbine communication
- **Productivity**– enhanced diagnostics with Mark\*Vle controller from GE
- **Smooth grid integration** – with wind farm to grid communication
- **Improved grid voltage support in the area** – with windfarm to windfarm coordination
- **Technical support around the world** – turbine to remote monitoring communication
- **New revenue streams** – advanced forecasting algorithms and storage ready

## Tailor-Made Service Solutions

A flexible service agreement is offered on GE's 2.75-120. Turbine performance and life can be improved with power output software enhancements, predictive condition monitoring, and unplanned maintenance services. For customers that prefer to manage the O&M of their assets, flexible options are available:

- Service support
- 24/7 Remote control center
- Upgrades packages
- Performance improvements
- Spare part centers
- Lifetime extension

We have 1,000+ service professionals – available to you 24/7.

## GE's 2.75-120 Wind Turbine

GE's 2.5 MW product platform is evolving towards a wider range of site applications by introducing the 2.75-120 wind turbine designed for IEC Wind Class III environments. This new turbine features a 120 meter rotor in combination with the proven single-blade pitch control that offers the latest enhancements in load management controls, low acoustic emissions, efficient electrical power conversion and robust performance.

As part of GE's brilliant wind platform, the 2.75-120 is a powerful turbine that generates 5 % more AEP than its predecessor the 2.5-120. The 2.75-120 is available on a steel or hybrid tower, ranging from 85–139 meters tall, helping to tailor the turbine for unique site conditions and bring wind power to new places across the continent. Short- or long-term energy storage is also available with the 2.75-120, making wind power more predictable, flexible and fast responding through battery software applications.

## Building Upon Proven Performance

With an installed global fleet of more than 25,000 units, GE's proven platform runs at 98%+ availability, making it the world's best producing fleet. Together with GE's tailored customer service options, GE can enhance the value of your assets over their lifetime – generating high yields at low to medium wind speeds – and reduce the cost of electricity for our customers.

With over 1,500 units in operation, GE's 2.5 MW platform is the turbine of choice for two of the world's largest onshore wind farms in operation today:

- 845 MW Shepherds Flat wind farm, USA
- 600 MW Fantanele wind farm, Romania

As one of the world's leading wind turbine suppliers, GE provides evolutionary wind turbine designs and support services extending from development assistance to operation and maintenance for the successful implementation of projects. This creditable track record supports customers with the financeability of their wind projects.

## Technical Description

GE's 2.75-120 is based on a proven platform design of over 1,500 operating 2.5 MW turbines. With the 120 meter rotor, the 2.75-120 wind turbine is designed to meet certification requirements for IEC Wind Class III and German DiBt WZ 2 environments. GE's patented loads control system proactively measures stress during operation. The individually adjustable blade pitch system from GE is used to operate the unit for high-energy generation. The GE partial power converter system efficiently converts the produced energy into the 50/60 Hz power network, maximizing the annual energy production. GE has a global reputation of meeting the strictest grid requirements and delivering reliable energy to the grid.

Focusing on performance, reliability and efficiency, GE's 2.75-120 wind turbine provides high customer value through evolutionary design.

## Features and Benefits

GE's 2.75-120 offers the following technical features:

- 120 meter rotor diameter
- 50/60 Hz
- 85 meter or 110 meter steel towers, up to 139 meter hybrid concrete
- 106 dB(A) standard sound power level
- Sound reduced operations and sound mitigation technology available
- Standard and cold weather extreme package



# MAKING RENEWABLES THE ENERGY OF CHOICE FOR A CLEANER FUTURE

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WindSCADA™

CONNECTED MACHINES

INDUSTRIAL INTERNET

TORQUE

YAW

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GE Renewable Energy

# GE's 3 MW Platform

POWERFUL AND EFFICIENT



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## GE'S 3 MW PLATFORM

Since entering the wind industry in 2002, GE Renewable Energy has invested more than \$2 billion in next-generation wind turbine technology to provide more value to customers—whether at the turbine, plant or grid level. Through the use of advanced analytics, GE Renewable Energy is redefining the future of wind power, delivering with proven performance, availability and reliability. With the integration of big data and the industrial internet, we can help customers manage the variability that comes with this resource for smooth, predictable power. Our onshore product portfolio includes wind turbines with rated capacities from 1.6-3.4 MW and flexible support services that range from basic operations and maintenance to farm- or fleet-level enhancements.

For more information visit our website:

[www.ge.com/wind](http://www.ge.com/wind)

PITCH  
CONTROLS

Predix™

WIND POWER DOMAIN

BIG DATA

MONITORING

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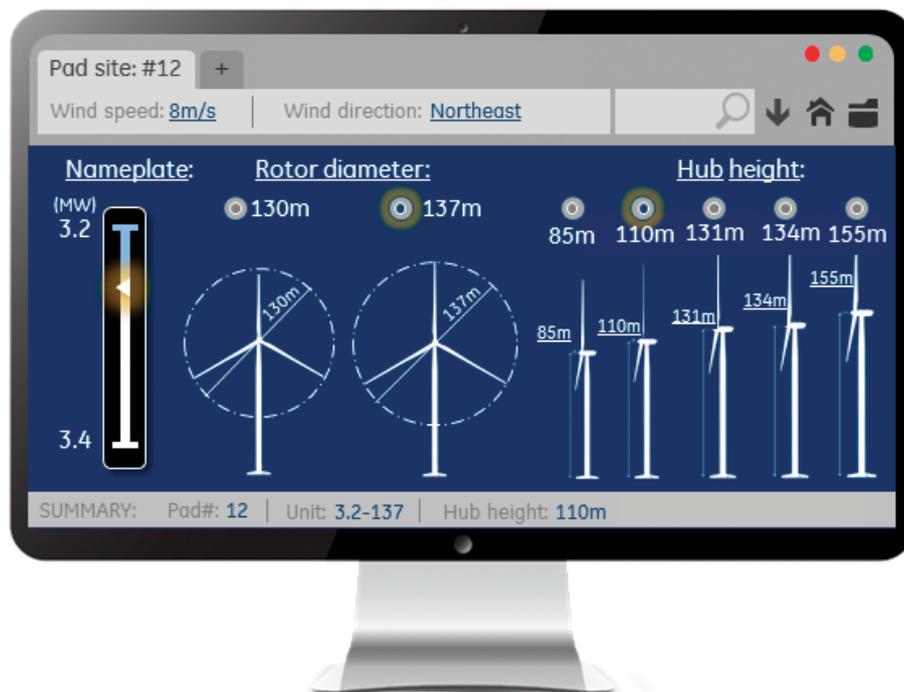
## GE's 3 MW Platform

Extending the capability of the Digital Wind Farm to our 3 MW machines, GE's powerful and efficient 3.2-3.4 platform is adaptable to a full spectrum of wind regimes. The platform includes the 3.4-137, our highest performing turbine for Class III winds, providing up to a 24% higher output compared to the 2.75-120 turbine and improving project economics for our customers.

