

INGECON HYDRO



HYDROPOWER

A complete range of products for the automation of hydropower plants

Ingeteam



HYDROPOWER

MORE THAN 50 GW SUPPLIED TO THE RENEWABLE ENERGY MARKET WORLDWIDE

Energy

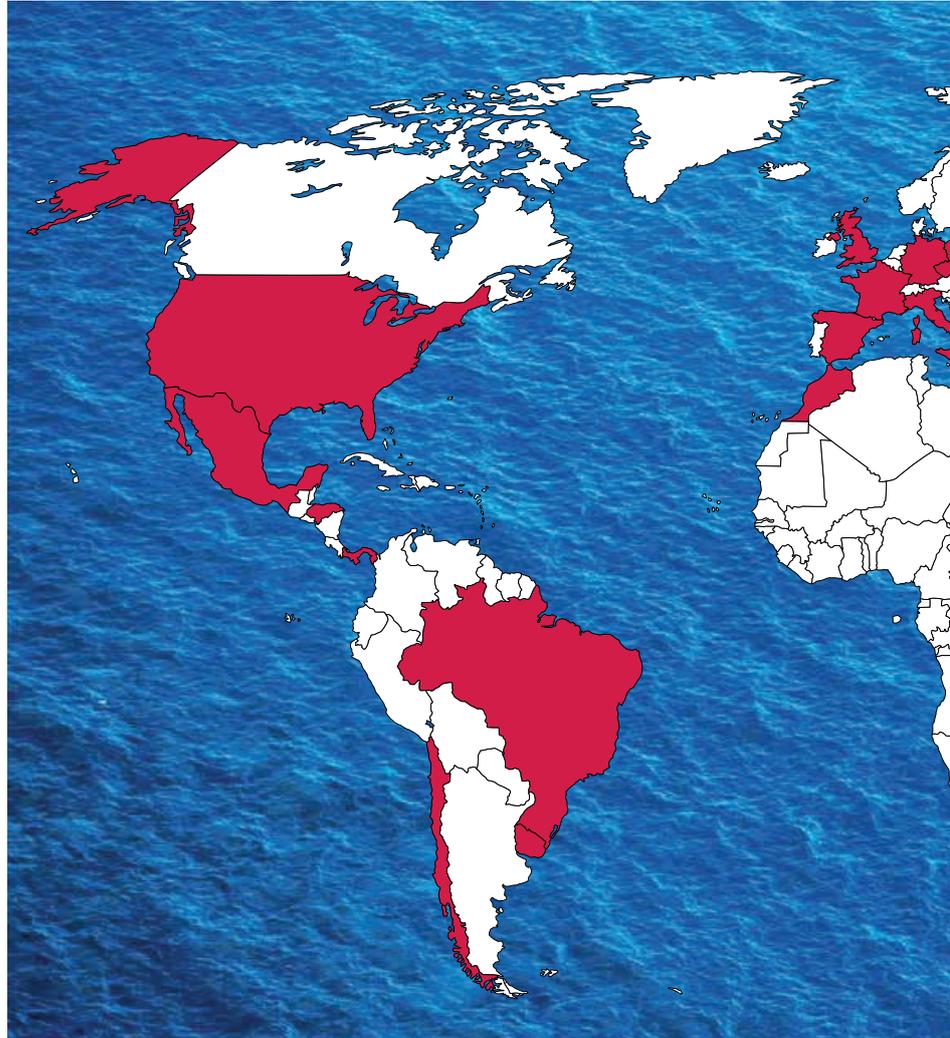
Industry

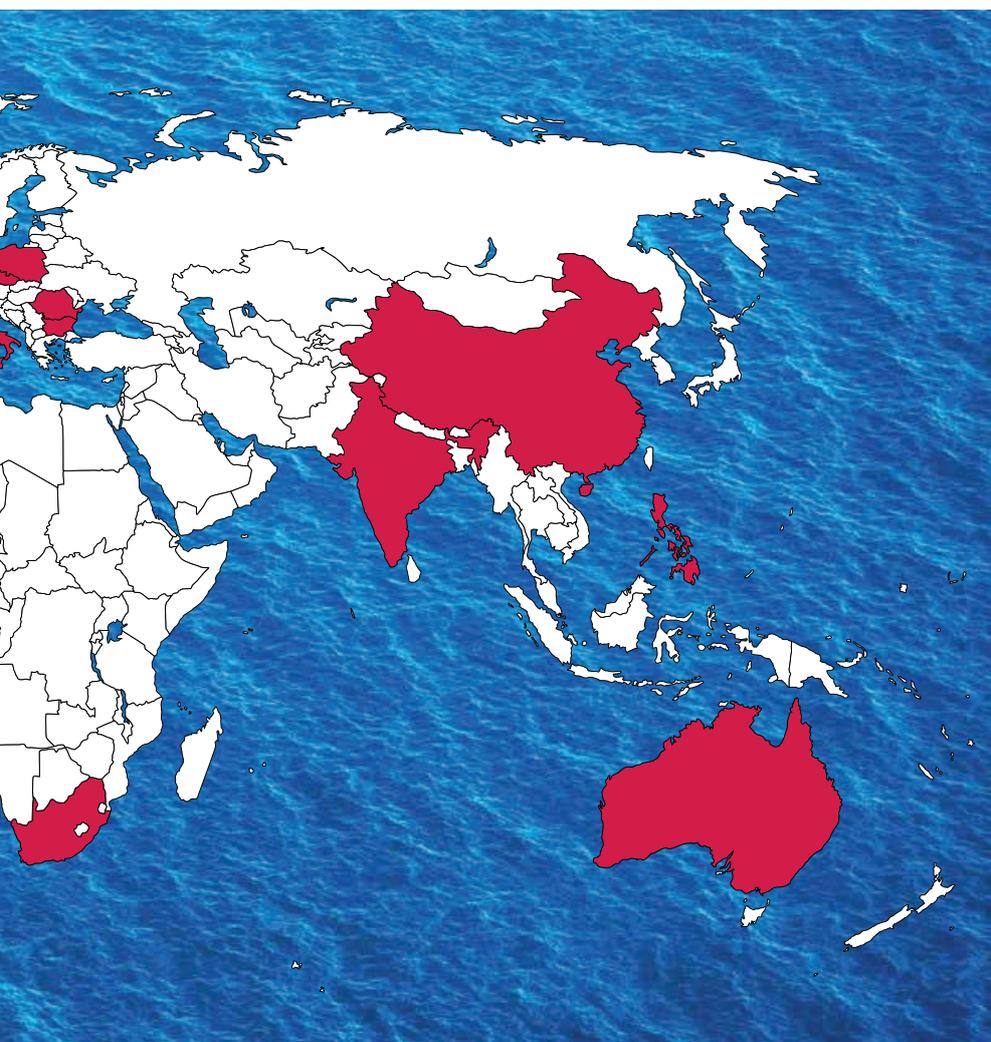
Marine

Traction

Basic Technologies

Services





NORTH AMERICA

- EEUU
- Mexico

Workforce: 149
Work Centres: 7

EUROPE

- Spain
- France
- Italy
- Germany
- Poland
- Czech Republic
- Romania
- United Kingdom*
- Bulgaria*

