

Gamesa

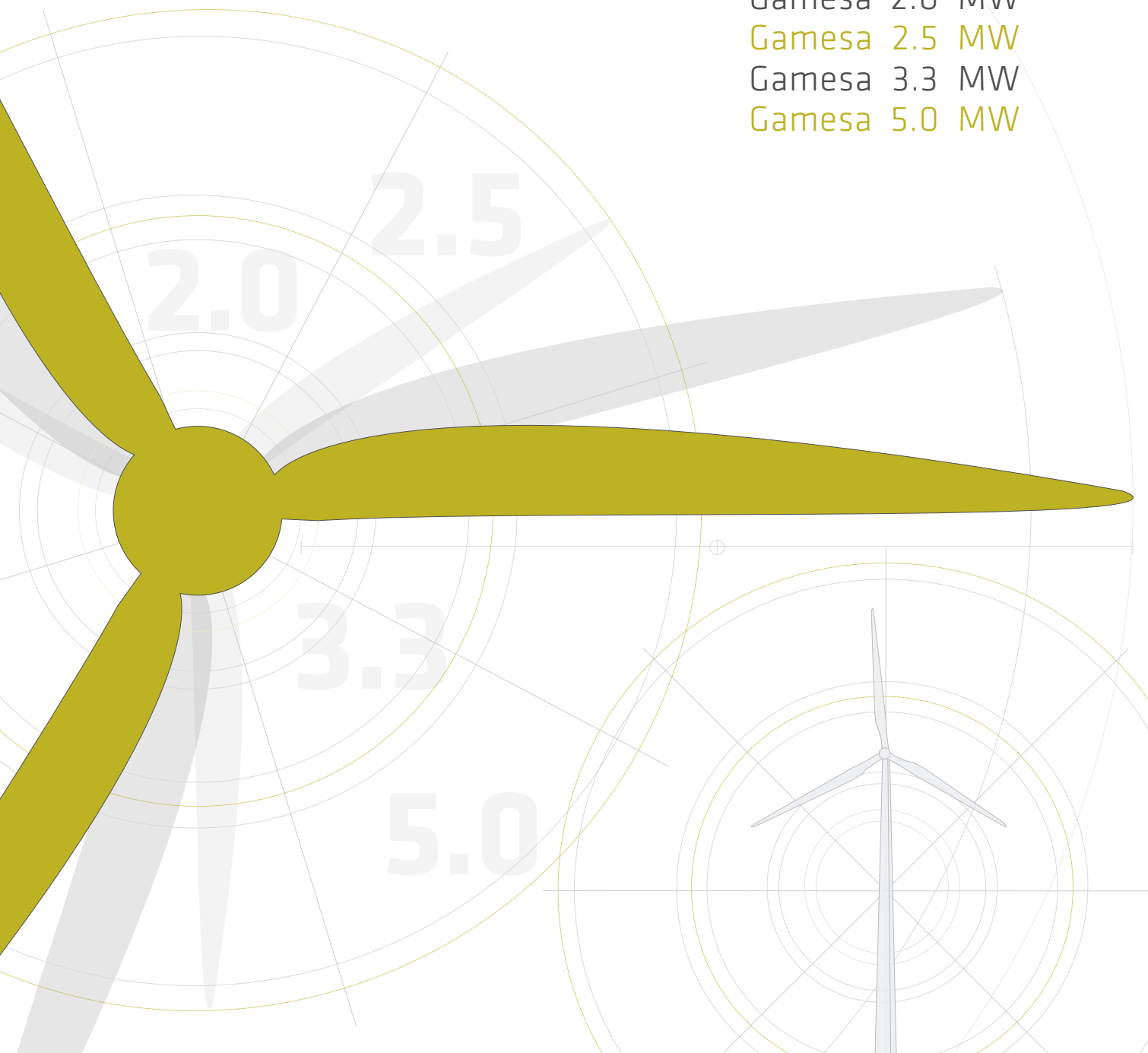
PLATFORM CATALOGUE

Gamesa 2.0 MW

Gamesa 2.5 MW

Gamesa 3.3 MW

Gamesa 5.0 MW



GLOBAL TECHNOLOGY
EVERLASTING ENERGY

Gamesa



C O N T E N T



05	06	08	11
GAMESA, OVER 20 YEARS COMMITTED TO SUSTAINABLE DEVELOPMENT	GAMESA, A TECHNOLOGICAL ALLY FOR YOUR WIND POWER PROJECTS	GAMESA, GLOBAL CAPACITY FOR PRODUCTION	GAMESA, EXTENSIVE EXPERIENCE IN OPERATION AND MAINTENANCE
■	■	■	■
12	15	18	23
GAMESA TECHNOLOGICAL EVOLUTION	GAMESA, THE BEST TECHNOLOGICAL PARTNER FOR YOUR WIND POWER PROJECTS ALL OVER THE WORLD	TECHNICAL SPECIFICATIONS AND SERVICES OF GAMESA'S PLATFORMS	DISCOVERING GAMESA 2.0 MW PLATFORM
■	■	■	■
29	31	37	39
GAMESA 2.0 MW TECHNICAL SPECIFICATIONS	DISCOVERING GAMESA 2.5 MW PLATFORM	GAMESA 2.5 MW TECHNICAL SPECIFICATIONS	DISCOVERING GAMESA 3.3 MW PLATFORM
■	■	■	■
43	45	51	55
GAMESA 3.3 MW TECHNICAL SPECIFICATIONS	DISCOVERING GAMESA 5.0 MW PLATFORM	GAMESA 5.0 MW PLATFORM TECHNOLOGIES	GAMESA 5.0 MW TECHNICAL SPECIFICATIONS



GAMESA, OVER 20 YEARS COMMITTED TO **SUSTAINABLE DEVELOPMENT**



This is the great challenge facing today's society. In the areas of energy management and power generation, Gamesa is tackling this challenge by developing technologies that foster energy sustainability in a clean, efficient and profitable manner.

More than 20 years of accumulated experience in design, manufacturing, assembly, operation and maintenance of wind turbines consolidate the company as one of the leaders in the worldwide wind power industry.

The application of the best and most modern technology, combined with a high level of industrial potential make Gamesa a market leader. At the same time, this allows the company to improve the efficiency and capacity of its products and services through the continuous advancement in the design and manufacture of wind turbines.

Passion for the customer is what drives Gamesa, and underpins its goal of ensuring total customer satisfaction. And, it is customer confidence that has turned the Gamesa product range into the one of the most competitive on the market.



GAMESA, A **TECHNOLOGICAL ALLY**
FOR YOUR WIND POWER PROJECTS



Gamesa embraces technology as the essential core of its activity, making constant efforts in R&D to implement continuous improvements in its products and services.

Since the manufacture of its first turbine in 1994, wind turbines developed and manufactured by Gamesa have evolved significantly, incorporating the latest technological advances and growing, not just in terms of power but also in performance for the customer.

With 34.6 GW installed in 53 countries and four product platforms (Gamesa 2.0 MW, Gamesa 2.5 MW, Gamesa 3.3 MW and Gamesa 5.0 MW), the company is established as one of the main worldwide technological leaders in the multi-megawatt segment.

The cornerstones of this broad product catalog are its robustness, high reliability, and adaptability to all types of locations and wind conditions; from the most demanding and difficult regions, to more accessible locations with medium and low wind conditions. All of this is based on extensive, experience gained from over 20 years of activity, making Gamesa an excellent ally for its customers' wind power projects.



GAMESA, GLOBAL CAPACITY FOR PRODUCTION

Within the wind sector, Gamesa manages the entire process, from the design, manufacture and installation of wind turbines, to their operation and maintenance.

Gamesa relies on a global industrial base with optimal vertical integration that covers the design and manufacture of its wind turbines. The tailor-made development of the critical components of its turbines-from the gearbox to the blades- ensures excellence in the design and the very highest quality standards. At the same time, it permits the shortest delivery times and the fastest technical response during the maintenance period.

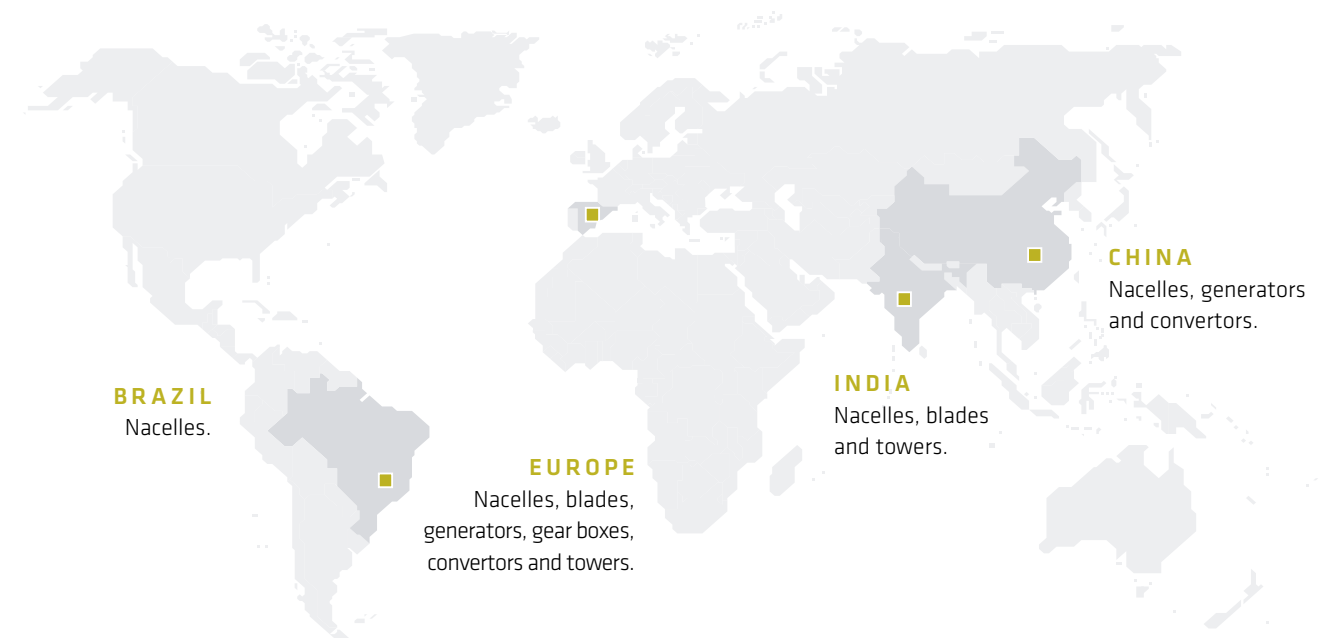
Research, Development and Innovation form an integral part of the company's processes and products as well as its

tasks and operations all along the supply chain, ensuring customer satisfaction and the search for excellence.

