



Revitalizing  
communication  
networks to boost  
digital transformation  
while safeguarding  
operational continuity

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Case study

# Centralschweizerische Kraftwerke (CKW)

# The customer

Centralschweizerische Kraftwerke (CKW) is the largest energy service provider in central Switzerland, supplying power to more than 200,000 customers. The company operates a power distribution network that provides electricity and other services to residential, commercial, utility and municipal customers.

In 2017, CKW announced plans to upgrade the communication system on its transmission network. To support greater bandwidth demands and new digital technologies, CKW initiated the Grid Communication 2020+ program for a future-proofed telecommunications infrastructure. The new architecture aims to enable a smarter energy grid while meeting three key requirements: reach state-of-the-art cybersecurity, guarantee seamless and scalable operation of mission-critical services over a unified infrastructure, and build a strong foundation for the digital grid of tomorrow.



## Challenges

- Modernize OT network with state-of-the-art packet technology
- Converge multiple applications on the same infrastructure
- Guarantee correct functioning of teleprotection and SCADA services
- Enable wide deployment of IEC61850, GOOSE and Sampled Values
- Simplify management of legacy and packet networks
- Ensure the highest level of cyber protection



## Technology solution

- FOX615 Hybrid Multiservice platform
  - Transport: 10GbE MPLS-TP-capable
- Quantum-safe encryption for superior network security
- Teleprotection-specific solutions over packet-switched networks
  - TEPI2, OPIC2 and TEGO1 modules
- IEC61850 proxy gateway with GOOSE and sampled values
- FOXMAN-UN for network management



## Benefits

- Ensured high availability during a complex migration
- Increased efficiency with a single packet-switched OT network
- Enabled teleprotection over packet-switched network with guaranteed performance
- Improved network visibility with a unified network management
- Seamless transition to IEC-61850-based protection
- Protected critical systems with quantum-safe technology
- Deployed a utility-grade MPLS-TP network with limited network staff

# The challenges

Utilities today are increasingly planning for a future based on smart grid applications; unfortunately, traditional network infrastructures weren't designed for the evolving system requirements. An increasingly digitized environment generates volumes of data that drive demand for higher network capacity, while new digital technologies accelerate the need for transition toward more flexible and scalable networks.

An additional challenge in this environment of aging infrastructure is the adoption of strategies to cost-effectively maintain an installed base of legacy devices while simultaneously enabling future innovations such as IEC61850-based teleprotection. To support this rapidly changing scenario, many organizations are evolving their current network infrastructure toward packet-switched technology.

Like many other utilities, CKW was utilizing time division multiplexing (TDM) for its OT communications network, which required a hardware refresh in order to support the organization's long-term vision for a transition to a fully digital utility. CKW needed a leading-edge networking solution that could deliver superior performance, resilience, scalability, and—above all—strong cybersecurity to meet the stringent regulation upcoming in Switzerland.

It's hard to overstate the complexities involved: The solution needed to withstand a harsh utility environment with high and low temperature variations, dust, demanding electromagnetic compatibility (EMC/EMV) requirement, and vibrations, while remaining highly available and redundant to ensure continuity of critical services in case of any failure. Additionally, the new architecture had to be capable of handling legacy interfaces and technologies to protect past investments, while providing a very long lifecycle to support an evolving ecosystem over the next 15 years.

At the core of its modernization project, CKW envisions a new energy future for its customers with increasing grid availability and operational efficiency.

Accustomed to the solid and deterministic behavior of its long-proven SDH infrastructure, CKW selected multi-protocol label switching MPLS-TP as a reliable transport technology for the migration of its vital services; particularly SCADA and teleprotection.

CKW's vision requires a powerful technology foundation. One that can gracefully migrate critical services from the legacy network to the new packet-switched network. One that can easily enable faster protection schemes through a gradual

application of IEC61850 to conventional distance and differential protection. One that secures every application with real-time encryption capability of time-critical services, including precise time-of-day distribution. All managed through a single unified network management system for deeper visibility across the entire network and application components.

CKW initiated a two-stage process to assess the capabilities of various products and vendors to fulfill its stringent requirements. At the end of the process, Hitachi Energy was selected, primarily because they could satisfy all technical requirements, but also because of the company's expertise and long record of providing and protecting mission-critical communications in the most demanding utility environments.

## Key applications over packet

- Distance protection
- Differential protection
- IEC61850-based protection with GOOSE and SV
- SCADA
- RTU traffic (IEC101 and IEC104)
- Telephony

## Key network services

- High capacity IP/Ethernet services
- Virtual private LAN service (VPLS)
- Virtual private wire service (VPWS)
- IEEE1588v2 PTP network time synchronization
- SyncE synchronization
- Real-time quantum encryption
- Real-time quantum PTP encryption

# The network solution

For CKW, the foundation of successful network transformation is built on the highest availability and redundancy for mission-critical services. With an MPLS-TP network based on Hitachi Energy's FOX Hybrid Multiservice platform, CKW created an agile network that is high-performing, secure, and operationally efficient.

At the heart of the solution is the FOX615 multiplexer, which provides low-latency 1GbE/10GbE transport capacity in a compact and space-optimized form factor. FOX615 delivers great scalability and availability, while providing long-term investment protection.

A utility-grade design, along with flexible service unit configurations, power efficiency, and fast switchover time were key aspects in favor of FOX615, enabling CKW to contain operational cost while handling long-term traffic growth and the introduction of new services.