GE has employed selected legacy components with proven performance for the 3 MW platform, helping to ensure the consistent performance and reliability for which GE wind turbines are known. Turbine models within the 3 MW platform share drivetrain and electrical system architecture, with both systems scaled and upgraded for improved performance and greater energy production, as compared to previous models.

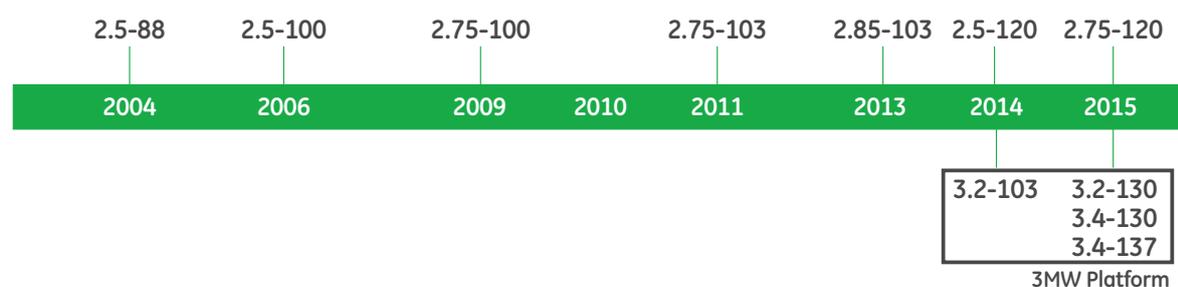
## Parameters of the 3MW Platform

GE's 3MW platform can be customized based on nameplate, rotor diameter and hub height.



## Building Upon Proven Technology

Model introduction  
in Europe



Built from the maturity of its predecessors, the 3 MW platform increases the capacity factor, annual energy production (AEP) and application space. Component enhancements to the 2.5 MW models have resulted in a substantial performance increase, enabling the use of a 130- and 137- meter rotor on the 3 MW series and a nameplate ranging from 3.2–3.4 MW. These enhancements include gearbox and controls improvements, and a new aerodynamic structure enabling a greater blade length (130–137 meter rotor). Crafted for high reliability, GE's 3 MW platform offers excellent availability that is comparable to the 2.5 MW series units operating in the field today.

## Technical Description

GE's 3 MW platform machines are three-blade, upwind, horizontal axis wind turbines with a rotor diameter ranging from 130 to 137 meters. The turbine rotor and nacelle are mounted on top of a tubular steel tower, with a range of hub height options that includes 85-, 110-, 131-, 134- and 155-meter variants. The turbines use active yaw control to keep the blades pointed into the wind. The 3 MW platform is engineered to operate at variable speeds and uses a doubly fed asynchronous generator with a partial power converter system.

## Specifications

### 3 MW platform

- Standard and cold weather extreme options
- Standard tower corrosion protection: C2 internal and C3 external with internal and external C4/C5 options available
- Rotational direction: Clockwise viewed from an upwind location
- Speed regulation: Electric drive pitch control with battery backup
- Aerodynamic brake: Full feathering of blade pitch

### GE's 3.2-130 IEC3A

- Up to 20% higher output than GE's 2.5-120
- Improved load management system and more efficient drive train technology
- Same electrical system as 3.2-103 turbine
- Sound power level of 106 db(A), reduced noise modes available
- Tip heights include 150 m, 175 m, 199 m, and 220 m rotor

### GE's 3.4-130 IEC2B

- Up to 30% higher output than GE's 3.2-103
- Increased electrical rating of 3.4 MW combined with 130-meter rotor
- 107 dB(A) normal operation sound power level, reduced noise modes available
- Tip heights include 150 m, 175 m, and 199 m

### GE's 3.4-137 IEC3B

- Up to 24% higher output than GE's 2.75-120
- New blade for more efficient production in low wind conditions
- Sound power level of 106 db(A), reduced noise modes available
- Tip heights include 180 m, 199 m, and 223.5 m

# Features and Benefits

- Engineered to meet or exceed the 2.5 MW platform's historic high availability
- Available grid-friendly options:
  - Enhanced Reactive Power, Low & Zero Voltage Ride Thru, Power Factor Control, WindFreeReactive Power
- Wind Farm Control System; WindSCADA\*
- Available in both 50 Hz and 60 Hz versions

### Construction

Towers:

- Tubular steel sections provide a hub height of 85 and 110-meters
- Hybrid pre-cast concrete/tubular steel towers for 134-meter hub height
- Logistic friendly tower for a hub height of 131 m, 134 m, and 155 m

Blades:

- 63.7-meter blades (130-meter rotor); 67.2-meter blades (137-meter rotor)

Drivetrain components:

- GE's 3 MW platform uses an enhanced gearbox, main shaft with double bearings, and generator with appropriate improvements to enable the 130- and 137-meter diameter rotor in medium and lower wind speeds.

# Enhanced Controls Technology

The 3 MW platform uses enhanced controls features:

- GE's patented Advanced Loads Control reduces loads on turbine components by measuring stresses and individually adjusting blade pitch.
- Controls were developed by GE Global Research to reduce extreme loads, including those near rated wind speeds, to improve annual energy production (AEP).

# Condition Monitoring System

GE's Condition Monitoring System (CMS) and SCADA Anomaly Detection Services, a complementary suite of advanced condition monitoring solutions, proactively detects impending drive train and whole-turbine issues, enabling increased availability and decreased maintenance expenses. Built upon half a century of power generation drivetrain and data anomaly monitoring experience, this service solution is now standard on GE's 3 MW platform.

