

With Full Power into the Future

Sustainable Modernization of a Pumped Storage Power Plant



bachmann.



In the Linth-Limmern (CH) power plant, built between 1957 and 1968, four power plant steps use the water inflows of a 140 km² area near the source of the Linth. In a multi-year, stepwise project, the company Rittmeyer AG from Baar, Switzerland, has now equipped the high-pressure pumped storage power plant with a completely new control technology. In the final expansion, more than 50 networked process stations ensure safe power plant operation using the Bachmann M1 automation system.

Rittmeyer is a company of the BRUGG Group, with around 1,500 employees and 30 companies in 9 countries as well as offices in all major industrialized nations. The products and services of Rittmeyer AG distinguish themselves through the most modern technology, leading know-how and highest quality. The company sees the optimal combination of efficiency and safety for people and environment as the central task in construction and modernization of hydroelectric power plants.

Rittmeyer AG has made a name for itself with its many years of experience and innovative solutions in automation and environmental engineering. Its efficient and sustainable plant technology, whose heart is the Bachmann M1-automation system, also convinced the operators of the Linth-Limmern power plants when they awarded the assignment to modernize the technical control systems.

Complex controls require fast systems

Besides the new control and protection equipment, the total of 7 machine sets of the power plant were also equipped with voltage and turbine controllers. For machine control and mechanical thermal protection, two independent M1-automation systems are used per machine group. An additional one is the electronic turbine controller. This controls the hydraulic control unit, takes on the speed and opening control and controls the nozzles and jet deflector of the turbine via positioning circuits.

“The complex control and limitation functions at idle, in network and isolated operation as well as the dynamic operation transitions with load shedding and emergency/

trips require rapid work-off cycles and high performance from the controller,” says Martin Wolf, project manager at Rittmeyer AG, describing one of the core competencies of his company and illustrating one of the high demands placed on the automation system. Around 10,000 decentrally recorded or depicted process variables must be processed on the control system.

Great distances at the plant

“In addition, the process data must be recorded over a great distance,” says Martin Wolf, explaining one of the greatest challenges for the control system at hydroelectric power plants. In the current extension state, more than 4,500 galvanic I/O points and over 40 process stations are integrated in several redundantly linked Ethernet fiber-optic rings.

Signaler recording is thereby frequently achieved with decentralized I/O bus rails. The inputs or outputs placed at up to 200 m distance are connected to the process stations with the fast FASTBUS via disturbance-free fiber-optic conductor connections.

In addition, various controllers already present in existing parts of the power plant would have to be included in the control technology. »The openness and performance of the M1-system has allowed us to implement the standardized protocols IEC60870-5-101/103/104 directly on the controllers and thus to communicate directly with other control systems, such as the higher-level network control center in Baden (CH),« says Martin Wolf, explaining only one of the motivators for using the Bachmann M1-system.

Robustness replaces redundancy

Some process stations are used in subplants, which are located at altitudes over 2,000 m above sea level. »Here we value the excellent operational availability of the M1 system, since we can reach these stations only in a few weeks of the year,« says Martin Wolf, describing the conditions entailed in the use of control technology in the high mountains. The stations, which can be operated without redundancy due to the high reliability of the Bachmann system, are used directly in the ducts of various water catchments. The access points are snowed in for large parts of the year; it is not uncommon for temperatures to drop below minus 20°C; and »the rest of the environment is also not exactly free of disturbances,« Mr. Wolf says, indicating the strong electromagnetic influences on the controllers when, for example, the turbines start up.

Operation

A hierarchically built operating concept (higher operating authority with increasing process closeness) and a comprehensive software solution ensure secure control of the entire plant. Additional mimic diagram panels are installed next to the touchscreen panels for local operation and visualization of the machine sets and cooling water system in the pump house. Rittmeyer RITOP independent process operating systems are used in various configurations in each of the three operating levels. In all levels, the same processes are visualized with identical process images. With these, the operator has a uniform and comprehensive process visualization and operating philosophy "independent of whether the operator is located in the power plant control center or locally in a far-removed part of the plant," Martin Wolf explains. With step-appropriate information and operation possibilities and clear interfaces designed specifically for the plant, the RITOP-system permits intuitive and secure operation of all plant sections.

Controlled by Bachmann M1 systems: Turbines ► in the machine room of the Tierfehd power station.



Future built in

An expansion planned for 2015 with a turbine and pump capacity of around 1,000 MW should almost quadruple the output of the Linth-Limmern power plants. The necessary connections to the central power plant con-

trol station were already conceptually considered in the project. "With the M1-system, we feel ideally equipped for this new order of magnitude," says Martin Wolf in conclusion.

High-Pressure Pumped Storage Power Plant Linth-Limmern (CH)

- Volume of Limmernboden reservoir:** 92 million m³
- Total turbine performance:** 340 MW
- Average annual production:** 430 million kWh
(equivalent to full power supply for approx. 60,000 households)
- Total pump capacity:** 34 MW
- Drop at Limmern step:** 1,040 m
- Drop at Hintersand step:** 481 m