Workforce: 3,089
Work Centres: 27

ASIA

- India
- China
- Philippines

Workforce: 29
Work Centres: 3

SOUTH AMERICA AND CENTRAL AMERICA

- Brazil
- Chile
- Honduras
- Panama
- Uruguay

Workforce: 209
Work Centres: 7

AFRICA

- South Africa
- Morocco*

Workforce: 30
Work Centres: 2

OCEANIA

- Australia

Workforce: 2
Work Centres: 1

Production centres
* New set-ups in 2016

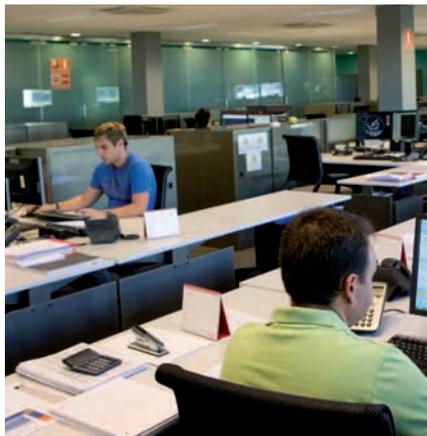
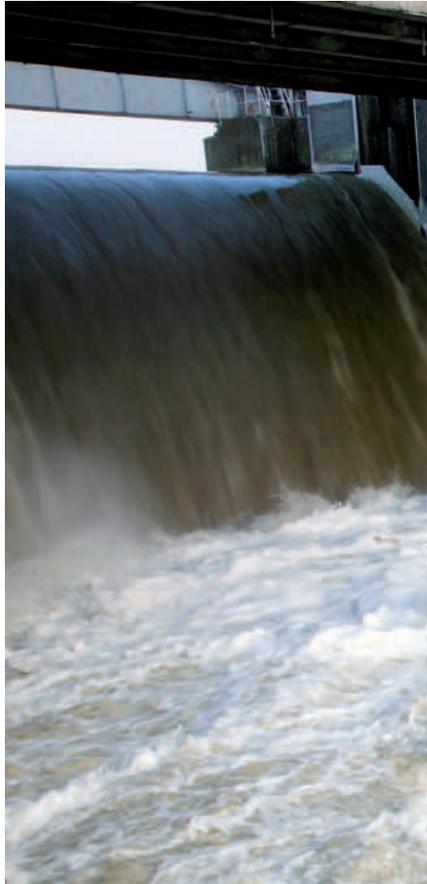
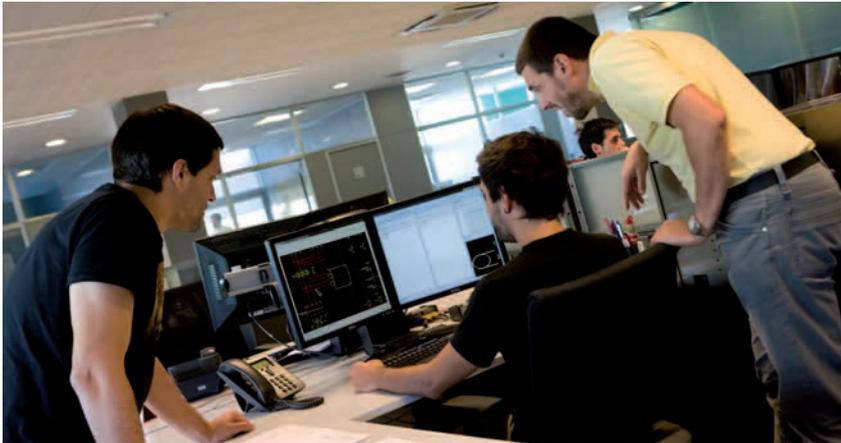
Ingeteam is a global corporation specialized in 4 different sectors (Energy, Industry, Marine and Railway Traction), all customer oriented and based on power and control electronics, electrical machines and application engineering.

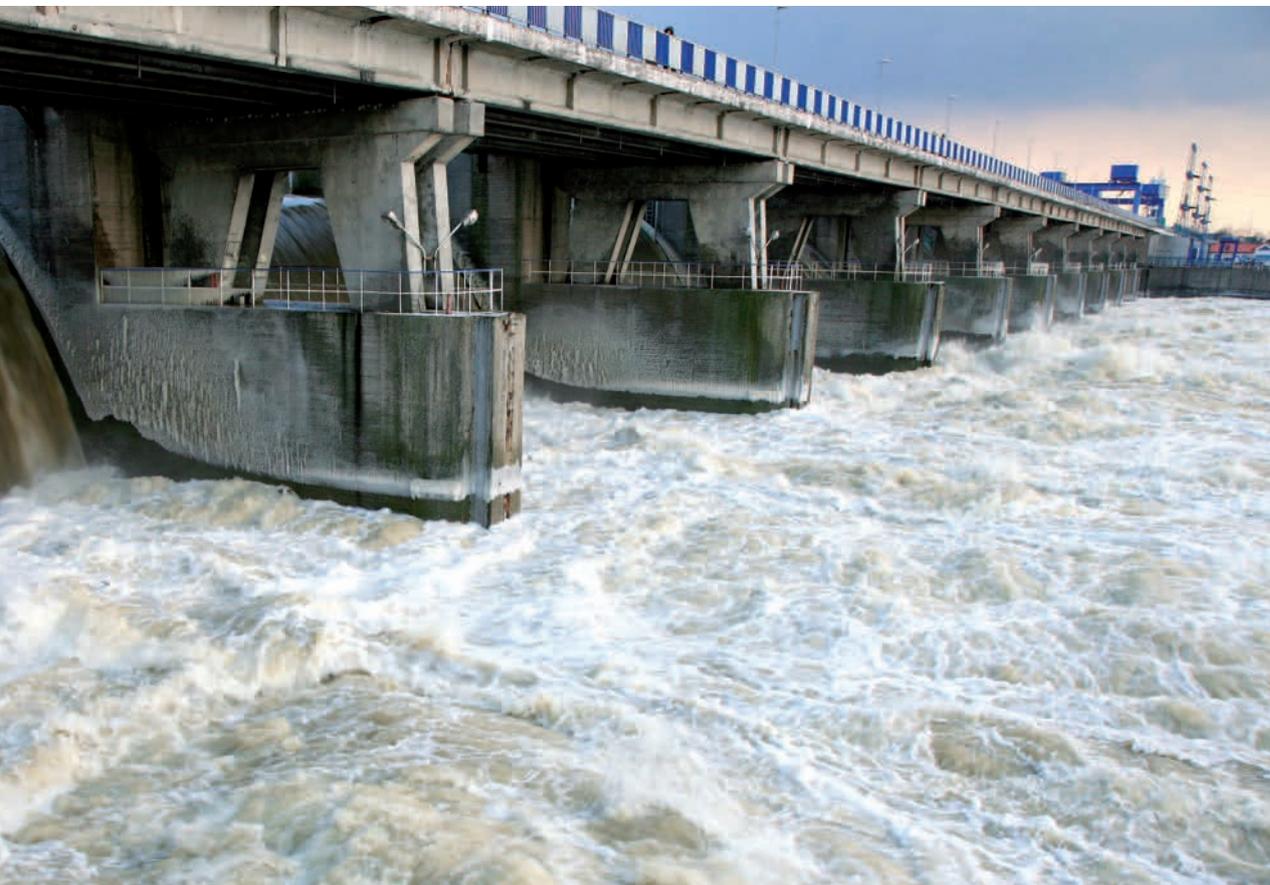
With more than 60 years experience in the electricity sector, more than 3,800 professionals dedicated to engineering and project development, and more than 50 GW supplied to the renewable energy market worldwide, Ingeteam is committed to investing in technology and innovation as the drivers of future growth.

Since 1990, the Energy business unit of Ingeteam Power Technology, S.A. has been dedicated to supplying equipment for the renewable energies sector (wind power, photovoltaic, solar thermal, hydropower, biomass and biofuels).

