



Endesa

Digitalised hydroelectric
power plants



Endesa takes conventional hydroelectric power into the digital age

Automation solutions from ifm deliver greater efficiency, while also ensuring more security and sustainability

The Spanish company Endesa is one of Europe's leading energy suppliers and strongly committed to renewable sources for their energy production. To ensure that their existing power plants, some of which are historic, continue to operate reliably and efficiently in the future, the company is pursuing a consistent digitalisation strategy as part of their transformation towards Industry 4.0. In this effort, Endesa counts on the expertise of automation specialist ifm.

Efficient modernisation of historic power plants

Endesa operates a total of 174 hydroelectric power plants across Spain through their subsidiary Enel Green Power España. With an installed capacity of 5,350 megawatts, these facilities generate around 9,000 gigawatt hours of electricity annually. Many of the plants were built in the early 20th century and were originally operated entirely manually. As a result of advancing digitalisation and increasing demands for efficiency, security and sustainability, Endesa was faced with the complex task of upgrading all sites to the latest standards.

"Our aim is to transform our conventional power plants into state-of-the-art facilities. By leveraging modern digitalisation technology, we gain greater transparency across our plants and can act proactively. This enhances the overall security of the energy supply," explains Julian Alberto Alonso, Head of Maintenance and Technical Services Hydro at Endesa.

A century of hydroelectric power – and beyond

One of Endesa's pioneers in digitalisation is the El Carpio hydroelectric power plant in the Spanish province of Córdoba. Here, the link between tradition and modernity is particularly strong: this architectural and technical landmark has been generating green energy for almost a century. A total of three turbines harness the flow of the Guadalquivir river to produce electricity. *"We decided to use advanced instrumentation and automation to optimise operations at this rather remote power plant, monitor it efficiently and maintain it effectively. The aim was to minimise downtimes as much as possible and optimise maintenance cycles,"* says Antonio Roldán Reina, Predictive Maintenance Technical Manager at Endesa.

“ Our plants face high temperatures and humidity, yet the ifm sensors have performed flawlessly so far.



Digitalisation with ifm and IO-Link – for good reasons

To meet the ambitious modernisation goals, Endesa and their subsidiary Enel Green Power España decided to work closely with the automation specialist ifm.

"We chose the ifm solution because of its reliability under extreme conditions," continues Antonio Roldán Reina. "Our plants face high temperatures and humidity, yet the ifm sensors have performed flawlessly so far. Moreover, ifm has delivered solid technical support right from the beginning of our cooperation."

Adopting IO-Link for data communication was another pivotal move in the digitalisation journey. The open industrial communication standard IO-Link, co-founded by ifm, has long been

well established in the industrial sector – and for good reason: The bidirectional communication enables flexible remote sensor configuration via the IO-Link master. What is more, IO-Link sensors provide more information than conventional sensors, for example on device status, sensor temperature or operating cycles. They also provide several process values at the same time: Pressure sensors also transmit data on the medium temperature, while flow meters detect the current flow rate, temperature, medium pressure and total volume. This reduces the need for additional measuring points and cuts installation effort, time and costs.

As the data is transmitted digitally and free from interference, the accuracy and reliability of the values is improved compared to analogue transmission. Moreover, IO-Link offers the convenience of transferring stored parameters from the IO-Link master to a new sensor during replacement of identical devices. This minimises human error and reduces downtime.

Today, the condition of the hydroelectric power plant's generators is closely monitored using sensor technology.

Wiring complexity cut by 30 %

Another advantage is the decentralised data acquisition via field-compatible IO-Link masters, which collect information on site and transmit it in a consolidated form. The result is a significant reduction in wiring complexity – whether between sensors and the IO-Link master within the plant or from the master to the controller or IT level. This enables end-to-end digital communication from the sensor to the IT level in the shortest time possible.

"For us, IO-Link cuts wiring complexity by about 30 per cent. Added to this is the increased operational reliability that we gain through the continuous sensor condition monitoring," emphasises Antonio Roldán Reina. "ifm's extensive IO-Link product portfolio also allows us to source all components for our automation solutions from one single supplier, making implementation even simpler."



IO-Link masters and evaluation units for vibration sensors collect the data and transmit it in consolidated form to the IT level.

Analysis of 3,000 real-time data points per plant

"To be able to precisely monitor the condition of the generators in the modernised plants, Endesa relies on a wide range of ifm sensors. Pressure, temperature and flow meters, along with particle and moisture analysis sensors, ensure the correct and reliable use of cooling lubricants at all times. Vibration sensors detect early signs of potential damage at critical points on the machine. The latter, in particular, now form the backbone of our predictive maintenance programme," notes Antonio Roldán Reina.

Endesa collects around 3,000 real-time data points per plant in a central IT system, where the information is analysed using artificial intelligence. *"We are now in a position to detect imminent generator damage, which enables us to plan main-*

tenance proactively, carrying it out during scheduled shutdowns," explains the Endesa maintenance expert, describing the advantages.

A decisive step towards energy production 4.0

The benefits also extend to the organisational level: "We are in the process of implementing ifm solutions as standard in all our hydroelectric power plants. This enables us to optimise sensor inventory and significantly reduce downtimes in the event of malfunctions," reports Julian Alberto Alonso.

Endesa also gains from the partnership-based, trust-driven cooperation with the automation specialist. *"ifm's technology, combined with a solid collaboration based on knowledge, experience and trust, has allowed us to take a major step towards Industry 4.0."*



The data from the vibration sensors is analysed at IT level. This allows maintenance operations to be optimised.

Conclusion

Over the past three years, Endesa has equipped roughly half of its installed power plant capacity with automation solutions from ifm. By embracing comprehensive digitalisation, Endesa is driving greater efficiency and higher security in sustainable energy production.