Vestas®

EnVentus™ platform

Wind. It means the world to us.™

The **foundation** for the future of wind

We are pioneers. We keep moving and improving. It's what Vestas does. EnVentus™ is the next phase of this journey. By connecting heritage with innovation, Vestas creates solutions that responsibly address tomorrow's energy challenges.

Market opportunities

Our customers are demanding ever more advanced wind turbines, enabling profitable project realisation in increasingly challenging locations as the renewable energy landscape expands and diversifies; larger, more powerful turbines responsive to evolving grid requirements.

Customised to maximise

EnVentus™ represents the next generation in the evolution of wind turbines. It is the architecture from which new variants will arise. Designed to encompass a wide range of turbine configurations, system designs apply modularity to meet customisation and market demands more efficiently. Combined with the extensive Vestas portfolio of solutions, EnVentus™ variants can maximise the potential of each unique wind site.

On the shoulders of giants

EnVentus™ is the realisation of a vision to connect the best engineering from Vestas. Building on 100 GW of tried and tested technology, EnVentus™ aims to ensure continued leadership. Using technology and experience from both on- and offshore, the EnVentus™ platform architecture combines advanced proven system designs that deliver innovation.

100 GW

By connecting advanced modular design with 100 GW of tried and tested technology, EnVentus™ aims to ensure continued technology leadership.

40 years of experience

The EnVentus™ platform architecture connects proven system designs from the 2 MW platform, 4 MW platform, and 9 MW platform.

Connecting certainty with innovation

The EnVentus™ platform is the result of meticulous and careful evaluation of an unbroken line of Vestas technology solutions. With 100 GW of wind turbine capacity installed and 40 years of experience in relentlessly pursuing better performance through technology and service, EnVentus™ is Vestas' next generation in the evolution of wind turbines.

Proven technology

The EnVentus™ platform architecture connects proven system designs from the 2 MW platform, 4 MW platform and 9 MW platform turbine technology. The result is one versatile platform that delivers a higher level of robustness and performance with the ability to meet varying grid compliance requirements around the world.

System efficiency

The EnVentus™ platform architecture features a full-scale converter, proven from the 4 MW platform, capable of meeting complex and differing grid requirements in local markets. The full-scale converter is matched by a permanent magnet generator for maximum system efficiency and balanced by a medium-speed drivetrain. Known from the 9 MW platform, the EnVentus™ powertrain is optimised to reduce structural loads and has been chosen for reasons of mechanical robustness and flexibility. Combined with advanced load management strategies, the EnVentus™ platform enables siting at increasingly complex project conditions.

Latest solutions

The EnVentus™ platform architecture benefits from the latest developments in control systems, applying the Vestas Control System 8000 currently operating on the 4 MW platform. Similarly, the portfolio of standard towers are based on Tubular Steel Tower (TST), High Tubular Steel Tower (HTST), or Large Diameter Steel Tower (LDST) technology, reaching hub heights of up to 166m.

V138-3.0 MW™, V150-5.6 MW™ and V162-5.6 MW™ blades are the result of incremental improvements to proven technical solutions. Similar to 2 MW and 4 MW platform variants, all EnVentus™ turbines feature slender profile and pre-bent blades, optimised for weight through application of carbon pultrusion material and a structural shell blade design, enabling the optimisation of the structural loads while increasing the rotor sizes. Vestas' most advanced aerofoil design ensures high aerodynamic performance and excellent sound power levels.

Tested to the limit

By applying reusable modules, versatility in offering can be achieved while adhering to Vestas' rigorous testing standards. The Vestas Test Centre is unrivalled in the wind industry. We test nacelle components using accelerated life testing under mixed and aggregated environmental conditions. For critical components, Highly Accelerated Life Testing (HALT) identifies potential failure modes and mechanisms. Specialised test rigs ensure strength and robustness for the gearbox, generator, yaw and pitch system, lubrication system and accumulators. Our quality control system ensures that each component is manufactured to design specifications and performs at site. We systematically monitor measurement trends that are critical to quality, locating defects before they occur.

We know wind

Vestas is the right partner to help you realise the full potential of your wind site. We have the largest installed capacity in the industry and currently monitor over 30,000 turbines across the globe: Tangible proof of our commitment to making renewable energy solutions that are productive, reliable and economical.

Maximised site potential

The Vestas EnVentus™ platform adds three new variants to the wide range of existing Vestas turbines, providing the ability to create an even more finely matched combination of turbines to harness available wind energy in any specific location.

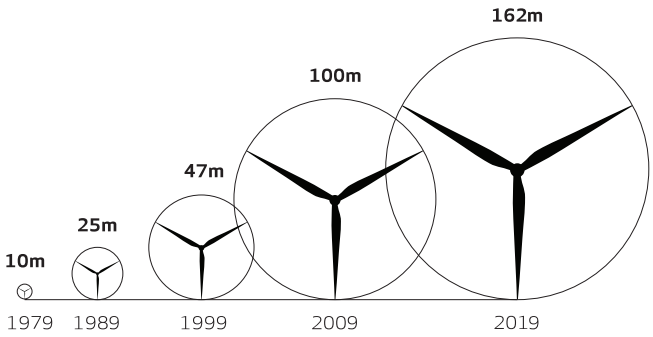
Versatility at the core

Through advanced modularity in design, EnVentus™ aims to meet customisation needs more efficiently combining reusable modules depending on unique market and project conditions. V138-3.0 MW™, V150-5.6 MW™ and V162-5.6 MW™ are designed with global applicability in mind. EnVentus™ based variants benefit from a full-scale converter enabling compliance with varying market-specific grid code requirements. The wide range of standard hub heights, options, and modes of operation contribute to the ability to meet specific requirements.