CONTROLLING THE POWER OF WATER

A COMPLETE RANGE OF
PRODUCTS FOR THE AUTOMATION
OF HYDROPOWER PLANTS





Ingeteam designs and manufactures electrical and electronic equipment for hydropower plants.

Offering *turnkey* projects for the supply of electrical equipment, the automation of new hydropower plants and the up-grading of existing plants.

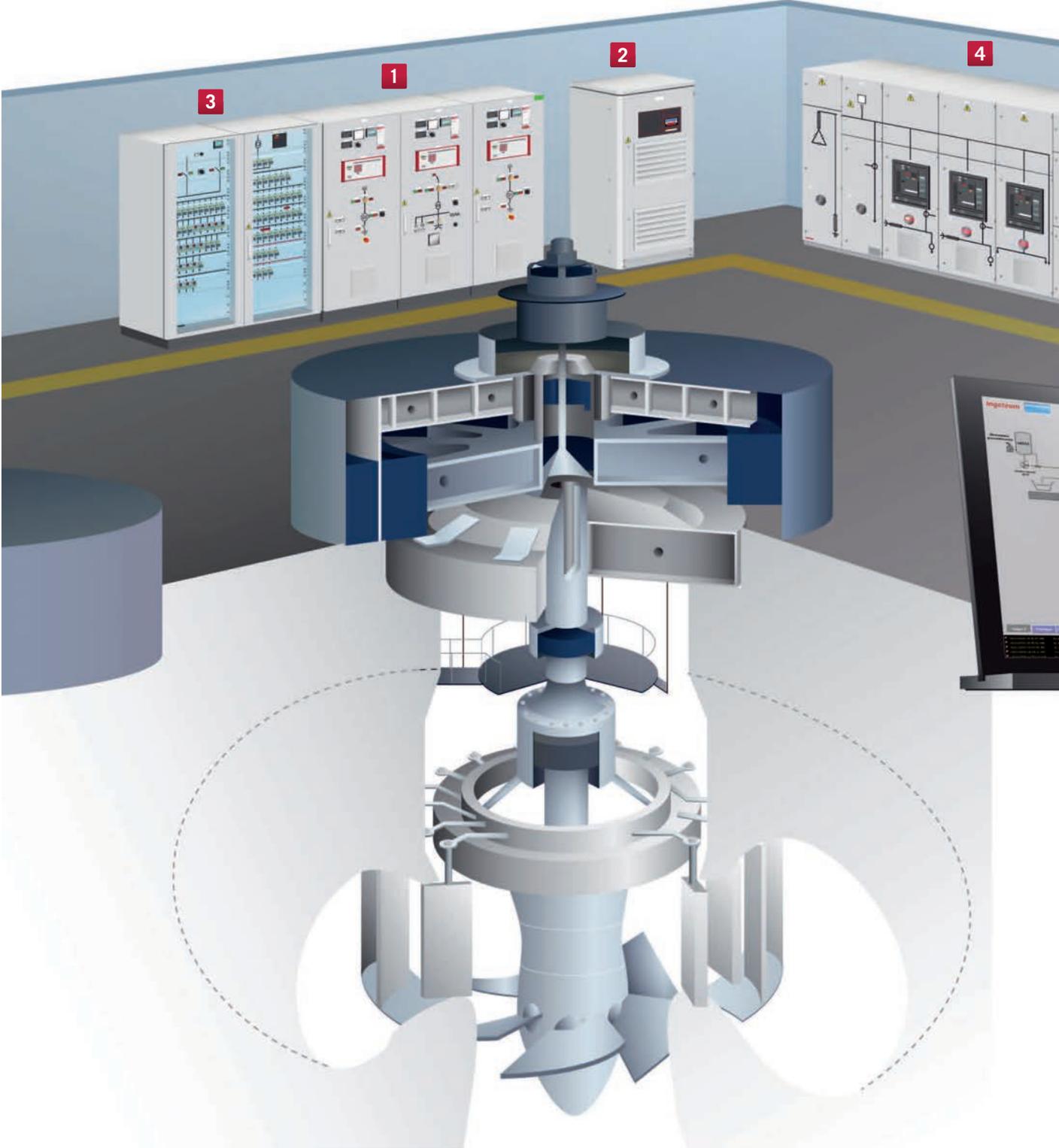
All the electronic equipment and software have been specifically developed for these applications, resulting in a high-quality end product that is tailored to meet the specific needs of each individual plant.

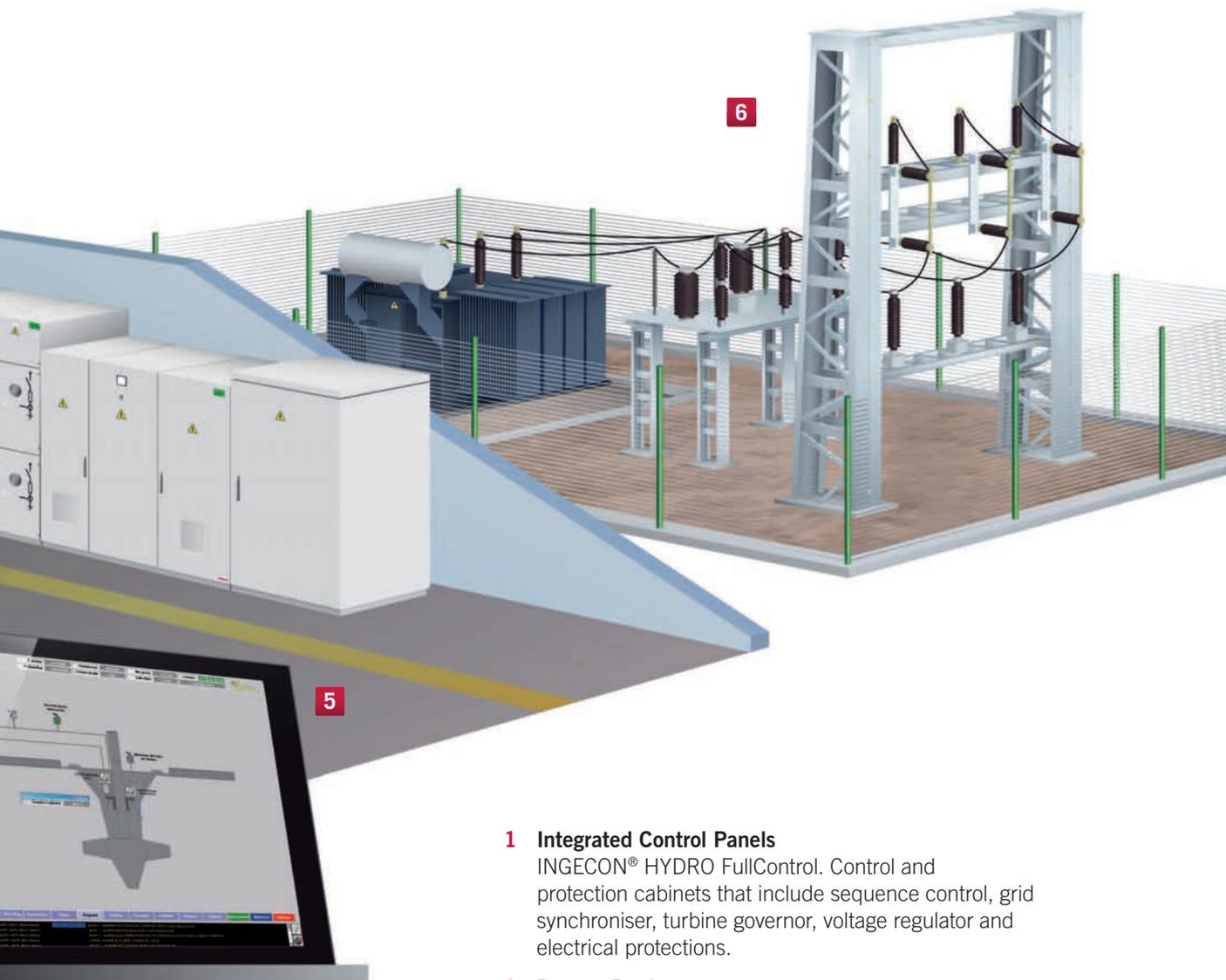
Ingeteam offers the following product range:

Control panels and protection systems; turbine governors and generator regulators; electrical equipment (medium voltage cells; battery banks; auxiliary services panels; sub-stations).

