

Gamesa G5X-850 kW

Reliability and Experience

Gamesa



G52

G58

850 kW

Gamesa G5X

P.4

Economic Progress and Sustainable Development.

P.5

Gamesa G5X-850 kW Platform.

P.6

Global Capacity for Production, Installation and Operation and Maintenance.

P.12

Gamesa G5X-850 kW:

Experience.

Adaptability.

Advantages of the Gamesa G5X-850 kW Platform.

Technical Characteristics.

Economic progress & Sustainable Development

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

By harnessing the best and most modern technologies in conjunction with its high industrial potential, Gamesa continues to improve the efficiency and capacity of its products and services by designing and manufacturing ever more advanced wind turbines.

The drive behind our work to develop more efficient technologies, products and services is to ensure that Gamesa's range of products is the most comprehensive in terms of capabilities and the most competitive in the market. That in turn guarantees complete customer satisfaction.



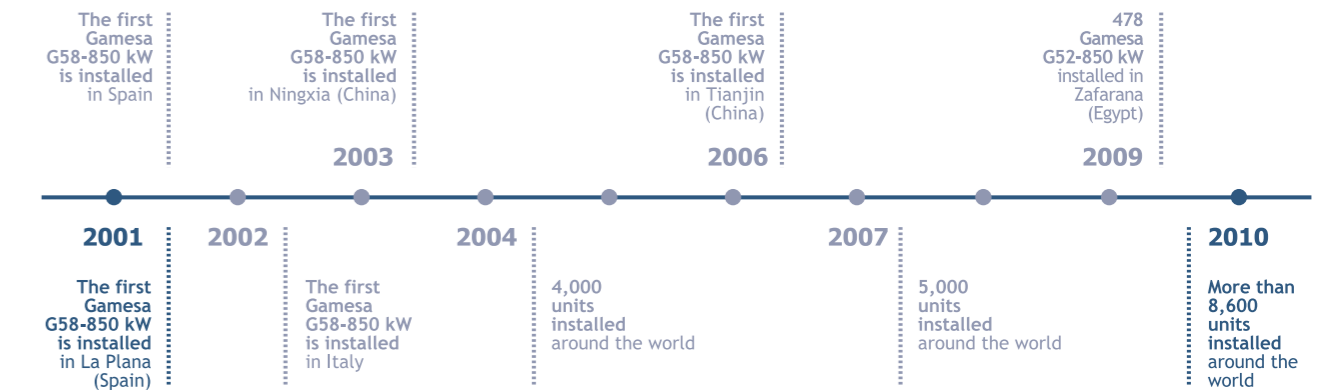
G5X GLOBAL experience

Technology is one of the fundamental focal points of Gamesa's activities, evidenced by the substantial research and development efforts employed by the company to continually improve to its line of products and services.

Since it manufactured its first wind turbines in 1994, with a nominal power of 500 kW, the wind turbines developed and manufactured by Gamesa have evolved significantly, incorporating the latest technological advances, growing not only in power, but also in performance, and have been very well received

by the market. Proof of these advancements is the Gamesa G52-850 kW and Gamesa G58-850 kW wind turbines, which have become Europe's most commonly installed turbines, renowned for their outstanding reliability and excellent output.

With more than 8,600 units installed around the world, Gamesa G5X-850 kW wind turbines guarantee unbeatable operability in any location and wind conditions due to their two 52- and 58-metre diameter rotors.



Gamesa specializes in sustainable energy technologies, primarily wind power. With more than 15 years of experience, Gamesa is one of the world's leading wind turbine manufacturers, with more than 20,800 MW installed capacity in 28 countries on four continents.

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

Gamesa's industrial capacity allows it to fully control the production process, from design to manufacture of the various critical wind-turbine components, offering its customers the highest quality standards and shortest customer response times. The company has 29 production centers in Europe, the United States, China and India with additional production capacity planned in China and Brazil. Gamesa designs and manufactures its own blades, nacelles, generators, gear boxes, control systems and towers, in addition to the final assembly of its wind turbines on site. Gamesa also works with other companies that manufacture other components that are particularly important in a wind turbine, such as the gear boxes, generators and converters.

