Introduction

With over 20 years experience, Gamesa is a global leader in the design, manufacture, installation and maintenance of wind turbines, with 38.9 GW installed in 53 countries across five continents.

Operation & Maintenance (O&M) is one of the key activities upon which Gamesa bases its development, having 63% of its fleet under an Operation & Maintenance contract thanks to an expansion of this activity in over 40 countries.

With a team of 6,900 highly qualified professionals, committed to health and safety, excellence, and customer satisfaction, Gamesa manages 24.3 GW.

Backed 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 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.
Gamesa Services’ contracts

Over 63% of the MW sold by Gamesa have an associated long-term O&M contract with the company, proof of customers’ satisfaction with this service.

Scope of Gamesa Services’ contracts

Gamesa offers elements which ADD VALUE, making its offer the most complete and attractive option for the customer.

- Among other services, Gamesa Servicios’ O&M agreements may include comprehensive management of repairs on the wind farm or improvement of major components, thereby optimizing wind turbine performance while making it possible for their useful life to be extended.
- The electricity availability guarantee is available for wind farms with at least 10 wind turbines on all platforms and in every country where Gamesa operates.
- All services available on the different Gamesa Services’ O&M contracts may be contracted separately.

### RISK FULL PREMIUM

<table>
<thead>
<tr>
<th>Duration</th>
<th>UP TO 15 YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability warranties</td>
<td></td>
</tr>
<tr>
<td>Operation and monitoring 24x7</td>
<td></td>
</tr>
</tbody>
</table>

### Maintenance

- Predictive maintenance
- Preventive maintenance
- Small Corrective
- Large Corrective
- Electrical infrastructure
- Replacement parts
- Consumables

### Web Portal Access & Reports

- Included

### Wind Turbines Upgrades

- Gamesa premium availability
- Reconditioning of main components
- Life extension program

### Security

- Certification & Maintenance

### Training

- Included

| Included | Fixed price option |

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A contract tailored to those customers with a broad and in-depth knowledge of wind turbines, who wish to manage their own assets and assume part of the risk. Gamesa proposes a basic range of service options, supplemented by optional services customers choose when they need, thus leaving in customers’ hands decision-making on issues related with internal O&M management.

Standard, low-risk O&M agreement chosen by over 80% of Gamesa’s customers. This agreement, available for any type of wind turbine, maximizes the turbine’s operating performance and life. Gamesa offers it in all countries where it operates.

Package with a full range of services and maintenance and a power availability guarantee, ensuring precision of the business plan and a stable cash flow.
Scope of Gamesa Services’ comprehensive wind farm maintenance contracts

Gamesa’s experience in electricity maintenance, as well as its expertise in civil works, allows it to ensure:

- Customized coverage of the main types of maintenance, as well as an array of optional services that meet its customers’ every day needs.
- Partial or complete insurance coverage for damage suffered on the wind farms*.
- Inclusion of a complete list of recommended spare parts for electricity infrastructure, according to the contract scope and type of wind farm.

**Civil works and electricity infrastructure maintenance**

Taking advantage of its expertise as one of the main providers of EPC “turnkey” projects in the wind sector and its extensive service network, Gamesa is launching this new comprehensive wind farm maintenance service to meet its customers’ needs.

### Risk Plus

**Full Plus**

This solution is specially designed for turnkey project customers who wish to have a long-term contract that minimizes impact stemming from any change in civil work and electricity infrastructure.

**Premium Plus**

This contract ensures complete control of financial risk related to any type of incident occurring on a wind farm. It is designed for investors and IPPs that do not want to assume any risk. The electricity availability guarantee and protection of all assets make this the greater value added offer.

* External causes and force majeure excluded.

