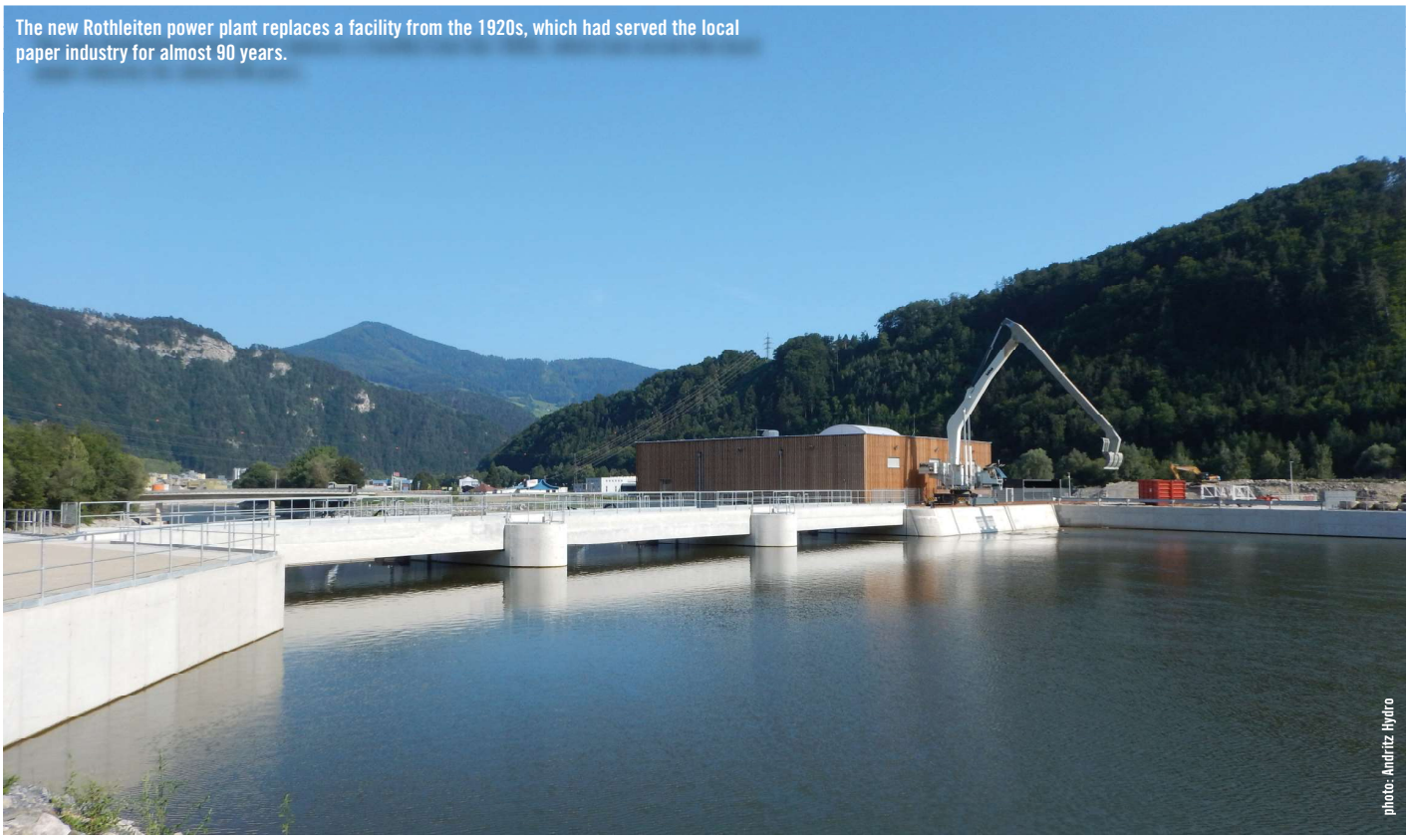


The new Rothleiten power plant replaces a facility from the 1920s, which had served the local paper industry for almost 90 years.