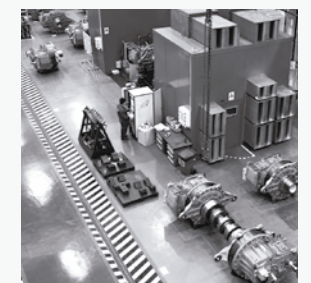
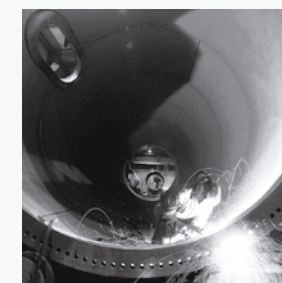
Gamesa has production centres in the main wind markets. Spain and China are the global production and supply hubs. Similarly, the company has an industrial presence in local markets such as India and Brazil. In addition to a strong internal industrial capacity, strategic alliances have been established with the foremost worldwide component providers.

Thanks to this global production and supply capacity, Gamesa fully controls the production process and attends to the needs of its clients on all five continents, offering its customers the highest quality standards and short customer response times.

PRODUCTION CENTERS IN THE MAIN WIND POWER MARKETS



Gamesa designs and manufactures its wind turbines' critical components, comprehensively controlling the production process.





GAMESA, EXTENSIVE EXPERIENCE IN OPERATION AND MAINTENANCE



Operation & Maintenance (O&M) is one of the key activities upon which Gamesa bases its development. With 70% of its installed capacity under O&M contracts and a broad operational knowledge in complex locations, Gamesa maintains 21 GW in 36 countries. All of this is possible thanks to a team of highly-qualified professionals, present worldwide and focused on health and safety as well as on service excellence and customer satisfaction.

Backed by over 20 years of experience in wind turbine O&M and optimization, Gamesa continues to be committed to adding value, offering cutting edge solutions, such as the

useful life extension, integral solutions for the O&M of other manufacturers' wind turbines, and personalized financing options to meet the needs of each customer. Gamesa also focuses intensively on programs for maximizing energy production, improving availability and reducing O&M related costs, with the goal of reducing the maximum cost of energy.

Through a detailed analysis of extensive data drawn from two decades in the field, Gamesa continuously adapts its equipment to the most demanding network and environmental settings.

New Gamesa WindNet® PRO

Gamesa WindNet® PRO is the new generation SCADA wind farm system entirely developed by Gamesa which allows remote operation and the monitoring of the wind turbine, its meteorological mast and electrical substation in real time.

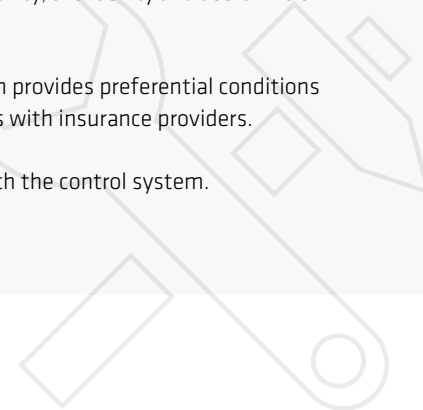
Gamesa WindNet® PRO's innovative, modular design is based on TCP/IP architecture. Control features include active and reactive power, voltage and frequency regulation tools and environmental options to optimize production while complying with current regulations. Accessible anywhere through a Web browser, Gamesa WindNet® PRO is simple to use and intuitive. It features the Report Generator and Information Manager analytical tools, as well as TrendViewer, an advanced tool to illustrate key data trends.

Predictive Maintenance System SMP

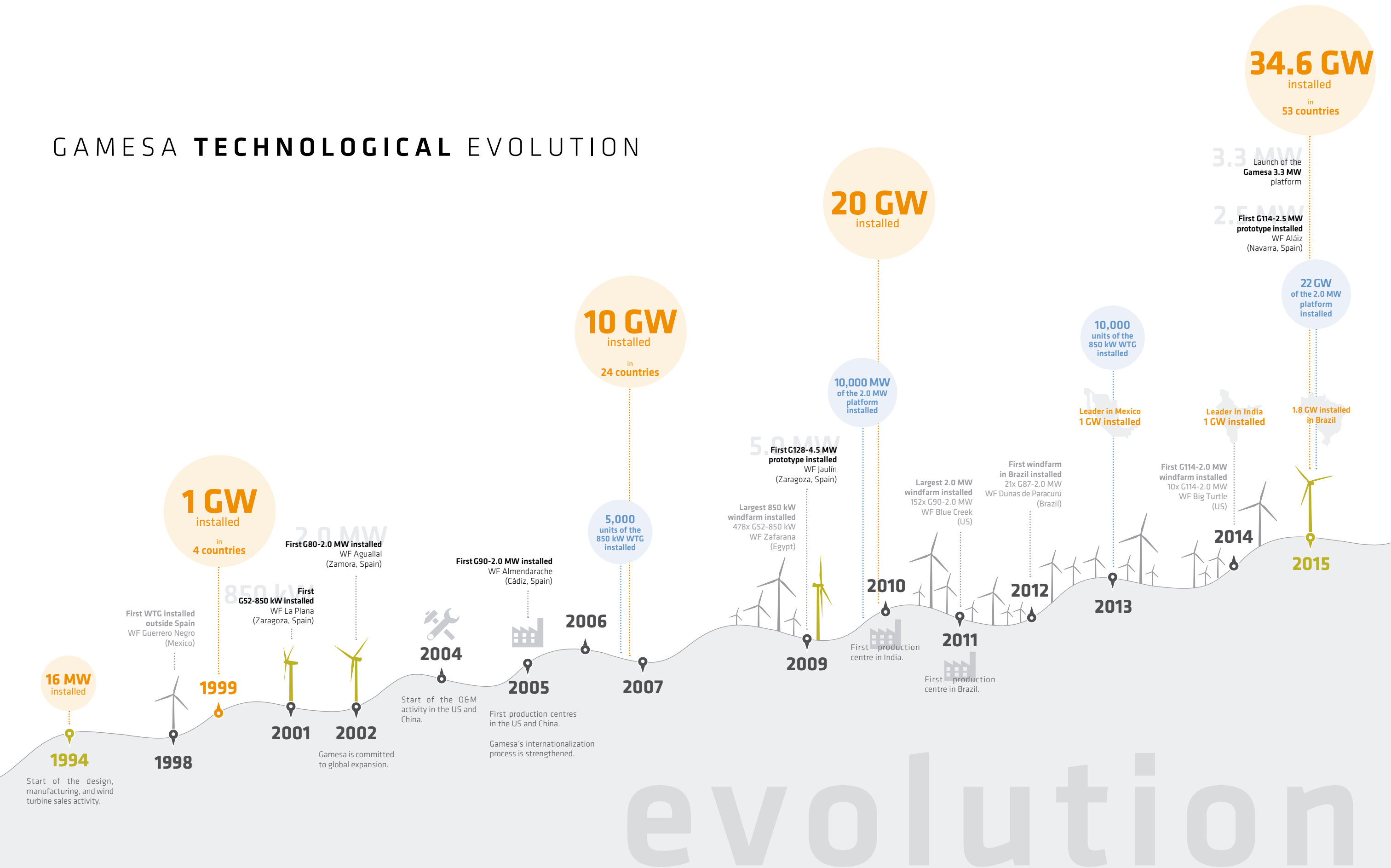
Predictive maintenance system for premature detection of potential deterioration or faults in the main wind-turbine components.

Advantages:

- Fewer large correctives.
- Improved reliability, availability and useful life of the machine.
- Risk mitigation provides preferential conditions in negotiations with insurance providers.
- Integration with the control system.

