



Operation &
Maintenance Services

Ingeteam



At Ingeteam, **life and health are not negotiable.**

In the knowledge that the Ingeteam Group's employees are our most important asset, **the Health and Safety** of each and every one of them is a priority objective, ensuring that best practices are implemented at both a national and international level.

Health and safety at work are present in all the corporate project phases, as well as in all corporate areas. It is based on the firm **commitment of Management** and works in a cross-cutting way with the different departments: Sales, Human Resources, Operations, Engineering, R&D&i.

Safety cannot be considered to be an activity that is the sole responsibility of the Safety Area, but as one that is embedded in all the company's day-to-day activities.



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FSC-certified paper

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.

SECTORS



HYDRO



RAILWAY & MOBILITY



WIND ENERGY



WATER



MARINE, METALS & MINING



SOLAR PV, BESS & H2



TRANSMISSION & DISTRIBUTION

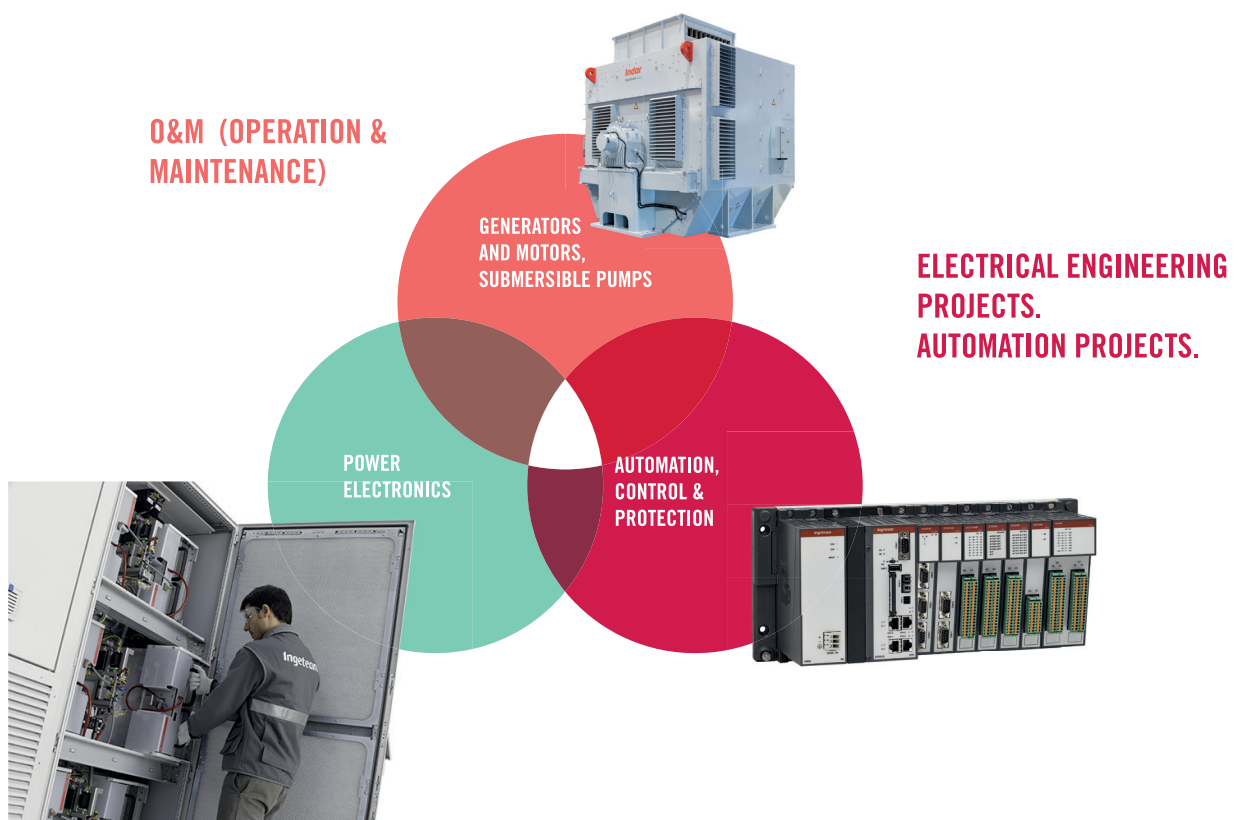
A comprehensive range of products and services, customised to meet the specific needs of each customer or project

A leading company in the electronics-electrotechnical sector.

Ingeteam's key asset is its team of more than **4,000 professionals**, **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%**.

