



HydroPHIL: a reduced scale PSP model with real-time performance capacity

Improve your pump storage plant's dynamic behaviour & operational efficiency

As a hydro power plant operator, control system designer or equipment manufacturer, our unique test rig allows you to test each individual element of your hydraulic system in real-time, from the equipment to the control system, by replicating the interfaces and performances of a real production site.



OVERVIEW

Pumped storage plants (PSP) are considered as the most mature and reliable technology for storing energy in bulk. While they are widely recognised for their ability to store energy in large quantities, R&D efforts are now focused on increasing flexibility to facilitate the integration of renewable energies into the grid.

Emerging technologies such as variable speed, hybridization, and advanced control strategies, improve the PSP's flexibility, thereby improving response times, increasing the operation range, or increasing the system's life expectancy.

At SuperGrid Institute, we have designed an innovative test platform capable of performing real-time simulations for these emerging hydro power storage technologies, the first of its kind.

We help our customers mitigate the risks of implementing new solutions, at a reasonable price.

DESCRIPTION

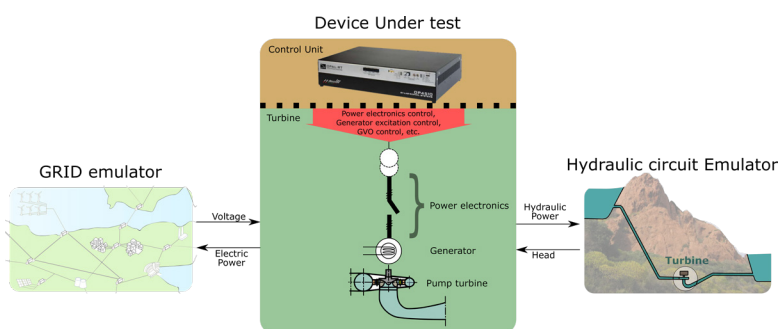
The HydroPHIL platform is a unique test rig that replicates various aspects of a PSP's behaviour in real time.

Our platform enables you to validate the control, supervision, system architecture, integration, and hydraulics (non IEC 60193) of your projects in a relevant environment.

Our one-of-a-kind installation includes an embedded hydraulic circuit emulator that replicates the head oscillations at the turbine inlet and outlet, while an embedded grid emulator allows you to study grid code compliancy along with the production unit's contribution to frequency & voltage reserves.

AVAILABLE SERVICES

- Dynamic performance & safety characterisation
 - Wicket gate control: speed and power regulation
 - Transient behaviour: overspeed, start-up, etc.
 - Grid compliance: fault ride-through, active & reactive power, ancillary services etc.
- Variable speed control
- Hybridisation
- Safety checks using fault injection
- 4 quadrants hydraulic characterisation (non IEC 60193)
- Training in line with your specific needs



TECHNICAL DESCRIPTION & CHARACTERISTICS OF HYDROPHIL

Our HydroPHIL platform replicates your hydroelectric unit, including its hydraulic design, mechanical inertia, actuator performance, electrical machine topology, power electronics, automation and instrumentation.

Reduced-scale model

- 4 quadrants pump-turbine
- Customizable hydraulic design
- Ability to replicate projects from 50 m to 900 m
- Real-time operating ring
- Turbine outlet up to ~20 cm diameter

Control

- OPAL OP4510 Real Time Controller
- MATLAB/Simulink interface
- Ability to connect and test any black boxed industrial controller

Grid emulation

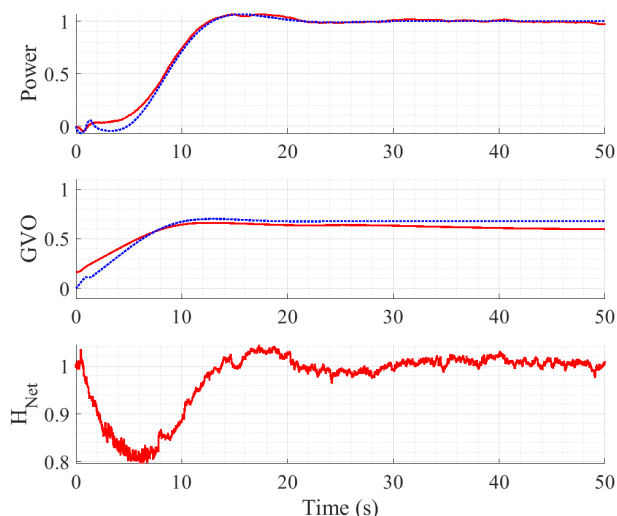
- 15 kVA bidirectional conversion mock-up
- 400 VAC grid, with harmonics up to 40 kHz

