Operation & Maintenance Services
“There is a driving force more powerful than steam, electricity and atomic energy: the will.”

Albert Einstein
CORPORATE HISTORY
A GREAT HISTORY FOR A GREAT FUTURE

BACKGROUND
First in-house products in control, measurement and power electronics.

EIGHTIES 80’s
Ingeteam strengthens its position in the industry and energy sectors, digital control products and application engineering.

NINETIES 90’s
Strengthening of the commitment to develop electrical and control systems for the renewable energy, wind and solar areas. The beginning of international expansion (Founding of subsidiaries in Germany, Czech Republic, China, Brazil and Mexico).

21st CENTURY
Commencement and consolidation of activities in the marine, traction, rail, engineering sectors and the turn-key supply of energy plants.

Ingeteam Service offers its customers all the experience and assurance of being part of the Ingeteam Group: A leading company in the electronics-electrotechnical sector.

The core of Ingeteam’s business is based on power and control electronics, the technology for electric machines, generators and motors, and application engineering.

Ingeteam’s key asset is its team of more than 3,900 professionals, 5,5% of which are dedicated to R&D&I. Whilst, with regard to the Renewable Energy division, the percentage of personnel dedicated to R&D is as high as 37%.

Ingeteam is committed to Technology and Innovation as a growth engine.

A comprehensive range of products and services, customised to meet the specific needs of each customer or project

A business corporation structured into 4 sectors, each specialising in the development of customer-oriented technology and service provision.

INGETEAM SERVICE HISTORY CHART
**Ingeteam Service**

**Ingeteam Service** is a member of the Ingeteam Group, with registered offices in Albacete (Spain). The company started up in 1999 and is currently a leader in the provision of operation and maintenance services at energy generating and exchange facilities, and enjoys a global presence.

**Ingeteam Service** provides **Operation & Maintenance services** at:

- Wind Farms
- PV Plants
- Energy generating plants

**Ingeteam Service** is a customer-oriented company, focused on providing excellent service through ongoing collaboration with customers. In this way, it is possible to meet the specific needs of each and every customer and to remain in close contact throughout the project life cycle.

In order to successfully meet the requirements of each specific plant, **Ingeteam Service** has a workforce that is committed to quality and efficiency. **Ingeteam Service** considers its team of staff to be the company’s greatest asset. As a result, the company is making an ongoing effort to ensure that personal safety is one of the key aspects of its work.

In this new period with a renewed commitment to innovation, **Ingeteam Service** is maintaining the company’s strategy of active participation in the different Research Programs of the European Union, Spain, and the Autonomous Communities. **Ingeteam Service** is directing the management of R&D&I towards the achievement of increasingly efficient processes, the development of new maintenance technologies, and the implementation of new tools that provide benefits and competitive advantages to shareholders, customers, and employees.

**Headcount:**

- 2017: 1,450
- 2018: 1,246
- 2019: 1,000
- 2020: 804
- 2021: 468

**MISSION**

To provide tailored services to customers in the energy generating and exchange sector, by applying engineering, research and design.

**VISION**

To be a leader in all the specialist services we provide.

**Why Ingeteam Service?**

- **Anywhere in the world**
  More than 1,600 professionals working across the globe. Present in more than 22 countries with local personnel and high performance capabilities.

15 GW maintained throughout the world

- **Experience in Multi-technology**
  Ingeteam Service’s extensive experience in the sector means that the company is considered to be a reputable leader by the principal renewable energy OEMs. With a business model that is differentiated by the added value derived from its capability to implement multi-technology services, the company provides innovation in its processes.

- **Throughout the value chain**
  Collaboration with the customer takes place throughout the service life of the plant, facilitating commissioning, carrying out all-inclusive maintenance and supporting plant management and operation, in order to maximise performance.
Since 1999, Ingeteam Service has been dedicated to the provision of all-inclusive Operation and Maintenance Services for wind farms. Currently, Ingeteam Service is working on more than 200 Onshore and Offshore wind farms throughout the world with a total installed power of more than 8,800 MW. The extensive experience gained means that Ingeteam Service is qualified to become your strategic partner for implementing maintenance programs.

Our knowledge, coupled with agreements with manufacturers, enables us to work on the implementation of maintenance programmes for wind turbines under warranty, according to the technologist’s specifications. Furthermore, being an independent supplier, we have developed strategies based on Customised Services: we aim to meet our customer’s requirements, by increasing plant availability.