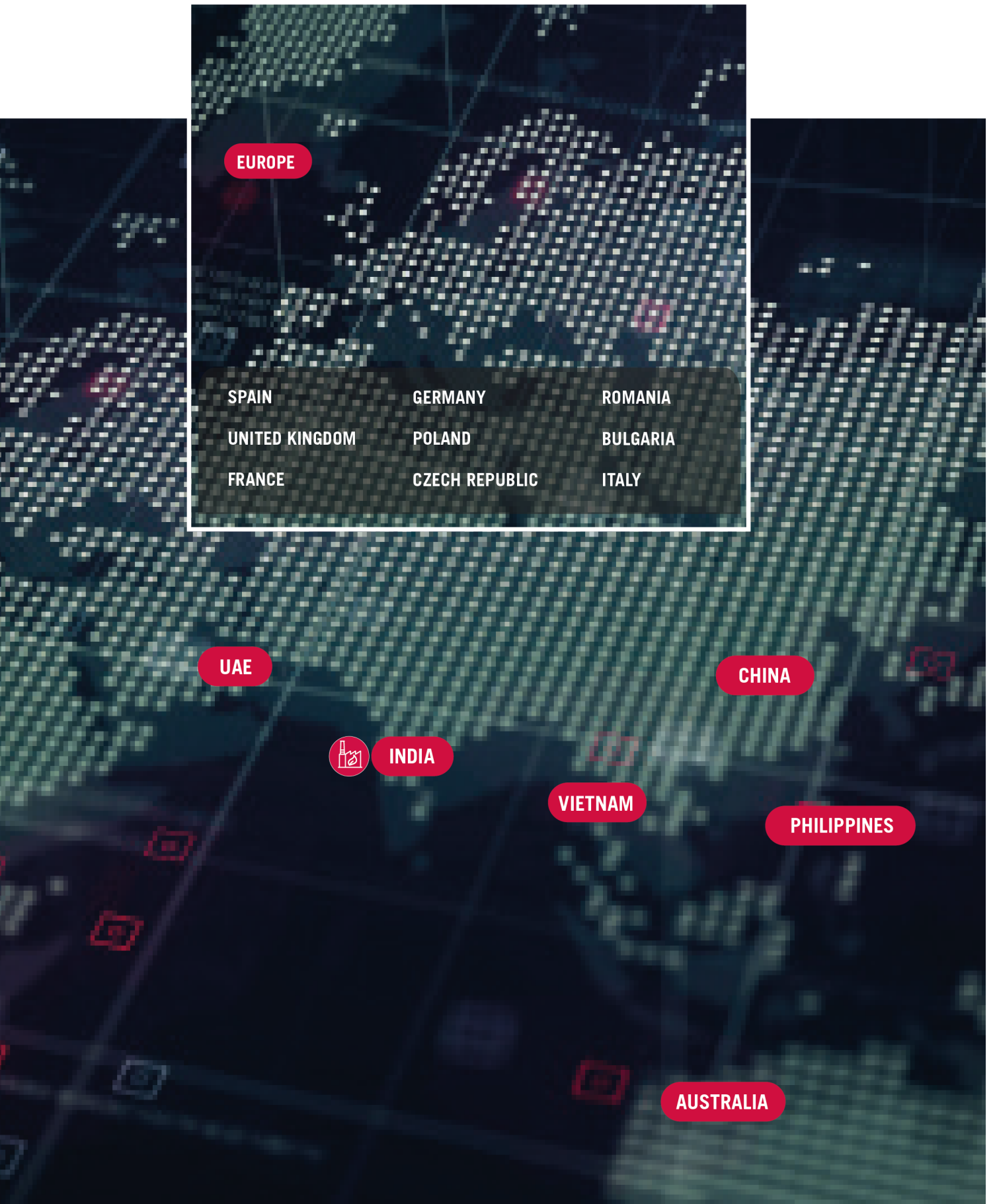
Ingeteam is committed to Technology and Innovation as a growth engine.