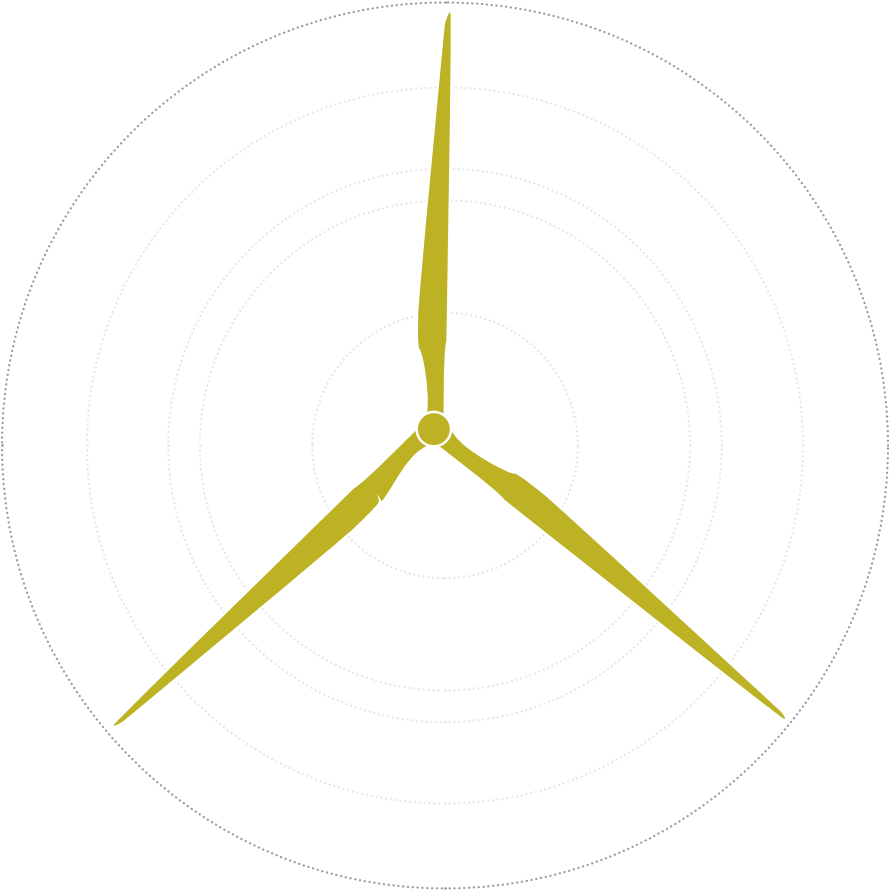


GAMESA TECHNOLOGICAL EVOLUTION



T H E B E S T
T E C H N O L O G I C A L
P A R T N E R

G A M E S A



F O R Y O U R W I N D P R O J E C T S
A L L O V E R T H E W O R L D



Extensive knowledge of design criteria for key components enables Gamesa to quickly implement innovative technology in new design models, with a proven capacity to adapt to any environment.

- FROM THIS WIDE TECHNOLOGICAL OFFER, GAMESA DEVELOPS **SPECIFIC PRODUCT CATALOGUES** ADAPTED TO ITS CLIENTS' REQUIREMENTS **IN EACH MARKET**.



Mechanical design:
Maximum reliability and performance

Gamesa turbines incorporate improved and increased mechanical capacity in key wind-turbine components such as the yaw system, the framework, main axis and blade bearings. These improvements guarantee maximum reliability of the equipment and allow larger rotors to be used to increase the power generated.

Drive train

The main axis is supported by two spherical bearings that provide significant advantages since lateral loads are transmitted directly to the framework through a rack. This prevents the gear box from receiving additional, unwanted loads, reduces the possibility of breakdown and provides a longer service life.

Control system:
Maximum output under any wind condition

Dual powered generator, speed and power controlled by IGBT converters and electronic PWM control (Pulse Width Modulation).

Advantages:

- Active and reactive power control.
- Low harmonic content and minimum losses.
- Increased efficiency and production.
- Improved useful life of the machine.

Total lightning protection

Gamesa turbines use the “Total Lightning Protection” system, designed according to the IEC 62305 standard. This system conducts the lightning from both sides of the tip of the blade to the root, and from there, through the nacelle and the tower structure, to the foundation grounding system. This protects the blade and prevents the lightning from going through the blade bearings and main axis, safeguarding sensitive electrical and electronic elements from damage.

Controlled brake system

The joint action of the primary aerodynamic brakes and mechanical emergency brake (located at the output of the high-speed axis of the gear box) with a hydraulic control system, allows controlled braking that prevents damage due to excessive transmission load.

Gamesa NRS®
Minimum noise emission

New aerodynamic design of the blade tip and mechanical components design minimize noise emissions.

In addition, Gamesa has developed the Gamesa NRS® noise control system, which makes it possible to program the turbine to reduce noise emissions according to such criteria as the date, time or wind direction. This achieves compliance with local regulations and enables maximum production.



Dynamic regulation of reactive power on the wind farm

The on-site power measurement equipment monitors the high-voltage active and reactive power data at the output of the substation transformer and send them to Gamesa WindNet®PRO via the control unit of the substation.

Gamesa WindNet® PRO dynamically calculates and corrects the power factor in accordance with the reference values of the System Operator.

Gamesa WindNet® PRO actuates on both the reactive power regulation capability of the turbine and, where available, other equipment in the substation such as capacitor banks and FACTS systems.

Optimum electrical grid connection and stable production

Gamesa's doubly fed wind turbines guarantee compliance with today's most demanding grid code requirements as well as future electrical grid and wind farm configurations, by offering full support for voltagedrop and dynamic active and reactive power regulation.

The DFIM Technology (Doubly Fed Induction Machine) in combination with Gamesa WindNet® PRO, the new SCADA System developed by Gamesa, allows the regulation of active and reactive power via the injection of rotor currents with variable amplitude, frequency and phase. Specifically, the injection of currents with variable amplitude allows the system to control the reactive power by varying the power factor, whereas the injection of currents with variable phase allows the system to control the active power. With less than 25% of the generated power passing through the converter, the DFIM Technology guarantees that the harmonics generated are minimized.

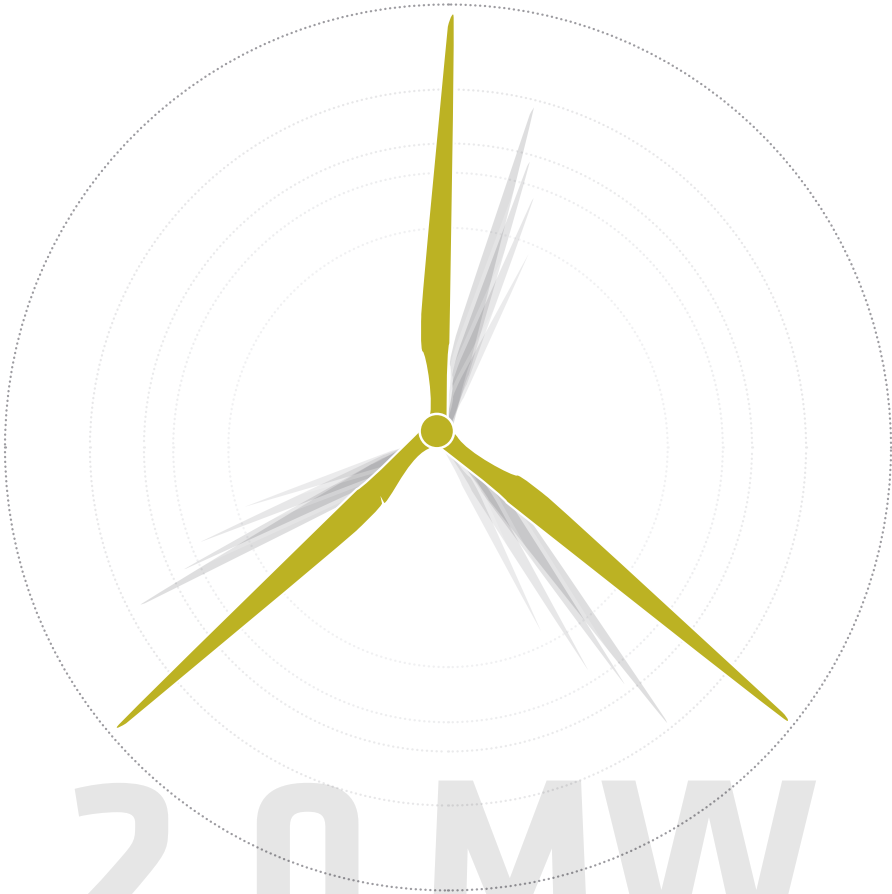
Requirement	Gamesa fulfillment ⁽¹⁾
Voltage ride-through	Low voltage ride-through capabilities covering the most important grid codes.
Reactive regulation ⁽²⁾	Up to Cos phi 0.95 (cap) - 0.95 (ind) in output terminals of the turbine.
Active regulation	±10% ΔP* and capacity to participate in primary regulation.
Operational frequency range	47 - 53 Hz (50 Hz) 57 - 63 Hz (60 Hz)
Operational voltage range	±5% in normal operation and ±10% in specific periods.
Remote control	Control via Gamesa WindNet® of the active and reactive power with different set-point options and the possibility of dealing dynamically with the commands for operations of the grid operator.

(1) Valid for new machines.
(2) Options to be defined in every order.

* The increase in power will depend on the existence of wind resources or previous commands from the O.S. to reduce power.

