
European Distribute Energy Resources Laboratories e.V.

DERlab Testing Facilities on Microgrids

Dr. Diana Craciun



Evora 2012 Symposium on Microgrids, September 3rd, 2012

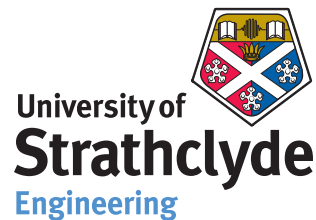
DERlab is a network



- of 20 institutes performing research related to Smart Grids (SG) integration of Distributed Energy Resources (DER)
- performing accredited testing of DER-units and SG-equipment
- supporting integration of Renewable Energies Smart Grids development
- organising information exchange on test facilities and DER knowledge
- contributing to standardisation

European Distributed Energy Resources Laboratories e.V.

Network Excellence for Smarter Grids



Main Business Areas



Electrical testing of DER components (inverters, grid protection devices & systems, storage devices, etc.)

- Performance
- Reliability
- Safety
- EMC



Testing of DER systems and power system services from distributed units

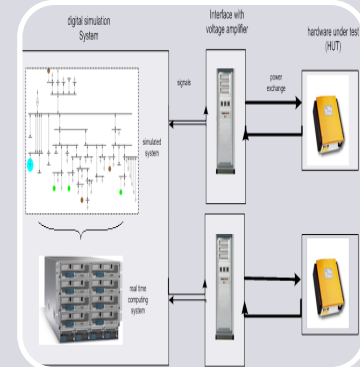
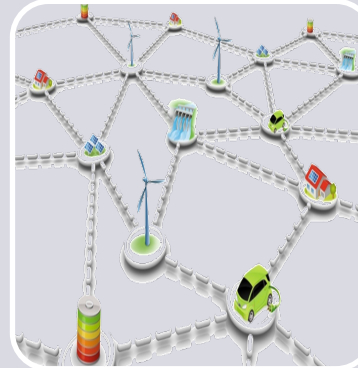
- Microgrids
- Virtual Power Plants
- Control strategies



Communications and IT security

- Communication technologies
- Smart metering
- Cyber security

Methods and Techniques



Full scale testing of DER components

- Lab capabilities up to the MVA range, LV to HV
- Dedicated facilities for all RES technologies
- Compliance testing and validation of all grid relevant functions
- Performance, safety and reliability

Lab and field testing of DER systems

- Testing and validation of power system (ancillary) services from distributed units

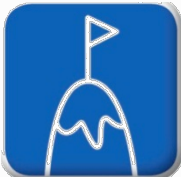



Interoperability and communications

- Laboratory platforms able to test the interoperability between DER units
- Testing of communication interfaces according to international standards

Power and Controller Hardware in the Loop (P-HIL/C-HIL)

- Synthesis of simulation and hardware experiments
- Allows equipment to be validated in a virtual power system

Member services

Visibility	Joint research	Information	Networking
<ul style="list-style-type: none">▪ Company profile▪ Description of facilities, services, expertise▪ Vacancies portal▪ Activities portal	<ul style="list-style-type: none">▪ Support and coordination of common research▪ Coordination of knowledge transfer	<ul style="list-style-type: none">▪ List of conferences and events▪ Standardisation activities▪ Research opportunities▪ Database of information material	<ul style="list-style-type: none">▪ Internal workshops and events▪ Interfacing contact to industry, other research institutes
			

External services

Testing

- DER Individual components
 - Full systems
 - Protection devices
- ...according to standards and grid codes



Technical support

- Technical workshops
- Training courses
- Consulting on interconnection requirements and standards