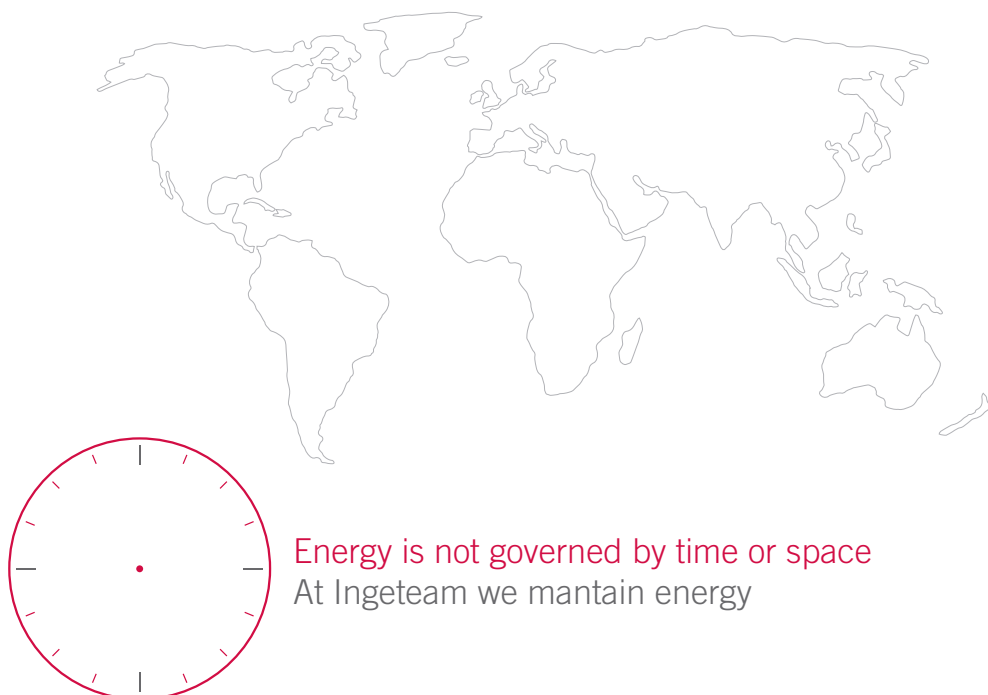
TECHNOLOGICAL CORE



INGETEAM IN THE WORLD







Energy is not governed by time or space
At Ingeteam we maintain energy

Ingeteam

Ingeteam is an international technology company specialising in **electrical energy conversion**.

Its technological developments in **power and control electronics** (inverters, variable frequency drives, controllers and protection devices), **rotary electrical machines** (Indar motors, generators and submersible motor pumping units), **systems** (integration of engineering, electromechanics & automation) and **O&M services** enable it to offer solutions for the wind power, photovoltaic, hydroelectric and fossil fuel energy sectors, for the metal processing industry, naval, green hydrogen, electric vehicle recharging, railway traction, and electric power grids, whilst always striving for more reliable, efficient and sustainable energy generation, transport, storage and consumption.

Ingeteam operates worldwide, with a permanent presence in 24 countries, and employs over 4,100 people. Its activity is based on in-house R&D&I, **investing more than 5% of its turnover annually**.

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



Wind Farms



PV Plants



Energy generating
plants



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 O&M Ingeteam services?

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

► Anywhere in the world

More than 4,000 professionals working across the globe. Present in **more than 24 countries** with local personnel and high performance capabilities.

+18 ^{GW} maintained throughout the world

► Experience in Multi-technology

Ingeteam 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**.

OMS Wind Power

Flexibility to meet your needs

Growth

Maintained Wind Power (MW)



9.2 GW

Technologies

Our experience includes the following technologies:

- ▶ **Vestas**
V25, V35, V39, V47, V47/660, V52/850, V5x, V82, V90.
- ▶ **Nordex Acciona**
AW 11x/3000, AW 12x/3000, AW 77/1500.
- ▶ **General Electric**
GE1.5, GE2.5, GE750.
- ▶ **Senvion**
3.0M122, 3.4M114, MM92.
- ▶ **M Torres**
TWT1,65.
- ▶ **Furhländer**
FL MD/77.
- ▶ **Nordtank**
NTK 600.
- ▶ **Adwen**
- ▶ **Siemens Gamesa**
G114, G128, G42, G47, G5x, G8x, G9x, Siemens 2.3.
- ▶ **Goldwind**
GW80/1500, GW90/2500, GW109/2500.
- ▶ **Made**
AE-23, AE-30, AE-32, AE-46.
- ▶ **NEG Micon**
NM44, NM48, NM82.
- ▶ **Mitsubishi Power Systems**
MWT-92.
- ▶ **Alstom**
ECO100
- ▶ **Clipper**
Liberty C89.
- ▶ **Suzlon**