POWERFUL AND EFFICIENT



# MAKING RENEWABLES THE ENERGY OF CHOICE FOR A CLEANER FUTURE

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DELTA GENERATION

PROVEN TECHNOLOGY –  
AT A NEW STAGE OF EVOLUTION



*N100/3300  
N117/3000  
N131/3000*

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

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## TECHNICAL DEVELOPMENT AT NORDEX

### *Experience keeps us one step ahead*

As one of the pioneers in the modern use of wind energy, Nordex has been developing increasingly efficient wind turbines for use onshore since 1985. Since then, we have always remained true to proven principles, using tried-and-tested series engineering and giving top priority to the reliability of all system components.

In 2000, Nordex installed the first 2.5 megawatt series turbine in the world. Since then, the company has connected more than 4,000 machines from this platform to the grid at a wide range of locations around the world. We know what we're talking about when we claim that our wind turbine generators offer quality, mature technology and dependable performance, even in extreme locations.

With Delta Generation, we are now offering the fourth turbine generation of our proven multi-megawatt platform. Thanks to its larger rotors, greater nominal capacity and optimised technical systems, Delta Generation sets new standards for economic efficiency, reliability and service- and HSE-friendliness.



## MATURE TECHNOLOGY

### *Proven concepts ensure a secure investment*

With the new Delta Generation, Nordex customers benefit from the know-how we have gathered in the multi-megawatt range over many years. Mature technical solutions that have proven their worth thousands of times form a sound basis for the new generation.

#### **Continuity: The electrical system**

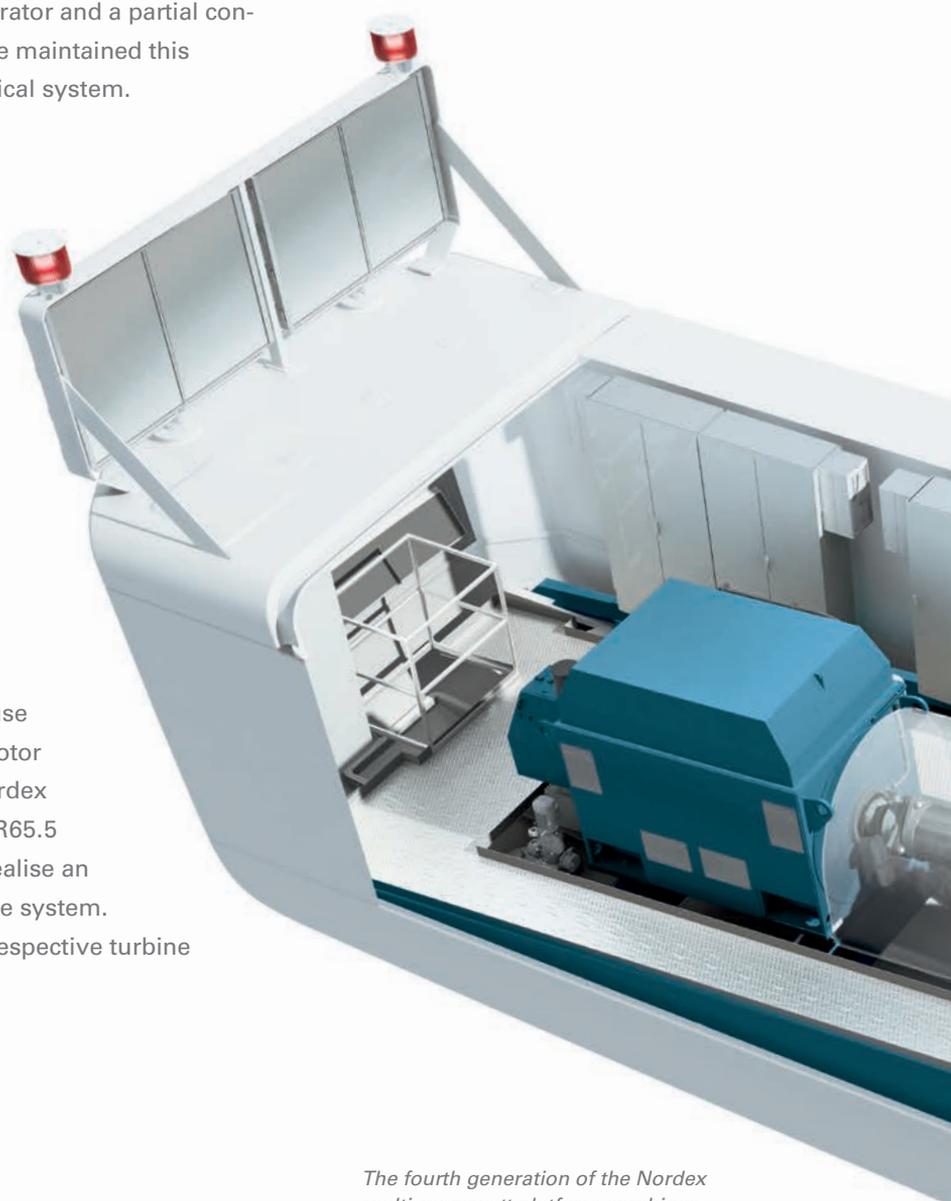
Even the first Nordex multi-megawatt turbine was equipped with a doubly fed asynchronous generator and a partial converter. With Delta Generation, we have maintained this proven and highly economical electrical system.

#### **Tried-and-tested drive train concept**

The drive train system is based on a modular drive train layout with a three-point suspension. We have used this system successfully from the outset. Together with our qualified suppliers, we work on continuously improving our drive train components. This delivers the output required while maintaining availability at a high level.

#### **Proven rotor blade designs**

The turbines of the new generation use proven aerodynamic designs for the rotor diameters of 100 and 117 metres. Nordex developed the NR50, NR58.5 and NR65.5 blades in-house. This allowed us to realise an optimal concept for the overall turbine system. The efficient rotor blades match the respective turbine technology perfectly.