Information Platforms

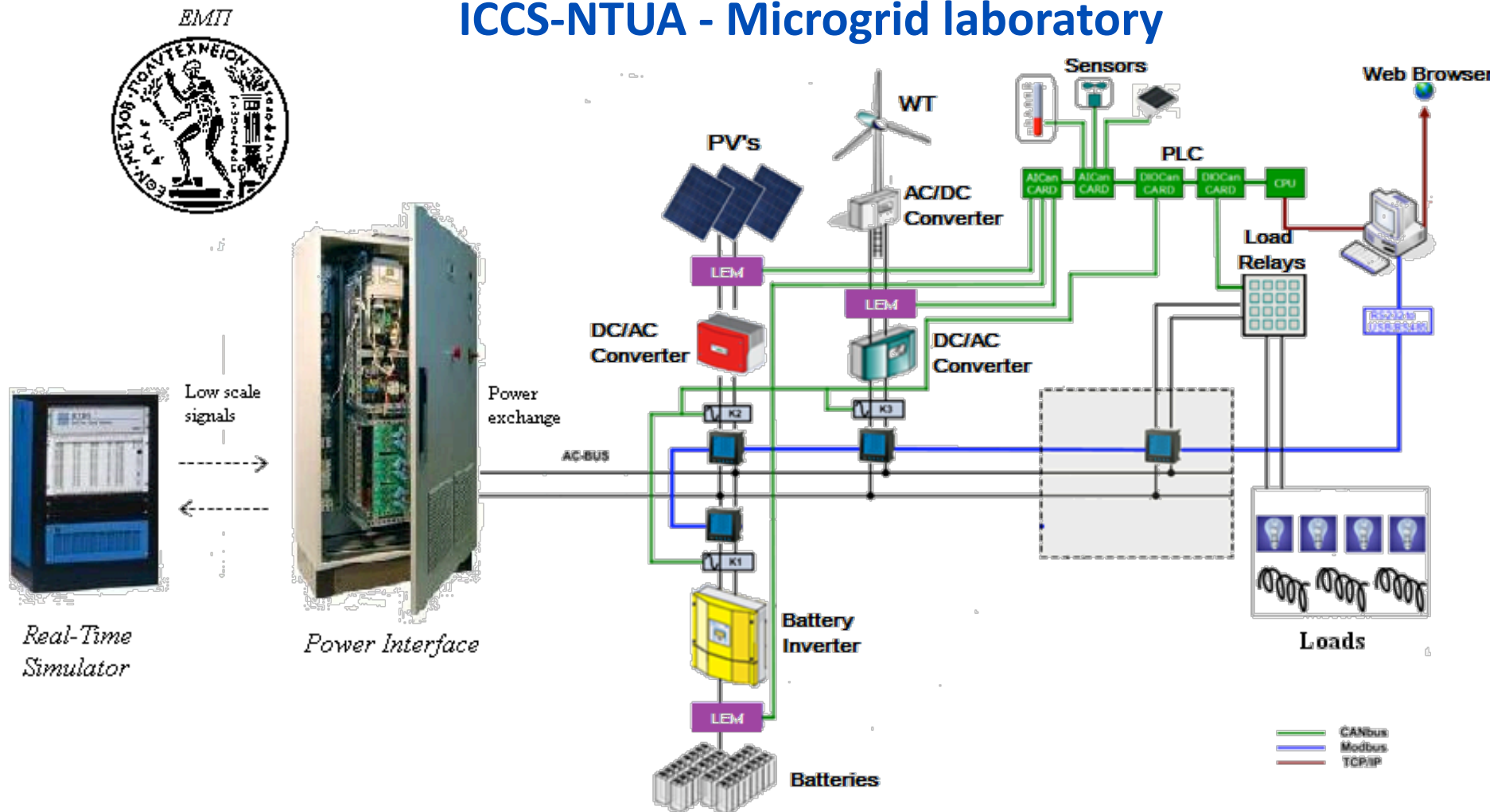
- Database of European Interconnection Specifications
- DERlab Infrastructures Database



Highlights of DERlab's testing facilities



ICCS-NTUA - Microgrid laboratory



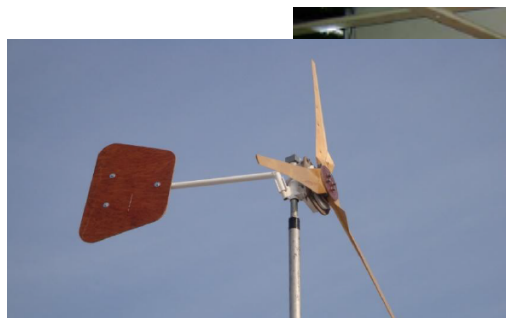
Highlights of DERlab's testing facilities



ICCS-NTUA - Microgrid laboratory

■ Wind

- SMA Windy Boy 1700 (1.7 kW)
+ WHISPER Wind Generator H80HV



■ Solar

- SMA Sunny Boy 1100E (1.1kW) +
11 monocrystalline panels, 110Wp each



■ Storage

- SMA Sunny Island 4500 (3.3 kW nominal) + 250 Ah, 60 V Lead Acid Solar OPzS Batteries

■ Controllable loads

- 15 kW Resistors, 1000 W lamps, 0.5HP motor, 2.5kVAr coils.