Business case flexibility

V150-5.6 MW™ and V162-5.6 MW™ maximise turbine level production, making them specially suitable for projects limited by the number of turbines installed. The relationship between rotor size and rating in V138-3.0 MW™ enhances production at park level while optimising for sound power performance. This makes it particularly appropriate for projects limited by the total capacity installed and for sound sensitve markets. Combining double-digit* annual energy production improvements in low, medium and high wind speeds with 2020 and early 2021 deliveries, V138-3.0 MW™, V150-5.6 MW™ and V162-5.6 MW™ are ready to secure project realisation in auction and permit based environments.

Rotor size development



V138-3.0 MW™

With a highly optimised rotor size to rating ratio, the V138-3.0 MW™ strengthens the competitiveness of Vestas' high capacity factor turbines in low to medium wind speed conditions. At 14,957 m² V138-3.0 MW™ features the industry's largest swept area under 152.4m (500ft) tip height while lifting the production potential at WTG level by more than 30 percent compared to the V120-2.2 MW™. The combination of segment leading sound power performance and a full-scale converter makes the turbine highly competitive also in sound sensitive markets. Through new standard towers, the V138-3.0 MW™ meets market specific hub height requirements and offers seamless transportation by using standard systems already proven by the 4 MW platform.

V150-5.6 MW™

The V150-5.6 MW™ lifts the larger rotor introduced with V150-4.2 MW™ into stronger wind speeds. Combined with its higher generator rating, it increases the production potential at WTG level by more than 20 percent compared to V136-4.2 MW™ in medium wind speed conditions. Applying Vestas' most advanced aerofoil blade design combined with lower rotational speeds of the EnVentus™ drivetrain, means realisation of power production potential at very low sound power levels. A comprehensive portfolio of standard and site-specific towers allow for application in tip height constraint markets, varying from 180m to 241m. Utilising Vestas LDST tower technology, V150-5.6 MW™ can take advantage of favourable wind conditions at 166m hub height.

V162-5.6 MW™

With a swept area of over 20,000m², the V162-5.6 MW™ applies the largest rotor size in the Vestas portfolio to achieve industry-leading energy production paired with a high capacity factor. Due to the large operational envelope, the V162-5.6 MW™ has great relative siteability on both turbulence and average wind speeds. With a maximum Sound Power Level of 104dB(A) and over 20 percent higher energy production than the V150-4.2 MW™, the V162-5.6 MW™ establishes a new benchmark in competitiveness.

*Depending on site specific conditions

WIND CLASSES

Turbine type	Low wind speeds	Medium wind speeds	High wind speeds
EnVentus™ turbines			
V150-5.6 MW™			
V162-5.6 MW™			
V138-3.0 MW™			

All of Vestas

As part of the suite of Vestas offerings, V138-3.0 MW™, V150-5.6 MW™ and V162-5.6 MW™ can be combined with an extensive list of technology options to create customised solutions to suit the needs of each unique project. By adding options to the standard turbine, we can enhance the performance and adaptability of the wind power project and facilitate a shorter permitting cycle at restricted sites. These options can be a decisive factor in realising your specific project and the business case certainty of your investments. Additionally, the well-established Vestas manufacturing and global supply chain setup ensure the ability to deliver, while supporting local requirement.

Options available for the EnVentus™ platform*:

- Aviation Markings on the Blades
- Increased Cut-In Wind Speed
- Aviation Lights
- Condition Monitoring System
- Fire Supression
- Lightning detection
- Load Optimised Modes
- Sound Optimised Modes
- Low Temperature Operation to -30°C
- Oil Debris Monitoring System
- Vestas Shadow Detection System
- Service Personnel Lift
- Vestas Ice Detection™
- Vestas Anti-Icing System™
- Vestas InteliLight®

*Depending on turbine variant.

The knowledge **to control**

Knowledge about wind project planning is key
Getting your wind energy project up and operating as quickly as possible is fundamental to its long-term success. One of the first and most important steps is to identify the most suitable location for your wind power plant. Vestas' SiteHunt® is an advanced analytical tool that examines a broad spectrum of wind and weather data to evaluate potential sites and establish which of them can provide optimum conditions for your project.

In addition, a team of specialised siting engineers customise the turbine selection and layout of your wind power plant. We perform simulations of the site conditions, using Computational Fluid Dynamics (CFD) software on our powerful in-house supercomputer, and use advanced load simulations to analyse the lifetime performance of the plant. Put simply, we find the optimal balance between annual revenue and investment over the lifetime of your plant. This will determine your project's true potential and provide a firm basis for your investment decision.

The complexity and specific requirements of grid connections vary considerably across the globe, making the optimal design of electrical components for your wind power plant essential. By identifying grid codes early in the project phase and simulating extreme operating conditions, Electrical PreDesign provides you with an ideal way to build a grid compliant, productive and highly profitable wind power plant. It allows customised collector network cabling, substation protection and reactive power compensation, which boost the cost efficiency of your business.