Gamesa has an annual production capacity of 4,400 MW utilizing the talent of our experienced international workforce of more than 7,000 members.

Global Capacity for Production, Installation, Operation and Maintenance

CHINA

4 production centers.
+ 2 under construction.

ASIA

INDIA

1 production center.

Blades, nacelles, generators and gear boxes .

2 production centers.

Blades and nacelles.

USA

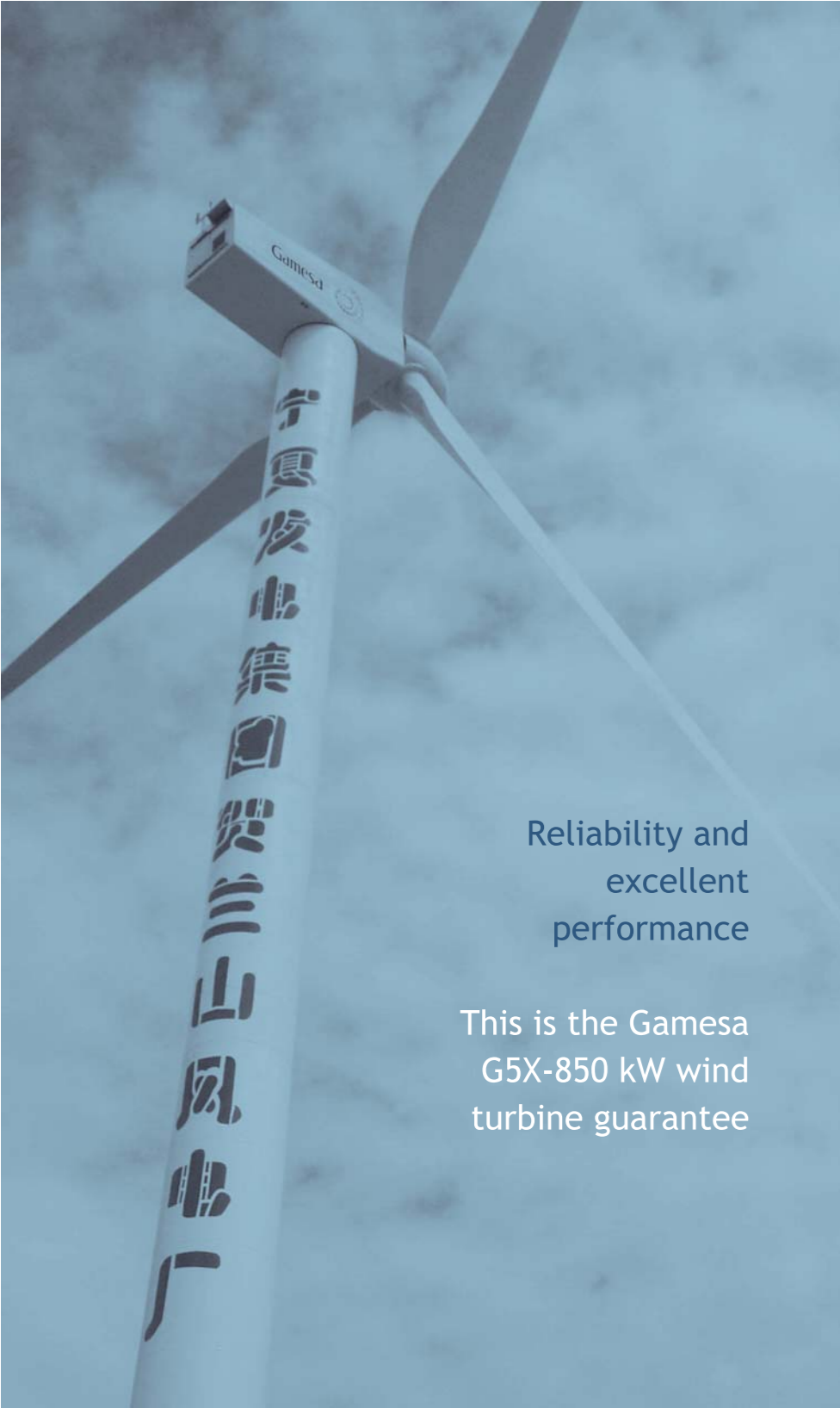
SPAIN

22 production centers.

