SIRFN Capability Summary
European Distributed Energy Resources Laboratories (DERlab) e. V.

Introduction

DERlab is the association of 20 leading laboratories and research institutes in the field of distributed energy resources equipment and systems. The association develops joint requirements and quality criteria for the connection and operation of distributed energy resources (DER) and supports the consistent development of DER technologies. The main business areas are:

- **Electrical testing of DER components** e.g. inverters, grid protection devices & systems, storage devices on
  - Performance
  - Reliability
  - Safety
  - EMC
- Testing of **DER systems and power system services** from distributed units e.g.
  - Microgrids
  - Virtual Power Plants
  - Control strategies
  - SCADA
- **Communications and IT security** e.g.
  - Communication technologies
  - Smart metering
  - Cyber security

For more information, contact:

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DERlab

Website URL: http://www.der-lab.net

SIRFN Capability Summary
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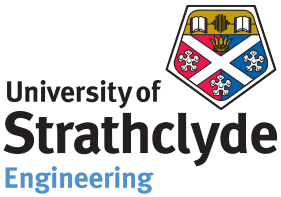
Member Institutes of DERlab:



Website URL: http://www.der-lab.net

Renewable Energy and DER Integration

Desired Level of SIRFN Participation: **2**

- 1 = Low 2 = Med 3 = High

Description of Activities

DERlab is active in several international research projects focusing on the grid integration of Renewable Energies and DER technologies e.g. PV GRID, HiPe-PV, Stargrid, DERri.

All of the DERlab member laboratories are involved in research and testing of DER components or whole DER systems connected to the electrical network. A central aspect of the research is the interoperability of different kinds of DER units.

DERlab member laboratories are able to test and validate the full range of power system services from distributed units of course including the communications and IT security.

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Building Automation

Desired Level of SIRFN Participation: **1**

- 1 = Low 2 = Med 3 = High

Description of Activities

DERlab partners are involved in the OGEMA alliance. The Open Gateway Energy Management Alliance (OGEMA) offers a software platform that supports standardized automated energy management. The platform can be applied in households, commercial environment and industries.

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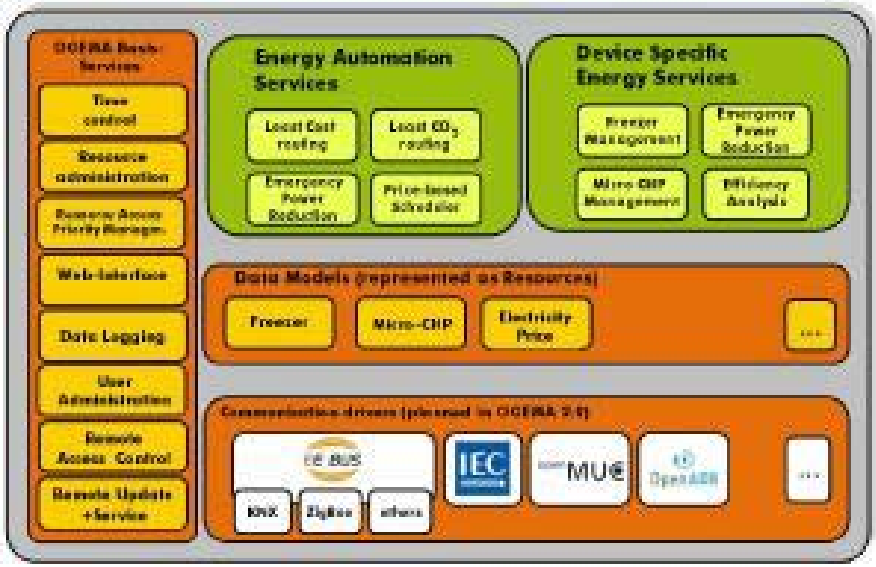

Website URL: http://der-lab.net

PEV Integration

Desired Level of SIRFN Participation: **2**

- 1 = Low 2 = Med 3 = High

Description of Activities

Some of the DERlab members are active in Plug-in Electric Vehicle research.

Fraunhofer IWES is supporting research and development for PEV Integration with its test facilities SYSTECH and DeMoTech. It covers topics like wireless charching, battery characteristics, or operational cycles.