These products are all adapted and tailored to suit the requirements of each particular customer, in line with Ingeteam's core values: **Customer orientation, service and flexibility.**

ELECTRICAL AND CONTROL SYSTEMS FOR HYDROPOWER PLANTS





1 Integrated Control Panels

INGECON® HYDRO FullControl. Control and protection cabinets that include sequence control, grid synchroniser, turbine governor, voltage regulator and electrical protections.

2 Battery Bank

A secure DC power supply for equipment that is sensitive to plant power outages.

3 Auxiliary Services Panel

AC and DC distribution cabinets to power electrical loads.

4 MV Cells

Equipment for the correct and safe transmission of the energy generated by the turbine-generator set.

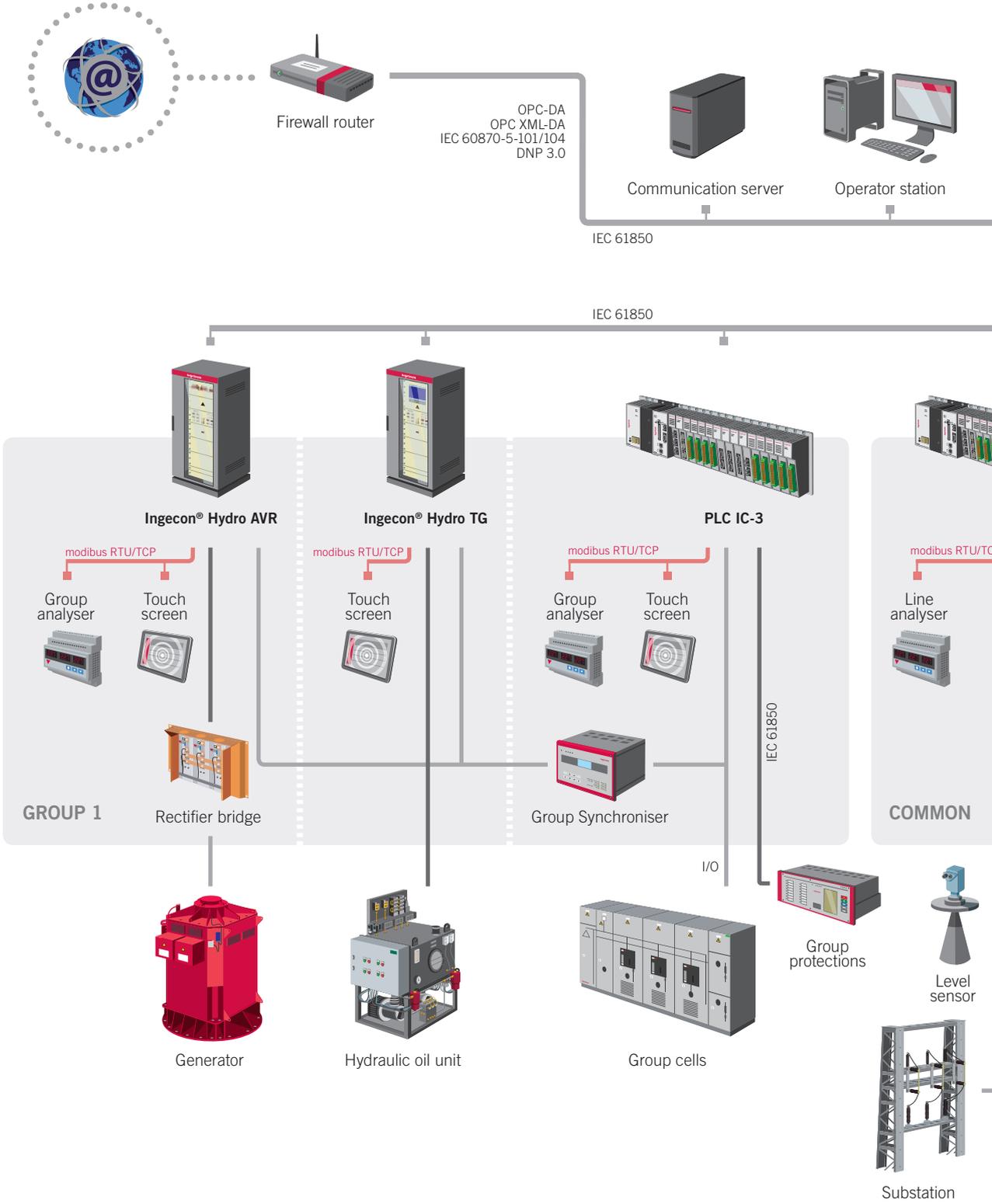
5 SCADA

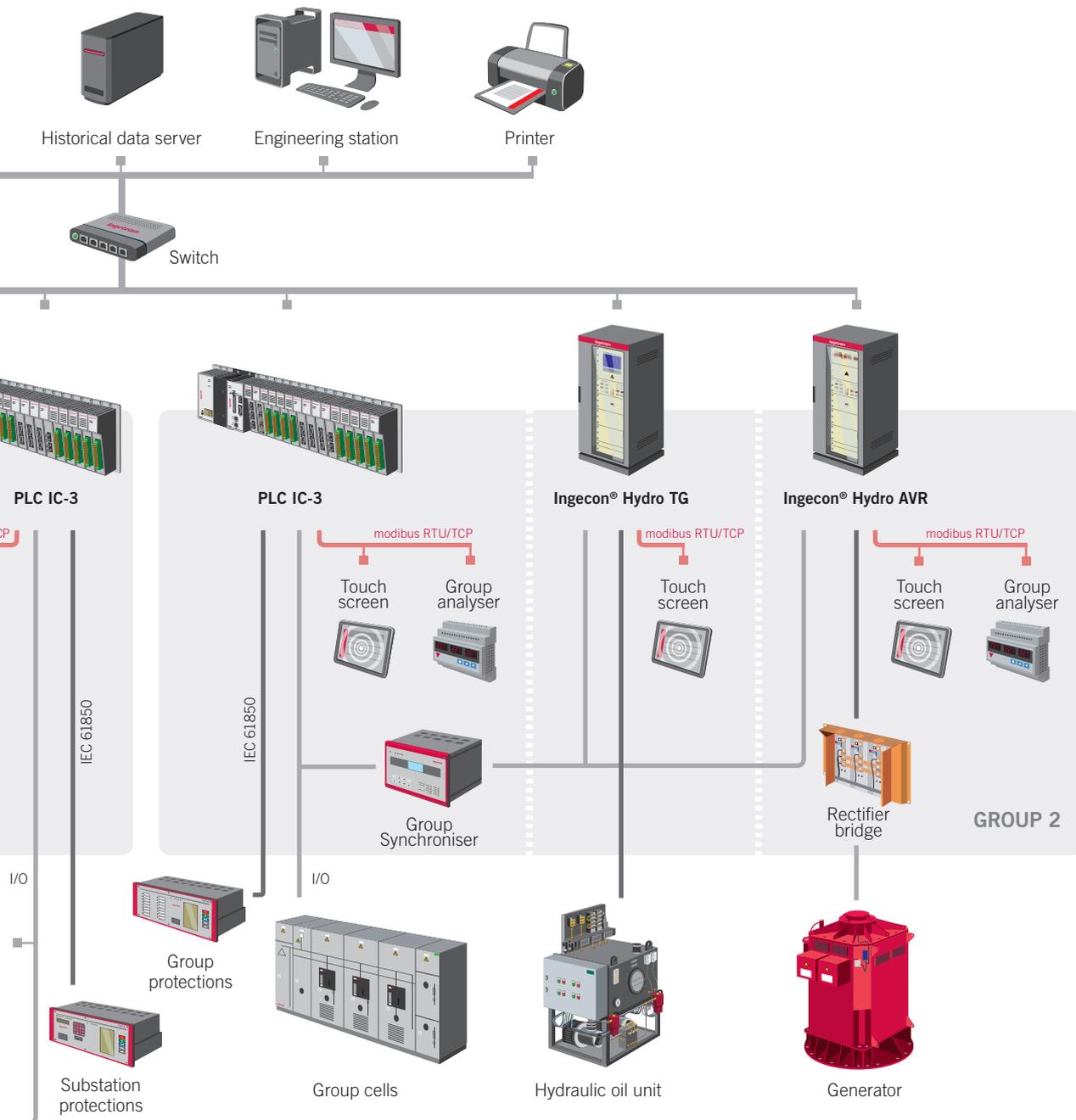
Control and monitoring hardware and software, comprising the man - machine interface with the power plant equipment.