Blades, nacelles, generators, gear boxes, control systems and towers.

EUROPE





Reliability and excellent performance

This is the Gamesa G5X-850 kW wind turbine guarantee

The 850 kW Gamesa G5X bases its technology on speed control and variable pitch, while incorporating the latest technologies to extract the maximum amount of energy from the wind and to do it as efficiently as possible:

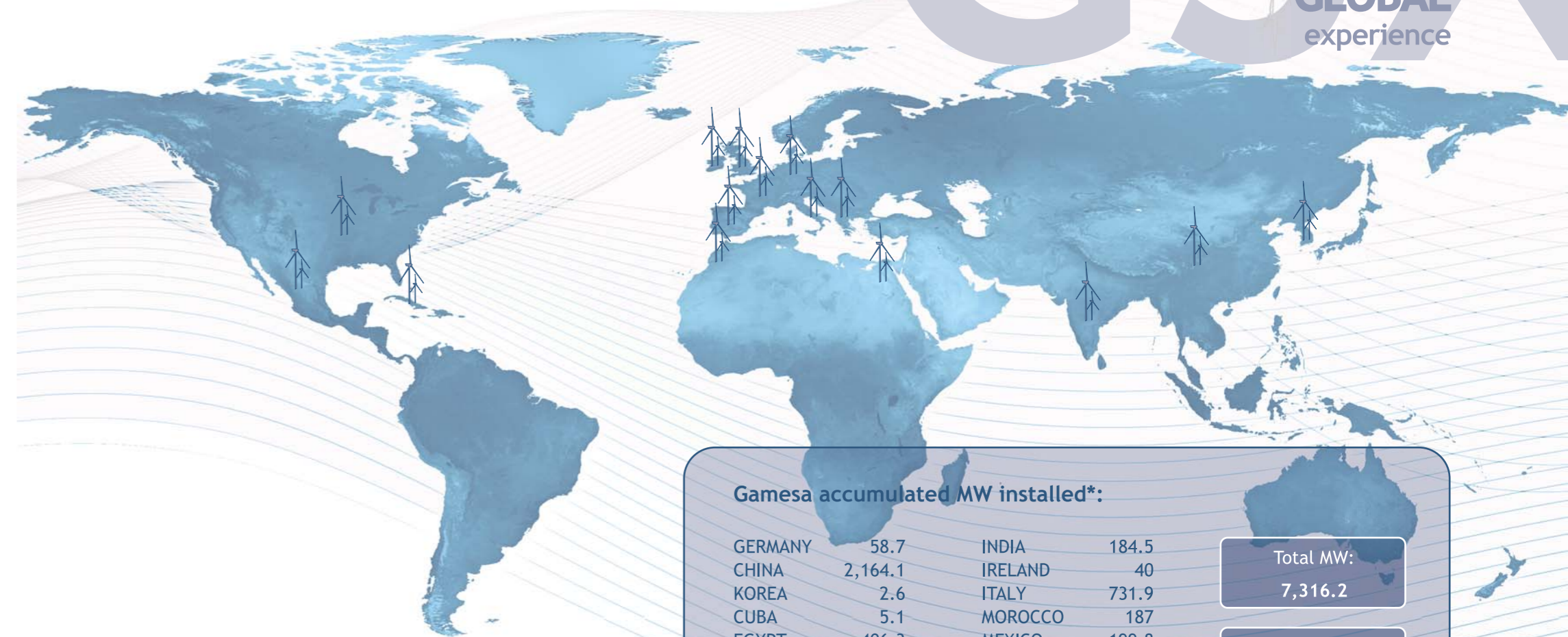
- ☛ Lighter blades manufactured by using fiberglass and prepregs.
- ☛ Gamesa SMP predictive maintenance.
- ☛ The Gamesa WindNet® remote control system.
- ☛ Gamesa NRS® noise control.
- ☛ Solutions for optimum grid connection.