V E R S A T I L I T Y

G A M E S A 2.0 M W



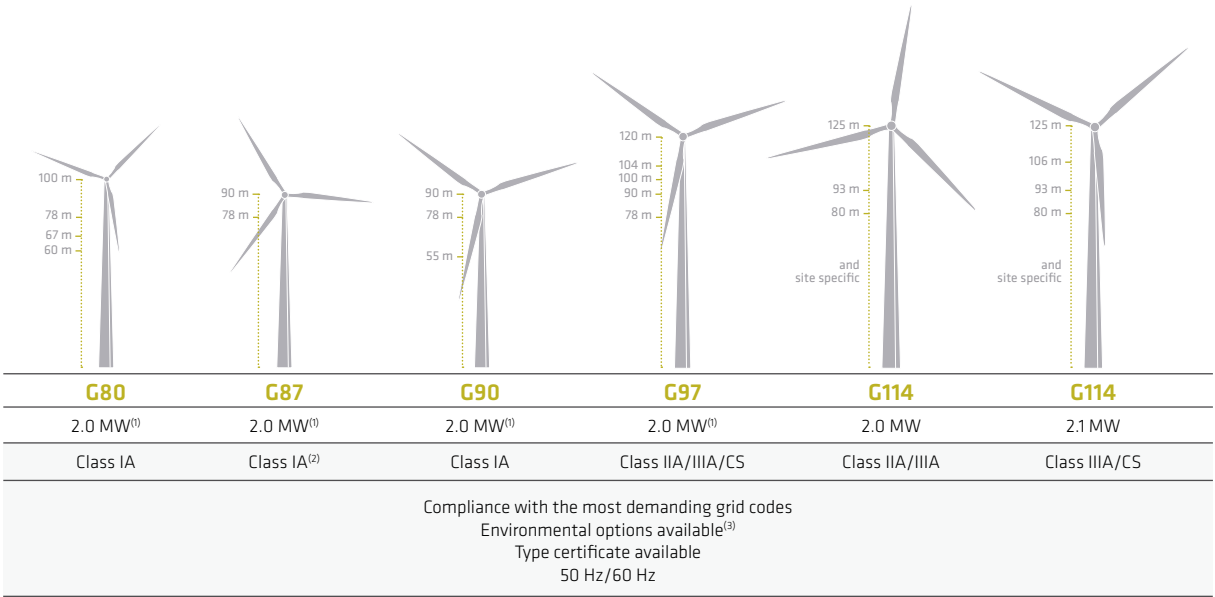
G80 ■ G87 ■ G90 ■ G97 ■ G114



DISCOVERING GAMESA 2.0 MW



Multi-megawatt wind turbines from the Gamesa 2.0 MW platform improve competitive investment ratios per MW installed and Cost of Energy produced. This is possible thanks to the versatile combination of a 2.0 MW rated power generator with the option to choose from five rotor diameters: 80, 87, 90, 97 and 114 meters in order to reach maximum performance for all types of locations and wind conditions.



(1) 2.1 MW nominal power upgrade available depending on the site.
(2) Class S.
(3) Different versions and optional kits are available to adapt machinery to high or low temperatures and saline or dusty environments.

2.0

GAMESA 2.0 MW, VERSATILITY AND MAXIMUM PRODUCTION

The 2.0 MW Gamesa platform, with 22 installed GW accumulated in 37 countries, bases its technology on speed control and variable pitch, incorporating the latest technologies in order to obtain maximum wind energy capture with the greatest efficiency.

- 2.0 MW and 2.1 MW generators.
- Maximum output in any type of site.
- New, latest generation 114-meter rotor for low and medium wind speeds which, together with the 80-, 87-, 90- and 97-meter rotors, make this the most versatile platform on the market.
- Availability figures exceeding 98%.
- State-of-the-art blade manufacturing technology:
 - Fiberglass reinforced materials in order to achieve lighter blades while maintaining rigidity and strength.
 - New optimized blade profiles guarantee maximum production and low noise.
- Variable pitch and speed technology maximize energy production.
- Technological solutions guarantee compliance with international grid connection requirements.
- Gamesa active yaw system ensures optimum adaptation to complex terrain.
- Aerodynamic design and the Gamesa NRS® control system minimize noise emissions.
- Gamesa WindNet® PRO: remote control and monitoring system with web access.
- Gamesa SMP: System for predictive maintenance.

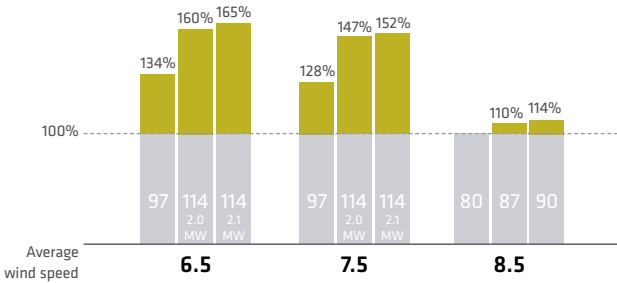
Latest models
Gamesa 2.0 MW

G114-2.1 MW IIIA/CS.
G114-2.0 MW IIA/IIIA.
G97-2.0 MW IIA/IIIA.
G90-2.0 MW IA.

IEC Class per model

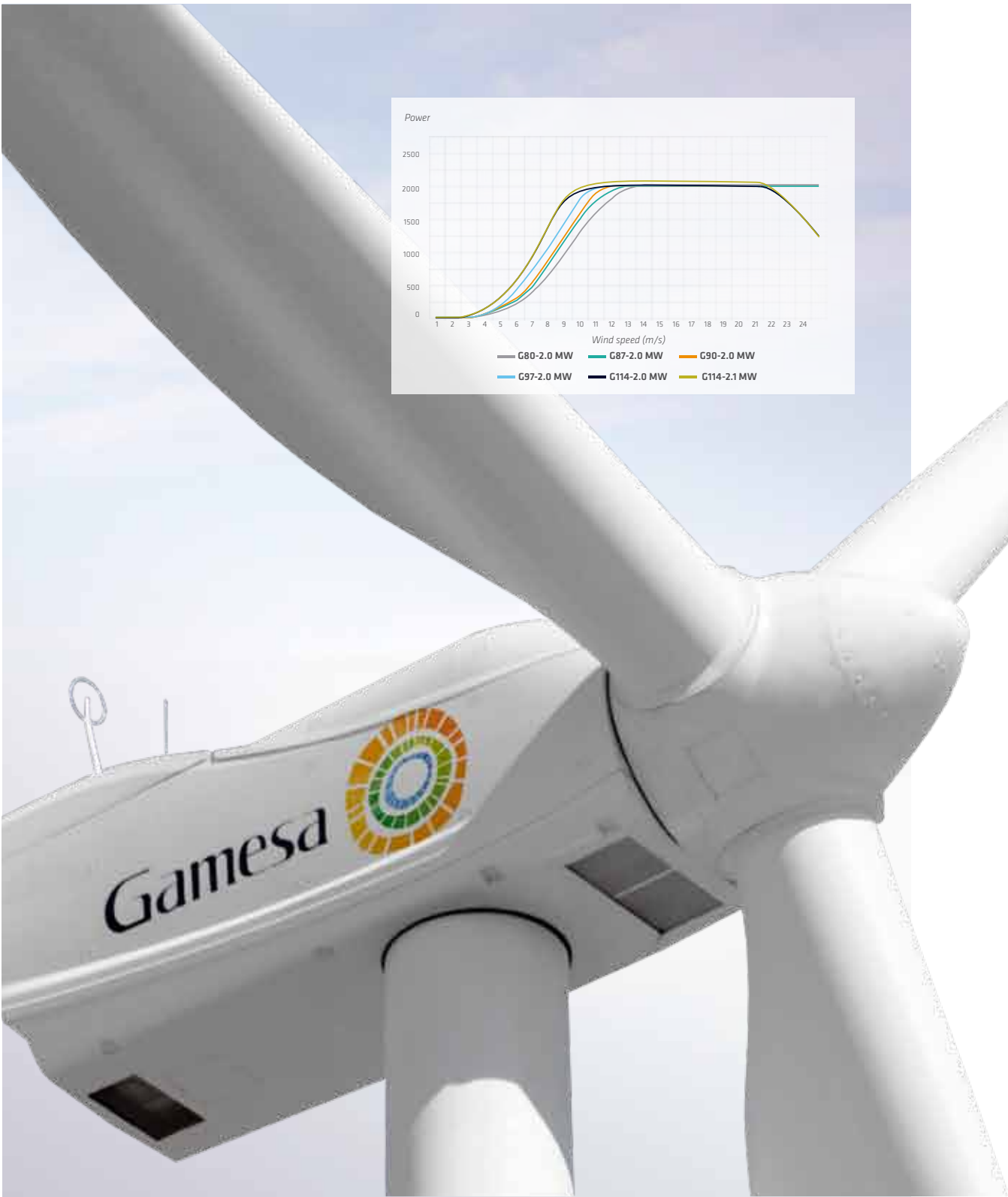
	Class I	Class II	Class III
G80			
G87			
G90			
G97			
G114			

Increase in production by average wind speed



G114-2.0 MW
G114-2.1 MW

- HIGHEST CAPACITY FACTOR of the market.
- MINIMUM power density.
- IMPROVED CoE.
- MAXIMUM PROFITABILITY.
- TYPE CERTIFICATES AVAILABLE.