MODERN COMPACT BULB TURBINES ENSURE EFFICIENT POWER PRODUCTION IN STYRIA

On June 3rd last year, MeinAlpenStrom GmbH ("My Alpine Power"), Austria's most recently established power provider, celebrated the official inauguration of their new hydropower plant in Frohnleiten in the Austrian province of Styria. The company, a part of Prinzhorn Holding, invested a total of around € 42.5m in the complete revitalisation of the facility, which was originally built in 1925. At its core, the power station consists of two ultra-modern Compact bulb turbines by ANDRITZ HYDRO, each with a capacity of 9.9 MW, generating a total of 50 GWh a year. This is enough to supply 14,300 households with clean energy. Compared to the original facility, the refurbishment of hydropower plant Rothleiten was not just a quantum leap in terms of energy technology, but also introduced comprehensive ecological improvements.

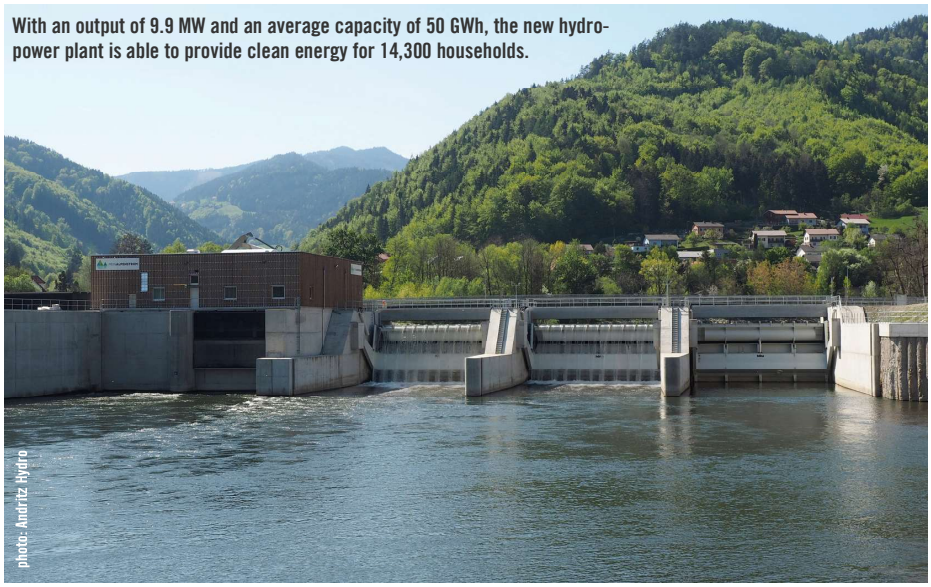
For centuries, the central Mur valley has been considered an important industrial area. Paper production, in particular, used to be a leading industry in this region, and the proximity to the River Mur was an essential enabling factor. The region's first hydraulic power station was built in the mid-1920s to supply the paper mill in Rothleiten with electric energy. Designed as a diversion power plant, this facility had a flow capacity of 80 m^3/sec and a design head of 4.6 m, with five Francis turbines providing an overall output of 2.2 MW. The facility's annual production of around 13.8 GWh was usually spent entirely on keeping the paper mill going.

When the equipment no longer met the required technical and safety standards, the operator decided to replace the old power station with a new, larger facility. One of the first challenges in this project was the need to pass the environmental impact assessment (EIA). In 2009, the project underwent the EIA process and was finally approved.

Another essential factor in the reconstruction project was the decision to increase the design flow rate from 80 m^3/s to 200 m^3/s. That alone would ensure a significant increase in the facility's productive capacity. Also, the plans called for the power house to be set up in a different location, the old discharge channel to be filled in, and the course of the Mur to be diverted – all based on an ecologically viable concept that was yet to be developed. "Together with our panning associates from BHM in Linz we ran a project analysis, which showed that it was possible to increase the head to boost efficiency even further," says project manager DI Helmut Murlasits.

DRILL-BLASTING DOWNWARD

In 2013, when the EIA certificate for the last of the required adaptations was granted, the operators were finally able to start the implementation process. On November 4, 2013, the time for the official project kick-of had finally come. The construction crew launched into the preparatory excavation work for the new weir gate. From March 2014, they worked on securing the building pit. As DI Gerhard Schönhart, BHM's engineer in charge, comments, "We began by setting up a deep-anchored bored pile retaining wall and integrated into the left buttress, facing the river. Around this we erected a diaphragm wall in combination with grout-anchored dense sheet piling." The result was in full compliance with legal requirements, which require the excavation inflow volume to be limited to



With an output of 9.9 MW and an average capacity of 50 GWh, the new hydropower plant is able to provide clean energy for 14,300 households.

photo: Andritz Hydro

between 10 and 14 litres per second. As for flood protection, the excavation pit was designed for an HQ20.