Model	Gamesa G52-850 kW	Gamesa G58-850 kW
IEC	IA *	IIA / IIIB
Unit Power	850 kW	850 kW
Certificate type available	√	√
Tower height	44, 55, 65 m	44**, 55, 65, 74 m
Network connection	√	√
Environment / Options ***	√	√
50/60 Hz	√	√

* Class S available for medium and/or turbulent wind conditions above class IA.
 ** Available with IEC IIIB certification.
 *** Different versions and optional kits to adapt machinery to high or low temperatures and saline or dusty environments.

G5X

GLOBAL experience



Gamesa G5X-850 kW track record

Gamesa accumulated MW installed*:

GERMANY	58.7	INDIA	184.5
CHINA	2,164.1	IRELAND	40
KOREA	2.6	ITALY	731.9
CUBA	5.1	MOROCCO	187
EGYPT	406.3	MEXICO	199.8
SPAIN	3,079.6	SWEDEN	3.4
FRANCE	127.5	UK	27.2
GREECE	48.5	USA	50.4

Total MW: **7,316.2**

Total wtg: **8,611**

* As of December 2010.



The Gamesa G5X-850 kW platform undergoes a continuous improvement process, which incorporates new versions with a view to adapting it to all possible environmental conditions (corrosive, desert, seismic, high and low temperatures, typhoons).