GAMESA 2.0 MW

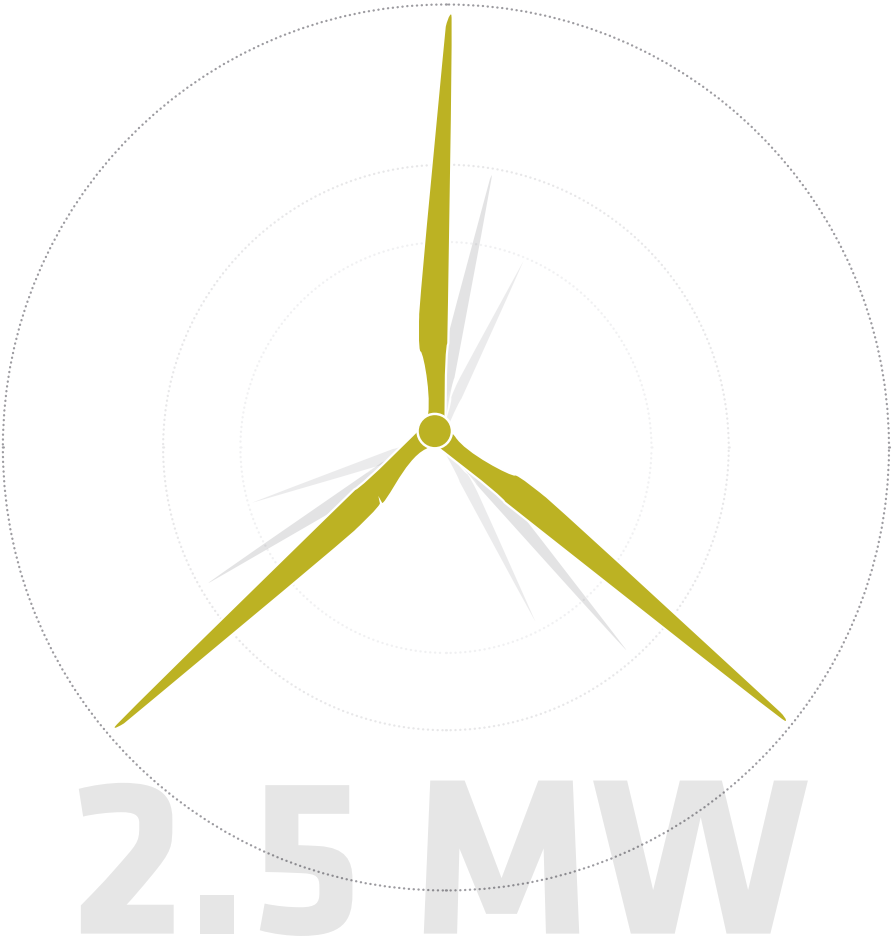
	G80-2.0 MW	G87-2.0 MW	G90-2.0 MW	G97-2.0 MW	G114-2.0 MW	G114-2.1 MW
ROTOR						
Diameter	80 m	87 m	90 m	97 m	114 m	114 m
Swept area	5,027 m²	5,945 m²	6,362 m²	7,390 m²	10,207 m²	10,207 m²
Rotational speed	9.0-19.0 rpm	9.0-19.0 rpm	9.0-19.0 rpm	9.6-17.8 rpm	7.8-14.8 rpm	7.8-14.8 rpm
BLADES						
Number of blades	3	3	3	3	3	3
Length	39 m	42.5 m	44 m	47.5 m	56 m	56 m
Airfoils	NACA 63 XXX + FFA-W3	DU + FFA-W3	Gamesa	Gamesa	Gamesa	Gamesa
Material	Pre-impregnated epoxy glass fiber	Pre-impregnated epoxy glass fiber	Fiberglass reinforced with polyester resin	Fiberglass reinforced with polyester resin	Fiberglass reinforced with epoxy or polyester resin	Fiberglass reinforced with epoxy or polyester resin
TOWER						
Type	Modular	Modular	Modular	Modular	Modular	Modular
Height	60, 67, 78 and 100 m	78 and 90 m	55, 78 and 90 m	78, 90, 100, 104 and 120 m	80, 93, 125 m and site specific	80, 93, 106, 125 m and site specific
GEAR BOX						
Type	1 planetary stage 2 parallel stages	1 planetary stage 2 parallel stages	1 planetary stage 2 parallel stages	1 planetary stage 2 parallel stages	1 planetary stage 2 parallel stages	1 planetary stage 2 parallel stages
Ratio	1:100.5 (50 Hz) 1:120.5 (60 Hz)	1:100.5 (50 Hz) 1:120.5 (60 Hz)	1:100.5 (50 Hz) 1:120.5 (60 Hz)	1:106.8 (50 Hz) 1:127.1 (60 Hz)	1:128.5 (50 Hz) 1:102.5 (60 Hz)	1:128.5 (50 Hz) 1:102.5 (60 Hz)
GENERATOR						
Type	Doubly-fed machine	Doubly-fed machine	Doubly-fed machine	Doubly-fed machine	Doubly-fed machine	Doubly-fed machine
Rated power	2.0 MW	2.0 MW	2.0 MW	2.0 MW	2.0 MW	2.1 MW
Voltage	690 V AC	690 V AC	690 V AC	690 V AC	690 V AC	690 V AC
Frequency	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz
Protection class	IP 54	IP 54	IP 54	IP 54	IP 54	IP 54
Power factor	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*

* Power factor at generator output terminals, on low voltage side before transformer input terminals.

versatility

I N T E L L I G E N T E V O L U T I O N

G A M E S A **2.5 M W**



G106 ■ G114 ■ G126

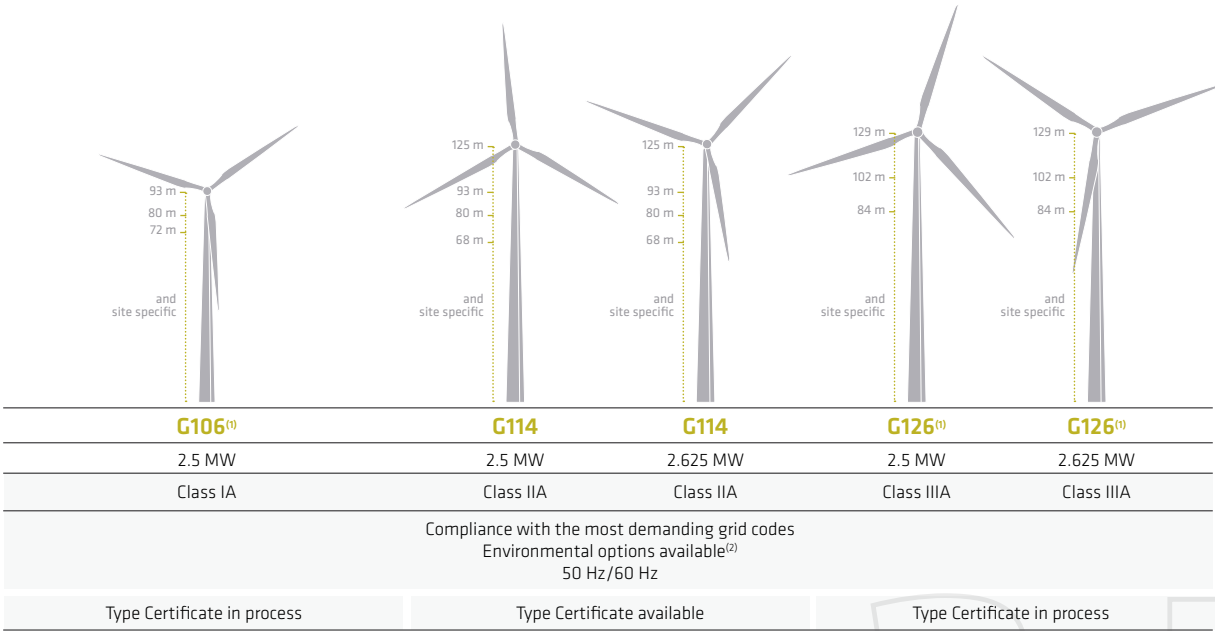


DISCOVERING GAMESA 2.5 MW



In order to improve the cost of energy in the 2.0-3.0 MW segment, Gamesa launches its Gamesa 2.5 MW platform, a new reference within its product catalog and the natural evolution of the 2.0 MW platform.

With three new 106-, 114- and 126-meter rotors, new tower options and a nominal power of 2.5 MW, the Gamesa 2.5 MW platform complements the Gamesa 2.0 MW product series, which has become a reference in the market, notable for excellent capacity factors and high profitability.



(1) Under development.
(2) Different versions and optional kits are available to adapt machinery to high or low temperatures and saline or dusty environments.

2.5

GAMESA 2.5 MW, INTELLIGENT EVOLUTION



Backed by extensive experience and demonstrated adaptability, this platform combines the proven reliability of its predecessor 2.0 MW platform with the company’s latest technological advances to deliver significant improvements in performance, thanks to optimized models and new tower portfolio:

- New 2.5 MW and 2.625 MW generators.
 - Demonstrated and validated technology from the Gamesa 2.0 MW platform.
 - Greater energy production: up to 14% in the G114-2.5 MW model and up to 21% in the G126-2.5 MW compared to the G114-2.0 MW model.
 - Excellent capacity factor and reduction of Cost of Energy.
 - Optimized models for medium and low wind locations.
 - Improved power curves.
- New and optimized blade root with high thickness profiles. Pre-impregnated fiberglass blades designed to reduce weight.
 - Variable pitch and speed technology maximize energy production.
 - Gamesa active yaw system ensures optimum adaptation to complex terrain.
 - Aerodynamic design and the Gamesa NRS® control system minimize noise emissions.
 - Gamesa WindNet® PRO: remote control and monitoring system with web access.
 - Gamesa SMP: System for predictive maintenance.



Turbine models
Gamesa 2.5 MW

G126-2.5 MW IIIA.

G114-2.5 MW IIA.

G106-2.5 MW IA.

G126-2.625 MW IIIA.

G114-2.625 MW IIA.

IEC Class per model

	Class I	Class II	Class III
G106			
G114			
G126			

Tower
portfolio

G106 - 72, 80, 93 m and site specific.

G114 - 68, 80, 93, 125 m and site specific.

G126 - 84, 102, 129 m and site specific.