Work on the foundation plate began in February 2014. This turned out to be not at all easy, as the team had to dig their way through a massive phyllite layer. It took around 20 rock blastings to reach the required depth. "The blasting meant that we had to implement comprehensive safety measures. There were rail tracks running past the site, so we had to install several pressure cells. Of course, the safety measures were also intended to protect the existing turbines, which were still generating power in the old station. To protect the facility against rockfalls, we had to cover the blasting area with mats," says Murlasits, adding that "for special geotechnical reasons we had to re-seal the exposed phyllite layer within 24 hours. Although the material is rock-hard under ground, it tends to become brittle once it's exposed to air."

SMOOTH-RUNNING TURBINES

Summer 2014 saw the delivery of the first turbine components, which were provided by the ANDRITZ HYDRO facilities in Ravensburg. For the turbines, the power plant operators relied on ANDRITZ HYDRO's know-how and quality, not least because of their positive experience in working with Andritz on the Niklasdorf power plant in 2013. Compared to the much smaller machines in Niklasdorf, however, the two Compact bulb turbines for HPP Rothleiten have some additional technical advantages. „Apart from their dimensions – each of the machines has a flow capacity of 100 m^3/s – these units also run more smoothly. The machines for Niklasdorf had anti-friction bearings, and these have slide bearings – one can easily hear and feel the difference. We also installed a hydraulically integrated cam lift mechanism, which minimises frictional resistance at start-up. This is rather important, especially as it helps to ensure a long useful life," as the plant manager explains. With ANDRITZ HYDRO the operators had found a partner to implement individual ideas and requirements in the best way possible.

KNOW-HOW AND PRECISION REQUIRED

The high product quality of the machine units is rounded off by high-quality generators provided by ELIN Motoren. "Using an ELIN generator was important to us, as this guarantees a long service life," says project leader Murlasits. In September 2014, while the hydraulic steelwork was gradually taking shape, the remaining turbine components were installed. A month later, the existing ground sill was removed, allowing the construction to be lowered by another 2 m. Meanwhile, installation work was under way at the power house. The ANDRITZ HYDRO engineers first installed the guide vane system, followed by the shaft with auxiliary spindle and, finally, the generator's stator unit. In several successive stages, a team of experienced ELIN technicians working in cooperation with Andritz engineers installed both generators in parallel. Both rotors, each of them equipped with 50 poles and weighing 26 tonnes, were lowered into the turbine shaft with hoisting equipment and attached onto the turbine units. With wiring complete and the generator rotors installed, the two stators – each weighing around 27.5 tonnes and measuring 4,100 mm in diameter – were placed over the rotors and fastened to the turbine flange. This required extreme precision on the part of the installers, as the required air gap between the components is only a few millimetres wide. In the end, after a full

