

# GridLab Dispatching



## Overall description of the infrastructure

The GridLab Dispatching is a reduced-scale infrastructure reproducing the injection of electricity into the high-voltage grid coming from a mix of renewable sources.

## Research activities

- Dynamic studies on the interaction among different types of sources
- Coupling of production and storage systems
- Microgrid concept and islanding functionality
- Black start protocols
- Power quality associated to renewables
- Advanced protection strategies

## Production units

Several production units, two power lines and a switchyard are rescaled (voltage reduced to 400 V and power levels reduced by a factor 5000) to all fit into a single room (Figs. 1-3). Actual industrial rotating machines or commercial inverters reproduce the injection into the grid coming from either 100 MW hydro, 15 MW solar or 3 MW wind production sites.

### Hydro:

The four production groups of an existing 65-kV, 100-MW hydroelectric system, as well as the relative overhead transmission lines, are reproduced in smaller size. The full-size Pelton and Francis turbines (two units per each) are emulated by means of motors driven by programmable drives.

### Solar:

The contribution coming from either 1-kWp actual photovoltaic panels or from a 3-kWp programmable DC source can be added to the production mix via a three-phase inverter, modeling up to 15-MWp of real-scale local solar injection.

### Wind:

3-MW generation, well representing the planned expansion of wind energy in the region, is reproduced by an indoor model of a wind turbine of horizontal axis (Fig. 4), controlled by a programmable drive, according to the production curve of an actual wind generator.

## Control panel

A control panel allows online monitoring (Figs. 5, 6) and modification of the parameters of each production site, reproducing the functionalities of a dispatching control room.

Such an installation represents the ideal test bench for every power plant operator or dispatcher, who can adjust the composition of the production mix according to different scenarios of grid demand and market price.

## Protection and automation test bench

A compact mobile test bench has been realized to reproduce the situation of a protection engineer faced to a typical electrical primary substation (Fig. 7). The bench hosts some of the most common digital relays of different manufacturers. Proper instrument transformers have been specifically designed to acquire current and voltage measurements from the 400-V GridLab Dispatching infrastructure.



Fig. 1 – Overview of the GridLab Dispatching



Fig. 2 – Reproduction of the HV switchyard and the transmission lines





Fig. 3 – Synchronous machine and transformer of the four production groups



Fig. 4 – Detail of the reduced-scale model of a wind turbine



Fig. 5 – Detail of the control panel of the synchronous machines



Fig. 6 – Real-time monitoring of the production mix of renewables



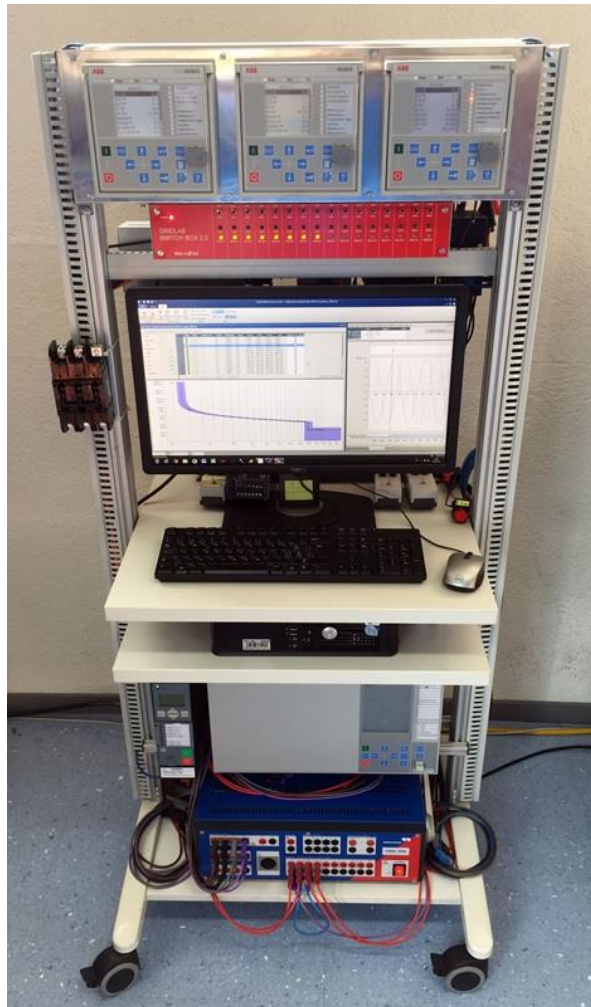


Fig. 7 – Protection and automation test bench