Highlights of DERlab's testing facilities



ICCS-NTUA - Microgrid laboratory

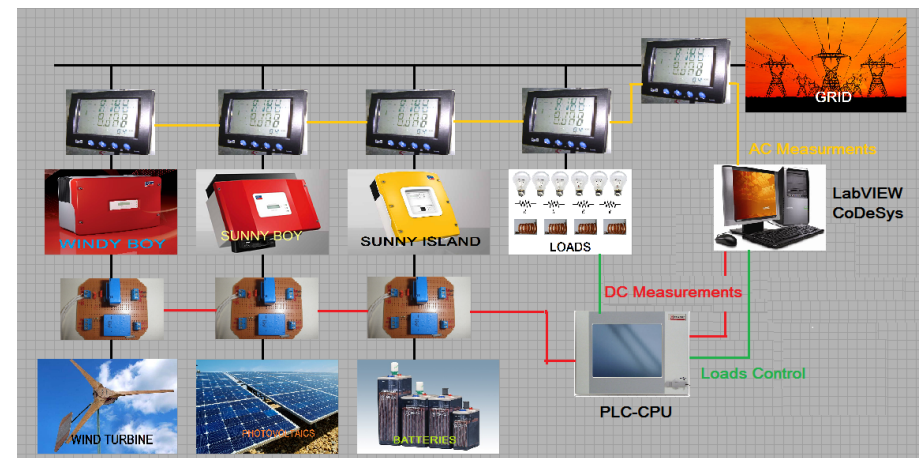
■ Microgrid SCADA

- LabVIEW and CoDeSys Software
- Units Control via PLC (ON/OFF) → Programmable Load Curve
- AC Measurements: Multi-instruments
- DC Measurements: LEM
- Environmental Measurements: Irradiation, Wind Speed, Wind Direction, Temperature, Humidity, Pressure



■ Multi-Agent System (MAS)