*The fourth generation of the Nordex multi-megawatt platform combines proven, dependable technology with targeted improvements for enhanced performance.*

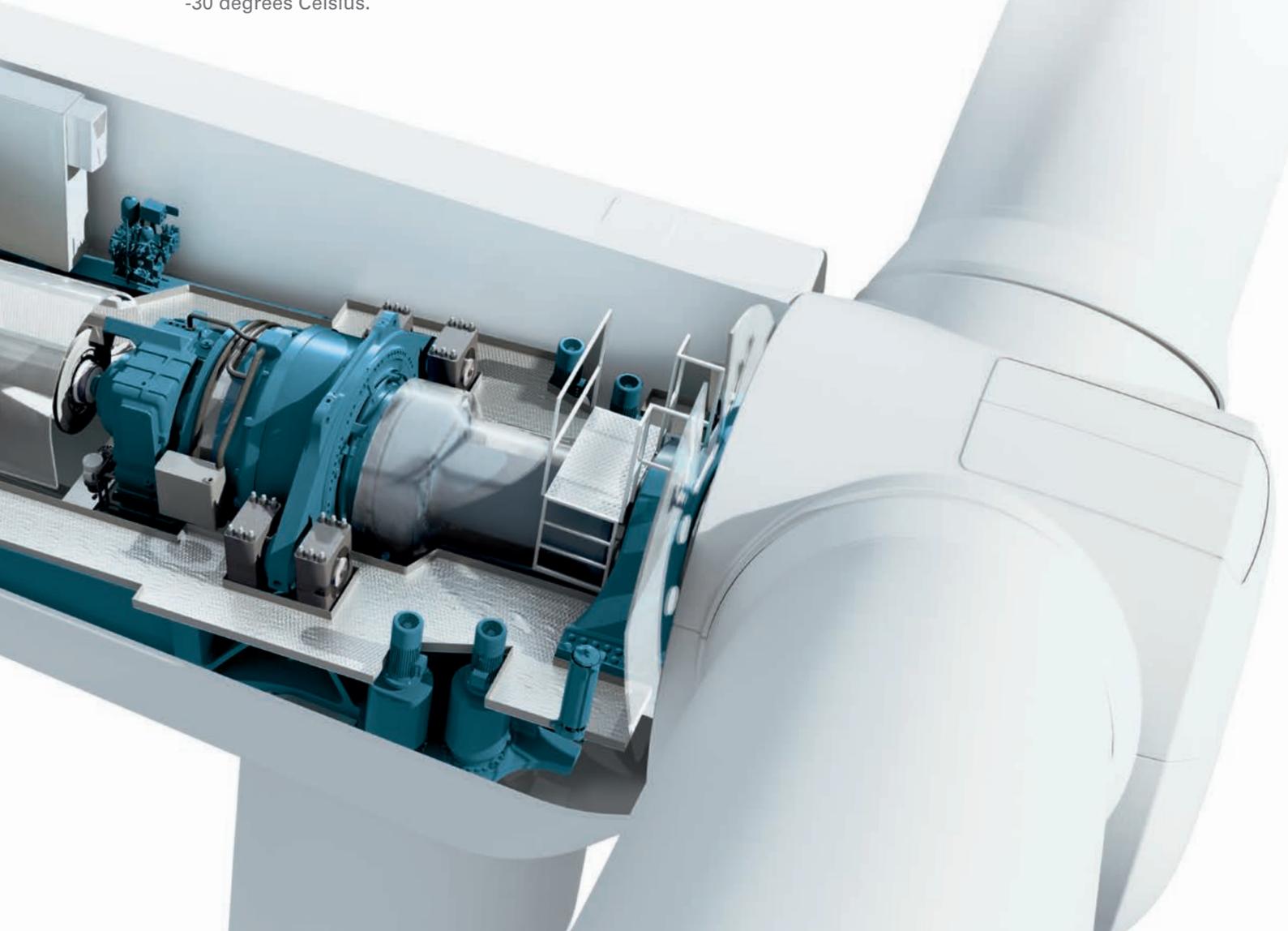
### Grid compatibility ensured

Like the previous generations, the turbines of Delta Generation meet the grid requirements of international markets. One of the most demanding grid connection directives in Europe is the German SDLWindV (Ordinance on System Services by Wind Energy Plants). Thanks to their fault-ride-through capability, our turbines are able to bridge voltage drops easily, thereby meeting all the requirements for the System Service Bonus (SDL Bonus). In addition, the Nordex Wind Farm Management System also allows the grid operator to directly control the active and reactive power of the wind farm in the grid.



### Making the most of cold locations

During the winter, temperatures can be extreme at many sites offering a high wind yield. The tried-and-tested Nordex cold-climate package is designed to meet the challenges of these especially cold locations. Turbines in the cold-climate version (CCV) are able to operate down to an outside temperature of -30 degrees Celsius.



## ECONOMIC EFFICIENCY

*Higher yields reduce the cost of energy*

In developing Delta Generation, we have met our main target – to cut the cost of energy. These Nordex multi-megawatt turbines deliver up to 31 per cent more yield from the sites, making Delta Generation turbines a particularly worthwhile investment.

### Larger: Rotors

Nordex has designed the turbines to use a much larger rotor for each wind class. This produces higher yields. For example, the rotor diameter for machines for strong-wind locations was increased by ten metres compared to the previous model, resulting in a 23 per cent increase in swept area. The rotor for sites with moderate wind speeds is 17 metres larger: a 37 per cent increase in rotor sweep. With its 14 metre larger diameter, the rotor for light-wind sites offers a 25 per cent increase in swept area.



### Stronger: Rated Output

With the N100/3300, Nordex has raised the rated output of the strong wind turbine by more than 30 per cent. The N117/3000 is designed for moderate wind speeds and has a 20 per cent higher rated output than the previous model. The increase in rated output amounts to 25 per cent for the N131/3000 light-wind turbine. This has a positive effect on the energy yields of the Delta turbines. In spite of the considerable increase in output, the sound power levels remain stable for each class. With the N131/3000, Nordex has further reduced the sound power level of the turbine for light-wind sites.

### Higher: Towers

New and higher hub heights produce even greater yield increases and make siting possible, even in wooded areas or locations with complex topography. For the first time, Nordex is offering a tubular steel tower with a hub height of 100 metres for strong wind locations and one with a hub height of 120 metres for sites with moderate wind speeds.



### Smarter: Anti-Icing Systems

Particularly in frost regions, ice forms on rotor blades in the winter months. Icing can reduce the efficiency of a wind turbine generator as well as lowering its availability. The proven Nordex anti-icing system heats the most aerodynamically important areas of the rotor blades and efficiently reduces icing levels. Nordex customers can rely on their turbines for dependable yields and maximum availability in cold regions.



