



Operation & Maintenance
Services

Ingeteam

**“There is a driving force more powerful than steam,
electricity and atomic energy: the will.”**
Albert Einstein

General Brochure
Ingeteam Power Technology S.A.

Service

Ingeteam



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FSC-certified paper

CORPORATE HISTORY

A GREAT HISTORY FOR A GREAT FUTURE

Ingeteam



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.

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



Energy



Industry



Traction



Marine

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.

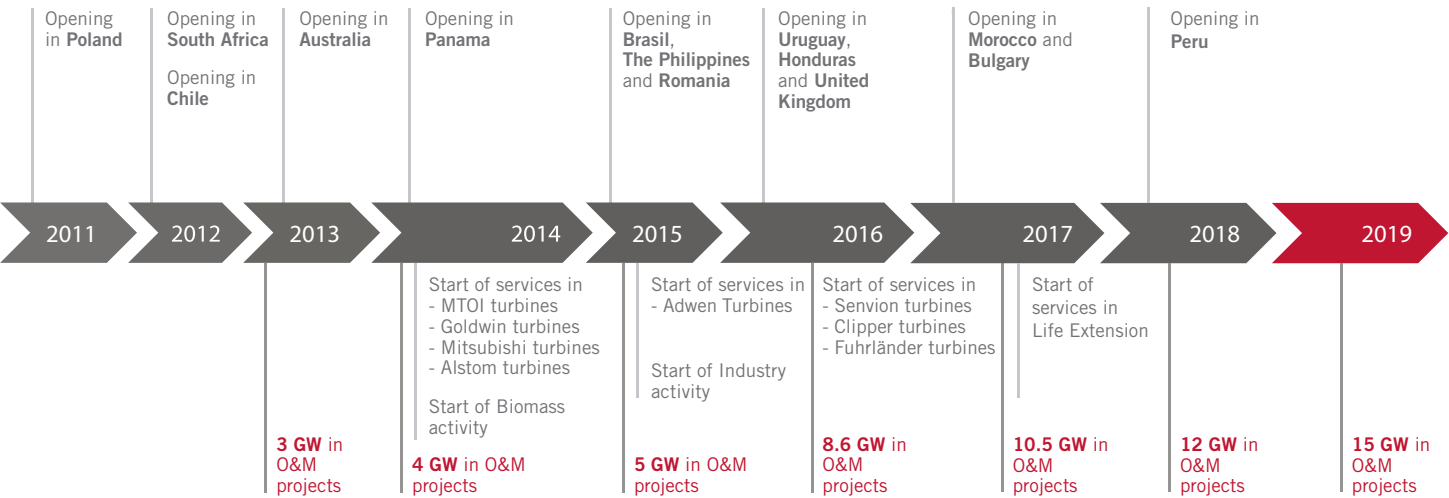
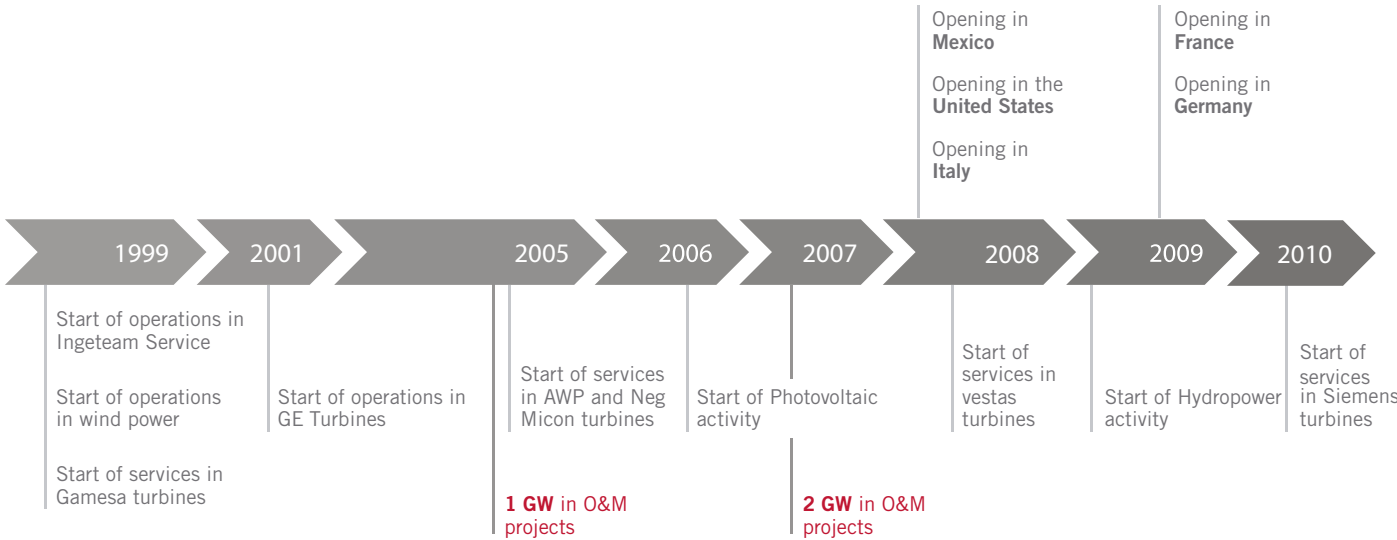
The core of **Ingeteam's** business is based on power and control electronics, the technology for electric machines, generators and motors, and application engineering.