2.5



GAMESA 2.5 MW

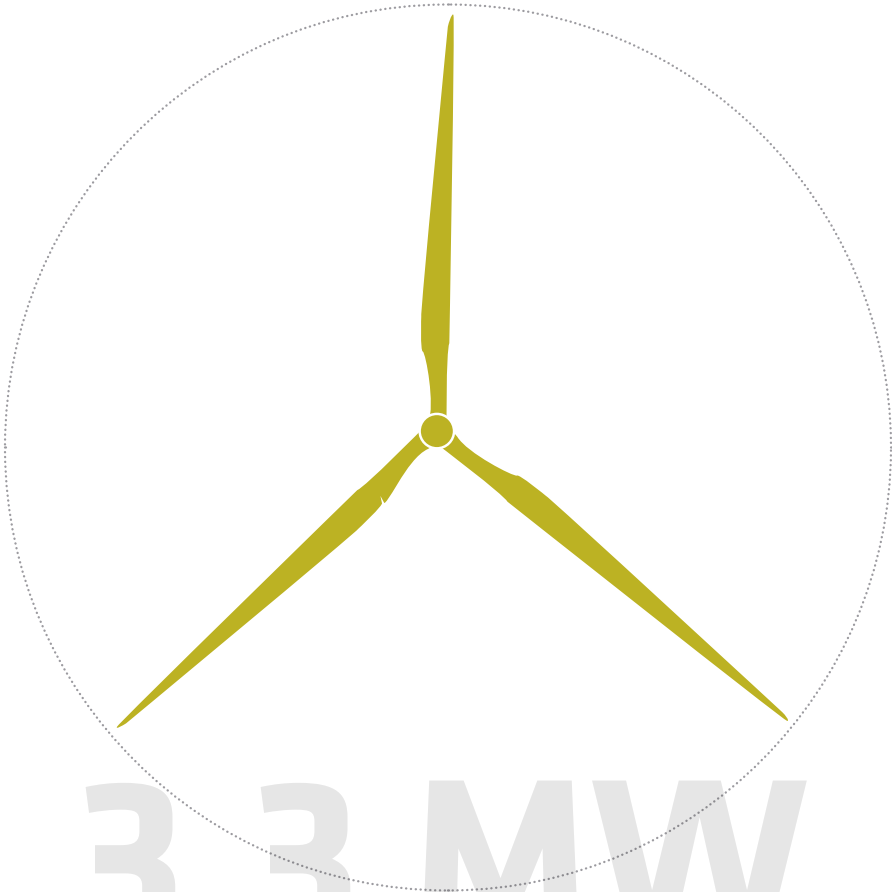
	G106-2.5 MW	G114-2.5 MW	G114-2.625 MW	G126-2.5 MW	G126-2.625 MW
ROTOR					
Diameter	106 m	114 m	114 m	126 m	126 m
Swept area	8,825 m²	10,207 m²	10,207 m²	12,469 m²	12,469 m²
Rotational speed	7.7 - 14.6 rpm	7.7 - 14.6 rpm	7.7 - 14.6 rpm	7.1 - 12.9 rpm	7.1 - 12.9 rpm
BLADES					
Number of blades	3	3	3	3	3
Length	52 m	56 m	56 m	62 m	62 m
Airfoils	Gamesa	Gamesa	Gamesa	Gamesa	Gamesa
Material	Fiberglass reinforced with epoxy or polyester resin	Fiberglass reinforced with epoxy or polyester resin	Fiberglass reinforced with epoxy or polyester resin	Fiberglass reinforced with epoxy or polyester resin	Fiberglass reinforced with epoxy or polyester resin
TOWER					
Type	Modular	Modular	Modular	Modular	Modular
Height	72, 80, 93 m and site specific	68, 80, 93, 125 m and site specific	68, 80, 93, 125 m and site specific	84, 102, 129 m and site specific	84, 102, 129 m and site specific
GEAR BOX					
Type	2 planetary stages 1 parallel stage	2 planetary stages 1 parallel stage	2 planetary stages 1 parallel stage	2 planetary stages 1 parallel stage	2 planetary stages 1 parallel stage
Ratio	1:129.7 (50 Hz) 1:103.8 (60 Hz)	1:129.7 (50 Hz) 1:103.8 (60 Hz)	1:129.7 (50 Hz) 1:103.8 (60 Hz)	1:98 (50 Hz) 1:118 (60 Hz)	1:98 (50 Hz) 1:118 (60 Hz)
GENERATOR					
Type	Doubly-fed machine	Doubly-fed machine	Doubly-fed machine	Doubly-fed machine	Doubly-fed machine
Rated power	2.5 MW	2.5 MW	2.625 MW	2.5 MW	2.625 MW
Voltage	690 V AC	690 V AC	690 V AC	690 V AC	690 V AC
Frequency	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz
Protection class	IP 54	IP 54	IP 54	IP 54	IP 54
Power factor	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*

* Power factor at generator output terminals, on low voltage side before transformer input terminals.

Intelligent evolution

O P T I M U M C O E

G A M E S A 3.3 M W



3.3 MW

■ G132 ■



DISCOVERING GAMESA 3.3 MW



One of the keys to Gamesa's success is the constant development of new and advanced products adapted to customers' needs in any type of site and with maximum profitability.

With this purpose in mind the new Gamesa 3.3 MW platform has been launched with its first model: the G132-3.3 MW wind turbine for Class II sites. A new generation of multi-megawatt turbines that reaches the market to become the best solution in terms of Cost of Energy in the 3.0-3.3 MW segment.



G132 ⁽¹⁾	G132 ⁽²⁾
3.3 MW	3.465 MW
Class IIA	Class IIA
Compliance with the most demanding grid codes Environmental options available ⁽²⁾ Type Certificate in process 50 Hz/60 Hz	

(1) Under development.
(2) Different versions and optional kits are available to adapt machinery to high or low temperatures and saline or dusty environments.

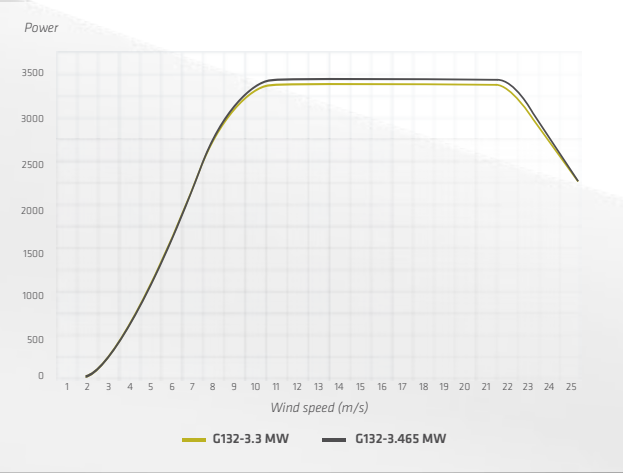
3.3

GAMESA 3.3 MW, OPTIMUM CoE



Thanks to the operative experience accumulated by Gamesa throughout more than 20 years in the wind energy market, the Gamesa 3.3 MW platform enables the company to guarantee the highest levels of reliability.

- The best CoE in the 3.0-3.3 MW segment.
 - New 3.3 MW platform based on mature technologies proven in the Gamesa portfolio.
 - 34% larger swept area vs. 114 m. rotor.
 - Installation of the first G132-3.3 MW prototype is expected in 2016.
 - Optimum solution for medium wind sites.
 - Improvement of the production capacity thanks to nominal powers of 3.3 MW and 3.465 MW and a greater rotor swept area.
- 64.5 m fibreglass blade, optimized for Class II sites and with aerofoils that have already been thoroughly tested and validated in the G132-5.0 MW IIA wind turbine.
 - New models G132-3.3 MW and G132-3.465 MW that guarantee maximum energy production and low noise emission levels.
 - Extensive portfolio of towers with heights ranging from 84 m to 134 m, which enables it to comply with the different maximum blade tip height restrictions in certain markets.



