

# How one TSO is building a resilient, adaptive smart grid

Belden helps a large TSO roll out a standardized digital substation network to effectively prepare for the demands of AI, renewables and future energy challenges.

## Case Study



## Customer

This large transmission system operator (TSO) in Europe manages a power transmission network in real-time, operating a grid made up of approximately hundreds of thousands of kilometers of power lines and thousands of substations that process tens of thousands of pieces of data per second. Its stakeholders include electricity generators, market operators, industrial consumers, distributors, tertiary SMEs and private industrials.

As an architect of the smart grid and a leader in substation digitalization and virtualization, its goal is to maximize transmission system efficiency while providing affordable solutions for customers and the community. To accomplish this, the TSO uses a wide range of innovative approaches, such as:

- Deploying next-generation substations
- Using drones to maintain infrastructure
- Making greater use of load shedding

## Challenge

New complexities rise to the surface for the TSO as electrification takes hold, data centers expand to support AI and variable energy generation from renewables increases. To handle new energy sources and more complex electricity flows, the grid must become smarter and more flexible to connect to what's possible. The operator must also anticipate more (and less predictable) demand.

One of its flagship initiatives involves implementing digital and interoperable control systems for substations to support evolving needs for electricity transmission. This requires a new generation of digital substation automation systems (DSAS) to handle dynamic and adaptive automation that can automatically respond in real-time to changing conditions at grid nodes and at the edge—enabled by virtualization—to make the grid more adaptive, efficient and reliable.

Supported by a 24/7 maintenance contract from Belden, the TSO also benefits from rapid assistance and minimal downtime to ensure secure, continuous operation of digital substations as it advances the smart grid.



To prepare its power grid control architecture for the next stage of the digital substation evolution, the TSO needed a network that:

- **Keeps mission-critical operations running**, even if a problem with a network component surfaces
- **Protects against cyberattacks** and makes sure only the right people and devices connect to the network
- **Moves lots of data** between devices without delays to support real-time monitoring and control of substation equipment
- **Acts as a backup** for Precision Time Protocol (PTP) synchronization to maintain accurate timing for substation operations

## Discovery

The TSO kicked off the project by requesting proposals from vendors that could help it prepare its network for the future.

Hirschmann, a Belden connected brand, already had a close working relationship with the operator due to its involvement with previous substation modernization and digitalization projects.

The TSO valued the flexibility of Belden's Hirschmann network switches, which made it easier to standardize and simplify switch configurations at different sites and support seamless integration across the network. This combination of proven partnership, expertise and reliable solutions is what prompted it to choose Belden for this project.

## Solution

Belden's Hirschmann GRS1042 switches, part of the GREYHOUND 1040 series of modular, managed industrial Ethernet switches, were deployed to transform the TSO's network infrastructure. They enable greater reliability, scalability and real-time control across the operator's digital substations to support the demands of a smart grid.

These switches are not only exceptionally durable, built to work in harsh environments without breaking down, but also easy to tailor to specific requirements. As needs change (integrating renewable energy sources or expanding substation capacity, for example), the operator can customize as needed.



This helps standardize equipment, improves management of spare components and simplifies maintenance and upgrades across locations, which are essential to the focus on operational efficiency and its ongoing initiatives.

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## Results

By working with Belden to streamline and optimize its digital substation modernization, the TSO was able to unlock new possibilities:

- **Simplified network architecture** and reduced ongoing maintenance efforts by reducing the variety of equipment it supplies and manages. It also avoided the need for Grandmaster Clock redundancy on smaller workstations.
- **Accelerated network design** and deployment by enabling more streamlined and standardized LAN engineering across substations.
- **Ensured seamless integration** across its digital substation ecosystem, with reliable communication between GLC/PRP interfaces, intelligent electronic devices (IEDs) and virtualization servers.
- **Eliminated compatibility bottlenecks** to ensure data flow across the network and support communication between devices and systems.
- **Prepared to adapt** to evolving operational demands so the grid can integrate new technologies and energy sources without disruption.

These outcomes help lay the foundation for innovation and operational excellence in digital substations, ensuring that the TSO is ready to support a reliable, efficient and future-ready smart grid.

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