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Microgrids

Desired Level of SIRFN Participation: **3**

- 1 = Low 2 = Med 3 = High

Description of Activities

DERlab offers with its partner laboratories the full scale testing of DER components for Microgrids. Components and whole systems are tested either in the laboratory environment or in field tests. The interoperability between DER units as well as communication interfaces are tested in accredited laboratory platforms. Power and Controller (P-HIL/C-HIL) Hardware in the Loop testing allows the equipment to be tested and validated in a virtual power system.

With the expertise of its 20 member institutes, DERlab is apart from the testing capabilities also able to offer technical support in terms of organizing technical workshops, training courses and consulting on interconnection specification requirements and standards.

The following slides are highlighting some the DERlab testing facilities for Microgrid.

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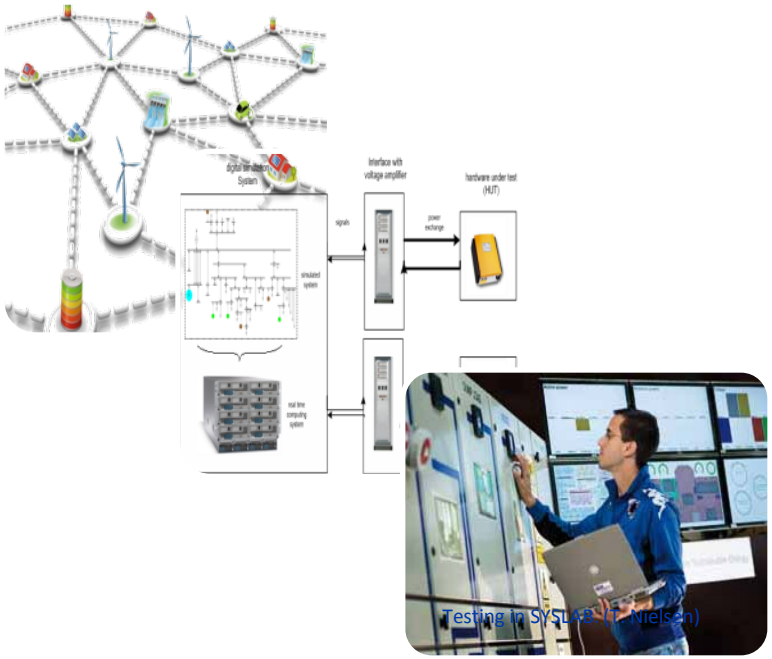