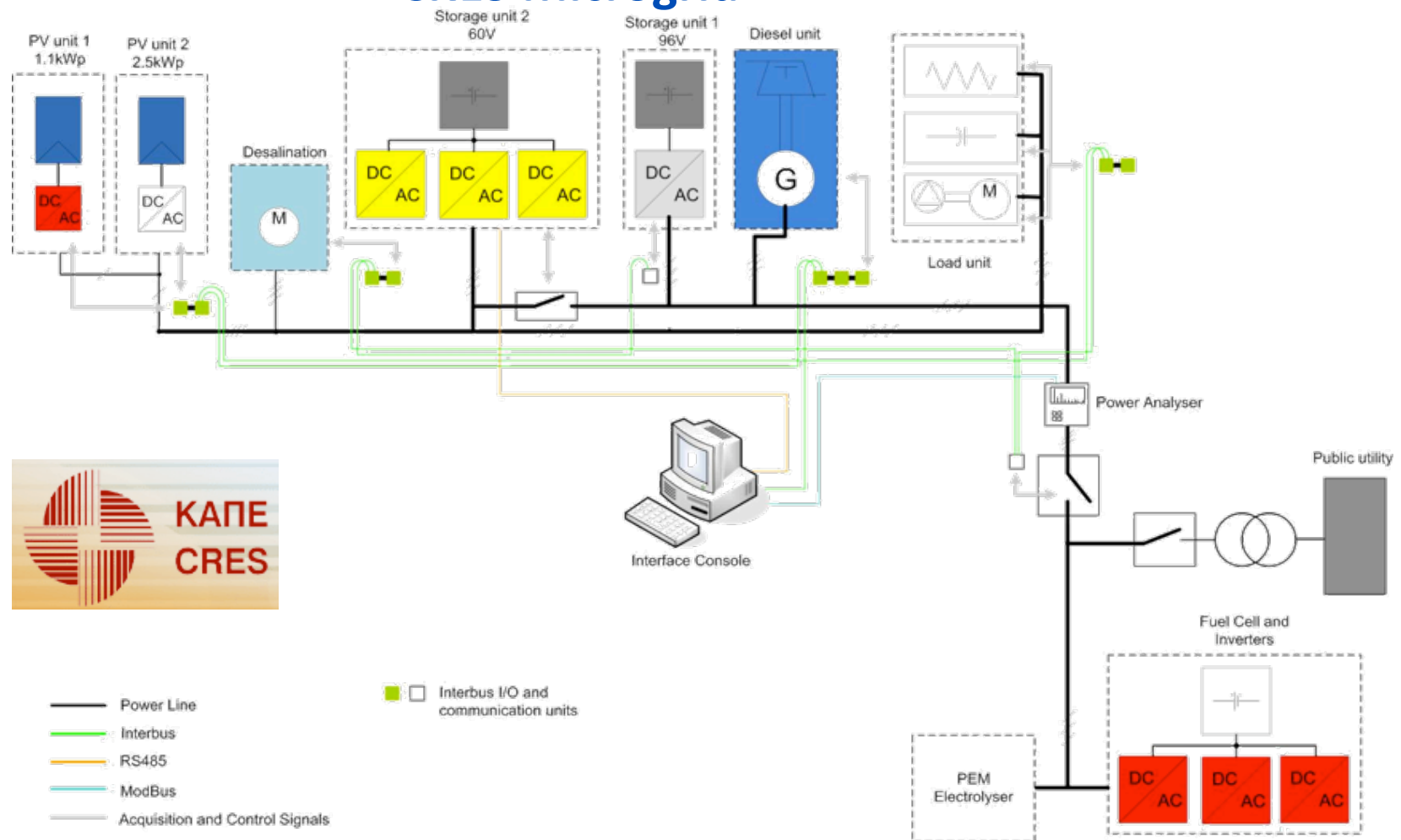
- Embedded system
- Java apps and Windows CE based
- Controllers used for I, V, f, P, Q measurements and to control 2 household loads through Power Line Communication (PLC).



Highlights of DERlab's testing facilities



CRES Microgrid

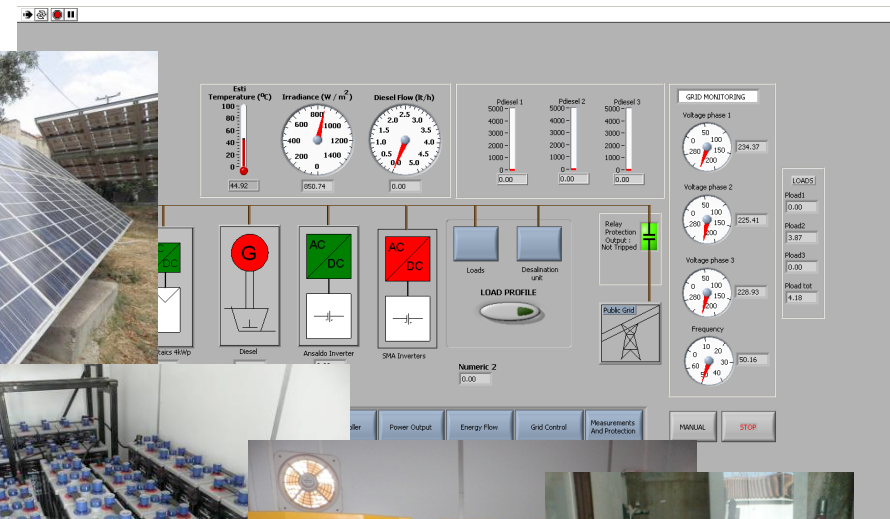


Highlights of DERlab's testing facilities



CRES Microgrid

- Solar (1,1 and 4,4kWp)
- Storage (40 kWh)
- Controllable loads (13 kW)
- Diesel generator (12,5kVA)
- PEM Fuel Cell (5kW)
- Interconnection to public grid
- Data Acquisition and Control using Interbus
- Supervisory control console developed in LabVIEW



Highlights of DERlab's testing facilities



Test Centre for Smart Grids and
Electromobility (SysTec)

