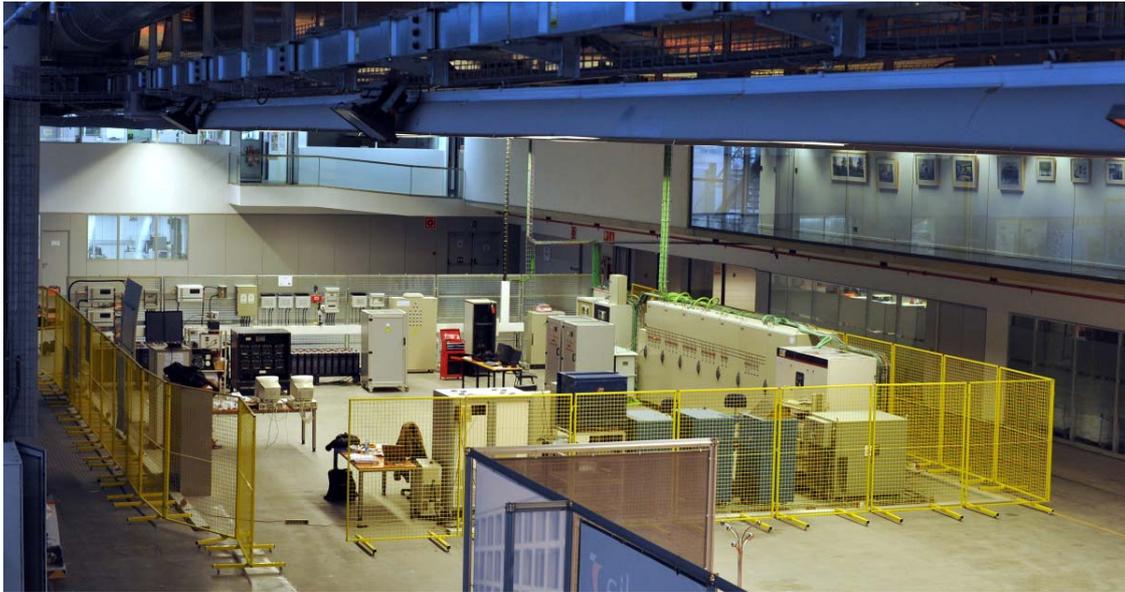


## Centre for Development and Demonstration of DER Technologies (TECNALIA)

The Centre for Development and Demonstration of DER Technologies (“microgrid”) of TECNALIA is formed by different generation and storage devices and several loads, with a manageable power of around 200 kVA.

The facility deals with the connection, integration and validation of technologies related to DER, as well as with the operation and control strategies of the entire microgrid.



A large variety of devices are integrated in this facility. It has been erected and extended during the last years according to the successful models of other few existing worldwide. The possibility to connect, disconnect, and operate the different systems, allow to test equipment, assess operation and control algorithms, and evaluate the impact and consequences for the network. This capability and the ability of TECNALIA’s experts to propose convenient scenarios, correlate results with other tools/models (for example, simulations), and extract conclusions, make of the use of this facility a good opportunity for users to validate their developments and participate in the definition of the electricity network of the future.

The characteristics and features of the microgrid equipment are as follows:

### 1. Generator sets:

- Photovoltaic installations: single-phase 0.6 kW, single-phase 1.6 kW and three-phase 3.6 kW
- Diesel generators: 2 x 55 kW (both controlled by an AC/AC converter)
- Microturbine MAGNETEK EG-50: 50 kW
- Wind turbine INCLIN NEO 6000: 6 kW, 4 m rotor
- Fuel cell-based controlled power source

### 2. Network simulator:

- Power electronics-based generating system for simulating the electrical network Pacific Power Source 3060-MS: 62.5 kVA/50 kW, 3-phase voltage 228/132 Vac, up to 500Hz, a step-up auto-transformer to output 456/264 Vac and a programmable controller (UPC32) for simulation of transients in voltage, frequency and waveform, harmonics, programmable output impedance, etc.

### 3. Storage devices:

- Flywheel UPS Caterpillar: 250 kVA
- 1120 Ah battery bank (24 Vdc): single-phase coupling using one Xantrex SW 3024 inverter.
- 1925 Ah battery bank (48 Vdc): three-phase coupling using three Xantrex SW 3048 inverters.
- 5 kW ultracapacitor-based UPS: 4500 F, 360 kJ of energy storage.

### 4. Loads:

- Resistive load bank AVTRON K595: 33.75 kW
- Resistive load bank AVTRON Millenium 150: 150 kW
- Inductive load banks AVTRON K596: 2 x 36 kVA
- Capacitive load banks: 2 x 157 kVA
- Programmable DC electronic load: 1.5 kW, 3 programmable modes (constant resistance, constant current and constant power).

5. Power converters: different rectifier-based DC sources, AC/AC converters, DGFACTS, 4Q full converters, etc.

6. Microgrid switching and connection system: 3 three-phase buses with neutral, 3x20 matrix of 4-poles contactors, Interbus-S control system, local HMI and interface for remote SCADA.

7. EV platform: system for algorithms development and simulation of electric vehicles connected to the electricity network, based on a bi-directional 4 kW Xantrex inverter, 2.64 kWh battery storage, a grid analyzer, a power meter, and PLC/GPRS communications.

### 8. Power quality analysis:

- DRANETZ-BMI Signature System: power quality and energy monitoring system.
- DRANETZ-BMI PX5: portable Class A power quality analyser.
- LEM TOPAS 1000: portable power network analyser.

The following figure shows most of the equipment integrated in the microgrid.