6 Substation

An installation designed to step-up the voltage generated at the plant to the grid voltage level through a power transformer.

CONTROL ARCHITECTURE FOR HYDROPOWER PLANTS





CUSTOMISED PLANT AUTOMATION SOLUTIONS



All the Ingeteam hydropower products have been designed using state-of-the-art technology, manufactured with components of the highest quality, and approved and certified to the most stringent standards and regulations.

1

INGECON® HYDRO FullControl

A complete hydropower plant control system integrated into a single panel:

- Operating sequence.
- Turbine governors and voltage regulators.
- Group and sub-station protection systems.
- Synchronisation.
- Communications.

2

INGECON® HYDRO SmarTS

The perfect solution for small hydropower plants. A single cabinet houses:

- Power switchboard, for energy transmission.
- Control, protection and synchronisation panel.



3

INGECON® HYDRO AVR

The INGECON® HYDRO AVR automatic voltage regulators can be used for direct or indirect excitation. A highly accurate digital system with a wide range of excitation currents.

4

INGECON® HYDRO TG

The INGECON® HYDRO TG turbine governor is a microprocessor-based system for controlling all types of turbines (Francis, Pelton and Kaplan).

5

INGECON® HYDRO Manager

An asset management system offering maximum flexibility and scalability for the plant operator, using customer/server software specifically developed for hydropower plants.

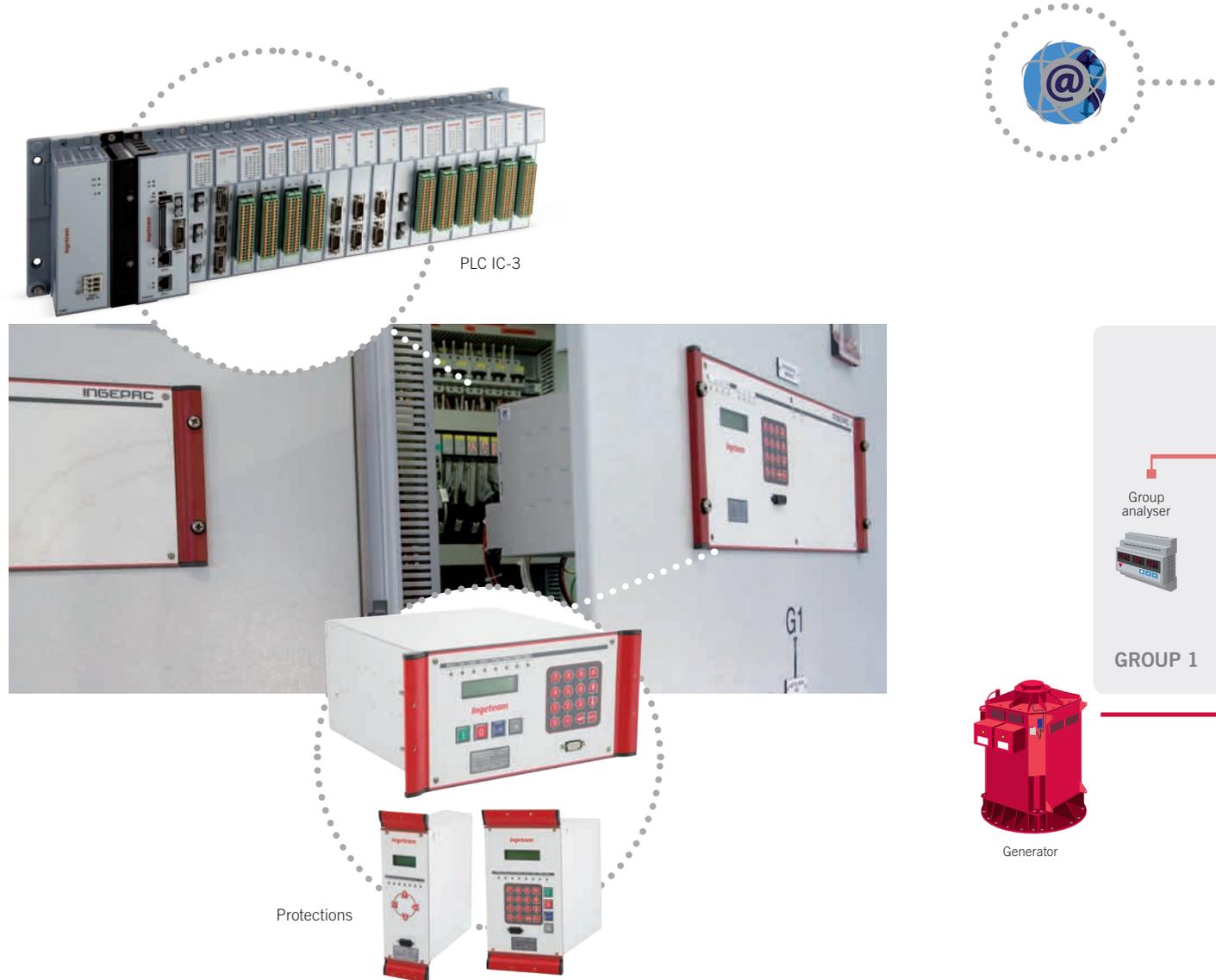
6

ELECTRICAL EQUIPMENT

The complete supply of the electrical system for all types of hydropower plants. Medium voltage cells (SF6 or vacuum). Battery banks (24V, 48 V, 110 V or 125 V). Auxiliary services panels. Wiring and installation of power and lighting. Complete substation (power transformer, switchgear and assembly).

INGECON HYDRO FullControl

All the functionalities integrated in one panel



INGECON® HYDRO FullControl is a compact unit incorporating all the functionalities required for the correct control and protection of a hydropower plant.

This hydro plant control and governing application is based on the INGECON® family of equipment.