Advanced monitoring and real-time plant control
All our wind turbines can benefit from VestasOnline® Business, the latest Supervisory Control and Data Acquisition (SCADA) system for modern wind power plants.

This flexible system includes an extensive range of monitoring and management functions to control your wind power plant.

VestasOnline® Business enables you to optimise production levels, monitor performance and produce detailed, tailored reports from anywhere in the world. The VestasOnline® Power Plant Controller offers scalability and fast, reliable real-time control and features customisable configuration, allowing you to implement any control concept needed to meet local grid requirements.

Surveillance, maintenance and service

Operating a large wind power plant calls for efficient management strategies to ensure uninterrupted power production and to control operational expenses. We offer 24/7 monitoring, performance reporting and predictive maintenance systems to improve turbine performance and availability. Predicting faults in advance is essential, helping to avoid costly emergency repairs and unscheduled interruptions to energy production.

Our Condition Monitoring System (CMS) assesses the status of the turbines by analysing vibration signals. For example, by measuring the vibration of the drive train, it can detect faults at an early stage and monitor detected damage. This information allows pre-emptive maintenance to be carried out before the component fails, reducing repair costs and production loss.

Additionally, our Active Output Management® (AOM) concept provides detailed plans and long-term agreements for service and maintenance, online monitoring, optimisation and troubleshooting. It is possible to get a full scope contract, combining your turbines' state-of-the-art technology with guaranteed time or energy-based availability performance targets, thereby creating a solid base for your power plant investment. The Active Output Management® agreement provides you with long-term and financial operational peace of mind for your business.

V138-3.0 MW™ IEC S
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	3,000 kW
Cut-in wind speed	3m/s
Cut-out wind speed*	24m/s
Wind class	IEC S

Standard operating temperature range from -20°C** to +45°C

*High Wind Operation available as standard
**Subject to different temperature options

SOUND POWER

Maximum*	102.7/106.6 dB(A)**

*Depending on configuration
**Sound Optimised Modes available dependent on site and country

ROTOR

Rotor diameter	138m
Swept area	14,957m²
Aerodynamic brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60Hz
Converter	full scale

GEARBOX

Type	two planetary stages

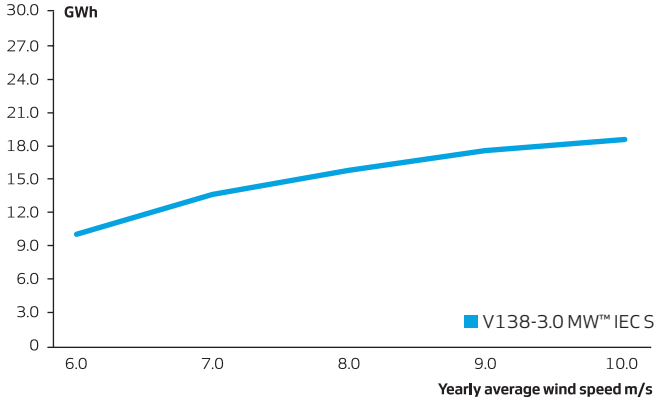
TOWER

Hub height	83m (IEC S), 96m (IEC S)

TURBINE OPTIONS

- Condition Monitoring System
- Oil Debris Monitoring System
- Service Personnel Lift
- Low Temperature Operation to -30°C
- Vestas Ice Detection™
- Vestas InteliLight®
- Vestas Shadow Detection System
- Aviation Lights
- Aviation Markings on the Blades
- Fire Suppression System
- Increased Cut-In Wind Speed
- Lightning Detection System
- Load Optimised Modes
- Sound Optimised Modes

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2.5
Standard air density = 1.225, wind speed at hub height

V150-5.6 MW™ IEC S
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	5,600 kW
Cut-in wind speed	3m/s
Cut-out wind speed*	25m/s
Wind class	IEC S

Standard operating temperature range from -20°C** to +45°C

*High Wind Operation available as standard
**Subject to different temperature options

SOUND POWER

Maximum	104.9 dB(A)***

***Sound Optimised Modes available dependent on site and country

ROTOR

Rotor diameter	150m
Swept area	17,671m²
Aerodynamic brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60Hz
Converter	full scale

GEARBOX

Type	two planetary stages

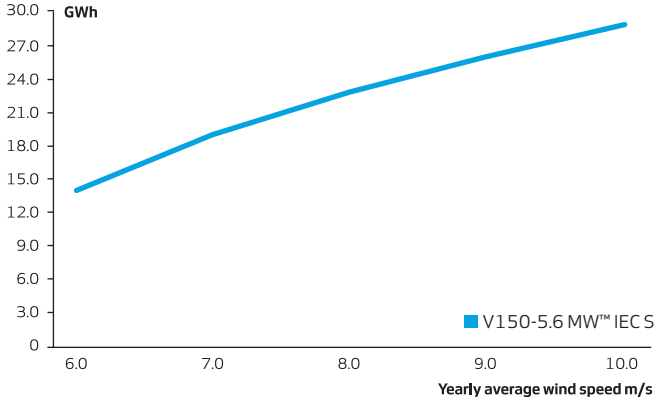
TOWER

Hub height	105m (IEC S), 125m (IEC S/DIBt S), 148m (DIBt S), 155m (IEC S), 166m (DIBt S)