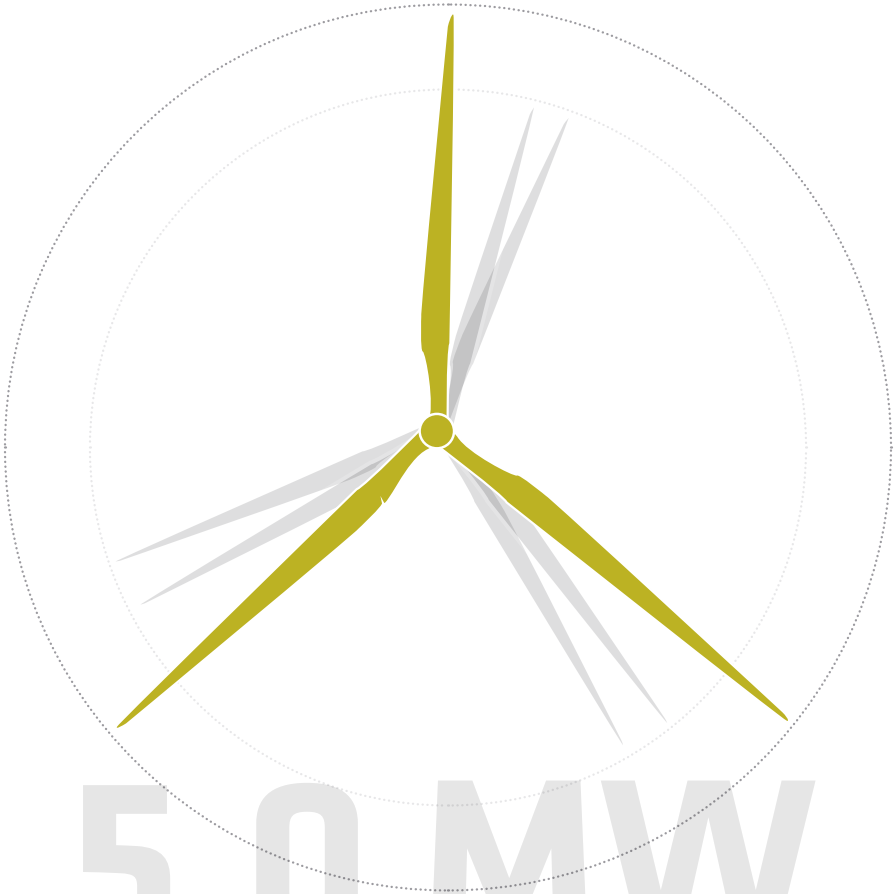
GAMESA 3.3 MW

	G132-3.3 MW	G132-3.465 MW
ROTOR		
Diameter	132 m	132 m
Swept area	13,685 m²	13,685 m²
Rotational speed	6.82 - 10.9 rpm	6.82 - 10.9 rpm
BLADES		
Number of blades	3	3
Length	64.5 m	64.5 m
Airfoils	Gamesa	Gamesa
Material	Fiberglass reinforced with epoxy or polyester resin	Fiberglass reinforced with epoxy or polyester resin
TOWER		
Type	Modular	Modular
Height	84, 97, 114, 134 m and site specific	84, 97, 114, 134 m and site specific
GEAR BOX		
Type	3 stages	3 stages
Ratio	1:102.75 (50 Hz) 1:123.3 (60 Hz)	1:102.75 (50 Hz) 1:123.3 (60 Hz)
GENERATOR		
Type	Doubly-fed machine	Doubly-fed machine
Rated power	3.3 MW	3.465 MW
Voltage	690 V AC	690 V AC
Frequency	50 Hz/60 Hz	50 Hz/60 Hz
Protection class	IP 54	IP 54
Power factor	0.95 CAP-0.95 IND throughout the power range*	0.95 CAP-0.95 IND throughout the power range*

* Power factor at generator output terminals, on low voltage side before transformer input terminals.

R E L I A B I L I T Y

G A M E S A 5.0 M W



5.0 MW

G128 ■ G132



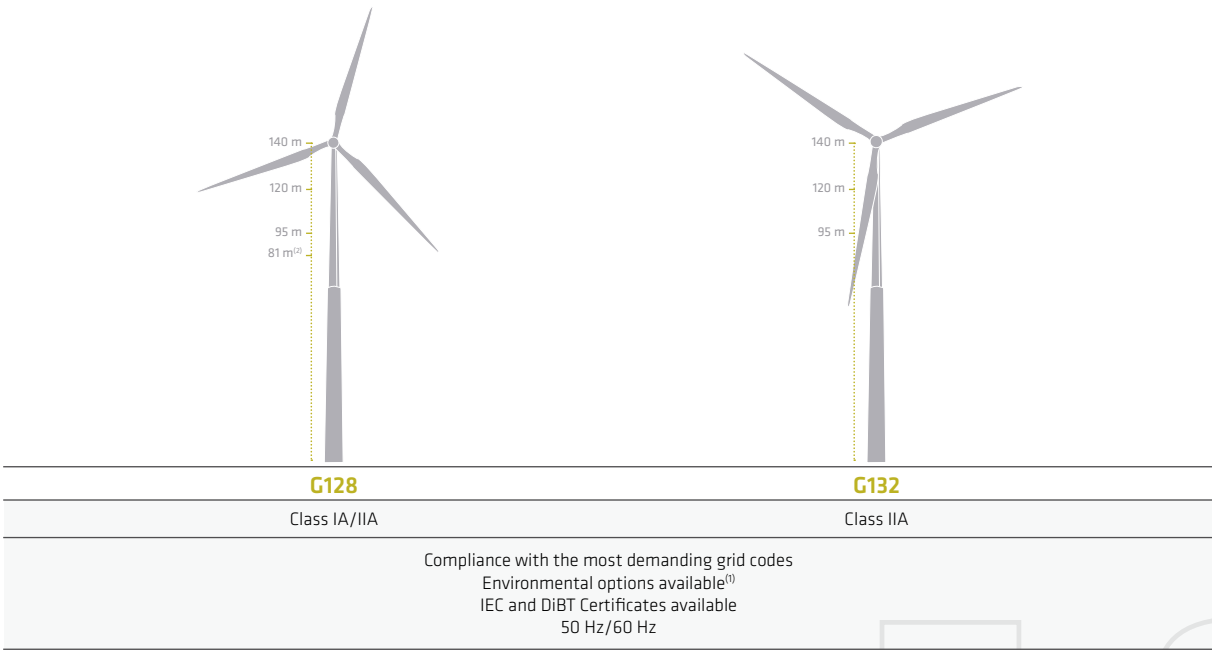
DISCOVERING GAMESA 5.0 MW



Once again, Gamesa has demonstrated that it has the knowledge, experience and resources needed to develop wind turbines capable of extracting maximum power from the wind.

The Spanish company has taken a leap forward in one of its biggest, most ambitious technological challenges to date: the design and development of the Gamesa 5.0 MW platform. With this new product platform, Gamesa intends to position itself at the forefront of the multimegawatt platform segment.

The company thus expands its technology and service offering by including in this platform two wind turbines in order to meet the needs of all the customers in the onshore wind power industry.



(1) Different versions and optional kits are available to adapt machinery to high or low temperatures and saline or dusty environments.
(2) Only tower height available for Class I.

5.0

GAMESA 5.0 MW, GREATER SIZE FOR GREATER PRODUCTION



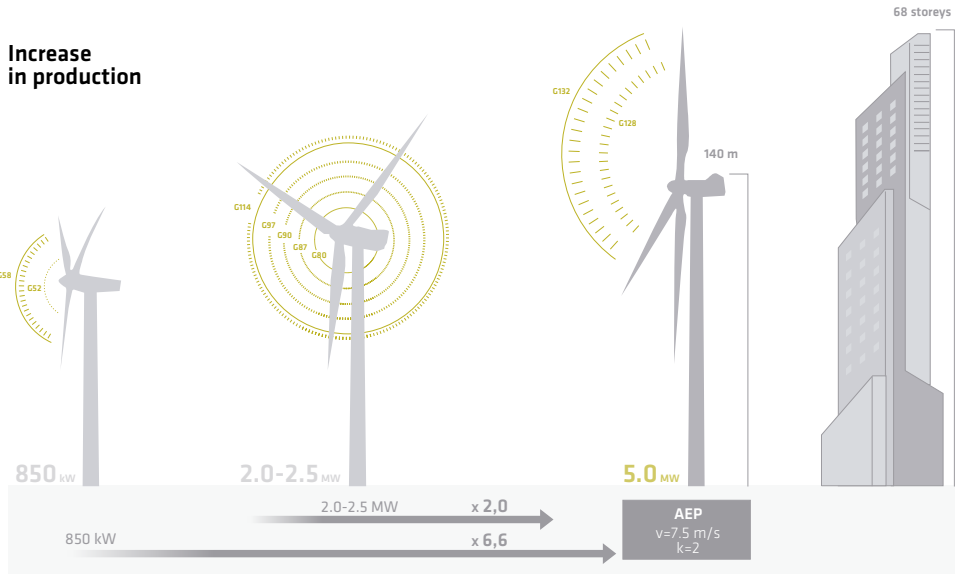
Gamesa has applied design and validation concepts to its new wind turbine development that are only comparable to those used in such demanding industries as the aeronautical industry, where product reliability must be assured from the first day in operation. Gamesa 5.0 MW is the result of the evolution of Gamesa technology:

- Individual pitch and multivariable control maximize energy and minimize weight, loads and noise.
 - Sectional blade for easy transport and installation.
 - Permanent magnet synchronous generator and full converter technology that allow the most demanding grid code requirements to be met.
 - Add-on crane attaches to nacelle for assisting in the assembly of the main modules.
- Compact, high-performance drive train reduces mechanical stress.
 - Aerodynamic blade design and the Gamesa NRS® control system minimize noise emissions.
 - Gamesa WindNet® PRO: remote control and monitoring system with web access.
 - Gamesa SMP System: system for predictive maintenance.

Siting optimization taking advantage of the most productive positions

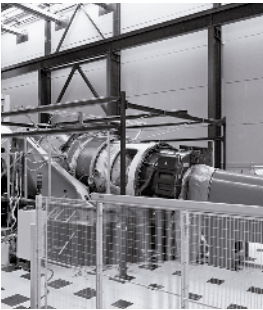
IEC Class per model

	Class I	Class II	Class III
G128			
G132			



Superior **reliability**

- Nacelle and blades modular design focused on minimizing inactive time.
- Drive train with no high-speed rotating components.
- Exhaustive validation and testing plan, as well as the first operational prototype since 2009.



Optimizes cost of energy (CoE)

- Higher production for projects with limited space.
- Optimization of energetical positions.
- Potential savings in project civil works.