## QUALITY AND RELIABILITY

### *A focus on high availability*

To ensure that our turbines perform reliably, we conduct exhaustive tests. We certify the quality of all components and manufacture in a modern line production. The average availability of all turbines covered by Nordex Service stands at 98 per cent. We ensure this high level of availability by consistently further developing the vital important systems. This contributes to a further reduction in the cost of energy.

#### **Extreme tests for hardware and software**

In the Nordex Test Centre, engineers test the components and systems of the new turbine generation under simulated wind and weather conditions. By subjecting them to strains in excess of the usual specifications, Nordex ensures that the design meets all criteria, delivering a high-quality, mature product for serial production.

#### **Highest industrial standards**

Nordex continues to meet high industrial standards, manufacturing the nacelle and hub modules in a continuous flow process. Many of the steps needed for assembly and commissioning are performed in the protected factory hall before the equipment is shipped to the site.

*In the Nordex Test Centre engineers ensure the quality of components.*



#### Advanced control infrastructure

Nordex has equipped the new turbine generation with the Profinet communication system. Its ethernet-based fieldbus transfers turbine data rapidly, reliably and by priority. All actuators and sensors in the turbine control systems, as well as the different module options, are directly integrated into the network. This ensures improved diagnostics and the reliability of the system.

#### Optimised drive train

The drive train design of Delta Generation reduces the forces acting on the individual components, taking greater strain off the robust rotor bearing. Innovations in the cooling system of the drive train ensure constant temperatures over a wide operating range – with lower internal energy consumption.



## SERVICE AND HSE

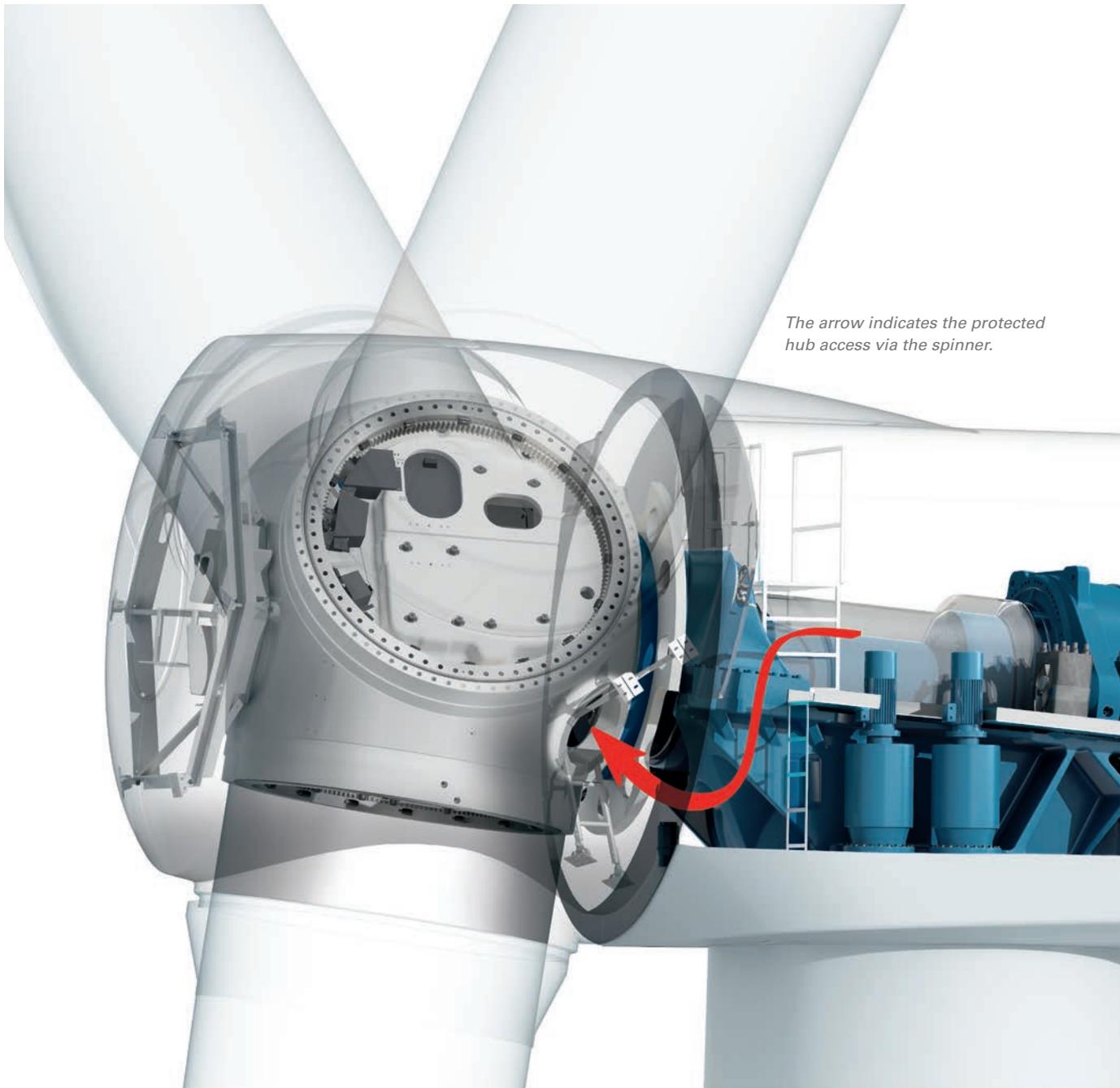
### *Fast and safe turbine O&M*

Delta Generation is designed so that service operations can be conducted rapidly and safely. This reduces ongoing operational costs. We make no compromise when it comes to HSE – the turbines of the new generation meet the most stringent requirements.



#### **Protected hub access**

The new spinner, a complete housing for the rotor hub, provides rapid and protected access to the hub. This means that service work can be carried out in a wider range of wind and weather conditions. This is of particular advantage in cold regions – making it possible to reduce downtimes for service purposes.



*The arrow indicates the protected hub access via the spinner.*

### Ergonomics and safety

When we were developing the new multi-megawatt generation, we gave high priority to designing the turbines as a particularly safe and spacious workplace. In case of an emergency, the platform also offers extended escape and rescue routes. All systems are easily accessible for maintenance. Nacelle components weighing less than one tonne can be reached with the onboard crane and, if necessary, can be exchanged without additional equipment.