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



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



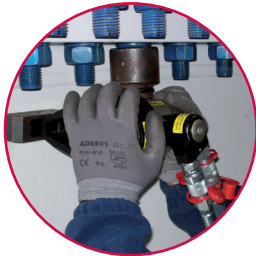
Major Corrective Services

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



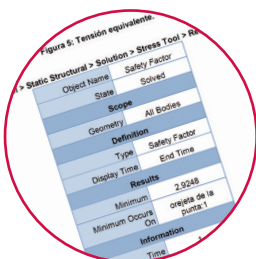
Spares

- ▶ 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



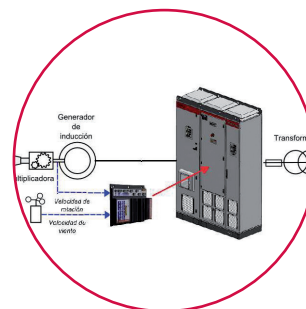
Maintenance Engineering and Management

- ▶ Development and implementation of work instructions and procedures
- ▶ Design and certification of specific tooling
- ▶ Customised training courses

OMS Wind Power

Life-time Extension

- Audit to certify the remaining life ◀
- Replacement of components to extend life time ◀
- Technological upgrades for FSWT-VSWT turbines ◀



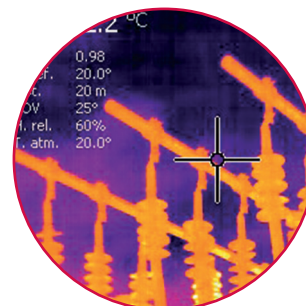
High voltage services

- 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 ◀



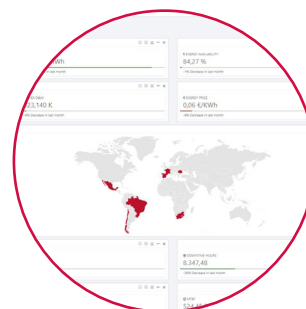
INGESYS® CMS Condition monitoring system

- 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

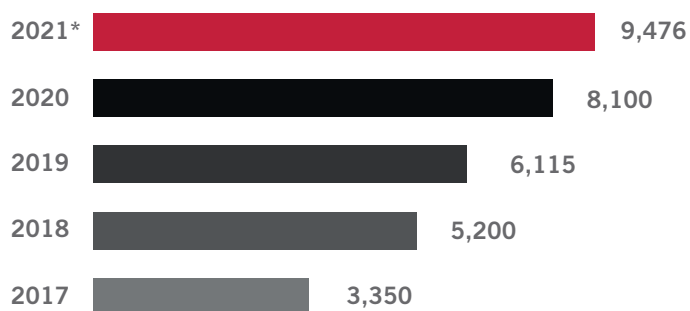
The solutions provided by Ingeteam for any type of PV plant, guarantee **reliability** and maximum efficiency.

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

Maintained power (MW)



9.4 GW



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**.

Photovoltaic OMS



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**.

Ingeteam

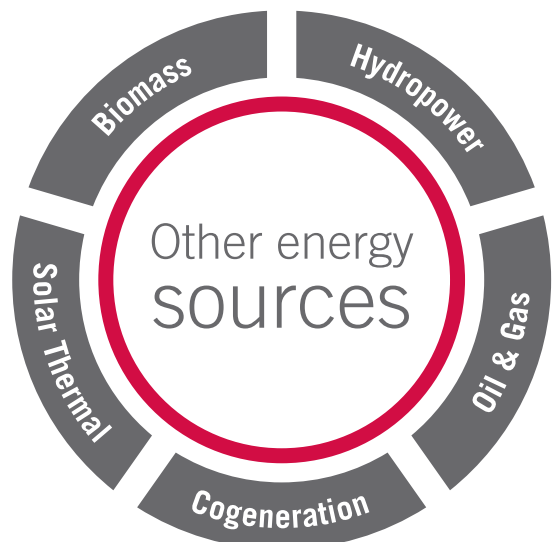
Other energy sources

Ready for your challenges



Thermosolar energy

The experience of the Ingeteam, 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