Website URL: http://der-lab.net

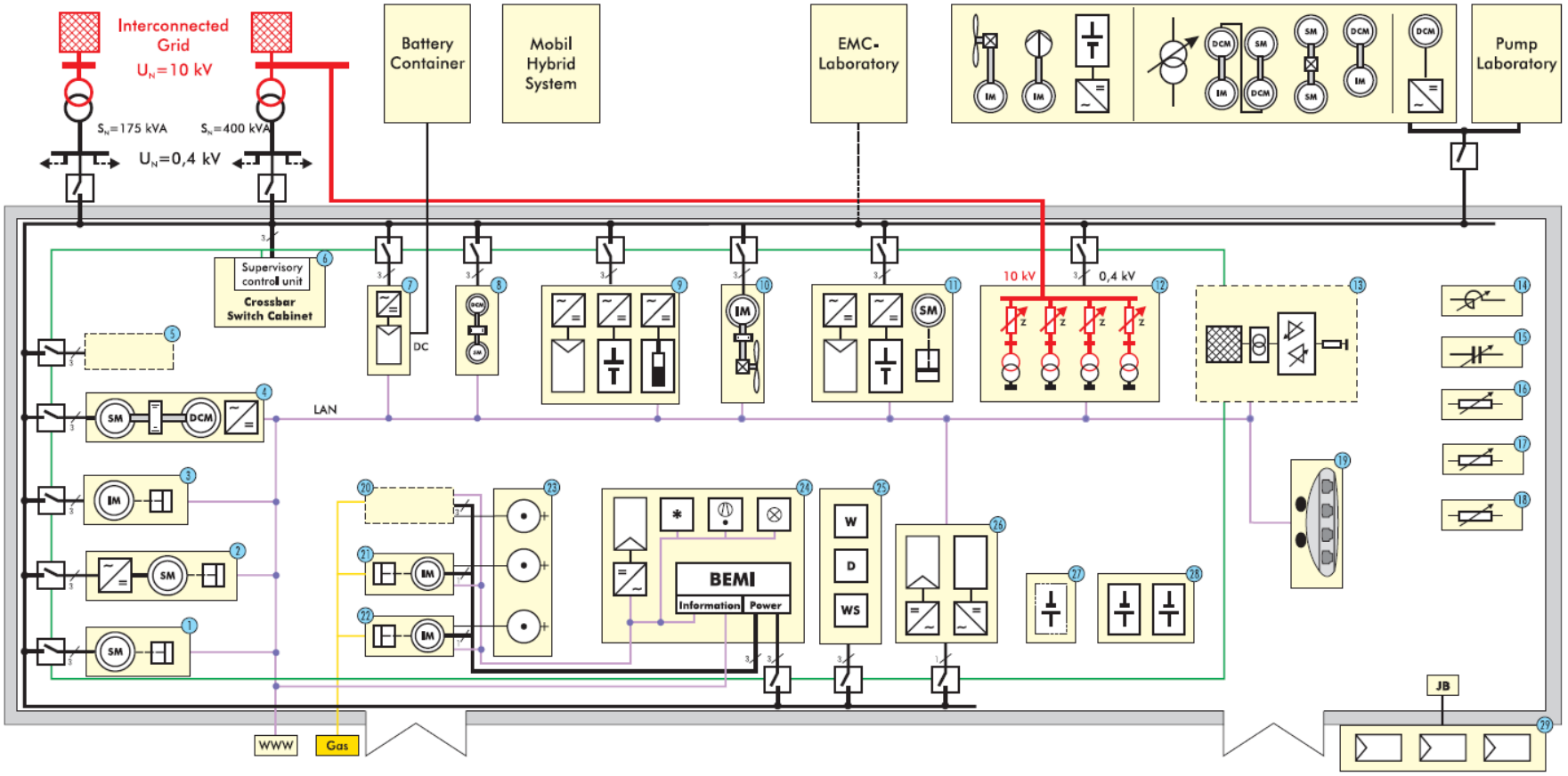
Fraunhofer IWES - Microgrid laboratory (SYSTEC)

Description of laboratory capabilities

- Measurements of the static and dynamic electrical properties of DER units and networks
  - LV up to 1.25 MVA, MV up to 6 MVA
- Examination of generation plants in accordance with different grid connection guidelines (low voltage, medium voltage)
- Measurements of grid quality and analyses of performance
- Field and laboratory tests of hybrid systems, small wind power plants and individual components as well as tests with hardware emulations under defined operating profiles
- Complete investigations and examinations in view of the grid integration and the energy management of electric vehicles
- Real time distribution grid simulations to test control centers and the grid integration of distributed generators, electric vehicles and power storage (hardware-in-the-loop)

Website URL: http://www.der-lab.net/members/iwes.html

Fraunhofer IWES - Microgrid laboratory



ICCS-NTUA - Microgrid laboratory

Description of laboratory equipment (I)

Wind

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

Solar

SMA Sunny Boy 1100E (1.1kW) +
11 monocrystaline 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.

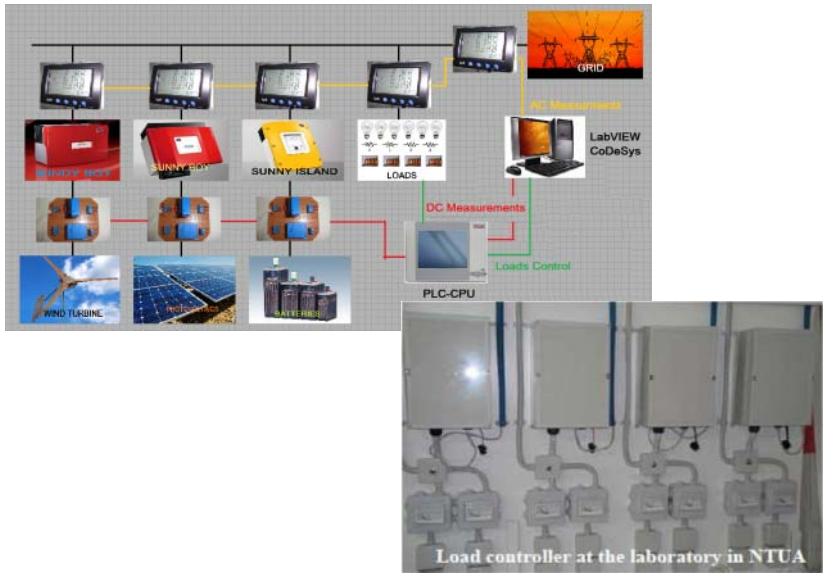
Website URL: http://www.der-lab.net/members/ntua.html

ICCS-NTUA - Microgrid laboratory

Description of laboratory equipment (II)

- 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).