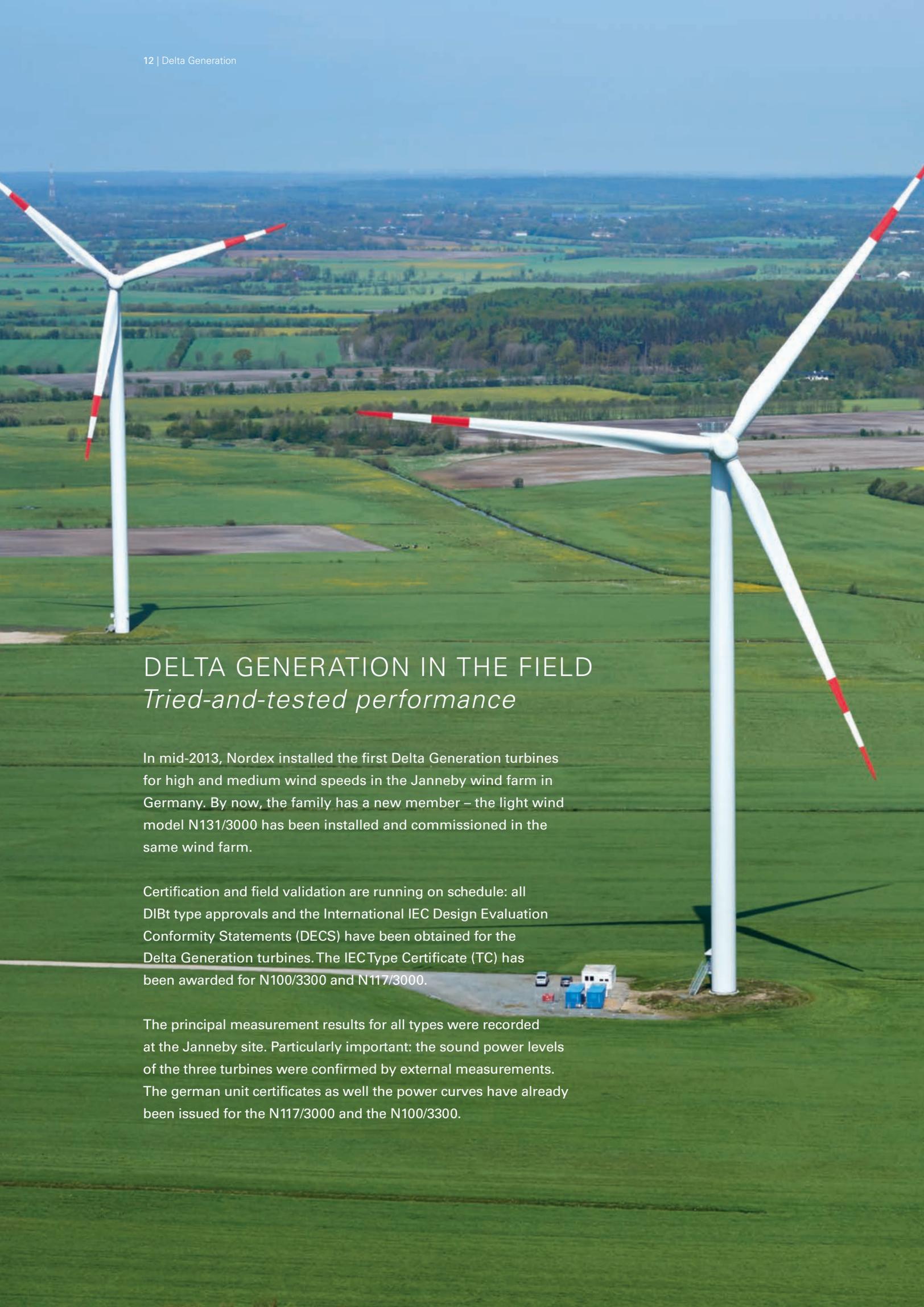
### Annual service interval

The technical design of Delta Generation allows for an annual service interval. Automatic lubrication of the bearings in the pitch system replaces manual processes. These bearings, as well as the main bearing and the generator bearings, are supplied automatically with lubricant, making them less susceptible to wear. This minimises the service requirements and reduces the O&M expenses.

### Yaw n-1 concept

The yaw system runs with four drives in standard operation. However, should one drive break down, the turbine can continue to run temporarily on three drives, making it possible to plan any needed service work. This concept increases turbine availability and reduces service costs.





## DELTA GENERATION IN THE FIELD

*Tried-and-tested performance*

In mid-2013, Nordex installed the first Delta Generation turbines for high and medium wind speeds in the Janneby wind farm in Germany. By now, the family has a new member – the light wind model N131/3000 has been installed and commissioned in the same wind farm.

Certification and field validation are running on schedule: all DIBt type approvals and the International IEC Design Evaluation Conformity Statements (DECS) have been obtained for the Delta Generation turbines. The IEC Type Certificate (TC) has been awarded for N100/3300 and N117/3000.

The principal measurement results for all types were recorded at the Janneby site. Particularly important: the sound power levels of the three turbines were confirmed by external measurements. The German unit certificates as well as the power curves have already been issued for the N117/3000 and the N100/3300.

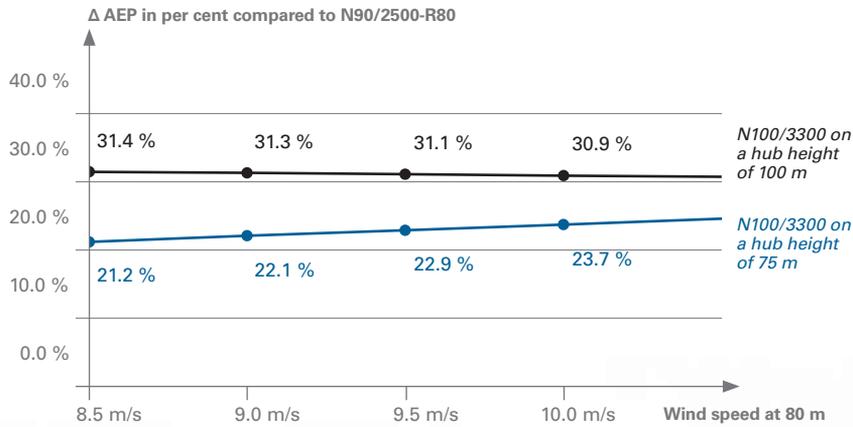


## SOLUTION FOR STRONG WIND

### *High yields in rough climates*

Wind sites with a rough environment call for mature, robust technology. With the turbines of Delta Generation, Nordex offers the proven 100-metre rotor, now also for IEC 1 locations. Thanks to the large rotor diameter and the higher rated output, the N100/3300 obtains much higher energy yields at sites with strong winds compared to the previous model. This turbine is available with hub heights of 75, 85 and 100 metres.