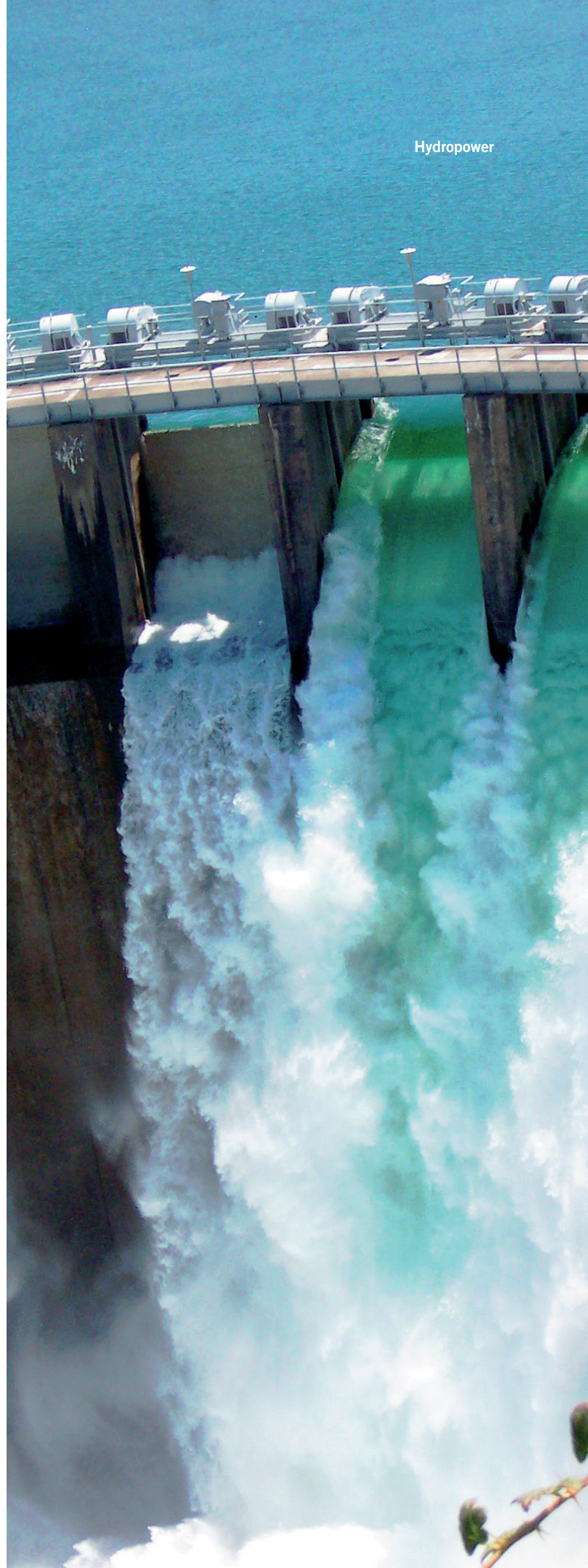
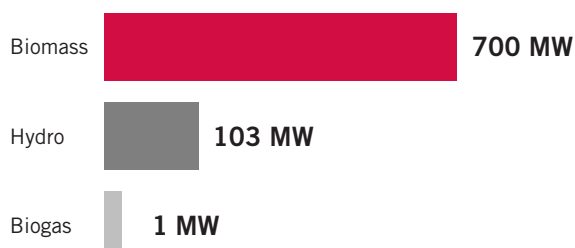
Biomass



Oil & Gas

Energy Sources

Power (MW)



Hydropower



O&M Services

+18 GW IN O&M PROJECTS

- ✓ O&M “Full Service” in power generation plants.
- ✓ Preventive / Corrective Maintenance Campaigns.
- ✓ Predictive maintenance service.
- ✓ Audits and inspections.
- ✓ Retrofits.
- ✓ Work at height and blade services.
- ✓ Electrical infrastructure maintenance.
- ✓ Maintenance Engineering.
- ✓ Major Corrective Maintenance Service.



Spares and Repairs

- ✓ Supply of spares
- ✓ Component repair.
- ✓ Logistics management.

Digital Services

- ✓ CMMS tools.
- ✓ Control Centre Service.
- ✓ Analytics Tools: Ingeboards®.
- ✓ Predictive Tools: IngePredict®.
- ✓ O&M Offshore Tools: Ingeocean®.



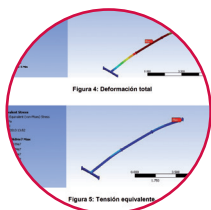
Maintenance Engineering

- 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)

- **+200 UTM**s developed and certified



Development of technical instructions (TIs) and checklists (CKLs)

- **+2,000 IT**s developed
- **+300 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.**

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"

OPTIMUS: "Development of methods and tools for the optimisation of large sized wind turbines".

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

At an international level, Ingeteam is a leader in safety within the renewables sector.

It meets the highest standards of quality with regard to training.

We have been a certified GWO training provider since 2015, with offices in Spain and Mexico.