TURBINE OPTIONS

- Condition Monitoring System
- Oil Debris Monitoring System
- Service Personnel Lift
- Low Temperature Operation to -30°C
- Vestas Ice Detection™
- Vestas Anti-Icing System™
- Vestas InteliLight®
- Vestas Shadow Detection System
- Aviation Lights
- Aviation Markings on the Blades
- Fire Suppression System
- Increased Cut-In Wind Speed
- Lightning Detection System
- Load Optimised Modes

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor = 2, Standard air density = 1.225, wind speed at hub height

V162-5.6 MW™ IEC S
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA

Rated power	5,600 kW
Cut-in wind speed	3m/s
Cut-out wind speed*	25m/s
Wind class	IEC S
Standard operating temperature range from -20°C* to +45°C	

*High Wind Operation available as standard
**Subject to different temperature options

SOUND POWER

Maximum	104dB(A)***

***Sound Optimised Modes available dependent on site and country

ROTOR

Rotor diameter	162m
Swept area	20,612m²
Aerodynamic brake	full blade feathering with 3 pitch cylinders

ELECTRICAL

Frequency	50/60Hz
Converter	full scale

GEARBOX

Type	two planetary stages

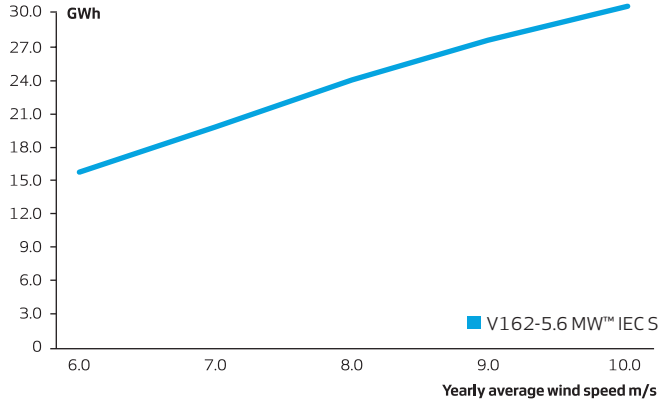
TOWER

Hub height	119m (IEC S/DIBt S), 125m (IEC S), 148m (DIBt S), 149m (IEC S), 166m (DIBt S)

TURBINE OPTIONS

- Condition Monitoring System
- Oil Debris Monitoring System
- Service Personnel Lift
- Low Temperature Operation to -30°C
- Vestas Ice Detection™
- Vestas Anti-Icing System™
- Vestas InteliLight®
- Vestas Shadow Detection System
- Aviation Lights
- Aviation Markings on the Blades
- Fire Suppression System
- Increased Cut-In Wind Speed
- Lightning Detection System
- Load Optimised Modes

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor = 2, Standard air density = 1.225, wind speed at hub height

Vestas

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05/19-EN

*The **POWER PACKAGE** for successful projects*

DELTA4000

MAXIMUM FLEXIBILITY. MAXIMUM OUTPUT.

N149/4.0-4.5

NORDEX

acciona Windpower

OPTIMISED YIELDS
Through flexible site adjustments

In developing the N149/4.0-4.5, there was one primary focus: the sustainable reduction of electricity generation costs (COE). In comparison to the N131/3600, the N149/4.0-4.5 achieves up to 28 per cent higher yields at locations with light to moderate wind speeds. This is a significant improvement that maximises the chances of success in auction processes.

Highest efficiency

The rotor diameter has been enlarged by 18 metres, to 149 metres, compared to the largest rotor of the Delta Generation. This means the rotor sweep has been increased by 30 per cent – for maximum efficiency in areas with light to moderate wind speeds. While the aerodynamic shape of the rotor blade has been adapted to meet the new requirements, the construction of the one-piece blade has remained essentially the same.