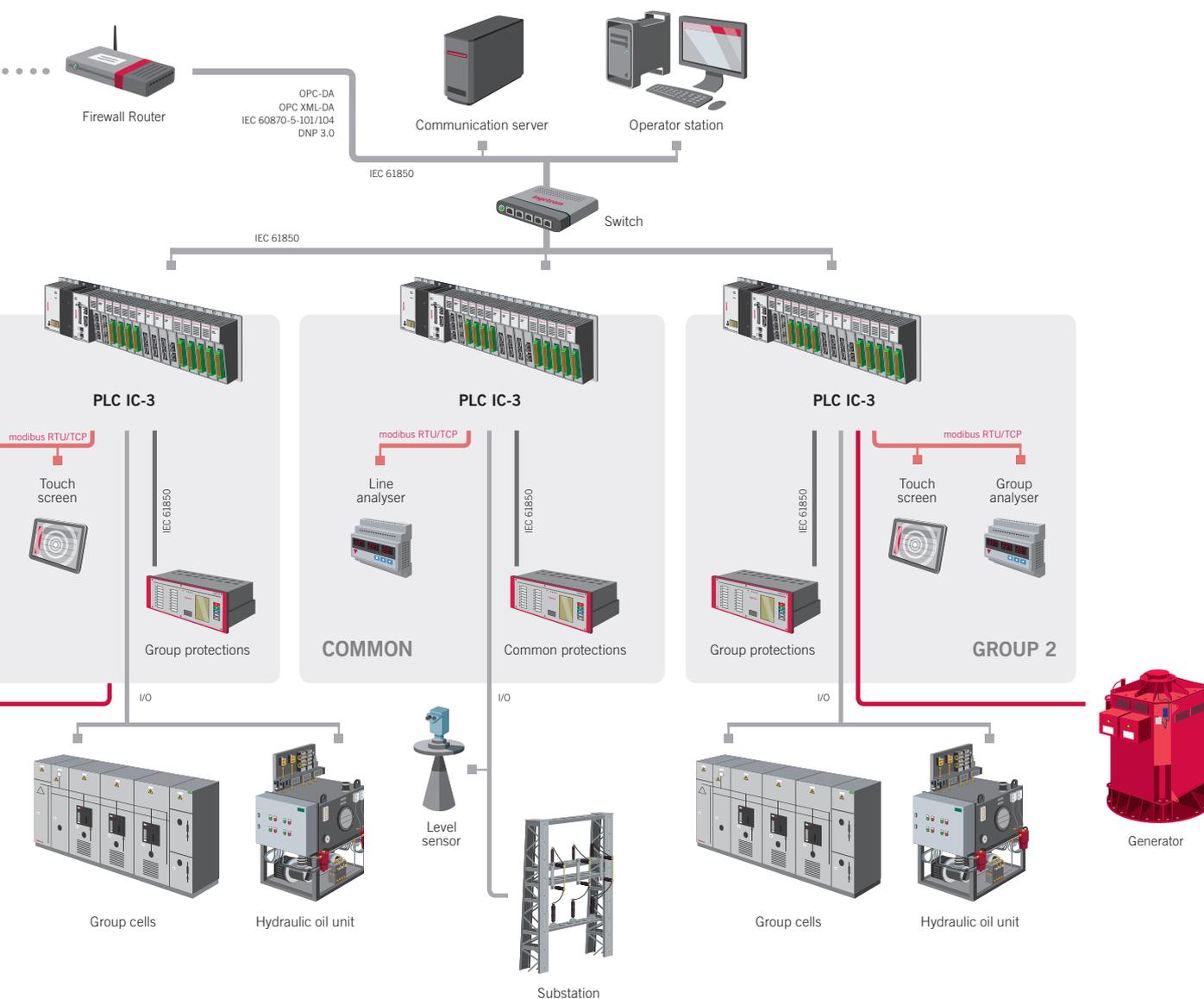
One single cabinet houses all the control and protection functionalities required by a plant of these characteristics:

- Start-up and shut-down sequences.
- Grid synchronisation.
- Turbine governing.
- Automatic voltage regulation.
- Electrical protections.
- Man-Machine interface.

COMMUNICATIONS

- Ethernet TCP-IP (Modbus, IEC 61850, IEC-60870-5-104,...).
- RS232 (Modbus, 3964, IEC-60870-5-101,...).
- RS485 (Modbus, 3964,...).
- CAN.

CONTROL ARCHITECTURE



The INGECON® HYDRO FullControl offers outstanding advantages with regard to installation and also to plant operation and maintenance, leading to savings in the total plant cost.

INSTALLATION ADVANTAGES

- Shorter assembly time.
- Less cabling.
- Space saving.

OPERATION AND MAINTENANCE ADVANTAGES

- Easy to operate.
- Fewer spares required.

The equipment can be integrated through **standard IEC-61850**.

Compact panel for small hydropower plants



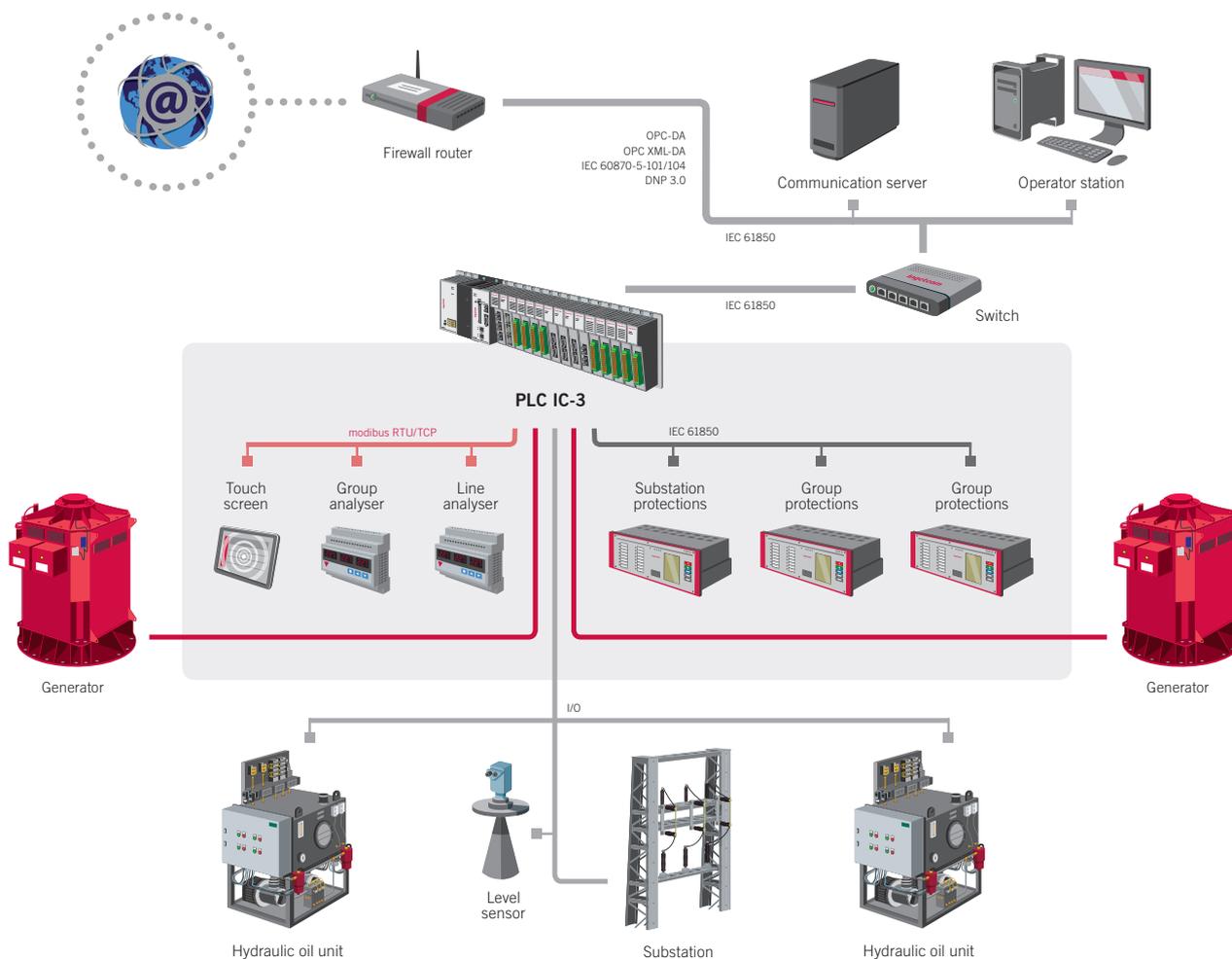
As part of the INGECON® family of equipment, the INGECON® HYDRO SmarTS offers a simple and effective solution for the control and protection of hydropower groups of up to 1 MW.