Wind Power Maintenance Models

1. Support for the customer’s maintenance teams or maintenance campaigns with specialist technicians.
2. Preventive maintenance, according to the manufacturer’s manual, our own criteria and that of our customers.
3. Preventive maintenance and Minor corrective maintenance, either in-person or through a 24/365 on-call service.
4. Customised design of Maintenance Services according to the customer’s requirements and warranties.
5. Integrated Operation and Maintenance of the plant.
- Preventive Maintenance, Minor Corrective Services and Major Corrective Services.
- Maintenance of safety elements, roads and infrastructures.
- Predictive maintenance and on-line indicator monitoring.
- Plant operation, Monitoring and reporting.
- Plant performance study, efficiency analysis and continuous improvement.
- Provision of stock, the supply of spares, consumables and components.
- Management of purchasing, logistics and repairs.
- Environmental management.
On / Off-shore commissioning services
- Pre-Commission / Commissioning
- Maintenance Service up to power up
- Technical training of local teams.

Blade Services
- Work using a platform, rope access and skyclimber.
- Preventive/Corrective maintenance.
- Supply of materials and spares.
- Cleaning of blades and towers.
- On-ground and at-height inspections
- SAR Conductivity measurement
- Fitting marking lights
- Blade balancing
- Fibre repairs Nacelle and Cone

Major Corrective Services
- Replacement of Major Components
- Technology-specific tooling.
- Spares: Sale or Exchange
- All-inclusive management of the service
- Up-tower Repairs

Spares
- Characterisation of components
- Development of maintenance stocks
- Repair of components
- Supply of components
- Exchange of components
- Supply of consumables & material for preventive material
- Logistics management of customer warehouses

Retrofits and Maintenance support
- Design improvements
- Lubrication
- Oil changes
- Generator alignment
- Joint re-tightening

Maintenance Engineering and Management
- Development and implementation of work instructions and procedures
- Design and certification of specific tooling
- Customised training courses

Life-time Extension
- Audit to certify the remaining life
- Replacement of components to extend life time
- Technological upgrades for FSWT-WSWT turbines

High voltage services
- Preventive & Corrective Maintenance TS & E Substations
- Electrical Protection Testing
- Predictive Testing on Substation Switchgear Preventive & Corrective
- Maintenance of MV and HV
- Power Quality Measurement
- Prev. Maint S. Circuit Controllers for Power Transformers
- Automation & Control
- On-call service 24/365
- Management of Regulatory Technical Inspections

External Audits and QC/QA
- End-of-warranty audits
- Maintenance Audits
- Condition monitoring
- Audits Inspections with videoscope
- Power train inspection through vibrations
- Thermography and Electrical Testing
- Oil & grease analysis
- Supervision of Construction, Assembly, Quality and CNP
- Supervision of Logistics and Ocean shipments

INGEYS® CMS
Condition monitoring system
- Equipment supply and installation
- Data analysis and processing
- Training in vibration analysis
- Integration of data from different manufacturers

OMS Wind Power
- Data analysis operations
- Analysis of errors, alarms, defects and stoppages
- Analysis of predictive data and inspections
- Display and comparative analysis of variables
- Data processing service
Ingeteam not only designs and manufactures the power and control electronics installed at PV plants. In addition, since 1999, Ingeteam has also been focused on offering the best possible maintenance service to ensure optimum performance and continuous operation.

The knowledge, experience and specialization of Ingeteam’s team of highly qualified specialists, are all decisive factors in the maintenance of your PV plant.

Realistic flexibility

The solutions provided by Ingeteam for any type of PV plant, guarantee reliability and maximum efficiency.

Simply tell us what you need. Our company is so versatile that we can meet your requests right from the outset, when the contract is drawn up, so that we are always in a position to offer you excellent service.

Growth

<table>
<thead>
<tr>
<th>Year</th>
<th>Maintained Power (MW)</th>
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</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.500</td>
</tr>
<tr>
<td>2011</td>
<td>250</td>
</tr>
<tr>
<td>2012</td>
<td>1,400</td>
</tr>
<tr>
<td>2013</td>
<td>3,350</td>
</tr>
<tr>
<td>2014</td>
<td>5,200</td>
</tr>
<tr>
<td>2015</td>
<td>6,100</td>
</tr>
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More than 550 plants maintained throughout the world with a Total Installed Power of 6,100 MW
Photovoltaic OMS

Our supply is governed by your needs
We adapt to the specific stock size requirements of each plant. With our own logistics centres, we are able to guarantee the supply and an immediate response time with no need to invest in spares.

We can guarantee the procurement of all brands of spares and components, thanks to agreements with leading manufacturers and distributors.

We have the necessary technical capability to achieve the production expected from your plant and the necessary financial standing to cover the production cost of possible deviations.

The operational availability of components is guaranteed, and so is the Performance Ratio. Should the financial result obtained be lower than that stated in the contract, then Ingeteam will provide financial compensation. Our commitment is to guarantee a return on investment.

Operation
Proactive service excellence
Each plant is constantly monitored from our Control Centre.