Flexible site adjustments

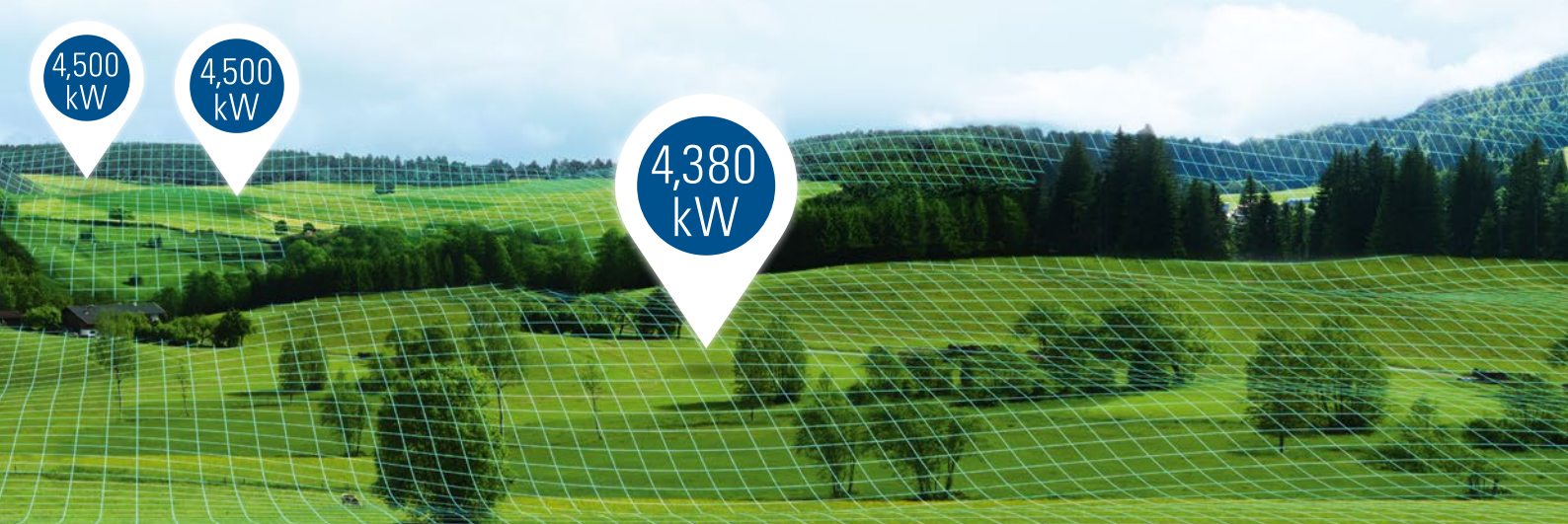
As the maximum output of the turbine varies between 4.0 and 4.5 megawatts, it is ideal for adapting to the grid operator's individual requirements, local wind conditions and noise restraints. This also means that it's possible to optimise the overall yield of a wind farm by means of the different maximum output of individual turbines, thus always exploiting the full potential of each turbine position within each single wind farm. This is an advantage, among other things, with large-scale projects that often come with different wind conditions and complex topography.

Acoustically optimised operating modes

The N149/4.0-4.5 can master particularly demanding locations thanks to different operating modes. Its sound power level ranges from 103.6 to 106.1 decibels, depending on the maximum output. When operated at a reduced output level, the sound power reaches a maximum level of 96.5 decibels.

Advantages at a glance

- **+ 28% improved output**
- **+ 30% enlarged rotor area**
- **Site-specific performance modes available from 4.0 to 4.5 MW**
- **103.6 dB(A) at a nominal power level of 4.0 MW**
- **Service life of up to 25 years possible, depending on the site**



PROVEN CONCEPTS
One step ahead through experience

With the Delta4000 product line, the Nordex Group relies on tried-and-tested series-production technology, based on experience of the Delta Generation. The Nordex Group currently has an installed capacity of 1 gigawatt of this platform in operation and more than 1 gigawatt is in installation. In the process, we remain faithful to established principles and attach great importance to the reliability of all system components.

Electrical system maintained

Nordex had already equipped the first multi-megawatt system with a double-fed asynchronous generator and a partial converter in the year 2000. With the Delta4000 product line, we have remained faithful to this proven and highly economical electrical system.

Reliable drivetrain concept

The drivetrain concept is based on a modular build system with three-point suspension. We have successfully implemented this system from the very outset. Together with our qualified suppliers, we are continuously enhancing our drivetrain components. This not only ensures the required performance, but also a high degree of availability.

Over 1 GW in worldwide installations of the Delta platform

Grid compatibility guaranteed

Like its predecessor generation, the turbines of the Delta4000 product line meet the grid requirements of international markets. In addition, they provide grid-stabilising system services.