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

INGETEAM SERVICE HISTORY CHART





Zamudio
(Bizkaia)



Ingeteam Power Technology
Service · (Albacete)



Germany



Australia



Brazil



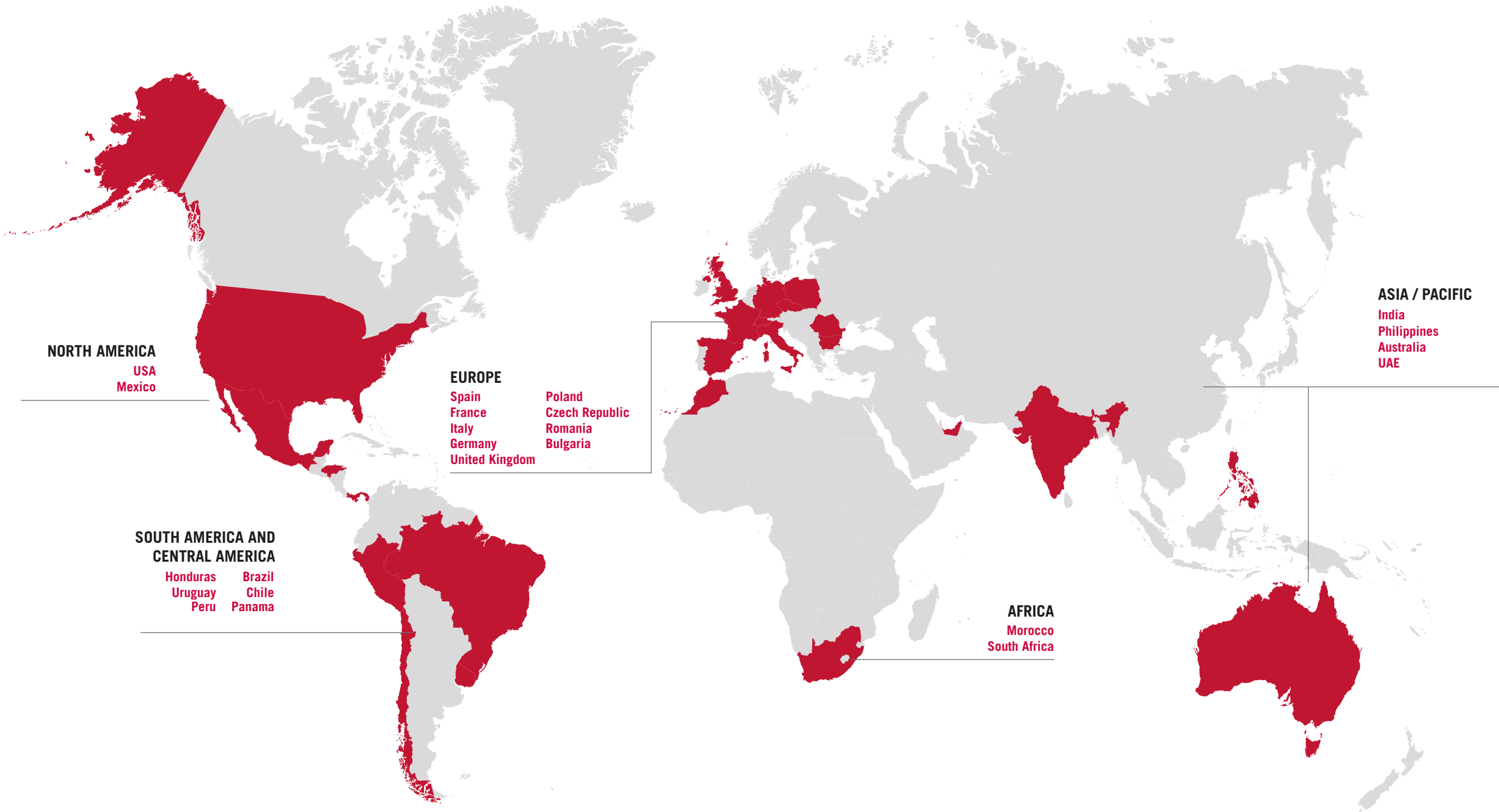
Chile



USA



Philippines



France



Italy



Mexico



Panama



Poland



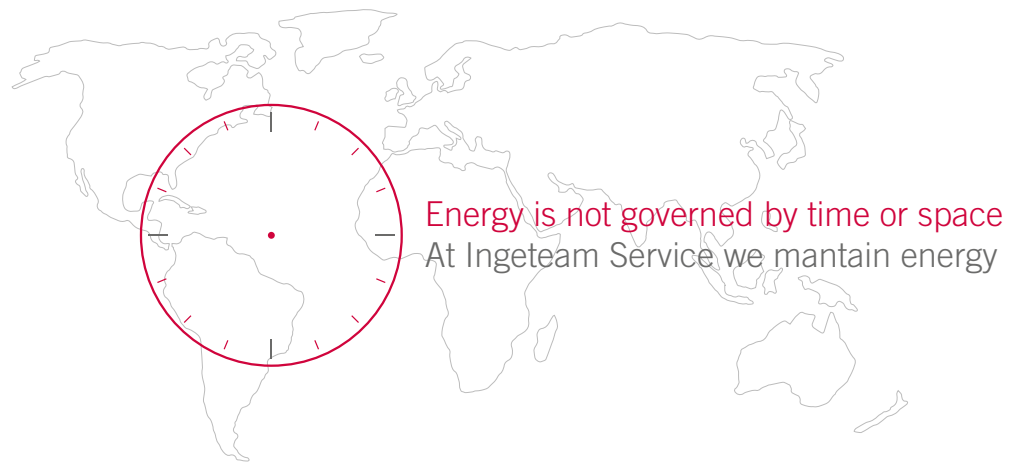
United Kingdom



Romania



South Africa



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



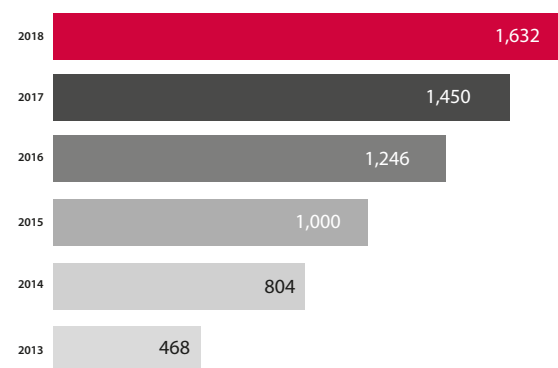
Energy generating plants

Ingeteam Service is a customer-oriented company, focussed 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:



VISION

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

MISSION

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

Why Ingeteam Service?

Because we're the world leader in the provision of Operation & Maintenance Services to energy generating plants.

► 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.**

Ingeteam

OMS Wind Power

Flexibility to meet your needs



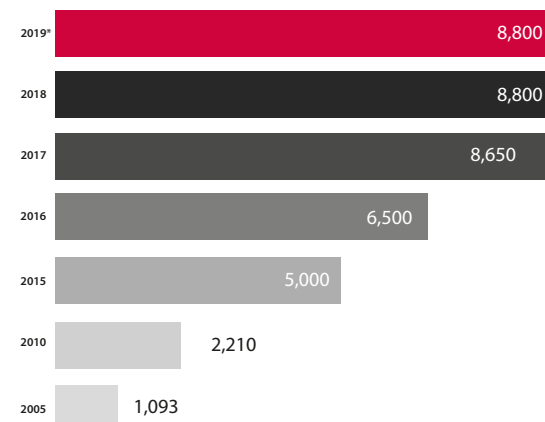
Technologies

Our experience includes the following technologies:

