

**"The aim is to secure reliable operation of the plants so that these 'oldies' can continue to generate clean hydropower for many years to come."**

Project Manager Øyvind Kristiansen.

**Norway** – Årlifoss and Grønvollfoss are two run-of-river plants located close to each other on the same river in Southeastern Norway. Owned and operated by Skagerak Kraft AS, a utility company with about 4% of total electricity output in Norway, both plants are equipped with Kaplan turbines and have an installed power of 26 MW and 32 MW, respectively. Årlifoss is the older of the two dating back to 1915, while Grønvollfoss began operations in 1933.

In 2020, ANDRITZ was awarded a large automation rehabilitation order for both hydropower plants. It is one of the larger ANDRITZ Hydro automation orders globally within service and rehabilitation with the project scope consisting of new control systems for the generators, common systems, water level, and gates, as well as the electric power systems (EPS). This combination of automation and EPS

is customary for hydropower contracts in Norway. The upgrades are being conducted as a single common project.

The project – compliant with the Machine Directive of the EU – is being executed as a collaboration between ANDRITZ locations at Jevnaker in Norway and Prague in the Czech Republic. A second contract for a mechanical upgrade at Årlifoss has also been awarded to ANDRITZ. Replacement of the rotor and other generator upgrades, a new Kaplan turbine, and a new high pressure oil unit for the turbine governor are included.

The project has progressed as planned with Phase 1 at Årlifoss, consisting of gate, water level, and station control completely installed and commissioned two weeks earlier than specified in the contract. Scheduled for November 2022, the second phase of the Årlifoss refurbishment is also on target with turbine controls, generator and 9.5 kV switchgear.

At the same time a full range of activities has been on-going at the Grønvollfoss site with the installation of the station supply part of the contract. To optimize logistics, the order of installation was reversed at Grønvollfoss, combining the engineering, installation, and



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commissioning of the station controller with the water level regulator and the gate controller. The project will continue until 2024.

The project manager Øyvind Kristiansen is full of praise for the excellent level of cooperation with Skagerak Kraft: "We have been able to find good solutions with the customer during these times with high uncertainty in our sub-supplier markets. The customer was concerned that at least one generator was operating at all times as the power plants play a crucial role in supplying power to the small communities of Årlifoss and Grønvollfoss. Limited grid capacity makes it difficult to maintain stable power supply to these villages from the external grid".

Both power plants have undergone several previous upgrades since they were commissioned. Increased power output is not the objective of the ongoing effort, instead the aim is to secure reliable operation of the plants so that these "oldies" can continue to generate clean hydropower for many years to come. Although the project was planned before the current turmoil in global energy markets occurred, the circumstances make the project even more relevant. The project serves as a good illustration of the important role hydropower plays as a provider of stable and dependable clean energy.

## TECHNICAL DETAILS

### Årlifoss:

Total output: 26 MW

Scope: 1 × 26 MW

Head: 16 m

Voltage: 9.5 kV

Speed: 136.4 rpm

Runner diameter: 4,500 mm

### Grønvollfoss:

Total output: 32 MW

Scope: 2 × 16 MW

Head: 23 m

Voltage: 8.0 kV

Speed: 200 rpm

Runner diameter: 3,120 mm

### AUTHOR

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# E AND OPERATION