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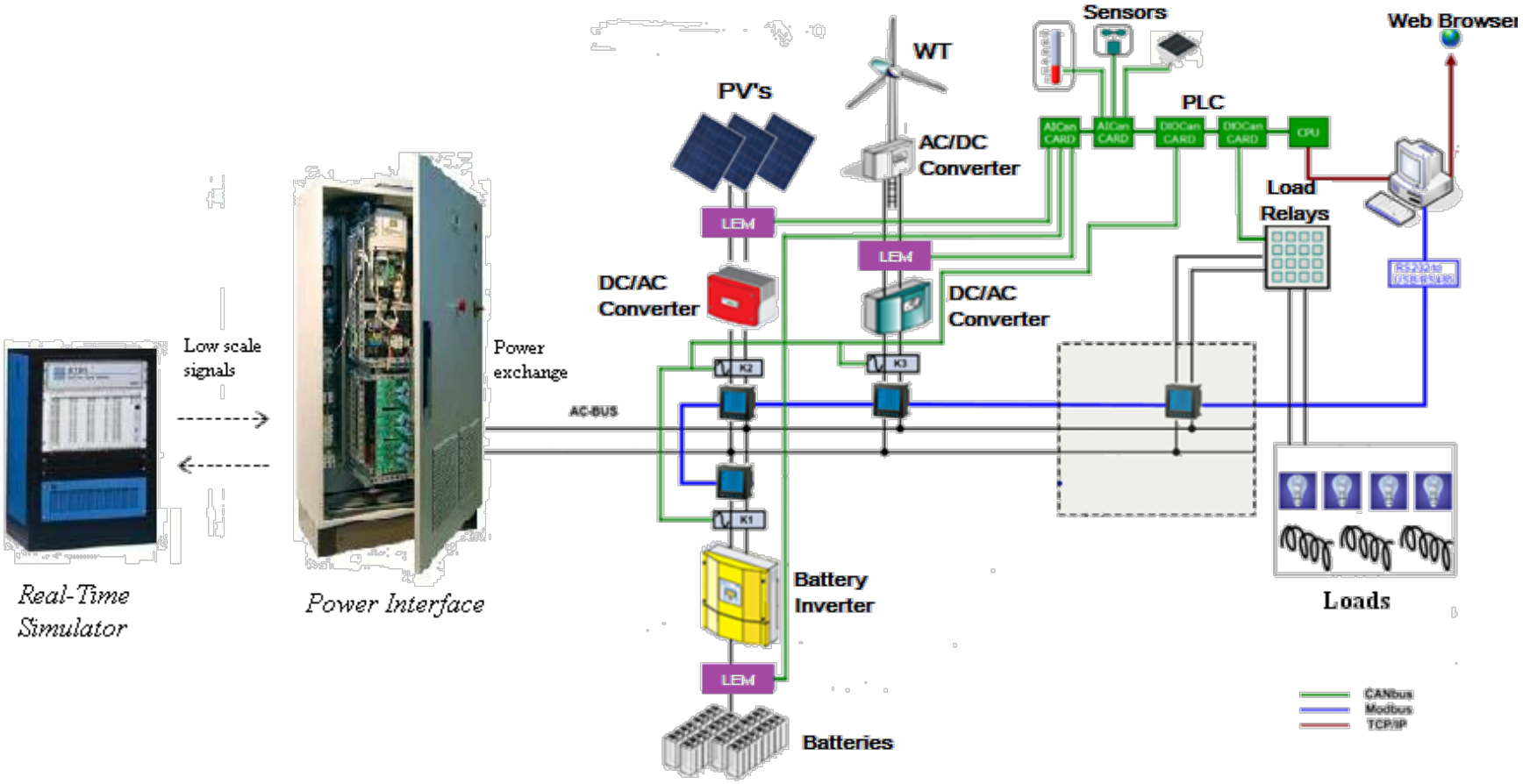
EMIT