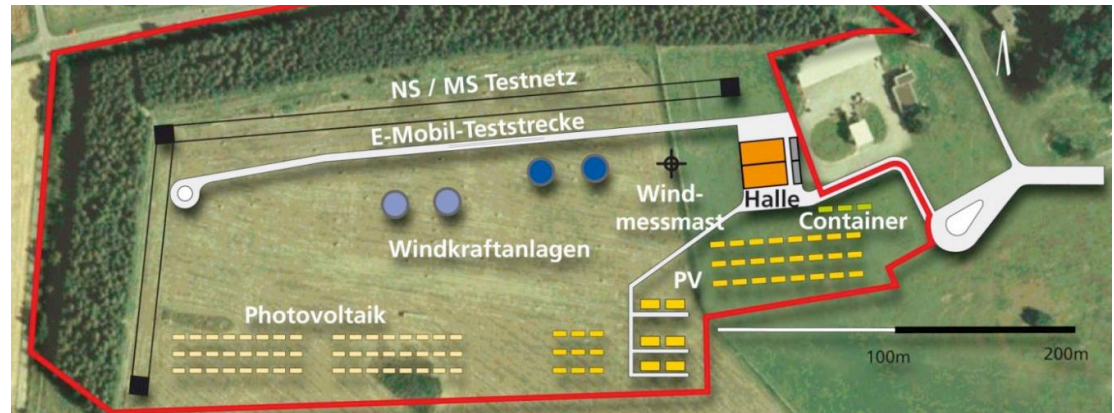


Highlights of DERlab's testing facilities



Test Centre for Smart Grids and Electromobility (SysTec)

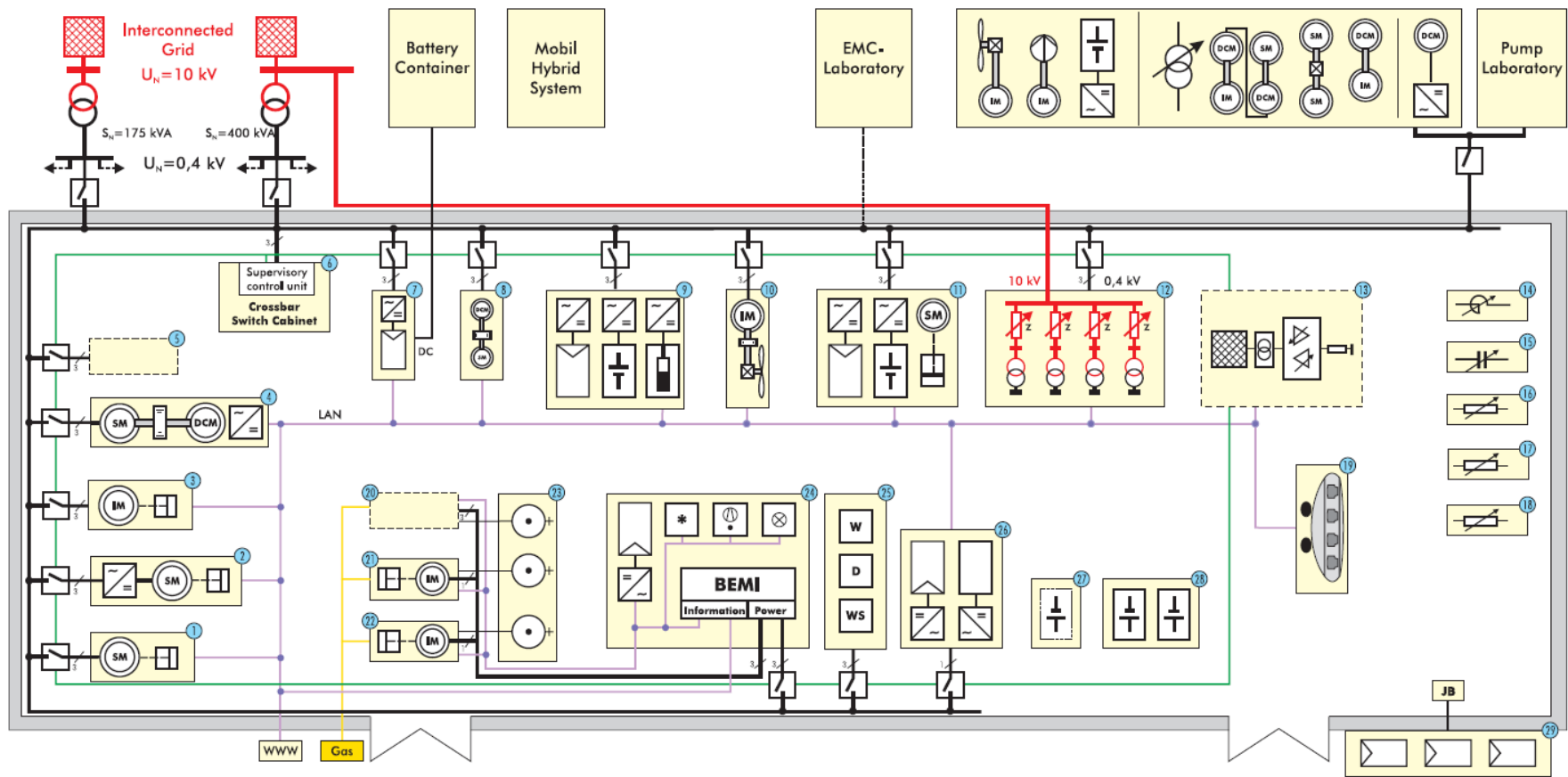
- Measurements of the static and dynamic electrical properties of DER units and networks
 - LV up to 1.25 MVA, MV up to 6 MVA
- LV and MV test networks including generators and controllable loads for interconnected and island operation
 - PV, Wind and Hybrid systems