#### Wind-turbine O&M agreement

<table>
<thead>
<tr>
<th>Availability Guarantee</th>
<th>Temporary</th>
<th>Full</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preventive maintenance</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Small corrective</td>
<td>[ ]</td>
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</tr>
<tr>
<td>Large corrective</td>
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<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>External causes</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Compensation for loss of revenue as of first day</td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete materials coverage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>List of recommended electricity infrastructure responses</td>
<td></td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

#### Civil infrastructure

<table>
<thead>
<tr>
<th>Civil Infrastructure</th>
<th>Temporary</th>
<th>Full</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preventive maintenance</td>
<td>[ ]</td>
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<td>[ ]</td>
</tr>
<tr>
<td>Small corrective</td>
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<td>[ ]</td>
</tr>
<tr>
<td>Large corrective</td>
<td>[ ]</td>
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<td>[ ]</td>
</tr>
<tr>
<td>Civil works jobs outside the farm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust/snow cleaning</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Building management</td>
<td>[ ]</td>
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</tr>
</tbody>
</table>

#### Terms and Conditions

Preventive maintenance considered as available time: 16h (1)

### Fixed price

<table>
<thead>
<tr>
<th>Compensation</th>
<th>10 days</th>
<th>0 days</th>
<th>100,000 € (2)</th>
<th>0 €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damages</td>
<td></td>
<td>[ ]</td>
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<td>[ ]</td>
</tr>
</tbody>
</table>

* Included; [ ] Fixed price

(1) Wind farm must have at least 10 turbines.
(2) Negotiable
Operations and Supervision

From its Control Centers in Spain, the US and India, Gamesa operates 15,500 MW in 43 countries worldwide, 24 hours per day, 365 days a year.

The company has developed a new generation of wind farm remote management tools, called Gamesa WindNet® PRO.

An innovative product, accessed via web browser and with a simple interface, designed to adapt to the needs of the most demanding operators.

- On-line supervision of wind turbine data, weather masts and electric substations.
- Remote control of wind turbines and the substation.
- Production and availability reports (Report Generator).
- Personalized reports (Information Manager) and management of user profiles.
- Screen for viewing trends in main variables (Trend Viewer) and integration with Gamesa SMP.
- Tools for regulating power and environmental options.

By analyzing the key parameters and remaining in permanent contact with the equipment located on site, Gamesa’s specialists ensure maximum operating performance of customer’s assets, and guarantee compliance with the most demanding grid codes.

Gamesa WindNet® PRO

ADVANCED
Is the appropriate option for the demanding and complex requirements of medium and large-scale wind power projects.

LIGHT
Is a compact solution for optimizing mid-sized wind farms (up to 25 wind turbines).

ULTRALIGHT
Is an ultracompact, robust solution, equipped with all the main features and designed for small wind farms (up to 5 wind turbines or 5 MW).

* Data as of 31st Dec. 2016.
Predictive Maintenance

Gamesa’s Condition Monitoring System consists of a gearbox oil analysis and Gamesa CMS system, installed in all Gamesa wind turbines since 2004. Diagnostics experts detect any possible wear or defect in any of the wind turbine’s main components at a very early stage, thus reducing corrective maintenance costs (logistics, auxiliary systems, labor and repair costs) and extending wind turbine life. Gamesa SMP including the on-site device, control center and software, is certified by Germanischer Lloyd.

In addition, using MEGA, with its own advanced weather forecast tool, Gamesa is able to maximize wind turbine performance by intervening only when it is really necessary and by scheduling the completion of any work exclusively during low-wind periods.

Preventive Maintenance

Annual maintenance scheduled during low-wind periods

With the engineering know-how of its employees, Gamesa has defined a complete maintenance program, Reliability Centered Maintenance (RCM), in order to guarantee the extended performance of its wind turbines.

By applying practices recommended for the aeronautical and automotive sectors to the wind energy sector, and making use of the 21 years of experience in O&M, Gamesa has managed to reduce maintenance times by 40%, over the last four years, reducing by up to 50% the possible losses of production. This reduction combined with the use of the MEGA weather forecast tool to schedule preventive maintenance during low-wind periods allows to maximize production as well as to maximize revenues when taking into account energy prices in same countries. Each task is carried out in optimal order in accordance with strictest H&S standards. The continuous revisions of the preventive maintenance ranges incorporate new methods and processes that allow for the reduction of manual tasks as well as increasing the maintenance quality and consequent reliability of the systems. Likewise, the management of preventive maintenance, carried out by Gamesa, allows for a better administration of the materials used during these tasks.