Advantages of the Gamesa G5X-850 kW platform

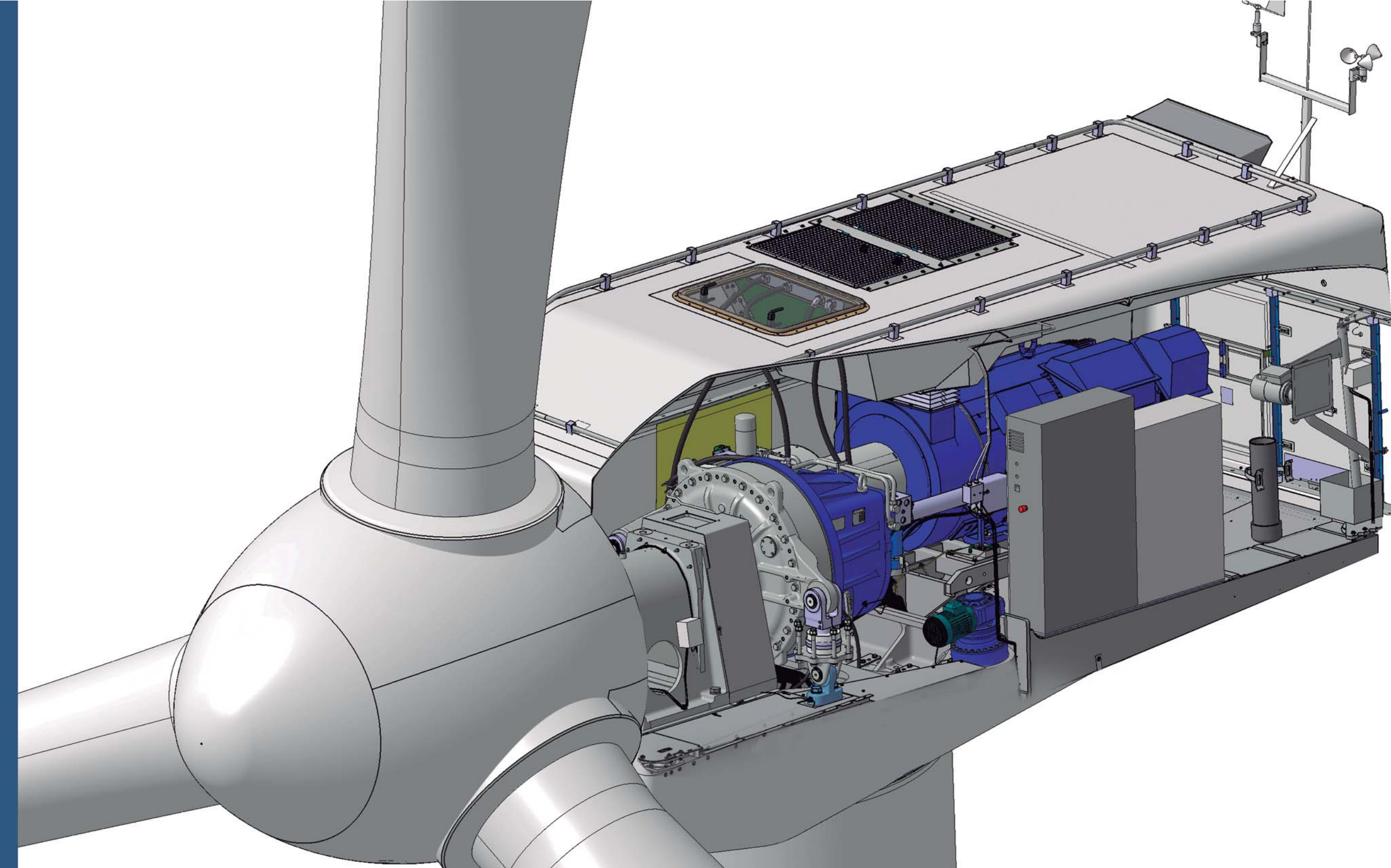
- ▣ Experience, excellent reliability and performance.
- ▣ Variable pitch and speed technology maximize energy production.
- ▣ Lighter blades manufactured by using fiberglass and prepregs.
- ▣ Technological solutions guarantee compliance with main international grid connection requirements.
- ▣ Gamesa active yaw system ensures optimum adaptation to complex terrain.
- ▣ Aerodynamic design and the Gamesa NRS® control system minimize noise emissions.
- ▣ Gamesa WindNet®: Remote control and monitoring system with web access.
- ▣ Gamesa SMP: Own system for scheduled predictive maintenance.



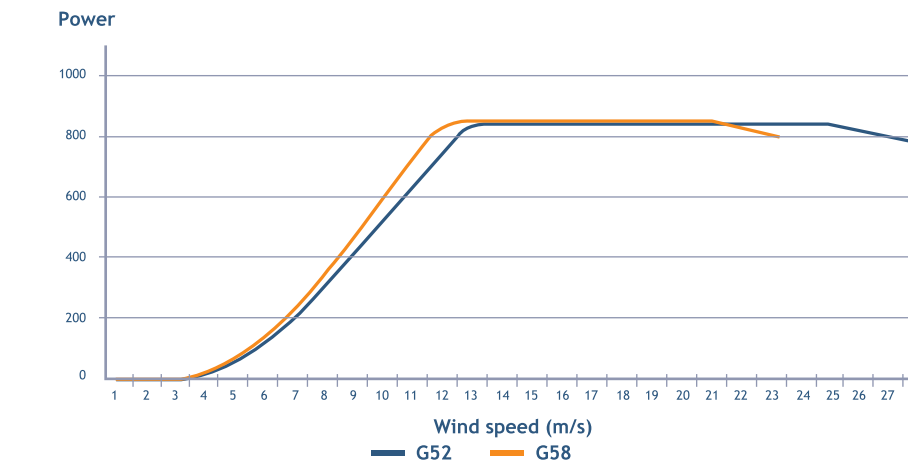
Gamesa G5X

Advantages of the Gamesa G5X-850 kW platform

- ☞ Experience, excellent reliability and performance.
- ☞ Variable pitch and speed technology maximize energy production.
- ☞ Lighter blades manufactured by using fiberglass and prepregs.
- ☞ Technological solutions guarantee compliance with main 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®: Remote control and monitoring system with web access.
- ☞ Gamesa SMP: Own system for scheduled predictive maintenance.