Tapping into colder locations

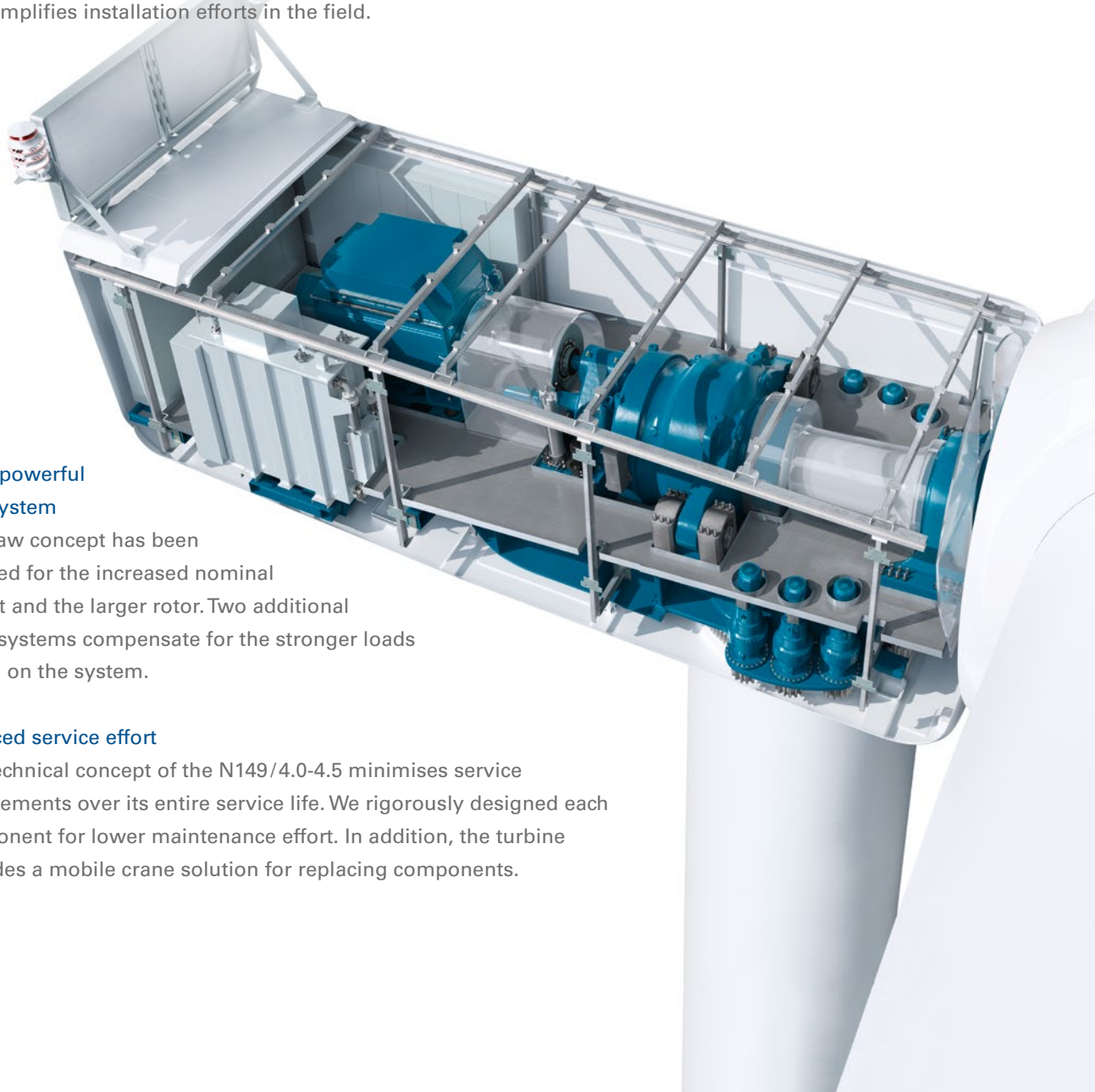
The proven Nordex Cold Climate Package enables particularly cold locations to be developed. Turbines of the cold climate variant (CCV) are operational in outside temperatures of down to minus 30 degrees Celsius and can also be equipped with the proven rotor blade anti-icing system.

N149/4.0-4.5
For light- and medium-wind locations

For the Delta4000 product line, we took over the Delta Generation's fundamental design and transferred it to the 4 megawatt class, with the help of performance-enhancing concept adaptations. At the same time, we kept an eye on consequently reducing electricity generation costs.

New dimensions
With a rotor sweep of 17,460 square metres and a nominal output of 4.0 to 4.5 megawatts, the N149/4.0-4.5 achieves output gains of up to 28 per cent. The variable generator setting permits the individual customisation of each turbine to the site conditions, thereby improving the overall output of the wind park.

Optimised power transfer
Unlike the Delta Generation, the converter and transformer are no longer located in the tower base, but in the nacelle. This minimises electrical losses and simplifies installation efforts in the field.



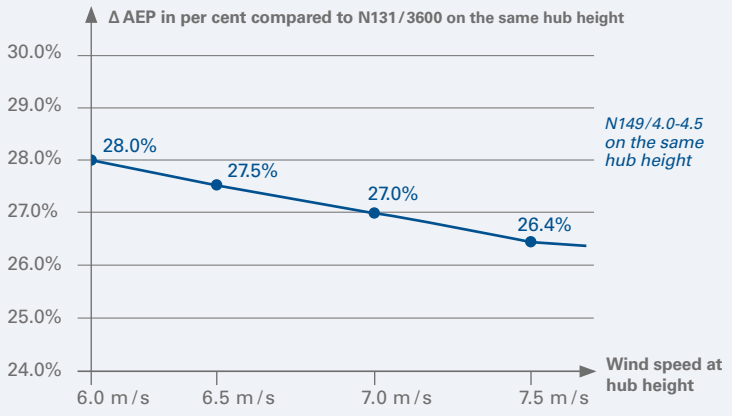
More powerful yaw system
The yaw concept has been adapted for the increased nominal output and the larger rotor. Two additional drive systems compensate for the stronger loads acting on the system.

Reduced service effort
The technical concept of the N149/4.0-4.5 minimises service requirements over its entire service life. We rigorously designed each component for lower maintenance effort. In addition, the turbine provides a mobile crane solution for replacing components.

TECHNICAL DATA

	N149 / 4.0-4.5
Operating data	
Rated power	4,000–4,500 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	20 m/s
Rotor	
Diameter	149.1 m
Swept area	17,460 m²
Operating range rotational speed	6.4–12.3 rpm
Rated rotational speed	9.8–11.0 rpm
Tip speed	76.5–86.0 rpm
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	Disc brake
Lightning protection	Fully compliant with IEC 61400-24
Hub height	
	105 m/IEC S, DIBt S 125 m/IEC S, DIBt S 164 m/IEC S, DIBt S

Compared to the N131 / 3600, the N149 / 4.0-4.5 generates additional annual yields of up to 28 per cent.