The INGECON® HYDRO SmarTS features the same control and protection functionalities as the INGECON® HYDRO FullControl.

- Start-up and shut-down sequences.
- Grid synchronisation.
- Turbine governing.
- Automatic voltage regulation.
- Electrical protections.
- Man - Machine interface.

Designed for synchronous and asynchronous generators alike.

CONTROL ARCHITECTURE



The INGECON® HYDRO SmarTS is a compact unit comprising two independent yet interconnected systems: the control system and the power generation system.

Control system

Integrated control system through a high performance digital PLC.

Optional generator excitation stage, for asynchronous generators.

Optional latest-generation electrical protection relay installed on the front of the cabinet.

Possibility of communications via Ethernet TCP-IP (Modbus,...) and serial communications (RS232, RS485, CAN,...)

Power system

The power system is physically separated from the control system, so that any faults in this stage cannot affect the control electronics.

GENERATION VOLTAGES	GENERATOR POWERS	INSTALLATION ADVANTAGES
- 400 V.	- 250 KW.	- Shorter assembly time.
- 690 V.	- 500 KW.	- Less cabling.
	- 750 KW.	- Space saving.
	- 1000 KW.	

INGECON HYDRO AVR

Voltage regulator



Generator excitation

Ingeteam offers a choice of either compact equipment for small groups, or equipment with independent power electronics.

The INGECON® HYDRO AVR can be used at different voltages and rated currents of several thousand Amps.

The generator excitation regulators are based on fully digital technology.

According to machine type:

- Direct excitation.
- Indirect excitation.

According to storage type:

- AC auxiliary services.
- DC auxiliary services or exciter dynamo.
- Self-supply from the machine.

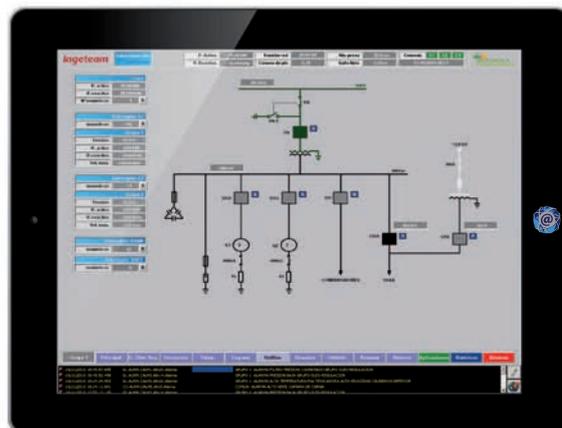
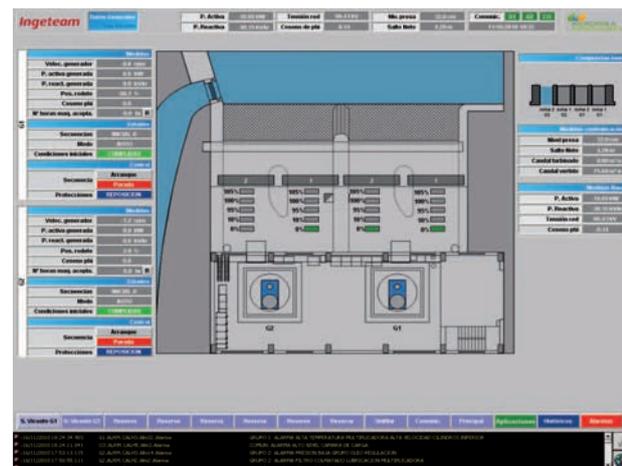
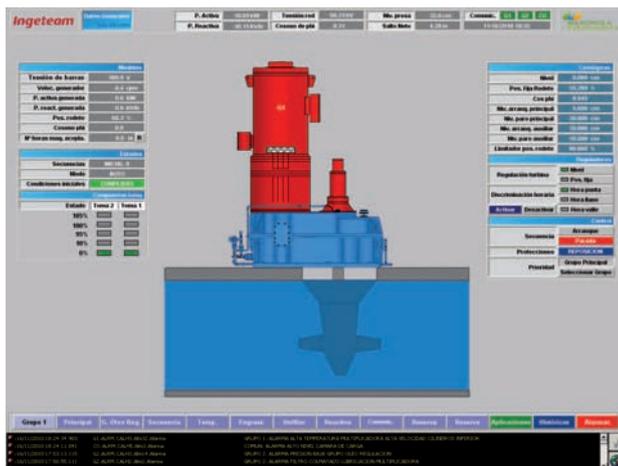
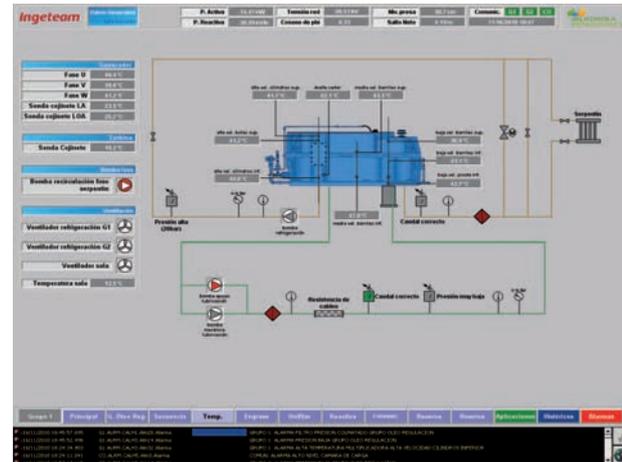
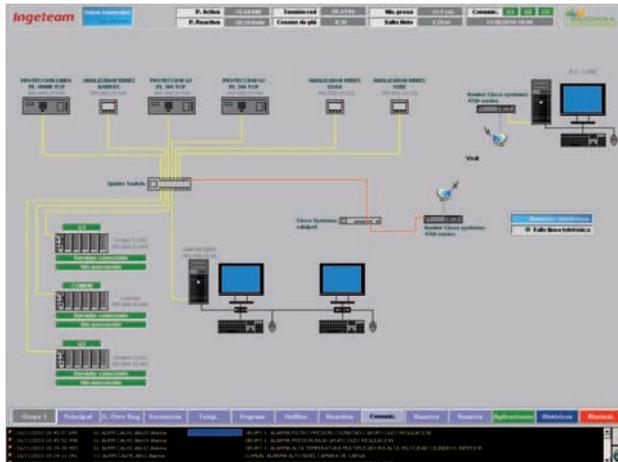
INGECON HYDRO TG**Turbine governor****Speed regulator**

These digital systems are able to control different types of turbines (Francis, Pelton, Kaplan and Bulbo) using specific control algorithms for each type of regulation:

- Speed.
- Power.
- Level.
- Opening.
- Flow rate.