Continuous performance improvements



G52 R47

- ☞ Class S for a Waverage >10 m/s and/or Wref < 53 m/s.
- ☞ Reinforced version for complex locations with high winds and intense turbulence.

Version AT, AC, AD *

- ☞ Version that withstands 45°C. environmental temperature at maximum power.
- ☞ Versions with special protection for corrosive and dusty atmospheres.

DAC Converter **

- ☞ New converter designed and manufactured by Gamesa.
- ☞ Main improvements: LVRT, reactive energy temperature and reliability.

CR4E Generator

- ☞ New generation of 50/60 Hz generators for the Gamesa G5X-850 kW platform. 0.95 CAP - 0.95 IND.

* HT: High Temperature / HC: High Corrosion / DE: Desert Environments.
** DAC: Dip Active Converter.

Gamesa G5X-850 kW

Technical Specifications and services

Drive train

Drive train with the main axis supported on 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, thus reducing the possibilities of breakdown as well as providing a longer service life.

Minimum Noise Emission, Maximum Production

Aerodynamic design of the blade tip and mechanical component designs that minimize noise emissions. In addition, Gamesa has developed the Gamesa NRS®, noise control system, which makes it possible to program noise emissions according to such criteria as the date, time or wind direction.

This achieves compliance with local regulations and enables maximum production.

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.

Total Lightning Protection

The Gamesa G5X-850 kW platform uses 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, protecting sensitive electrical and electronic elements from becoming damaged.



Gamesa WindNet®, Real-time Remote Operation and Monitoring

New generation SCADA wind farm system, entirely developed by Gamesa, which allows remote operation and the monitoring of wind turbines in real time, meteorological mast and electrical substation.

An innovative, modular design 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 the current regulations.

Accessible anywhere through a Web browser, WindNet is simple to use and intuitive. It features the Report Generator and Information Manager decision-taking analytical tools as well as TrendViewer, an advanced tool to visualize trends.



Designed for Simple Maintenance

Gamesa's global response also offers a wide range of operational and maintenance options. Equipment supplied by the company comes standard with a two-year warranty on components, availability and power curves together with a maintenance service.

But Gamesa's commitment to its customers does not end there. The company developed an Integral Management Service comprising of a long-term operation and maintenance contract (up to 15 years, renewable), providing wider coverage to guaranteeing maximum availability, ensuring long-term costs to operate the wind farm are known and assisting in smoothing out the road to funding.

Through detailed analysis of its extensive operational experience, Gamesa also continuously adapts its equipment to the most demanding connection grids and environmental surroundings.

G5X

Discovering
Gamesa G5X-850 kW

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.

On-Line Condition Monitoring System for Predictive Maintenance (SMP)

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

Advantages:

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

Optimum Electrical Grid Connection and Stable Production

Gamesa's dual power wind turbines and Active Crowbar technologies and oversized converters guarantee compliance with the most demanding requirements for connection to current grids and future electric grid and wind farm configurations.

Support for voltage-drop and dynamic active and reactive power regulation.





52 Gamesa G52-850 kW

58 Gamesa G58-850 kW

ROTOR		
Diameter	52 m	58 m
Swept area	2,214 m ²	2,642 m ²
Rotation speed	19.44 - 30.8 rpm	19.44 - 30.8 rpm
BLADES		
Number of blades	3	3
Length	25.3 m	28.3 m
Profile	NACA 63.XXX + FFA-W3	NACA 63.XXX + FFA-W3
Material	Fiberglass pre-impregnated with epoxy resin	Fiberglass pre-impregnated with epoxy resin
TOWERS		
Tower type	Modular	Modular
Height	44, 55 and 65 m	44, 55, 65 and 74 m
GEAR BOX		
Type	1 planetary stage 2 parallel axis stages	1 planetary stage 2 parallel axis stages
Ratio	1:61.74 (50 Hz) 1:74.5 (60 Hz)	1:61.74 (50 Hz) 1:74.5 (60 Hz)
GENERATOR 850 kW		
Type	Dual power fed	Dual power fed
Nominal power	850 kW	850 kW
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 at partial loads and 1 at nominal power*	0.95 CAP - 0.95 IND at partial loads and 1 at nominal power*