Highlights of DERlab's testing facilities



Design-Centre for Modular Supply Technology
DeMoTec



Highlights of DERlab's testing facilities



Microgrid Testing Facilities



- Distributed Energy Resources Test Facility (DERTF)
 - Testing microgrids up to 200kW
 - Grid Simulators, Load Banks, actual wind turbines and PV systems available
- Energy Systems Integration Facility (ESIF)
 - Opens October 2012
 - Low Voltage (600V and Under) and Medium Voltage (15kV and Under) test areas
 - Flexible connections for electrical, thermal, and fuel infrastructure
- National Wind Technology Center (NWTC)
 - 7MW grid simulation
 - access to MW scale wind turbines
 - MV distribution system



Highlights of DERlab's testing facilities

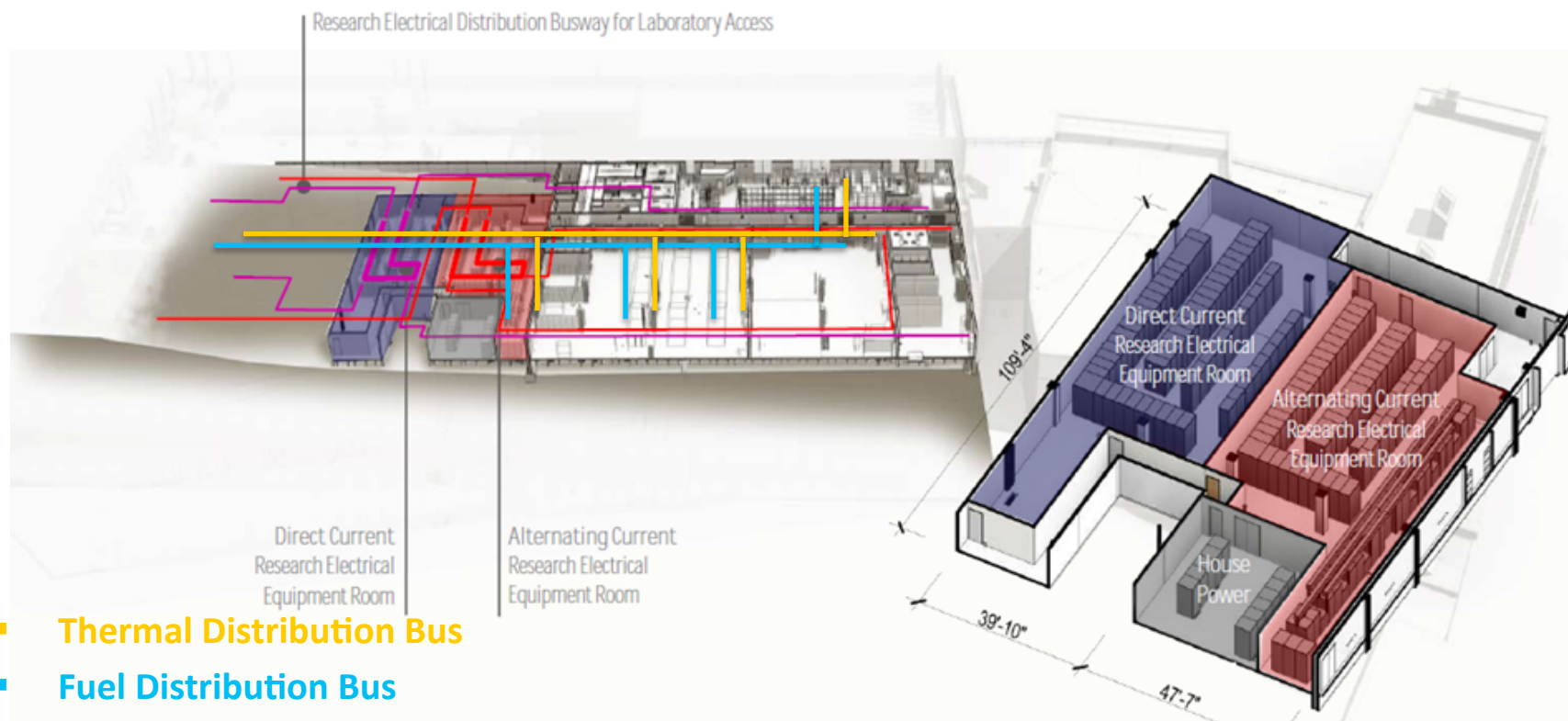


ESIF Research Infrastructure



- **Research Electrical Distribution Bus – REDB (AC 3ph, 600V, 1200A and DC +/-500V, 1200A)**

- Utility Scale Research
- 1.5 MW – Single Source REDB
- 1 M – Micro Grid Simulation



- **Thermal Distribution Bus**
- **Fuel Distribution Bus**
- **Supervisory Control and Data Acquisition (SCADA)**

Highlights of DERlab's testing facilities



Flex Power Grid Lab (FPGLab)



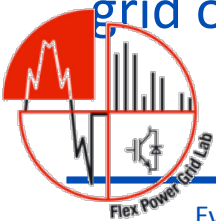
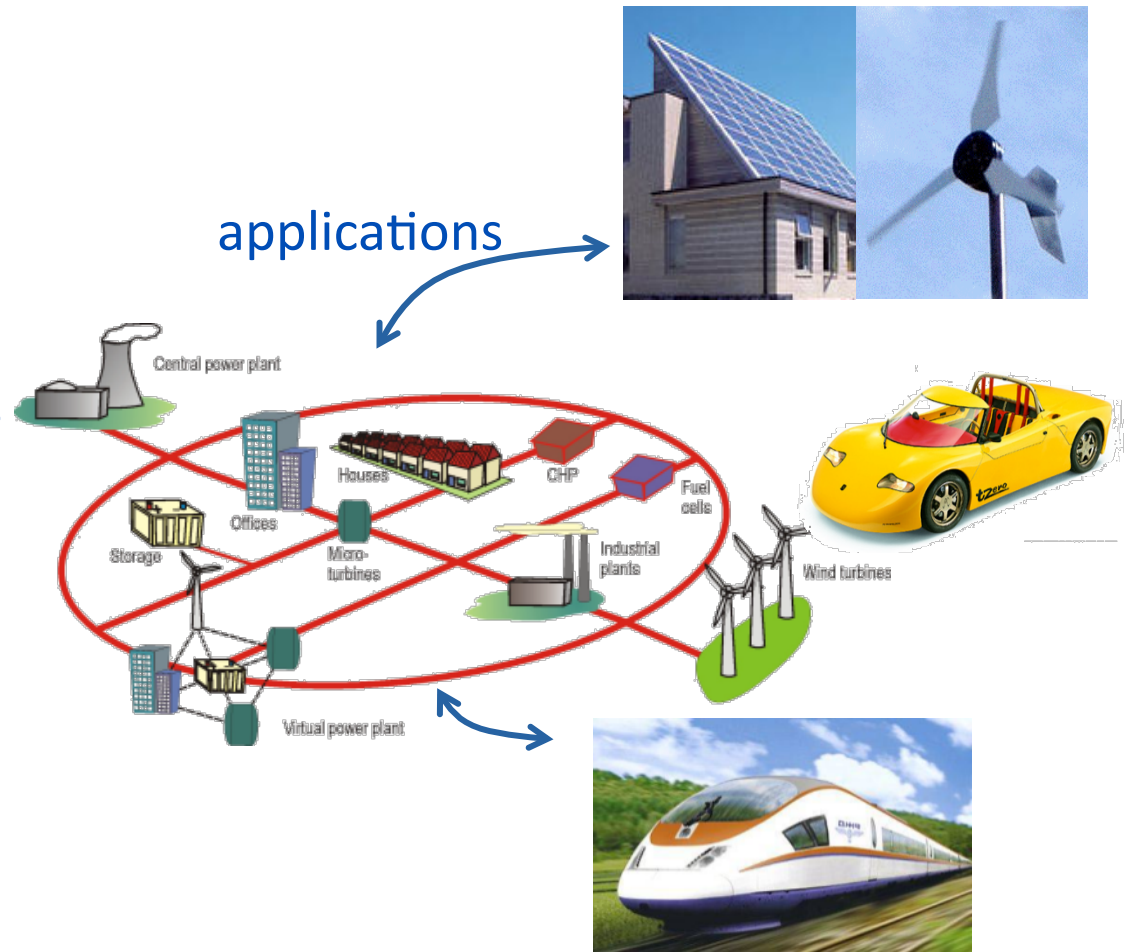
Highlights of DERlab's testing facilities



