AIT Distributed Generation Laboratory - DG Lab

Overview

Increasing numbers of distributed energy resources, including generators and storage facilities are feeding electricity into the distribution grids contributing in maintaining power quality. Inverters are of key importance in this context since they act as the interface between the primary electricity source and the grid.

Since 1995 AIT's PV laboratory is involved into testing and optimization of inverters for grid-connected and stand-alone PV systems. AIT's activities include high quality performance assessment as well as accredited conformity and qualification testing in the fields of safety, reliability and electromagnetic compatibility. For development and research AIT offers unique opportunities to optimize products of distributed energy resources directly at the testing facilities, accompanied by qualified experts in order to shorten the time-to-market of new products in the dynamic PV business.

The unique PV inverter test laboratory allows close to reality investigations and testing of inverters designed for different markets. The state-of-the-art inverter laboratory is equipped with flexible means for grid and photovoltaic simulation and provides a realistic testing environment for evaluating the characteristics of the equipment under a wide range of operating conditions.

The test environment consists of 1-phase and 3-phase grid-simulators, which allow performing tests with different grid-voltage waveforms and frequencies for inverters up to 10 kW/1- phase and 30 kW/3-phase. The PV-array is simulated with the help of dynamic PV-array simulators, which allow generating arbitrary user defined I/V-curves. In total up to three individual PV strings with voltage up to 1000 VDC and a power of 36 kWDC can be simulated.

Research and Testing Services

<u>Testing and conformity assessment of integrated protection equipment</u>

- Qualification testing and conformity assessment of PV inverters and protection devices according to diverse national standards and recommendations (VDE-AR-N 4105, VDE 0126-1-1, UL1741, UK ER G83/1, EN50438, …*) (e.g. under balanced load conditions, impedance jump)
- Qualification of PV inverters according to the BDEW Medium Voltage and Low Voltage guidelines, including FGW TR 3. *
- Static and dynamic testing of over/under voltage/frequency protection according to diverse standards *
- Interference with centralized telecontrol signals (superposed interharmonics in the range 200 Hz to 2 kHz)
- Behaviour at loss-of-mains situations and short-circuits in the grid, measurement of transients

<u>Performance and operational tests</u>

- Conversion efficiency under different generation conditions (DC voltage/power) Determination of efficiency curves, maximum and European efficiency according to pr EN50530 *)
- Steady state & dynamic MPP-Tracking Efficiency under different PV-array conditions
- Switch on/off power on DC side, stand-by power consumption on AC side
- Harmonic analysis according to European Standard EN/IEC 61000-3-2/-3-12 *)
- Testing of the immunity to voltage dips, voltage fluctuations and superposed harmonics according to EN 61000-4-11/EN 61000-6-1/EN 61000-4-13 *)

- Measurement of line conducted disturbances on DC and AC side under different load conditions
- Measurement of thermal de-rating/power fold-back at high ambient temperatures

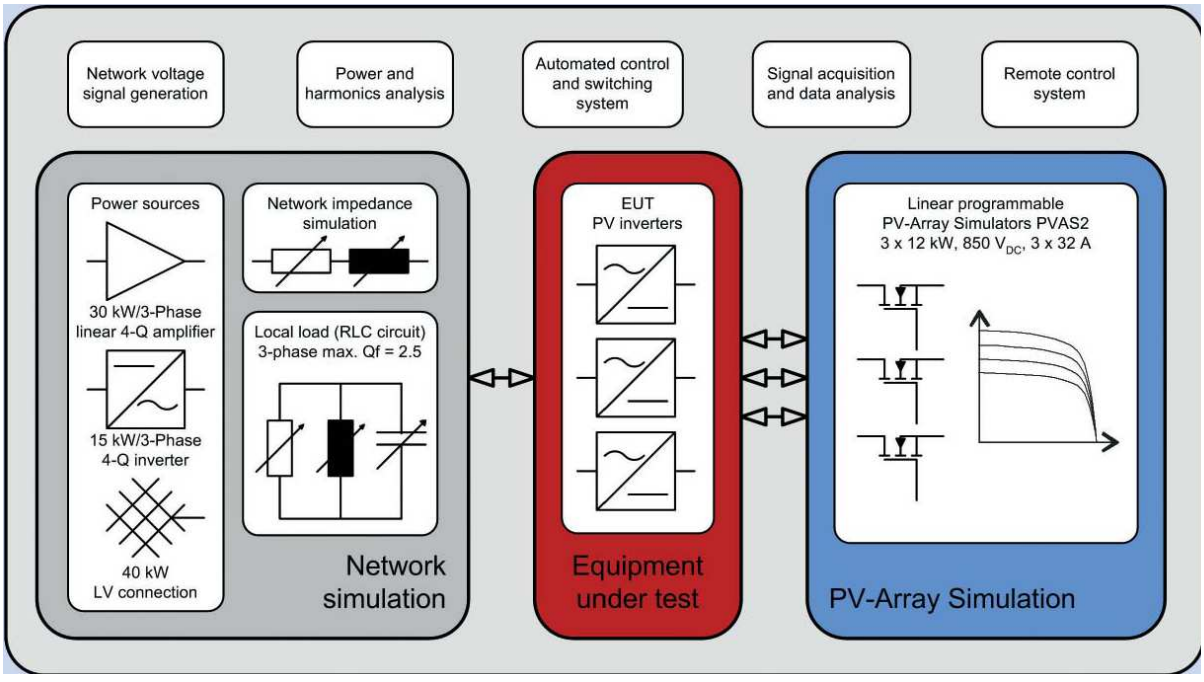
*) All qualification tests marked with * are carried out within the ISO 17025 accreditation.

Simulation and Numerical Computation

- Powerful workstations;
- General simulation tools: Matlab/Simulink, SimPowerSystems, PSpice/Cadence;
- Network simulation tools: DigSILENT, NEPLAN.

Key data of Infrastructure

- Programmable 3-phase grid-simulator, (generation of various grid-voltage waveforms and frequencies, of voltage sags/swells, harmonics) up to 30 kW/3-phase;
- 3 Dynamic PV-Array simulators;
- Network impedance simulation
- Continuously controllable RLC loads
- Re-configurable AC circuit (remotely controllable)
- High-performance control and acquisition system (Power Analyzers, Storage Oscilloscopes);
- Set of PV inverters (domestic installation size);
- Real-Time Simulator OPAL-RT with 8 CPUs, enabling advanced Power Hardware in the loop and Controller hardware in the loop analysis (Analog output directly coupled to voltage amplifier)



Accreditation and Certificates

- Accreditation according to EN ISO/IEC 17025 (No. GZ 92714/393-I/12/03)
- Certification according to ISO 9001:2000