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



C/ Ciudad de la Innovación, 9-11
31621 Sarriguren (Spain)
Tel: +34 948 771 000
Fax: +34 948 165 039
info@gamesacorp.com
www.gamesacorp.com

GERMANY

Wailandtstrasse 7
63741 Aschaffenburg
Tel: +49 (0) 6021 15 09 0
Fax: +49 (0) 6021 15 09 199
germany.wind@gamesacorp.com

BRAZIL

Av Brigadeiro Faria Lima, 3729, Sala 429
Pinheiros, CEP 404538-133
São Paulo (SP)
Tel: +5511 3443 7252

CHINA

Room 605,
CBD International Building
N.o 16, Yong An Dong Li,
Chaoyang District
Beijing 100022
Tel.: +86 10 6566 9388
Fax: +86 10 8521 9760

EGYPT

12 Dar el Shefa Street 3th. Floor,
Garden City- Cairo
Tel: +20 166642424
Fax: +20 227951866

UNITED STATES

2050 Cabot Boulevard West
Langhorne, PA 19047
Tel: +1 215 710 3100
Fax: +1 215 741 4048

FRANCE

Parc Mail, Bâtiment G
6 Allée Irène Joliot-Curie
69791 Saint Priest Cedex
Tel: +33 (0) 4 72 79 49 39

INDIA

N.o 489, GNT Road, Thandal Kazhani Village
Vadagarai Post, Redhills, Chennai-600 052
Tel: +91 44 3098 9898
sales.india@gamesacorp.com

ITALY

Via Mentore Maggini 48/50
00143 Rome
Tel: +39 0645543650
Fax: +39 0645553974

JAPAN

Daiwa Jisho Building 4F – 411
74-1 Naka-ku,
Yamashita-cho
Yokohama-city 231-0023
Kanagawa
Tel: +81 45 680 50 80
Fax: +81 45 680 50 81

MEXICO

Torre Diana, Piso 14
Av. Pº de la Reforma 389
Colonia Cuahatemoc
06500 México DF
Tel: +52 55 5093637

MOROCCO

345, Lot Gzennaya A B.P 397
Tangier (Boukhalef)
Tel: +212 539 393308/09
Fax: +212 539 393312

POLAND

Ul. Galaktyczna 30A
80-299 Gdańsk
Tel: +48 766 62 62
Fax: +48 766 62 99
poland.wind@gamesacorp.com

SINGAPORE

3 Temasek Avenue
Centennial Tower - Level 34
Singapore 039190
Tel: +65 6549 77 63
Fax: +65 6549 70 11

TURKEY

Swiss Offices Business Center
Büyükdere Cad. Maya Akar Center
Nº: 100-102 C Blok Nª Nª9
Sisli-Essentepe/ Istanbul
Tel: +90 212 318 90 25

In order to minimize the environmental impact, this document has been printed on paper made from 50% pure cellulose fiber (ECF), 40% selected pre-consumer recycled fiber, and 10% post-consumer deinked recycled fiber inks based exclusively on vegetable oils with a minimum volatile organic compound (VOC) content. Varnish based predominantly on natural and renewable raw materials.

The present document, its content, its annexes and/or amendments has been drawn up by Gamesa Corporación Tecnológica, S.A. for information purposes only and could be modified without prior notice. All the content of the Document is protected by intellectual and industrial property rights owned by Gamesa Corporación Tecnológica, S.A. The addressee shall not reproduce any of the information, neither totally nor partially.

Printed date: February 2011