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Stories of Success

Upgrading with Certainty: From analog I&C to digital

Relying on Framatome expertise for decades, Swiss operator takes necessary steps towards long-term production of clean energy.

In 1979, The Gösgen nuclear power plant was first connected to Switzerland's electrical grid. Since the start of full-load operation, the gross nominal output of the plant has continuously increased, from the initial 970 MW to 990 MW in 1992, to the present 1010 MW. Further various technical optimizations, including those for the plant's digital instrumentation and control (I&C) system with the incorporation of advanced load following, were conducted in cooperation with Framatome and its predecessor companies.

This achievement can be attributed to Gösgen's step-by-step approach, with Framatome support, of mid-size modernization packages — proven to be an extremely successful alternative to a large-scale I&C modernization.

Framatome modernizes I&C systems according to specific customer requirements. These solutions integrate seamlessly into existing systems and are applicable to all reactor designs (PWR, BWR, VVER, CANDU and more). Framatome also performs safety analysis and qualification, supports licensing and regulatory interaction, provides operator training and updates documentation.

New digital I&C for turbine control, reactor control and limitation

Framatome's first upgrade project at Gösgen was a non-safety modernization of the turbine control, using the digital safety I&C platform TELEPERM XS. That was followed by the replacement of obsolete legacy I&C for reactor control and limitation, also using the TELEPERM XS platform.

New digital I&C for emergency diesel generators

In the event of an external power supply failure, the continued safe operation of the nuclear power plant must be ensured via permanently installed emergency diesel generators (EDGs), for which I&C is an important safety function.

In 2019, the last of the electrical systems and I&C on the four EDGs was successfully converted to Framatome's digital safety I&C platform TELEPERM XS, demonstrating Framatome's commitment to delivering on-time.

"The joint team effort and the close cooperation between Framatome and Gösgen in all phases of the project were crucial to ensure the successful and early completion of the upgrade," said Frédéric Lelièvre, Framatome's senior executive vice president in charge of Sales, Regional Platforms and the Instrumentation and Control Business Unit.

Replacement of reactor protection systems

To further increase plant safety and ensure planned long-term operation, Gösgen awarded Framatome the contract for the replacement of one of their reactor protection systems (RPS) in 2019.

After initial concept and study, the entire RPS in the switchgear building was modernized, with extensive prior testing, reducing schedule risks during installation. The installation and commissioning of the new RPS was completed during the plant's 2022 outage.

"This marks another important milestone in the long-lasting cooperation between Gösgen NPP and Framatome," said Frédéric Lelièvre, Framatome's senior executive vice president in charge of Sales, Regional Platforms and the Instrumentation and Control Business Unit. "It is yet another example showing how, over the years, we have managed the transformation from analog to digital technology successfully together."

Next: Excore and Leakage Detection

Continuing to show that meticulous planning and gradual execution wins the day, Gösgen and Framatome are once again building upon past successes, with multiple modernization projects ongoing.

I&C upgrades for Gösgen's excore neutron detection systems are also being executed simultaneously with a leakage detection modernization project at the plant.

After the completion of the RPS replacement in the switchgear building, the remaining RPS parts in the emergency standby building have started to be changed out. This modernization project requires the use of the inherent diversity options within the TELEPERM XS platform, one of the diverse CPU-, FPGA-, and analog-based technologies in Framatome's I&C portfolio.

Solution expertise from Framatome – the advantages of digital I&C

Digital I&C offers the advantages of significantly more functionality than analog systems, and more efficient data processing and storage.

Software-based tools make it easier to efficiently modify, test and simulate implemented digital I&C functions, as well as to detect and replace failed components. In addition, spare parts are more readily available, preventing potential downtime due to supply chain issues.

The improved capabilities (e.g., fault tolerance, self-testing, signal validation, process system diagnostics) of digital systems provide the basis for fulfillment of reliability and safety requirements. Such functions minimize maintenance intervention and significantly reduce human error. The new technology also requires fewer service personnel.

Additionally, digital systems have a higher level of acceptance among the new generation of plant operators, as they are already familiar with computer-aided applications.

Regarding the completed and ongoing I&C modernizations, Rosa Sardella, head of the Radiation Protection Division at the Swiss Federal Nuclear Safety Inspectorate (ENSI), stated in a January 2024 ENSI news release that "This is the only way to ensure that a high level of safety is achieved as a basis for long-term operation. ENSI welcomes the proactive attitude of the operator who is investing in the safety of the Gösgen nuclear power plant for operation beyond 40 years."

The upgrade installations have been so smooth and well-executed that other Swiss plants may soon use them as a roadmap for their own I&C modernizations, despite the difference in designs.

Gösgen is a great example of successful transition from analog to digital control technologies, and the benefits and advantages gained by that transition. It is also an example of the certainty that comes from Framatome's upgrade expertise.

Learn more about our I&C solutions.

>> Read the January 2024 ENSI news release

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