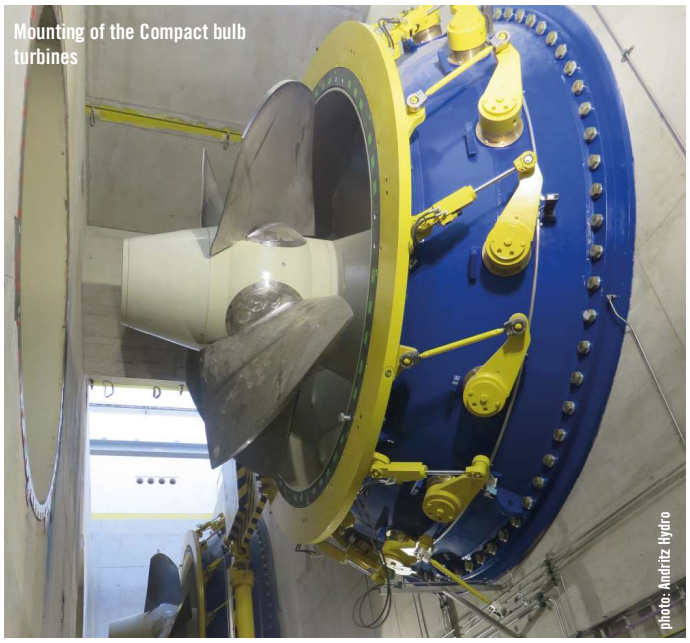

Mounting of the Compact bulb turbines

photo: Andritz Hydro

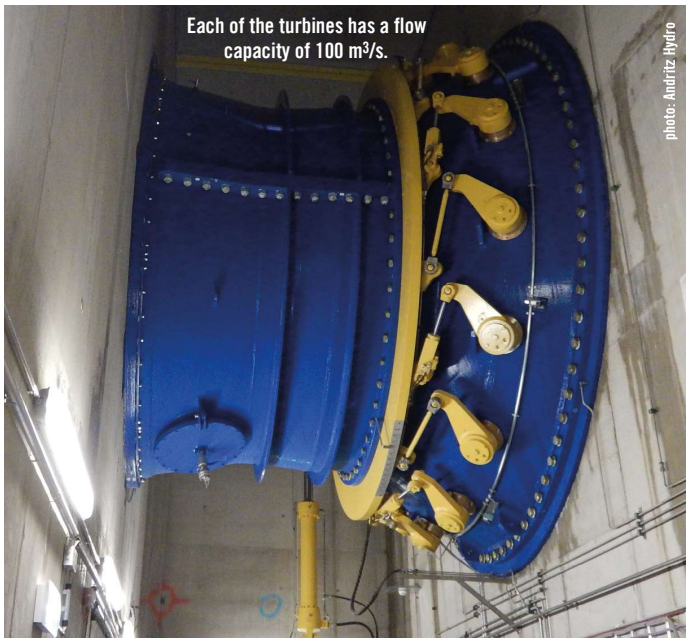

Each of the turbines has a flow capacity of 100 m³/s.

photo: Andritz Hydro

month of uninterrupted work and with both generators finally in place, the units were handed over to the customer, ready to be put into operation. Once the throat ring was closed, the generator was sealed with an end cover. Finally, the guide vane assembly, server motor joint and falling weight were installed.

OPTIMISED WATER FLOW

Optimising the plant's operational efficiency was by no means limited to the installed machine unit but included adjustments to the overall building structure. In collaboration with Graz University, the planners at BHM fine-tuned the intake structure, among other things.

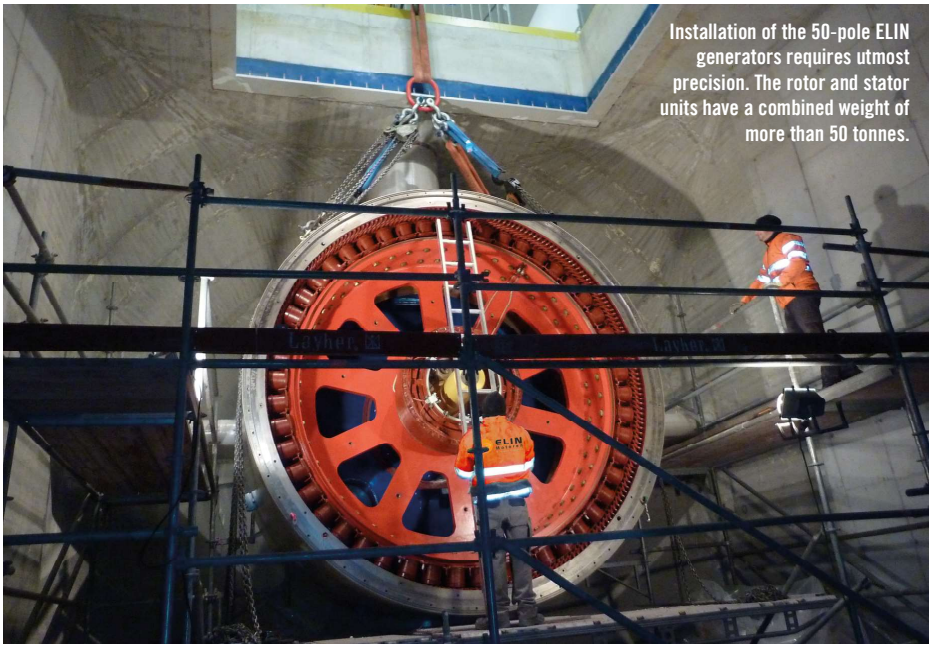
As Gerhard Schönhart explains, "The original design of the power station had been model tested already at the Graz Technical University's Institute for Hydraulic Engineering. But since the flow rate of the new design was 20 m³/sec higher and the overall construction of the power station had been lowered, we had the inflow recalculated. The result showed us instantly that the intake could be shortened and arranged at a rather steep 35 degree slant. It also turned out that the planned upstream retaining would cause a sub-optimal inflow to Turbine 1. So we moved the wall back a little and capped it with a calotte. Doing it this way not only improved the turbine inflow, it also saved us some construction work."