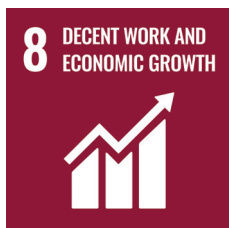
Given that we are a GWO certified provider, with the capacity to deliver training to the **GWO, BST, BRT and BTT standards**, Ingeteam has the capability to train technicians in the wind sector with a view to achieving an injury-free workplace. This allows Ingeteam to be part of the wind industry, forming a team with the major players in the sector.



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

Ingeteam 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**.

To Progress in Corporate Social Responsibility and Reconciliation models.





Company Directory

SPAIN

Ingeteam Power Technology S.A. - Service

Parque Científico y Tecnológico
Pº de la Innovación, 3
02006 ALBACETE - SPAIN
Phone: +34 967 245 504 | email: service@ingeteam.com

GERMANY

Ingeteam GmbH

Grand Bateau - Zollhof 6
DE 40221, Düsseldorf - GERMANY
Phone: (+49) 89 99 65 38 0 | email: service@ingeteam.com

AUSTRALIA

Ingeteam Australia Pty Ltd

iAccelerate Centre, Building 239,
Innovation Campus, Squires Way,
North Wollongong, 2500 NSW - AUSTRALIA
email: service@ingeteam.com

BRAZIL

INGETEAM LTDA.

Rua Estácio de Sá, 560 – Santa Genebra
Campinas - SP - CEP 13080-010 – BRASIL
Phone: (+55) 19 30 37 37 73 | email: service@ingeteam.com

CHILE

INGETEAM S.P.A.

Los Militares 5890, Oficina 401
Las Condes, Santiago - CHILE
Phone: +56 9 79861531 | email: service@ingeteam.com

USA

INGETEAM INC.

3550 W. Canal St. Milwaukee, WI 53208 – U.S.A.
Phone: +1 414 934 4100 | email: service@ingeteam.com

PHILIPPINES

INGETEAM PHILIPPINES INC

Incub8 Space, 9059 Centennial Road Batong Dalig,
Kawit, Cavite - PHILIPPINES
Phone: +63 (02) 3176677 | email: service@ingeteam.com

FRANCE

INGETEAM S.A.S.

Le Naurouze C -140 rue Carmin, 31670 Labège - FRANCE
Phone: +33 (0)5 61 25 00 00 | email: service@ingeteam.com

ITALY

INGETEAM S.R.L.

Via Antonio Salandra, 18, 00187, Roma - ITALY
Phone: +39 349 5940809 | email: service@ingeteam.com

MOROCCO

INGETEAM MOROCCO SARLAU

No. 59, Boulevard Zerktouni, 6ème étage No. 18
Casablanca
MOROCCO
email: service@ingeteam.com

MEXICO

INGETEAM S.A. DE CV.

C/. Lauro Pineda Col. Martires 31 de Julio
C.P. 70000, Juchitán Oaxaca - MEXICO
Phone: +52 971 281 0996 | email: service@ingeteam.com

PANAMA

INGETEAM PANAMA S.A.

Calle Manuel Espinosa Batista, Ed.Torre Internacional
Business Center, Apto./Local 407 Urb.C45 Bella Vista Corr.
Bella Vista - PANAMA
Phone: +507 61329467 | email: service@ingeteam.com

POLAND

INGETEAM SP. Z.O.O.

Ul. Kostrzynska 89 66-400 Gorzów Wlkp.
POLAND
Phone: +48 881 915 099 | email: service@ingeteam.com

UNITED KINGDOM

INGETEAM SERVICE UK LIMITED

Centre Suite Ground Floor, Colonsay House
GSO Business Park, East Kilbride G74 5PG - UK
Phone: +44 (0)141 488 5290 | email: service@ingeteam.com

RUMANIA

INGETEAM SERVICE S.R.L.

Constanta- Str.Alexandru cel Bun,nr.4B,parter - ROMANIA
Phone: +40 728.99.32.02 | email: service@ingeteam.com

SOUTH AFRICA

INGETEAM (PTY) LTD.

16th Road, Alphen Square South – Randjiespark 1682
Midrand, Gauteng - SOUTH AFRICA
Phone: +27 11 3143190 | email: service@ingeteam.com

URUGUAY

INGETEAM URUGUAY S.A.

World Trade Center Torre I Piso 10
11100, Montevideo - URUGUAY
Phone: +598 99 673 102 | email: service@ingeteam.com



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www.ingeteam.com