Hydraulic circuit emulation

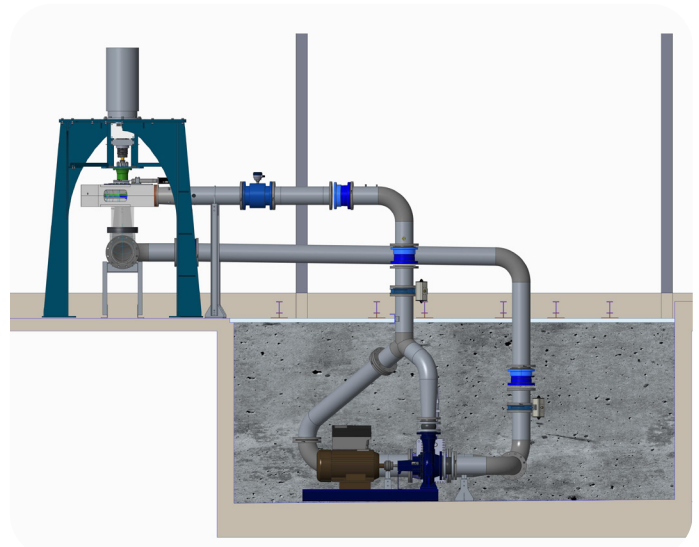
- Emulated water hammer with up to 16 mWC net head, 120 L/s

Time-based proportionality

- Hydraulic inertia & dynamics
- Mechanical inertia
- Electrical time constants
- Actuator's performances



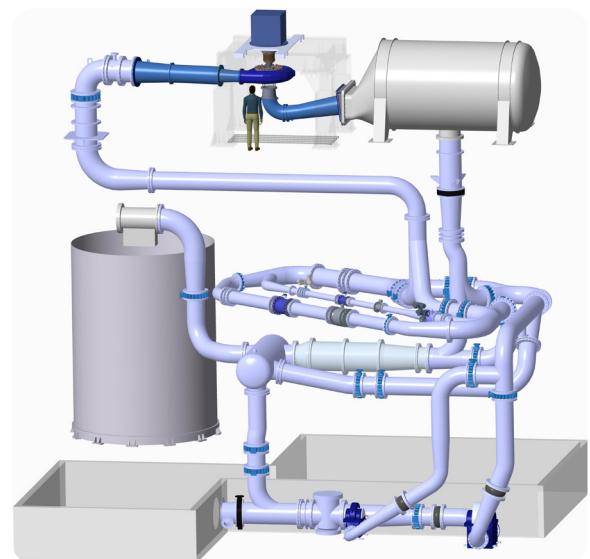
Comparison, per unit, between simulation power (blue) and generated power (red) from the hydraulic reduced scale model together with the expected (blue) and attained (red) guide vane opening (GVO) and measured head at the turbine.



Wide range of conversion system layouts among which we find conventional fixed speed units, DFIM variable speed, Fully FED variable speed and other topology such as Hybridized Hydro Power Plant.

OUR OTHER HYDROELECTRIC TESTING FACILITIES: OUR IEC 60193 HYDRAULIC MACHINES TEST PLATFORM

Our hydraulic machines platform is the only independent hydraulic test rig in France able to perform tests according to IEC 60193 standards. It is used to carry out tests from preliminary research and the development of new hydraulic designs to acceptance tests. Ask us for more information about our other hydroelectric test platform.



CONTACT

For additional information or to ask for a quote, please contact: sales@supergrid-institute.com