- ▶ Vestas
- ▶ Siemens Gamesa
- ▶ General Electric
- ▶ Mtoi
- ▶ Senvion
- ▶ Suzlon
- ▶ Goldwind
- ▶ Mitsubishi Power Systems
- ▶ Adwen
- ▶ Nordex Acciona

Growth

Maintained Wind Power (MW)



More than **5,600** Wind Turbines maintained throughout the world
with a Total Installed Wind Power of **+ 8,800** MW

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.



Ingeteam

OMS Wind Power



On / Off-shore commissioning services

- Pre-Commissioning / 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

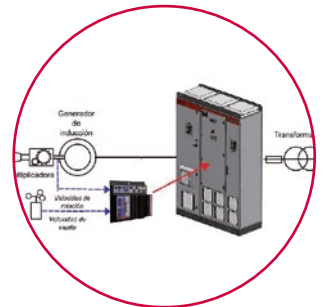


Maintenance Engineering and Management

- 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-VSWT turbines



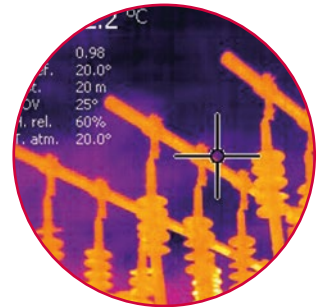
High voltage services

- Preventive & Corrective Maintenance TS & E.Substations
- Electrical Protection Testing
- Predictive Testing on Substation Switchgear Preventive & Corrective
- Maintenance of MVL and HVL
- 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 ORP
- Supervision of Logistics and Ocean shipments



INGESYS® CMS Condition monitoring system

- Equipment supply and installation
- Data analysis and processing
- Training in vibration analysis
- Integration of data from different manufacturers



Ingeboards® Tool for the Advanced Operation of Wind Farms

- 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





Photovoltaic OMS

Just the right solution for each customer



Ingeteam not only designs and manufactures the power and control electronics installed at PV plants. In addition, since 1999, Ingeteam has also been focussed on offering the best possible maintenance service to ensure optimum performance and continuous operation.

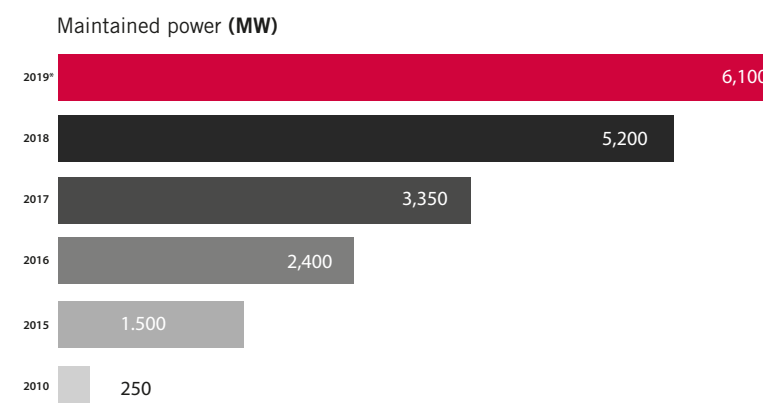
The knowledge, experience and specialisation of **Ingeteam's** team of highly qualified specialists, are all decisive factors in the maintenance of your PV plant.

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



More than **550** **Plants** maintained throughout the world
with a Total Installed Power of **6,100** MW



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**.

Spares

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.

Production Guarantee

Our supply is governed by your needs

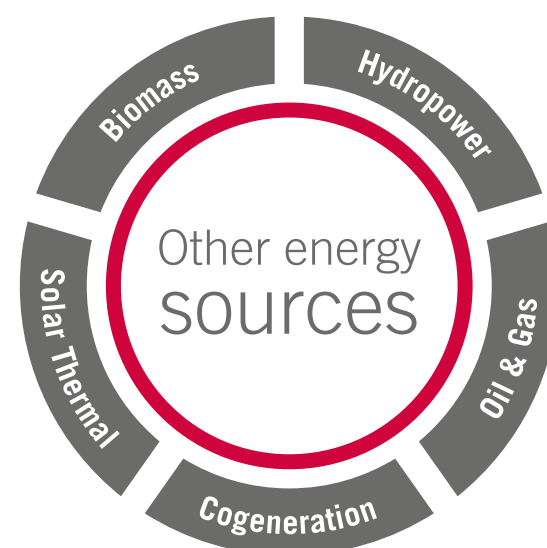
We have the necessary technical capability to achieve the production expected from your plant and the necessary financial standing to cover the production cost of possible deviations.