With the new hybrid architecture, CKW could migrate all critical services without disruptions, including SCADA, telephony and protection.

The fully redundant underlying architecture seamlessly connects resources across the 58 locations.

The network virtualization overlay, which leverages industry-standard virtual private LAN service (VPLS) and virtual private wire service (VPWS), provides superior traffic separation and prioritization while enabling efficient Layer 2 and Layer 3 network connectivity with greater scale and agility. Hitachi Energy's patented technology for distance and differential protections takes packet-switched technology (that was never designed for teleprotection and its time-critical requirements) and creates a system that allows it to function seamlessly during and after migration. Even when traffic activity spikes unexpectedly, the integrated teleprotection units remain stable and reliable.





Outages and unpredictable situations are now mitigated with application-specific service units over packet networks and robust PTP synchronization capability. To achieve this, CKW needed a partner that had proven expertise across multiple technology dimensions, including cybersecurity.

Data traffic is secured at the most stringent levels using quantum-safe technology, a proprietary solution from Hitachi Energy, for real-time encryption of critical data without latency penalty, which is fundamental for highly accurate PTP-capable synchronization. Access is secured through authentication, and there is granular control over user activity and access to network systems and resources.

The network modernization project provided CKW with the versatility needed to further digitize its substations. The technology supports the integration of IEC61850 protection applications, including GOOSE and Sampled Values, and provides a high degree of interoperability with conventional protection systems for riskless migration.

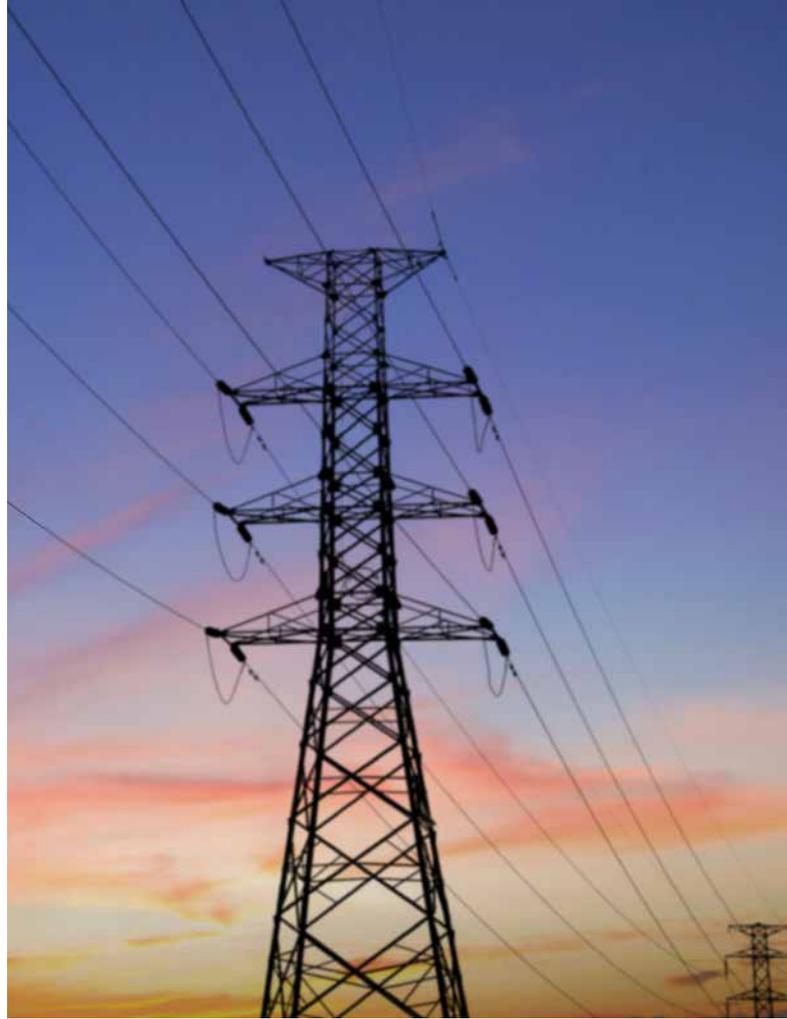
## Conclusions

By building an MPLS-TP network with Hitachi Energy, CKW was able to keep its operational traffic flowing swiftly, reliably and securely on a shared infrastructure. Increased visibility into traffic flows and application performance is made possible through the FOXMAN, a unified network management system for the entire hybrid environment. For Hitachi Energy, this project broke new ground and helped showcase the industry-leading capabilities of its FOX615 communications solutions, which will act as a reference for similar modernization projects in the future.

“For CKW, Hitachi Energy’s unique ability to integrate different types of leading edge communication technologies into a unified system, combined with deep knowhow of applications in the utility environment were critical factors in choosing to partner with the company for our Grid Communication 2020+ project.

Hitachi Energy is a proven and reliable technology partner with a strong capability in managing a very complex and demanding modernization project in a professional and efficient manner.”

— Stefan Mattmann, Project Manager,  
Grid Communication 2020+ project.



“The astounding lifecycle of the FOX615 communication solutions, its operational reliability and flexibility allows us to optimize CapEx and OpEx, protect our investment and extend the life of our installed base and assets. Close cooperation between our project teams and Hitachi Energy as well as confidence in their extensive domain expertise played a key role in a successful implementation of the project.”

— Remo Niffeler,  
Head of Grid Communication.



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