Flex Power Grid Lab (FPGLab)

- Independent laboratory dedicated to DER and RES integration in Smart Grids
- Power electronics development and testing for industrial high voltage (24kV)
- Power up to 1MVA
- Offering a predefined “bad” grid or load

applications



Highlights of DERlab's testing facilities

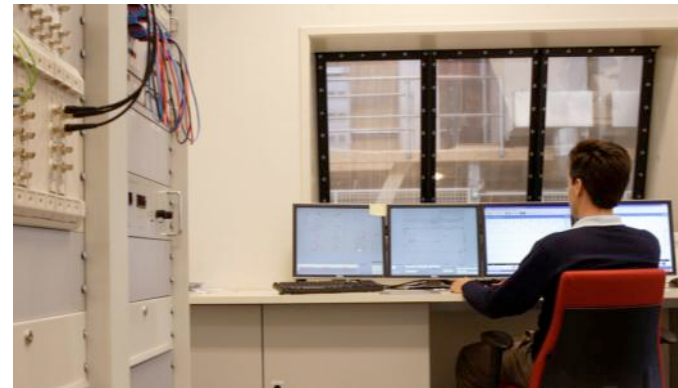


Flex Power Grid Lab (FPGLab)



Fully programmable grid

- Voltage level up to 24 kV
- DC to 75 Hz frequency range
- Continuous power up to 1 MVA
- Up to >25th harmonics
- 4 Quadrant operation
- Synchronization with other source
- Controllable power exchange
- Adjustable loads (0.5MW, 1MVA_r)



Highlights of DERlab's testing facilities



Power network demonstration Centre



Highlights of DERlab's testing facilities



Power network demonstration Centre

- Reconfigurable 11kV & LV network
- Islanded operation using M-G Set
- Real-time hardware-in-the-loop
- Capability to throw faults
- Industry standard equipment complemented by extensive instrumentation systems
- Control room with DMS

Research & Services

- Network control algorithm demonstration
- Generator/storage technology & control testing and demonstration
- Primary and secondary device characterisation
- Soak tests of new components
- Smart grid systems integration including communications



Highlights of DERlab's testing facilities



Testing infrastructure for Smart Grids

Facilities

- Extensive desktop simulation tools
- Real time simulation + RT- PHIL
- Network monitoring and WAMS data sets
- Control room simulator
- Industrial control & monitoring platforms





Contact us:

European Distributed Energy
Resources Laboratories (DERlab) e.V.

c/o Fraunhofer IWES
Königstor 59
34119 Kassel (Germany)

Fon. +49 561 7294 326
Fax. +49 561 7294 400

office@der-lab.net

www.der-lab.net