INGECON HYDRO Manager

Complete integration in a single system



The Remote control makes it possible to operate and supervise the Hydropower Stations in real time and is an essential tool for guaranteeing the highest possible availability. Based on SCADA modular architecture, it can be adapted to suit the requirements of each and every customers and can also be up-graded to incorporate new features. Thanks to its OPC-based customer/server architecture, the system is scalable and flexible.



The Substation and any other device capable of being remotely controlled can be integrated into the Remote Control system, being compatible with many different protocols and media (ADSL, RDSI, GSM, GPRS, In-ternet, fibre optics, radio, micro-wave, satellite).

The reliability of the SCADA systems developed by Ingeteam has been proven in a multitude of remote controlled facilities.

- **Complete integration** in a single system.
- **Open** system.
- **Scalable and flexible** through the **customer/server** architecture.
- Safe online operation via the **website**.
- Total connectivity even with communications with **a low bandwidth**.



Complete electrical integration of the plant



Ingeteam provides complete *turnkey* engineering for the supply, assembly and commissioning of the electrical equipment for electricity generation plants.

Electrical systems

The complete supply of low and medium voltage equipment for hydro-power plants.

- Medium voltage cells.
- Capacitor batteries.
- Battery banks.
- Electrical switchboards for auxiliary and essential systems.
- Auxiliary services transformers.
- Electrical assembly.
- Wiring for power and lighting.



Substations

The *turnkey* delivery of substations for electricity generation plants and autoproducer plants, from 13.2 kV up to 220 KV.

Extensive experience in the sector. Ingeteam has delivered more than 50 complete substations, of different characteristics.

Substation control

The complete supply of the engineering and the fabrication of equipment for the control and protection of Electrical substations.

The panels are fully configurable and can include:

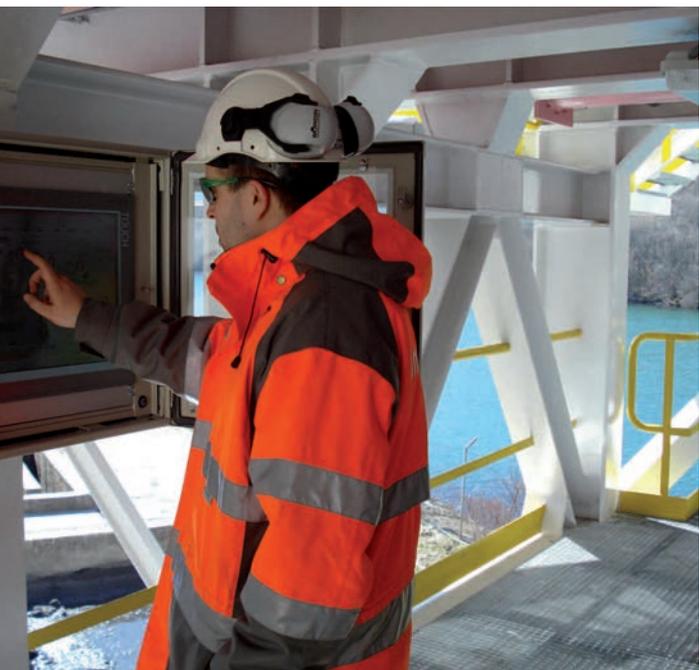
- Integrated control and protection system.
- Remote communications.
- Man-machine interface.

Remote tripping

Ingeteam supplies all the equipment required to manage the Remote Tripping of the autoproducer hydropower plant.

Communications between the Plant with one or more substations, can be implemented through fibre optics, cable, radio, microwave, etc...

COMMITMENT TO OUR CUSTOMERS, QUALITY AND THE ENVIRONMENT



Maintenance service

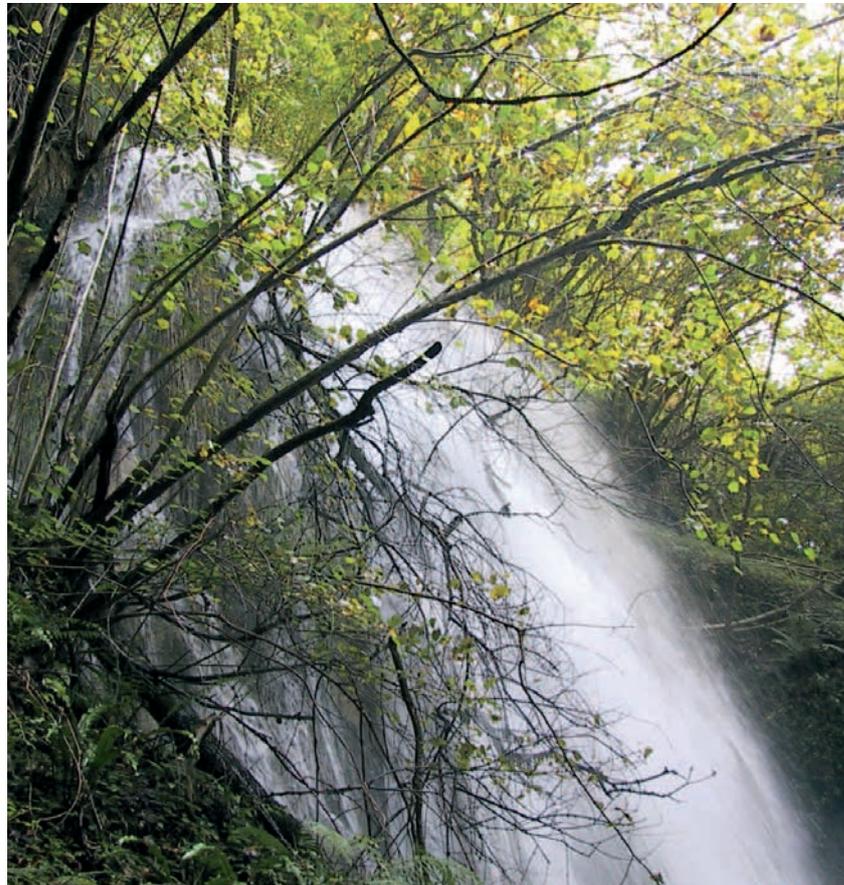
Ingeteam's commitment to its customers does not end with the supply of products.

Customer collaboration and service, initiated during the product development stage, continue throughout the entire product life cycle.

Ingeteam provides ongoing plant operational support to all its customers, by providing technical assistance and by performing maintenance tasks on the control systems and on the medium voltage side.

PREVENTIVE AND CORRECTIVE MAINTENANCE

- Control, regulation and remote control systems.
- Substation switchboards and protections.
- Medium voltage generators.
- Medium voltage equipment.
- Cubicles.
- Transformers.
- Cables and accessories.



Maximum respect for the environment

All products developed and manufactured by Ingeteam bear the corresponding CE Marking, based on compliance with the applicable Directives and, therefore, with the respective harmonised standards.

Likewise, should the customer so require, the products can be designed and manufactured to comply with the UL/CSA standards for the American market.

The production process control and final unit testing of all the equipment ensure that all products are finished to the highest possible standard, complying with even the most demanding specifications. Ingeteam's team of highly-qualified technicians are available to perform commissioning and start-up tasks and to provide after-sales service for all equipment supplied.

With this aim in mind, the key lines of action are as follows:

- Internal development of the EFQM model.
- Improved satisfaction of internal and external customers, suppliers and the social environment.
- Integration of the quality management, environmental impact and occupational safety systems according to ISO 9001: 2000, ISO 14001 and OHSAS 18001:1999.
- Reduction in emissions and hazardous waste, and also strict compliance with the RoHS regulations.



Ingeteam

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