Gamesa’s global presence allows for the customization of maintenance in accordance with the different technologies, clients, regulations or site conditions.

MEGA System

Gamesa’s MEGA tool uses standard prediction models (GFS, ECMWF, PROMES), processed by its patented statistical model, to generate wind and production prediction data of the highest quality. The ability to integrate real wind speed and production data into the MEGA system provides the feedback necessary to constantly improve the predictions generated for that specific wind farm.

The MEGA System provides the following advantages to Gamesa’s customers:

- Comprehensive service for customers for whom Gamesa provides total management (Communications, Energy Manager, etc.)
- Seven day forecast.
- Highly precise, thanks to real-time updates (10h) with the farm’s production data.
- Optimizes maintenance management during low-wind periods.
- Improves revenues on energy markets (less deviation)
- Ensures compliance with grid codes (power generation forecast must be sent to the system operator).
- Greater safety and risk control in maintenance work.
- Web access from anywhere, with the ability to download files.

MEGA is compatible with all wind turbines in the wind energy sector.
Gamesa O&M excellence is the result of a decentralized, local service network, comprising more than 1,500 technicians certified by its training centre. Gamesa Services has a team of over 300 engineers with extensive experience, available 24 hours per day, who provide support to local teams in offering innovative solutions:

- **Corrective Maintenance (unscheduled)**
  - Gamesa guarantees the highest long-term profitability, with over 98% average availability on its entire fleet, covering all platforms and including 16 year old wind farms.

- **Gamesa Parts Navigator**
  - On-line catalog of replacement parts, available for on-site technicians, which:
    - Allows the easy identification of wind turbine parts with 2D and 3D images and/or product structure.
    - Provides detailed information on each component (code, description, quantity, images...).

- **Reparator**
  - O&M documentation, user manuals and recommended practices specific to each model of wind turbine, in accordance with the S1000D (TPSMC) standard. Presented in electronic format via browser for more convenient use, these provide both the owner (Operations and Services Manual) and technical services (Maintenance Manual) with specific content.

**Key Points**

- 29 Service Centres operating in 36 countries.
- 300 experts, distributed among 5 Excellence Centers, available 24 hours per day.
- Over 800 local and regional logistics centers.
Personalized O&M Services

With the goal of meeting all its customers’ needs, Gamesa has developed a wide range of services which allow for a broader scope in the O&M contracts.

Health and safety

All Gamesa Services contracts could include the maintenance and certification of wind turbine safety elements. Gamesa maintains 24.3 GW for more than 400 customers, with unbeatable health and safety records, making its customers a reference for the wind energy sector.

<table>
<thead>
<tr>
<th>Contract Extension</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical and civil infrastructure maintenance</td>
<td>Blade maintenance</td>
</tr>
<tr>
<td>Both scheduled and unscheduled, with the possibility of including it within the availability warranty.</td>
<td>Annual maintenance to correct wear and maximize efficiency. Intervention within 24h in the event of breakdown due to a lightning strike.</td>
</tr>
<tr>
<td>Reconditioning of large components</td>
<td>Long term contracts with energy availability warranties</td>
</tr>
<tr>
<td>Repairing and upgrade of all components, employing the most advanced processes, to maximize durability and reliability.</td>
<td>With a personalized financing plan, stabilising cash flow and allowing you to make a more accurate business plan.</td>
</tr>
</tbody>
</table>

Health and safety

<table>
<thead>
<tr>
<th>Accident Frequency</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of fatalities</td>
<td>Number of fatalities/1000 hours worked</td>
</tr>
</tbody>
</table>

--- | --- | --- | --- | --- | --- | --- |
2.5 | 2.3 | 3.2 | 3.4 | 3.6 | 3.1 | 2.9 |

--- | --- | --- | --- | --- | --- | --- |
0.05 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.35 |

--- | --- | --- | --- | --- | --- | --- |
0.1 | 0.18 | 0.22 | 0.26 | 0.3 | 0.34 | 0.38 |

--- | --- | --- | --- | --- | --- | --- |
0 | 0 | 0 | 0 | 0.59 | 0.52 | 0.65 |

--- | --- | --- | --- | --- | --- | --- |
0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
Life Extension

Besides the Reliability Centered Maintenance and reconditioning programs, Gamesa keeps pace with the announced CoE reduction with a much more ambitious and promising proposition: turbine life extension.