Calculation of AEP based on air density of 1.225 kg/m³, wind shear of 0.2 and Weibull shape parameter of k = 2.0

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As of: 09 / 2017

For contact details please visit our homepage

NORDEX

acciona Windpower

SG 4.2-145
New SGRE turbine with the best-in-class LCoE >4 MW

SIEMENS Gamesa
RENEWABLE ENERGY

First onshore launch of SGRE. Medium-wind design covering a broad range of sites

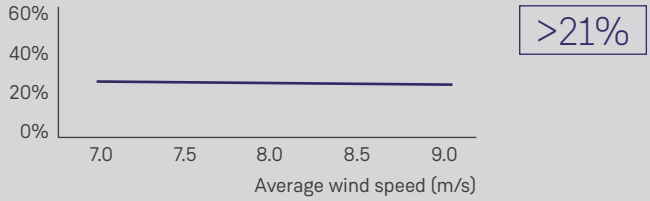
SG 4.2-145: low technological risk based on Siemens Gamesa's broad know-how of wind turbine technology

Siemens Gamesa, your trusted technological partner

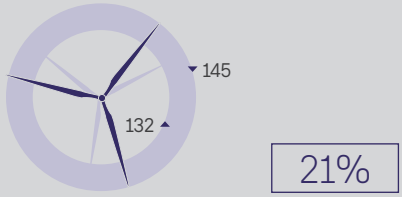
One of the key aspects to Siemens Gamesa's success is the continuous development of new and advanced products adapted to the business case of every customer. We strive to provide the best technological solutions for each project, while driving down the LCoE. We know that needs vary greatly. In response to those needs, we offer an extensive catalog of proven solutions for different site conditions and financial performance indicators. Our solutions are backed by:

- Our reputation as a trusted and stable partner (+84.5 GW installed worldwide).
- A proven track record spanning over 35 years that makes Siemens Gamesa a benchmark for wind projects.
- The recognition of the wind power sector.

AEP increase SG 4.2-145 vs. SG 3.4-132 (preliminary)



Swept area increase



New SG 4.2-145 wind turbine

The SG 4.2-145 is the first Siemens Gamesa onshore product launch and the first proposal of the Siemens Gamesa 4.X platform. Exemplar of a new generation of turbines, it is based on the operational experience accumulated by the company in the wind power market, and on the application of proven technological solutions. This new model fits into our catalog with a clear objective: to complement the product offer in the markets in which our clients require solutions with nominal powers greater than 4 MW, and with an excellent Cost of Energy. Given these premises and based on a design optimized for medium-wind speeds, its modularity and flexibility enable it to adapt to a wide range of sites.

Proven Siemens Gamesa technology

The knowledge acquired through our latest products, specifically in the optimization of design and industrialization processes, has been a key factor in the development of the SG 4.2-145 turbine. Siemens Gamesa has adopted proven technologies into this model, such as the combination of a three-stage gearbox (two planetary and one parallel) and a doubly-fed induction generator, greatly reducing technological risks. The inclusion of an optional premium converter also allows for compliance with the most demanding grid connection requirements.

It also has a new 71-meter blade made of fiberglass reinforced with epoxy resin, and integrates the aerodynamics and noise reduction know-how of Siemens legacy turbines. This is how, thanks to the incorporation of DinoTails® Next Generation technology, the SG 4.2-145 turbine guarantees a high production of energy and reduced noise emission levels.

Greater efficiency and profitability

The SG 4.2-145 model includes control technology and strategies from the Siemens legacy, which optimize the efficiency of the wind turbine depending on the site conditions. It offers a flexible power rating between 4.0 MW and 4.5 MW depending on the noise requirements, temperature and electrical properties of the project. With an increase of 21% of the swept area, and more than 21% of AEP over the SG 3.4-132 wind turbine, this new model will become a reference in the market for its high levels of efficiency and profitability.

The first SG 4.2-145 prototype installation is planned for 2018, and the Type Certificate is expected for the first half of 2019.

Technical specifications

General details	
Rated power	4.2 MW
Wind class	IEC IIA
Control	Pitch and variable speed
Standard operating temperature	Range from -20ºC to 35ºC [1]
Rotor	
Diameter	145 m
Swept area	16,513 m^2
Rotational speed	10.77 rpm
Power density	254.35 W/m^2
Blades	
Length	71 m
Airfoils	Siemens Gamesa
Material	Fiberglass reinforced with epoxy resin
Tower	
Type	Multiple technologies available
Height	107.5, 127.5, 157.5 m and site-specific
Gearbox	
Type	3 stages
Ratio	1:103.99 (50 Hz) 1:124.79 (60 Hz)
Generator	
Type	Doubly-fed induction machine
Voltage	690 V AC
Frequency	50 Hz/60 Hz
Protection class	IP 54
Power factor	0.9 CAP-0.9 IND throughout the power range [2]

[1] Different versions and optional kits are available to adapt machinery to high or low temperatures and saline or dusty environments.

[2] Power factor at generator output terminals, on low voltage side before transformer input terminals.

