XFLEX HYD

Source: Mathias Magg

ROADMAP TO MORE FLEXIBILITY
Europe is shifting away from fossil fuels and the growing share of renewables is changing grid operations. Greater flexibility is needed to respond to these changes.

INSIGHT: HYBRIDIZATION TECHNOLOGY
A run-of-river hydropower plant on the Rhine and owned by Électricité de France, Vogelgrun is testing hybridization technology, where eight partners are contributing.

XFLEX HYDRO, a consortium of 19 partners, is demonstrating how hydropower plants can provide more flexibility to the grid.

Under the Horizon 2020-funded XFLEX project, which started in September 2019, innovative technologies are being tested in seven hydropower plants to boost flexibility. Industry leaders, research organizations and universities are evaluating technologies such as enhanced fixed speed, variable speed, hydraulic short circuit and hybridization solutions under real operating conditions, as well as the run-of-river hydro power plant Vogelgrun, where the hybridization is being demonstrated and evaluated.

Vogelgrun has four low head, double-regulated Kaplan turbines. In early 2021, one unit was hybridized with a battery energy storage system (BESS). Since the beginning of August 2021, this unit is operating 24/7 in hybrid mode (35 MW Kaplan unit + 0.6 MW BESS) to provide 4 MW FCR (frequency containment reserve; primary control). See page 56 for more information on hydro-battery storage hybrid energy systems.

The addition of a battery system delivers a rapid power response to complement the hydraulic unit. A master control, running on a HIPASE* platform, calculates the individual set-points to provide FCR. Furthermore, a smart power plant supervisor is being developed that will minimize wear and tear. Two

KEY FACTS OF THE XFLEX HYDRO DEMONSTRATORS

Project	ALTO LINDOSO (PT)	ALQUEVA (PT)	CANIÇADA (PT)	FRADES 2 (PT)
Rated power	2 × 317 MW	4 × 130 MW	2 × 35 MW	2 × 390 MW
Rated head	276 m	65 m	121 m	414 m
Type	Reservoir storage	Pumped storage	Reservoir storage	Pumped storage
Demonstrated technologies	Enhanced fixed speed (high head)	Hydraulic short circuit	Enhanced fixed speed (medium head)	Variable speed (DFIM) technology

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Vogelgrun is a 142 MW run-of-river hydropower plant in France, situated near the border with Germany along the river Rhine. The plant has four low head Kaplan turbines, in service since 1959. During XFLEX HYDRO, one of the units was hybridized with a battery and the performance is being evaluated.

units were equipped with sensors. The second unit, providing FCR without a battery, serves as a benchmark to optimize and quantify the benefits of the hybridization.

Digitalization is another focus in the project: In particular, a smart power plant supervisor is being developed, including a multi-dimensional hillchart to optimally distribute the set-points to the BESS and the turbine.

Moreover, DiOMera** was deployed. With the DiOMera indicators and developed turbine models, the health index of the unit can be estimated. Additionally, a SIMSEN model (hydro clone) was developed and validated against the real unit.

KEY OBJECTIVES OF THE VOGELGRUN DEMONSTRATOR

- Hybridize the turbine unit with a battery to improve dynamic frequency response as well as reduce governor actions.
- Quantify and significantly reduce turbine wear.
- Evaluate the possibility of upgrading the 35 MW fixed-speed, double-regulated Kaplan turbine unit with an enhanced variable speed, propeller unit.

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Follow the latest updates on the project here: www.xflexhydro.net

GRAND MAISON (FR)	VOGELGRUN (FR)	Z'MUTT (CH)
8 × 154 MW 4 × 156 MW	4 × 35 MW	1 × 5 MW
900 m	12 m	115 m
Pumped storage	Run-of-river	Pumped storage
Hydraulic short circuit	Battery/Turbine hybrid	Variable speed (FSFC)

The Hydropower Extending Power System Flexibility (XFLEX HYDRO) project received grant funding (No. 857832) from the European Union's Horizon 2020 research and innovation program.

* HIPASE is the unique ANDRITZ Hydro automation platform for protection, excitation, synchronization, and turbine governing. To learn more about HIPASE see: https://www.andritz.com/hydro-en/hydronews/hydro-news-24/03-hipase

** Metris DiOMera is a modular and flexible platform for the operation and maintenance of hydropower plants. To learn more about DiOMera see: https://www.andritz.com/hydro-en/diomera