This program consists of audits, and preventive and corrective upgrades, implemented only when absolutely necessary, which improve the design of critical components with the latest state-of-the-art technology.

As Gamesa Services has already accumulated more than 15 years of experience (60 million operations’ hours) with the Gamesa 660 kW platform, the company has the operational experience and technical expertise to provide the high-level technological solutions needed by its customers. The extension of service life is an ongoing monitoring & upgrade program that could be applied to most existing turbines. Gamesa will launch soon a similar program for the Gamesa 850 kW, Gamesa 2.0 MW and 2.5 MW platforms, on which it has already accumulated a total of more than 250 million hours in maintenance experience.

The main, most immediate benefits for the customers are:

- 10 additional years of income that will be maintained in the long-term through an availability guarantee.
- More reliable turbines that are easier to maintain, keeping O&M costs low.
- A long term & full service O&M contract to guarantee that running costs are stabilized at the level generally incurred on a 10-year-old wind farm.
- A tailored investment & financing plan, based on technical audits of individual turbines, with the aim of achieving optimized cash flow for the customers.

As all the key parameters are known - wind, turbine availability, O&M costs and price of energy - Life Extension represents a minor risk investment for Gamesa’s customers.

In the last 15 years the whole industry has drastically increased its technical know-how and operational experience, now making a longer operation lifetime possible.

Improved aerelastic models

Years of operational experience have provided the necessary know-how to improve mathematical models in order to simulate the evolution of turbine structural elements (frame & tower) over the long term. Those simulations aim to check if specific structural upgrades are necessary to achieve an operational life of 30 years in perfectly safe conditions for the assets and people.

Easier access to real and useful data from the field

Gamesa uses the continuous and critical data from CMS to improve the design of existing main components (reconditioning), and to design new gearboxes and blades for out-of-production turbines, such as the G47-660 kW.
Drawing on over 20 years of experience in O&M and the optimization of wind turbines, Gamesa is able to offer integral O&M contracts for any of its wind turbine models.

Reconditioning of large components

**Generator and gearbox**

The reconditioning of major components consists of extending the life of large wind-turbine components by improving or replacing some parts of the component in question, bringing them up to date with the latest technology available. Our organization has set up plants to do this work exclusively in order to provide faster, more competitive and higher-quality services, cutting customer maintenance costs through:

- Updating of a wide range of major wind turbine components, both Gamesa machines and machines of other manufacturers.
- Abundant stock of reconditioned units, improving the availability of replacement parts.
- Extended manufacturer warranties (30 to 48 months, including labor, auxiliary systems and logistics).
- Minimum turnaround time.

**Blades**

Thanks to innovative products and optimized processes, Gamesa repairs blades in a very short space of time, notably decreasing costs arising from the replacement or reparation of this component.
Replacement Parts

The ability to deliver vital parts on time and where they are needed is proof of Gamesa Servicio’s management process and high standards.

Thanks to the continuous analysis of the parts consumed on all Gamesa wind farms, and a broad network of over 800 logistics centers, Gamesa Services constantly optimizes its inventories, thereby assuring its customers the best possible service.

As a manufacturer, Gamesa repairs, recycles and improves the design of wind turbine components to maximize both the availability and reliability of replacement parts. Gamesa O&M contracts provide complete coverage, so that customers need not assume the additional costs of installing replacement parts or main components, nor those arising from auxiliary systems and the transportation of large components.

In addition to guaranteeing these long-term savings, Gamesa Services ensures the availability of replacement parts and competitive prices. Testimony to this proficiency is the fact that Gamesa maintains over 60% of the wind farms equipped with its first platform turbines, installed when the company began its operations.