**The N100/3300 generates between 21.2 and 31.4 per cent more AEP compared to the preceding IEC 1 model.**



Calculation of AEP based on air density of 1.225 kg/m<sup>3</sup>, wind shear of 0.2 and Weibull shape parameter of  $k = 2.0$



# TECHNICAL DATA

<b>N100/3300</b>	
<b>Operating data</b>	
Rated power	3,300 kW
Cut-in wind speed	3.5 m/s
Cut-out wind speed	25 m/s
<b>Rotor</b>	
Diameter	99.8 m
Swept area	7,823 m <sup>2</sup>
Operating range rotational speed	9.0–16.1 rpm
Rated rotational speed	14.3 rpm
Tip speed	75 m/s
Speed control	Variable via microprocessor
Overspeed control	Pitch angle
<b>Gearbox</b>	
Type	3-stage gearbox (planetary-planetary-spur gear)
<b>Generator</b>	
Construction	Doubly-fed asynchronous generator
Cooling system	Liquid/air cooling
Voltage	660 V
Grid frequency	50 / 60 Hz
<b>Brake system</b>	
Main brake	Aerodynamic brake (Pitch)
Holding brake	Disk brake
<b>Lightning protection</b>	
	Fully compliant with IEC 61400-24
<b>Tower</b>	
Construction	Tubular steel tower
Hub height/Certification	75 m/IEC 1a, DIBt 3 85 m/IEC 1a 100 m/IEC 1a, DIBt 3

*The powerful N100/3300 is the first choice for strong wind sites.*



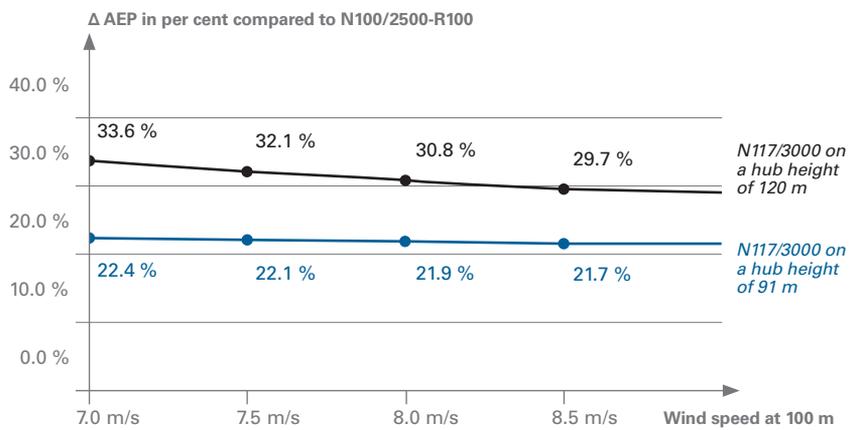
## SOLUTION FOR MODERATE WIND

### *Economical at a wide range of sites*

With the N117/3000, Nordex now offers an even more economical turbine for IEC 2 locations. The enlarged rotor sweep and higher rated output deliver much higher yields. The N117/3000 is available on tubular steel towers of 91 or 120 metres, as well as on a hybrid tower of 141 metres. Therefore, it is suitable for challenging sites as well.

To ensure high yields at sites in cold climates, Nordex equips the N117/3000 with the efficient anti-icing system as an option.

**The N117/3000 generates between 21.7 and 33.6 per cent more AEP compared to the preceding IEC 2 model.**



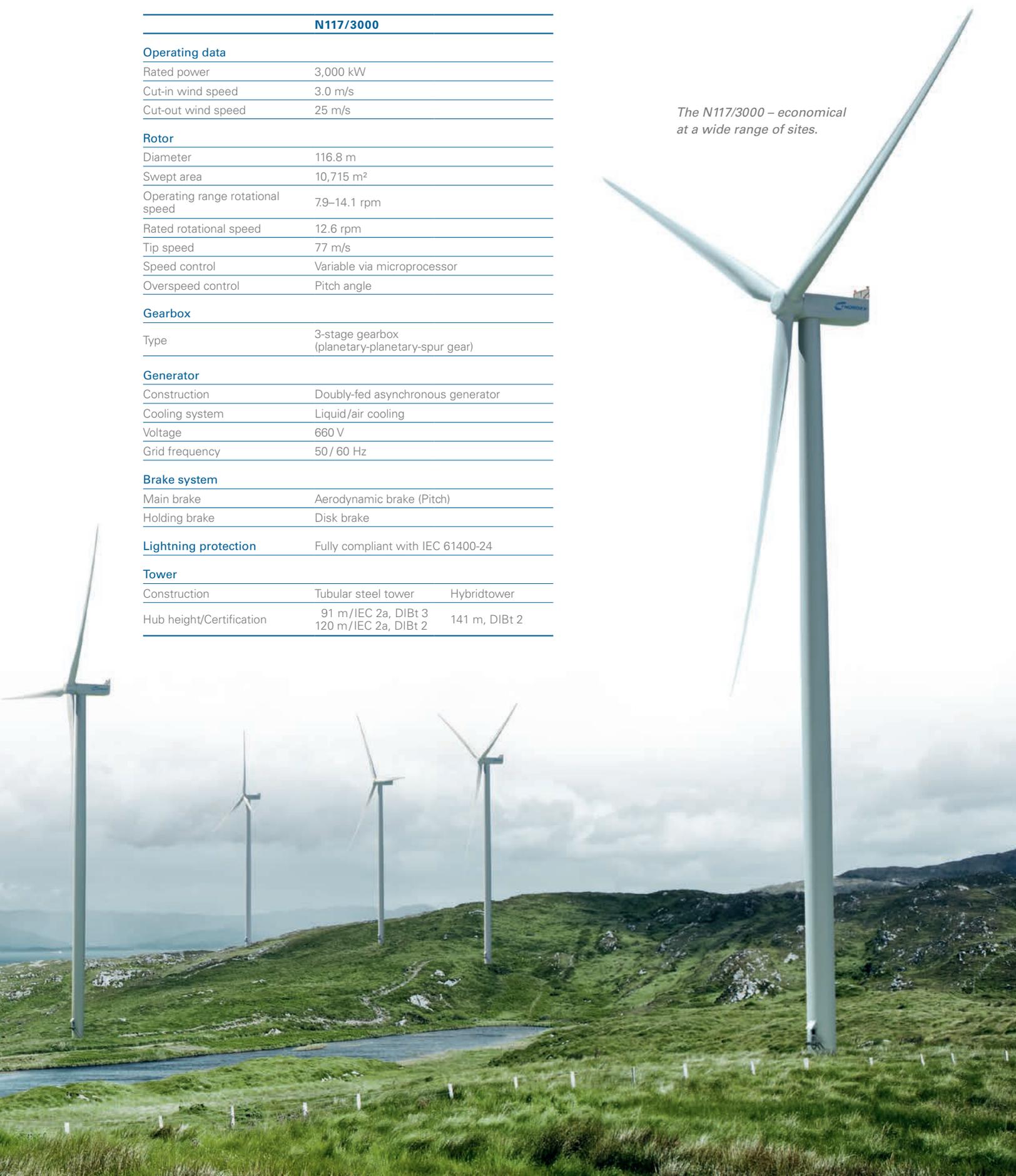
Calculation of AEP based on air density of 1.225 kg/m<sup>3</sup>, wind shear of 0.2 and Weibull shape parameter of  $k = 2.0$