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**.

Other energy sources Ready for your challenges



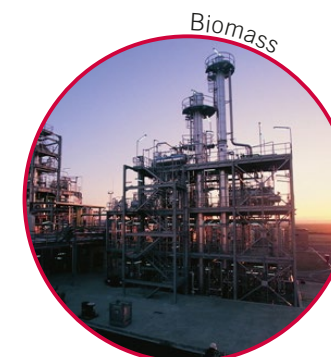
The experience of the Ingeteam group, together with its engineering and project management capabilities, means that it is capable of addressing **all types of challenges** ranging from the supply of a simple component to the operation and maintenance of any energy generating plant, supplying **all-inclusive 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.

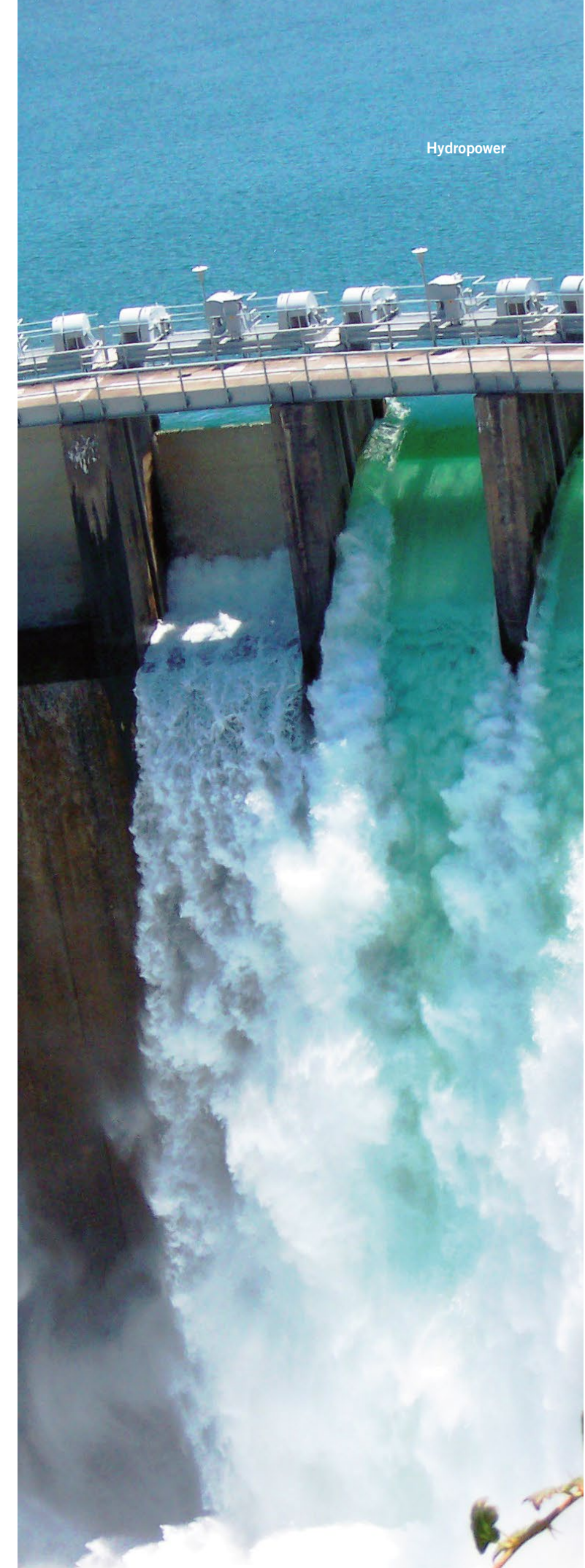
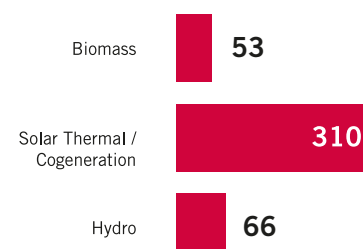
Types of Service