3 THINGS YOU SHOULD KNOW ABOUT GE's Cypress Platform

1 **50%** INCREASE IN **AEP** OVER GE's **3.X** OVER PLATFORM LIFE

2 **ENERGY OUTPUT** TODAY ... **20+** GWh/yr

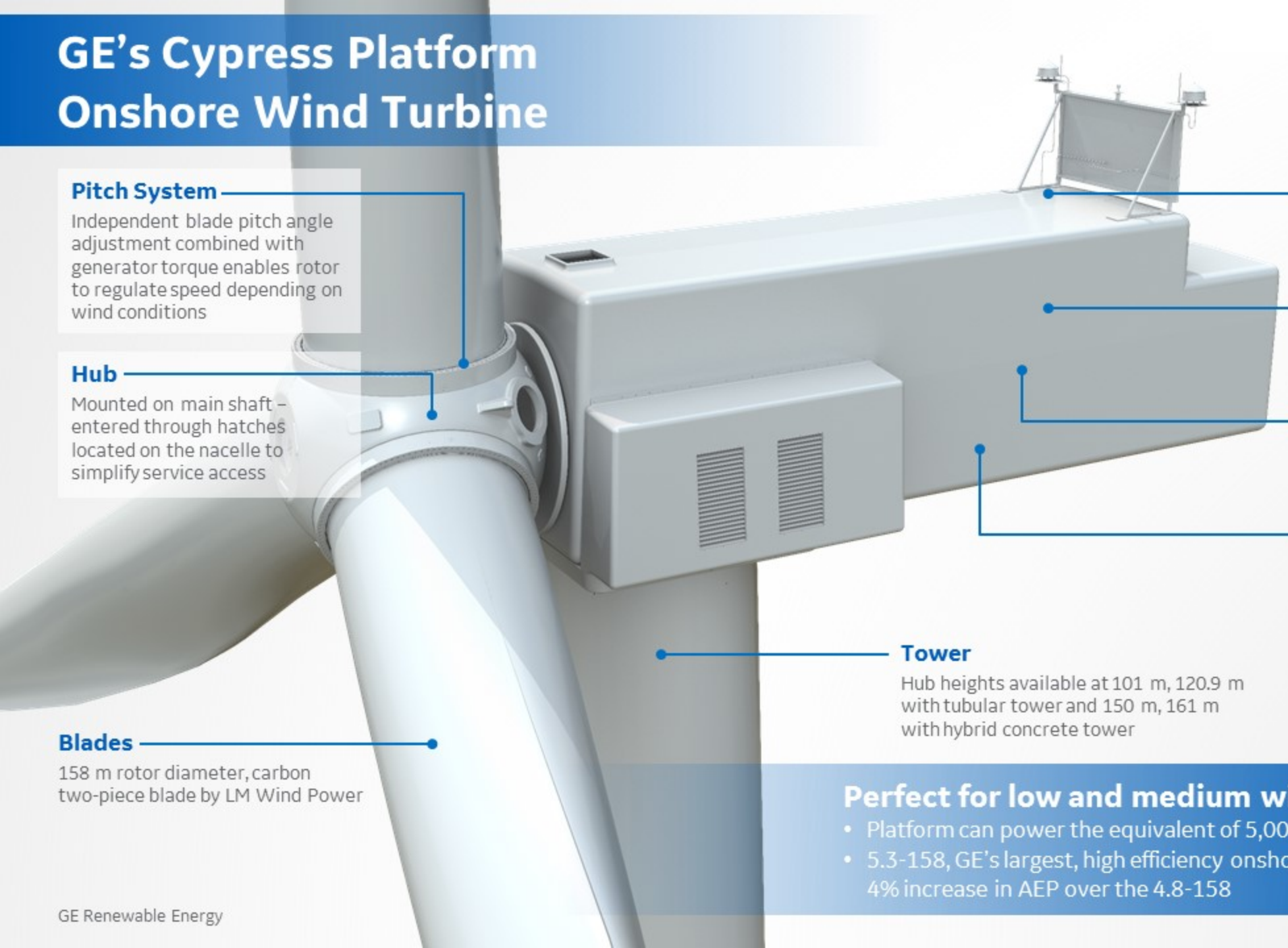
3 DRIVES DOWN **LCOE** WITH **FLEXIBILE PLATFORM**

INTRODUCING THE 5.3-158 MW

GE Renewable Energy's newest **5 MW** onshore wind turbine advances the proven technology of GE's 2 MW and 3 MW fleets, while utilizing the architecture and value-increasing innovations from the **4.8-158** turbine introduced in 2017.

- **4%** increase in **AEP** over the 4.8-158
- High tech **two-piece carbon blade** by LM Wind Power
- Services planned, condition-based and predictive services to **ensure more reliability, uptime and production**

GE's Cypress Platform Onshore Wind Turbine



Pitch System

Independent blade pitch angle adjustment combined with generator torque enables rotor to regulate speed depending on wind conditions

Hub

Mounted on main shaft – entered through hatches located on the nacelle to simplify service access

Blades

158 m rotor diameter, carbon two-piece blade by LM Wind Power

Nacelle

Larger nacelle platform brings more comfort to service personnel and facilitates up-tower repairs

Generator & Gearbox

Based on a proven doubly-fed induction generator (DFIG) electrical system, available at 50 Hz and 60 Hz

Electrical System

High power density electrical system for performance and grid integration

Control System

Fully digitally enabled, 24/7/365 remote control operations, Wind SCADA, cybersecurity

Tower

Hub heights available at 101 m, 120.9 m with tubular tower and 150 m, 161 m with hybrid concrete tower

Services

Planned, condition-based and predictive services to ensure more reliability, uptime and production

Perfect for low and medium wind speed sites

- Platform can power the equivalent of 5,000+ residential homes in Europe
- 5.3-158, GE's largest, high efficiency onshore wind turbine to date with a 4% increase in AEP over the 4.8-158