# TECHNICAL DATA

<b>N117/3000</b>		
<b>Operating data</b>		
Rated power	3,000 kW	
Cut-in wind speed	3.0 m/s	
Cut-out wind speed	25 m/s	
<b>Rotor</b>		
Diameter	116.8 m	
Swept area	10,715 m <sup>2</sup>	
Operating range rotational speed	7.9–14.1 rpm	
Rated rotational speed	12.6 rpm	
Tip speed	77 m/s	
Speed control	Variable via microprocessor	
Overspeed control	Pitch angle	
<b>Gearbox</b>		
Type	3-stage gearbox (planetary-planetary-spur gear)	
<b>Generator</b>		
Construction	Doubly-fed asynchronous generator	
Cooling system	Liquid/air cooling	
Voltage	660 V	
Grid frequency	50 / 60 Hz	
<b>Brake system</b>		
Main brake	Aerodynamic brake (Pitch)	
Holding brake	Disk brake	
<b>Lightning protection</b>		
	Fully compliant with IEC 61400-24	
<b>Tower</b>		
Construction	Tubular steel tower	Hybridtower
Hub height/Certification	91 m/IEC 2a, DIBt 3 120 m/IEC 2a, DIBt 2	141 m, DIBt 2

*The N117/3000 – economical  
at a wide range of sites.*



## SOLUTION FOR LIGHT WIND

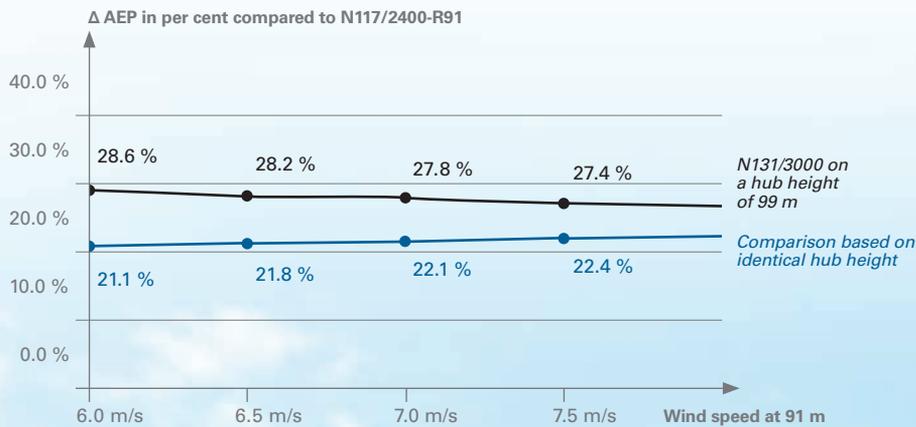
### *Maximum efficiency in the 3 MW segment*

High yield even in regions with light wind: thanks to its enlarged rotor sweep and higher rated output, the N131/3000 generates a much higher yield at light-wind locations. The turbine is available on tubular steel towers with hub heights of 99 or 114 metres.

Nordex limits the sound power level of the light-wind turbine to max. 104.5 dB(A) – a crucial factor for optimising wind farms and facilitating permitting.

To ensure high yields at sites in cold climates, Nordex equips the N131/3000 with the efficient anti-icing system as an option.

**The N131/3000 generates between 27.4 and 28.6 per cent more AEP compared to the preceding IEC3 model.**



Calculation of AEP based on air density of 1.225 kg/m<sup>3</sup>, wind shear of 0.2 and Weibull shape parameter of  $k = 2.0$



# TECHNICAL DATA

## N131/3000

### Operating data

Rated power	3,000 kW
Cut-in wind speed	3.0 m/s
Cut-out wind speed	20 m/s

### Rotor

Diameter	131.0 m
Swept area	13,478 m <sup>2</sup>
Operating range rotational speed	6.5–11.6 rpm
Rated rotational speed	10.3 rpm
Tip speed	70.5 m/s
Speed control	Variable via microprocessor
Overspeed control	Pitch angle

### Gearbox

Type	3-stage gearbox (planetary-planetary-spur gear)
------	----------------------------------------------------

### Generator

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

### Brake system

Main brake	Aerodynamic brake (Pitch)
Holding brake	Disk brake

### Lightning protection

Fully compliant with IEC 61400-24

### Tower

Construction	Tubular steel tower
Hub height/Certification	99 m/IEC 3a, DIBt 2 114 m/IEC 3a, DIBt 2

*Strong, efficient and quiet:  
the N131/3000.*



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As of: 09/2015