PROJECT SUCCESS WITHIN EIGHTEEN MONTHS

In retrospective, the figures of the construction project are quite impressive: Overall, 388,000 m³ of earth were moved, 44,000 m³ of armour stones were used, 27,000 m³ concrete was poured, and 2,600 tonnes of reinforcing steel were incorporated into the construction. Most of the excavated material was reused to fill up the original river bed and the original 400 m discharge channel.

In total, the main construction work took around eighteen months to complete. By May 2015, the first turbine start-up tests had begun while final construction work was still ongoing and individual ecological compensating measures were being implemented. The overall project was finally completed in time and in optimum quality, thanks not least to Helmut Murlasits and his construction management team, which included Josef Kreuzer, overall project leader and Managing Director of Added Value GmbH, Gerhard Schönhart and Rudi Kandler of BHM, as well as power plant specialist and chief electrical engineer Werner Machazek.

The turbine control and automation system was provided by ANDRITZ HYDRO, and


Installation of the 50-pole ELIN generators requires utmost precision. The rotor and stator units have a combined weight of more than 50 tonnes.

Technical Data

- Flow Rate: 200 m³/s • Head: 5.7 m
- Turbines: Compact Bulb Turbines (2 pc.)
- Manufacturer: ANDRITZ Hydro
- Output: 4,900 kW $_{each}$
- Runner Size Ø: 3.650 mm
- Generators: Synchronous (2 pc.)
- Manufacturer: ELIN Motoren
- Nominal Speed: 120 rpm
- Nominal Current: 569 A • Weight: 53.5 t $_{each}$
- Nominal Output: 6.212 MVA • Voltage: 6,300 V
- Control and communication system: Siemens
- Hydromechanical Equipment: Kuenz
- Planning: BHM Ingenieure
- Total Average Capacity: 46.9 GWh

Cord Prinzhorn, CEO of Prinzhorn Holding, and Johannes Wagner, the Mayor of Frohnleiten, placing fish in the River Mur.

the primary control and automation system, as well as the medium-voltage switchgear and low-voltage distribution system were provided by another, equally competent partner: Siemens.

ECOLOGY AND FLOOD PROTECTION

Ecological measures were a key item on the project agenda. For one thing, a perfectly designed fish migration support system was constructed in the form of a natural pool pass. Its most distinguishing feature is an integrated pool, from where the fish can reach a branched-off rivulet. In addition, several amphibian biotopes were set up, and a number of ecological compensating measures were implemented. Particular care was taken to preserve the ecology of the surrounding riparian zone.

Previously, the outflow reach had dried out frequently at low tide, whereas the new construction ensures a continuous flow of water at all times. Another item on the agenda was flood protection. Diverting the course of the River Mur and relocating the Gamsbach estuary ensures sufficient protection up to centennial floods.

MASSIVE BOOST TO POWER PRODUCTION

November 12, 2015 saw the successful completion of the uninterrupted 30-day trial operation of the two bulb turbines. The power plant was now ready to go into regular operation. Equipped with two new 4.49 MW bulb turbines by ANDRITZ HYDRO, the newly constructed power plant at Rothleiten uses Mur hydropower to generate around 46.9 GWh of clean energy per year. This is more than three times the output of the old facility, which had a capacity of around 13.8 GWH/year.

Together with the modernised Rothleiten power station, a bit of industrial history has been preserved in the tradition-steeped Frohnleiten region. Today, the facility is the core element of a group of four small-scale hydropower stations with a total capacity of 17 MW that Prinzhorn Holding operates to generate and market clean, inexpensive hydropower. Under the new label, "MeinAlpenStrom" ("my Alpine power") Prinzhorn is currently establishing itself as one of the national energy providers, offering 100% green electricity from Styria.