We are committed to offering our customers a proactive service, always planning ahead for any potential contingencies at the PV plant.

We compile data on production, performance, maintenance etc. Acting immediately to ensure the correct operation of the plant, whilst also providing plant status reports.

Maintenance
We’ll take care of everything, for your peace of mind
This service is an absolute must for any plant. Ingeteam uses its expertise to develop maintenance protocols that are based on the most demanding standards, for guaranteed plant operation and extended service life.

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We can guarantee the procurement of all brands of spares and components, thanks to agreements with leading manufacturers and distributors.

Production Guarantee
Our supply is governed by your needs
We have the necessary technical capability to achieve the production expected from your plant and the necessary financial standing to cover the production cost of possible deviations.

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Ready for your challenges

The experience of the Ingeteam group, together with its engineering and project management capabilities, means that it is capable of addressing all types of challenges ranging from the supply of a simple component to the operation and maintenance of any energy generating plant, supplying all-inclusive solutions for the development of electricity generating plants whilst seeking to optimise the use of energy resources.

We have combined our experience in O&M, which dates back to 1999, with our knowledge of the development of electronic monitoring products and our energy plant design know-how, in order to offer our customers all the services that maximise availability and profitability for all types of energy generating plants.

**Types of Service**
- All-inclusive Operation & Maintenance
- Supervision of assembly
- Commissioning and operating tests
- All-inclusive operating solutions
- Plant operation management
- Plant local and remote operation
- Programmed shut-downs and overall inspection
- Customised Predictive, Corrective and Preventive Maintenance
- Specialist services
- Supply of equipment and spares

**Energy Sources**

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**Other energy sources**

We have combined our experience in O&M, which dates back to 1999, with our knowledge of the development of electronic monitoring products and our energy plant design know-how, in order to offer our customers all the services that maximise availability and profitability for all types of energy generating plants.

**Types of Service**
- All-inclusive Operation & Maintenance
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**Engineering**

**Maintenance Engineering**
- Definitions of the types of maintenance
- Definition of work flows
- Supply and implementation of COMPUTERISED MAINTENANCE MANAGEMENT SYSTEMS (CMMS)

**Technical training**
- +3,000 Hours of technical training given each year
- +100 Hours of courses implemented
- INGEBAX e-Learning platform (www.ingebox.com)

**Development and certification of lifting tools and accessories (UTMs)**
- +400 UTM's developed and certified

**Development of technical instructions (TIs) and checklists (CKLs)**
- +2,500 TIs developed
- +400 CKL’S developed
- +50 Technical manuals developed

**Technical Support**
- +20 Tecnologies
- Specialisation

**R&D&i**

**Committed to ongoing innovation**

**Strategic lines**
- New diagnostic techniques applied to the maintenance of renewable energy plants and maritime and rail traction systems.
- Improvements in existing production technologies.
- New renewable energy production systems.
- **Field Technology.** Improvement of operative and resolutive capacities of technicians / through the use of technology.
- **Decision support tools** based on Big Data/Smart Data/Fast Data.

**Functions**
- Coordination and development of national and international R&D&I projects.
- New predictive maintenance systems.
- Technology Watch Newsletter.

**More than 25,000 hours per year dedicated to Research & Development**

**MOST OUTSTANDING PROJECTS**

**CENIT WIND POWER:** “Operation and Maintenance methodologies for deep water offshore wind farms”.

**ICINGBLADES:** “Development of advanced techniques for deicing wind turbine blades and preventing the accumulation of snow”.

**WINDDB:** Predictive diagnosis of the wind turbine power train through the application of smart algorithms to the acquisition of sound recorded at ground level”.

**SCARAB:** “Smart tool for the optimization of the operation and maintenance of photovoltaic plants, based on new monitoring systems shipped in UAVs”.

**SUPRAPOWER:** “Development of superconducting wind generators that are more lightweight, robust and reliable, installed in 10 MW offshore wind turbines”.

**RealTide:** “Power Take-off and control optimized for Tidal Energy Converters in Real sea conditions”.

With a staff of 30 employees
Ingeteam Service is firmly committed to establishing policies and guidelines that guarantee customer satisfaction whilst maintaining respect for the environment. Likewise, Ingeteam Service is committed to safety, as a core value, in order to guarantee the health and safety of its employees and collaborators.

With these aims in mind, the company’s actions are directed at:

- The continuous improvement of its integrated quality, environmental and occupational risk prevention management system, in line with standards: ISO 9001, ISO14001, OHSAS 18001 and UNE 166002.
- Furthermore, Ingeteam Service guarantees the training of its employees to the highest safety standards. The company is GWO certified.
- We are progressing in Corporate Social Responsibility models.