- ▶ 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



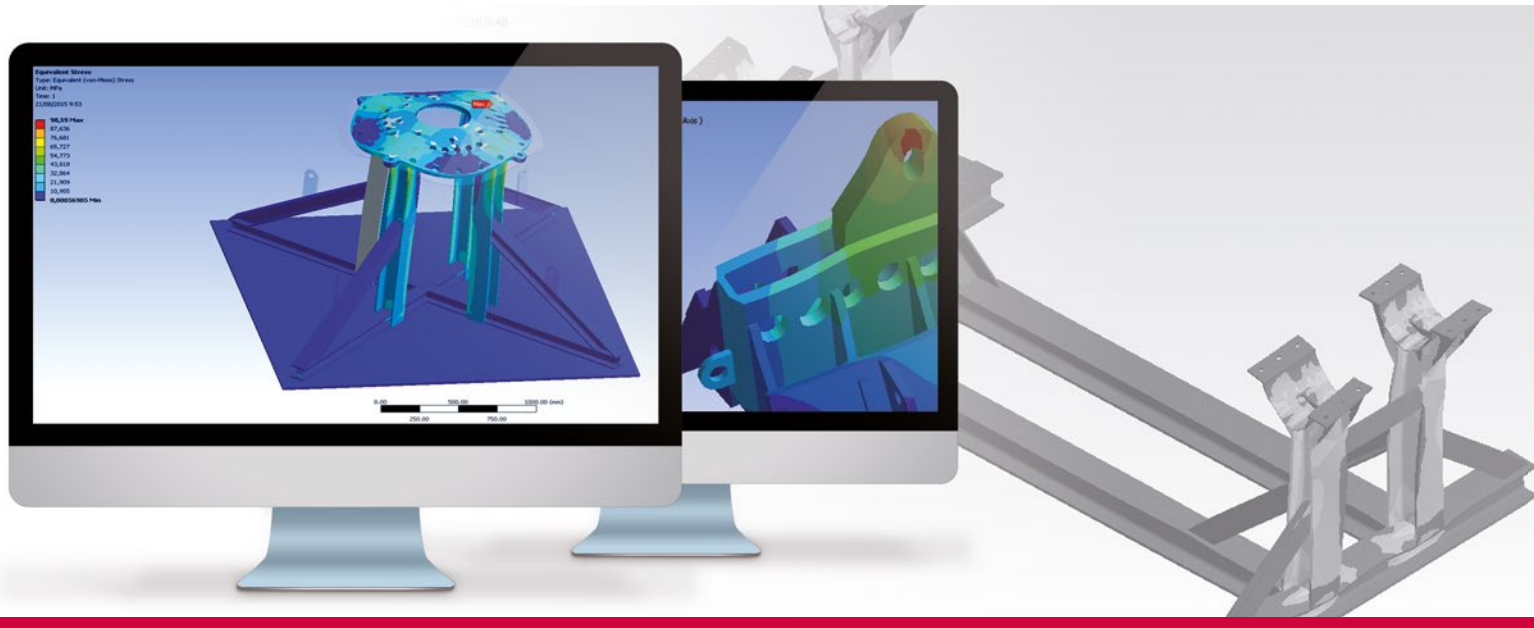
Energy Sources

Power (MW)



Ingeteam

Engineering



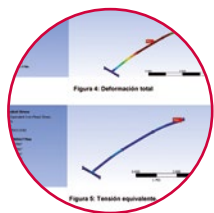
Maintenance Engineering

- 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
- **INGEBOX** 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 IT**s developed
- **+400 CKL**'S developed
- **+50** Technical manuals developed

Technical Support

- **+20 Technologies**
(Wind Power, Photovoltaic, Biomass & Solar Thermal)
- 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 resolute 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

With a staff of 30 employees

► MOST OUTSTANDING PROJECTS

CENIT WIND POWER: "Operation and Maintenance methodologies for deep water offshore wind farms".

ICINGBLADES: "Development of advanced techniques for defrosting 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".



Our commitment to quality, to
the environment and to the health and safety of
our 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.



Company Directory

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