Similar **logistics and construction requirements** as those of the Gamesa 2.0 MW platform

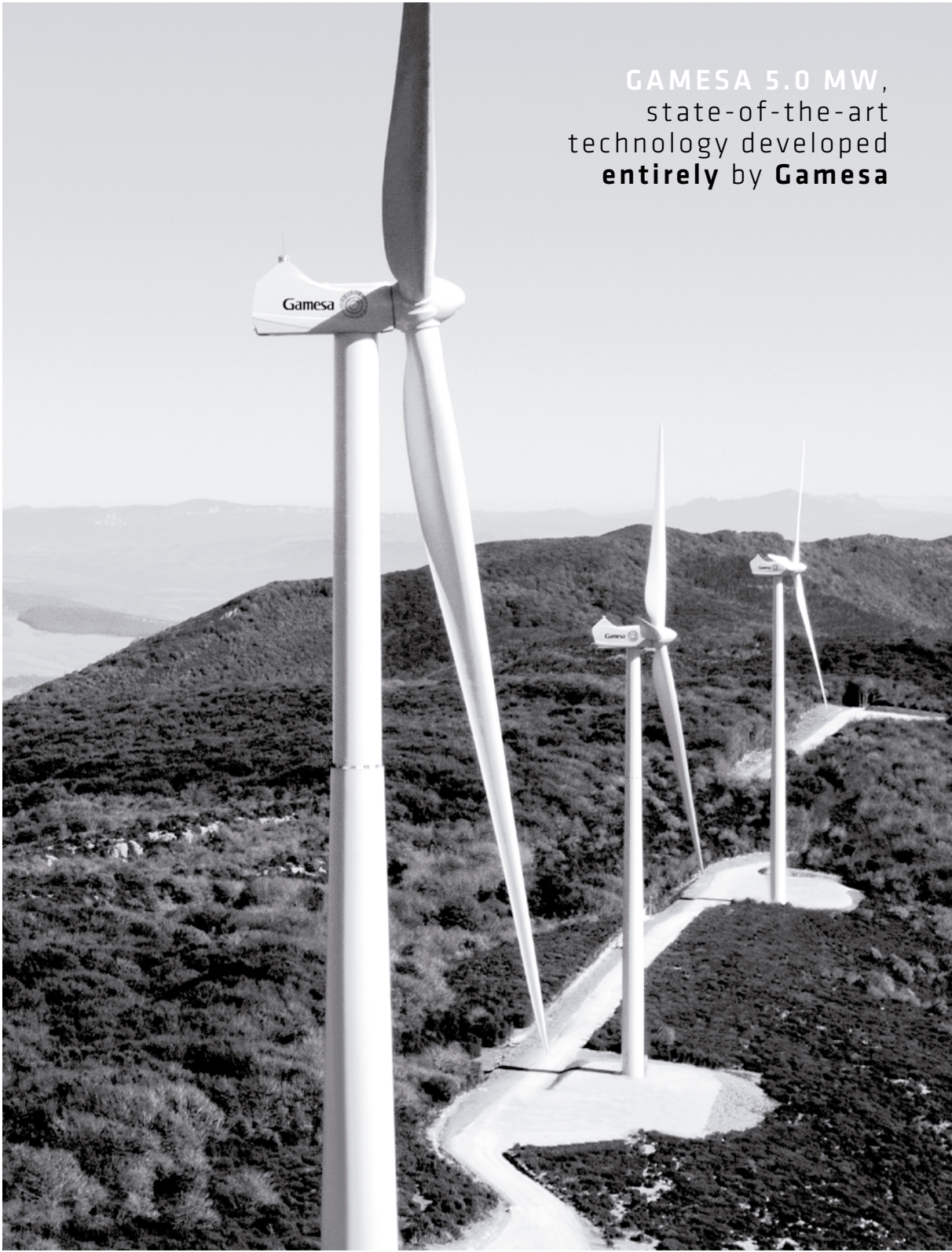
- Modular design of the nacelle and blades to optimize transport and logistics.
- The heaviest module weighs less than the weight of a 2-MW nacelle.
- Gamesa FlexiFit®: The add-on crane attached to nacelle to assembly and maintenance.

Gamesa GridMate®

- It complies with the most demanding grid connection requirements.
- Optimal grid connections due to permanent magnet generator technology + full converter.
- It complies with environmental regulations: reduced visual impact.
- Noise reduction: Gamesa NRS® system and new aerodynamic blade profile.



Maximum energy production in locations with limited space



GAMESA 5.0 MW,
state-of-the-art
technology developed
entirely by Gamesa

Gamesa InnoBlade®

Gamesa's new aerodynamic profiles reduce noise and maximize production. The innovative sectioned blade is manufactured using a combination of materials in a pioneering structure that reduces weight. Current tooling and equipment used to transport 2-MW models to the site are also suitable for the Gamesa InnoBlade®.

Gamesa MultiSmart®

The wind turbine control system constantly monitors the data it collects to regulate each individual blade, minimize vibration and reduces the load on some components up to 30%. This control system incorporates the most advanced technologies to reduce noise, based on optimizing aerodynamics and control.

Gamesa FlexiFit®

Gamesa FlexiFit® is used for onsite assembly and servicing of large components. Its main advantage is that it is coupled to the nacelle and requires no additional external structure. In many situations, it is an alternative to the use of heavy cranes. It requires no special means of transport to be moved and consists of several modules assembled at ground level. Once Gamesa FlexiFit® is fixed to the nacelle, the main components of the wind turbine can be raised and lowered.

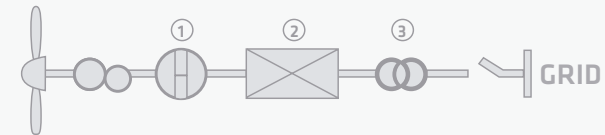
Gamesa CompacTrain®

The 5.0 MW drive train designed by Gamesa consists of a semiintegrated main shaft and a 2-stage gearbox with mid-speed range output. This integrated design makes the unit more compact, with fewer components. Furthermore, elimination of high-speed rotating mechanical components and use of the mid-range speed output improves the turbine reliability.

Gamesa GridMate®

The electrical system for the Gamesa 5.0 MW is based on a permanent magnet synchronous generator and a full converter. Gamesa GridMate® is comprised of four modules that operate in parallel which allows partial-load operation in the event of individual failure, and complies with the most demanding grid connection requirements.

- **Increased production:**
Optimum performance at variable speed at any wind speed.
- **Robust, reliable mechanical elements:**
De-coupling between the mechanical part and the grid, thus preventing grid disruptions from affecting the machine.
- **Greater adjustment capacity:**
Active and reactive power control through conversion of all the power generated.
- **Superior output:**
Improves efficiency at partial loads by optimally using the individual power modules in the converter.
- **Compliance with grid connection requirements:**
Smooth connection and disconnection from the grid.



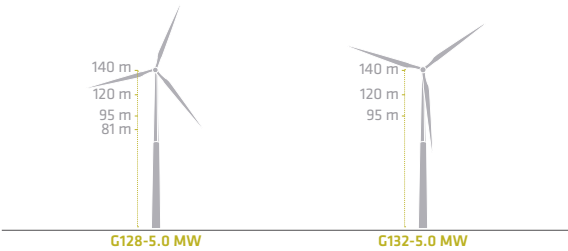
- | | | |
|---|---|--|
| 1. Multi-pole synchronous GENERATOR with four independent modules in parallel. | 2. CONVERTER with four independent modules and built-in automatic circuit breaker. | 3. TRANSFORMER with multiple grid voltage connection options. |
|---|---|--|

Range of power factor:	0.9 cap / 0.9 ind
Support of OV voltage-drop:	YES
Injection of reactive current:	YES
Adjustment of active, reactive, frequency and voltage:	YES, with Scada WindNet®



Towers

Several tower options available, using the appropriate materials and technologies to offer optimized solutions for each project.



Lower assembly and logistics cost

One of the key advantages of the Gamesa 5.0 MW platform is its compliance with the logistics and construction requirements of the Gamesa 2.0 MW platform. The modular design of the nacelle and blades of the Gamesa 5.0 MW means that the heaviest module does not exceed the total weight of the Gamesa 2.0 MW platform, which makes it just as easy to transport and assemble as a 2.0 MW wind turbine.

The Gamesa InnoBlade® segmented blade, patented by Gamesa, can be transported by road with no need for additional resources other than those already used for the Gamesa 2.0 MW wind turbine. The longest module is no more than 35 meters long. Furthermore, lifting the nacelle is the final step in the assembly requiring a heavy-tonnage crane. The remaining modules only require the help of a small auxiliary crane for assembly.

Reliability brought about through a thorough program of validation checks and tests

This goal has been achieved because of an ambitious validation and testing program that has allowed the Gamesa 5.0 MW to start operating at maximum availability right from the outset.

This extensive validation and development program has taken over six years. It was designed to test each component and system under real life operating conditions, in controlled environments in order to verify these components will function under the most demanding conditions.

- More than 600 tests on components of the various wind turbines in the Gamesa 5.0 MW platform were carried out at 100 certified laboratories in the United States, Japan and Europe.
- More than 190 functional and/or integration tests performed at the Wind Turbine Test Laboratory (LEA) at the National Renewable Energy Centre (CENER, Spain), one of the most highly qualified international technology centers specializing in applied research, development and promotion of renewable energies.
- More than 300,000 hours of validation and test engineering.



GAMESA 5.0 MW

	G128-5.0 MW	G132-5.0 MW
ROTOR		
Diameter	128 m	132 m
Swept area	12,868 m²	13,685 m²
Rotation speed	12 rpm	12 rpm
BLADES		
Number of blades	3	3
Length	62.5 m	64.5 m
Type	Segmented/One-piece	One-piece
Material	Organic matrix composite reinforced with fiber glass or carbon fiber	Organic matrix composite reinforced with fiber glass or carbon fiber
TOWER		
Type	Steel, hybrid or concrete	Steel, hybrid or concrete
Height	81, 95, 120, 140 m	95, 120, 140 m
GEAR BOX		
Type	2 planetary stages	2 planetary stages
Ratio	1:41.405	1:41.405
GENERATOR		
Type	Permanent magnet synchronous generator with independent modules in parallel	Permanent magnet synchronous generator with independent modules in parallel
Rated power	5.0 MW	5.0 MW
Voltage	690 V AC	690 V AC
Frequency	50 Hz/60 Hz	50 Hz/60 Hz
Protection class	IP 54	IP 54
Power factor	0.95 CAP-0.95 IND*	0.95 CAP-0.95 IND*

* Power factor at output terminals of the wind turbine on the low voltage side before entering the transformer, at the rated grid voltage.

reliability



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