Wind plant name:
El Pilar
La Plana II

Commissioning:
El Pilar: October 1997
La Plana II: August 1998

NBR:
25 wtg per windfarm

Type:
G47

Average:
6 last years:
El Pilar: 99.08 %
La Plana II: 98.84 %

2016:
El Pilar: 99.50 %
La Plana II: 99.47 %

Gamesa’s excellence in O&M ensures the utmost profitability in the long term (>98% availability in 15 year old platform).
Gamesa Services

O&M excellence is the result of over 20 years of experience in the manufacture, maintenance and optimization of wind turbines.

Availability

All of the Gamesa O&M services contracts include an availability warranty, and with the aid of the GPA program the aim is to reach 99% long-term availability in new installations and in the existing fleet.

In 2016, Gamesa delivered more than 98% of availability in wind turbines in operation for more than 15 years and in turbines from other manufacturer, guaranteeing customers the maximum profitability of their wind plants over the long term.

GPA (Gamesa Premium Availability)

Launched in 2010, Gamesa Premium Availability (GPA) is a program of continuous in-depth transformation with the aim of improving competitiveness in the Gamesa 2.0 and 2.5 MW platforms through:

- **Reliability:** Extensive field knowledge integrated in turbine design enables new maintenance programs centered on reliability.
- **Excellence:** Process automation and innovation maximize cost savings in Operations & maintenance, while reducing risk.
- **Financing:** Adapted financing scheme to maximize customers’ cash flow & guarantee risk free investment.

Results obtained with GPA are a reality and are certified by Garrad Hassan*. GPA improvements are incorporated on all new Gamesa wind turbines.

Gamesa proposes an energy based availability warranty for all its wind farms within the Premium contract.

*In an independent study CI Garrad Hassan analyzed and computed the availability achieved in the 2 GPA wind farms before and after the upgrades.
Customer Web Portal

The Customer Web Portal offers fast and easy access to the information customers need, at any time and from anywhere in the world, thus improving their efficiency.

The wide range of services offered through the web portal provides assistance to the customer’s entire organization: operators, department managers, sales and logistics departments, and middle and upper management, providing the appropriate level of information for each.

As part of Gamesa’s ongoing commitment to customer satisfaction, full access to the Customer Web Portal is included, at no extra cost, in all Gamesa Services O&M contracts.

Information & collaboration

- News
- Explore Products & Service Offering
- Explore Training Offers

Projects & WF Management Tool

- O&M Reports
- WindOne® Customers
- Work order management
- Mega® weather & production forecast

Easy To Use

- Multi-lingual

Comprehensive solution for customers to manage their wind assets

Gamesa training centre

Gamesa’s training department specializes in providing continuous training for customers as well as in-house and outsourced personnel. The department meets training needs arising from constant technological advancement and developments in Gamesa’s products and services.

Gamesa offers a flexible training program:

- At each of its training centers in Spain, the US, China, México, Brazil and India.
- On-site Experts (customer’s wind farm).
- Offering on-line or computer-based courses.
- Evaluating and awarding certificates for each of Gamesa’s maintenance levels.

Alternatively, Gamesa provides a wide range of support for customers who carry out their basic O&M activities internally, helping them improve their knowledge of Gamesa technology.

Gamesa guarantees the best quality service, wind turbine efficiency, and maximum availability, thanks to a mandatory, annual certification process for both Gamesa and subcontractors, which has made it possible for over 2,300 people to receive training in 2015, totalling more than 159,000 training hours.

Personalized training for Gamesa customers and employees.
Gamesa is committed to O&M excellence, and thanks to the technical experience of its employees has developed a wide range of technological and organizational solutions for all of its wind turbines, including the reconditioning of large components and the extension of the useful life of wind turbines. Long-term support provided by Gamesa guarantees profitability and security for customer investments.

Through the Gamesa Premium Availability program, Gamesa takes its O&M Services to a higher level, setting target availability at an emblematic 99% on all its platforms.
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.

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Printed date: January 2017