ICCS-NTUA - Microgrid laboratory

DERlab



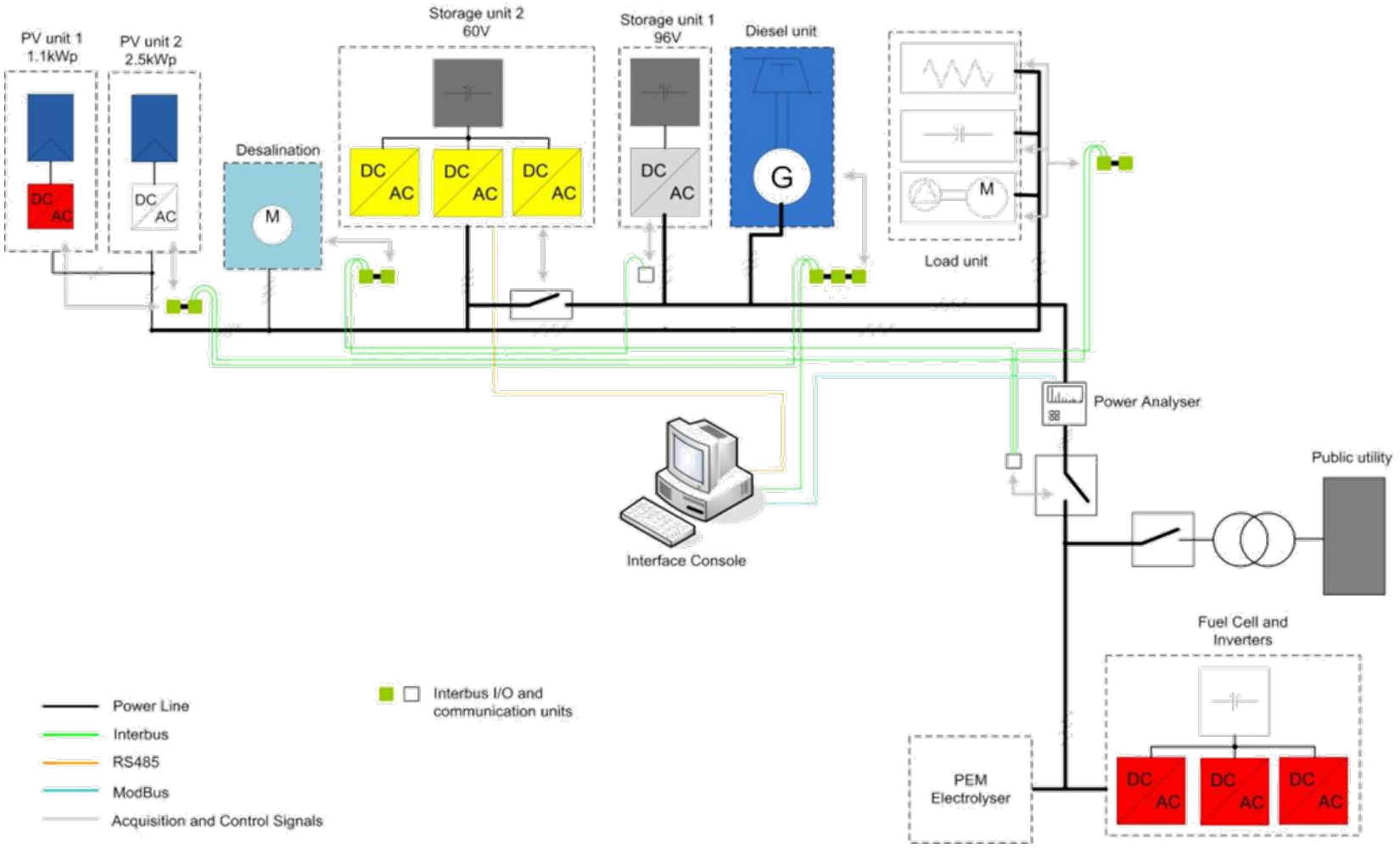
CRES Microgrid laboratory

Description of laboratory equipment

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

Website URL: http://www.der-lab.net/members/cres.html

CRES Microgrid laboratory



NREL Microgrid laboratory

Description of laboratory capabilities

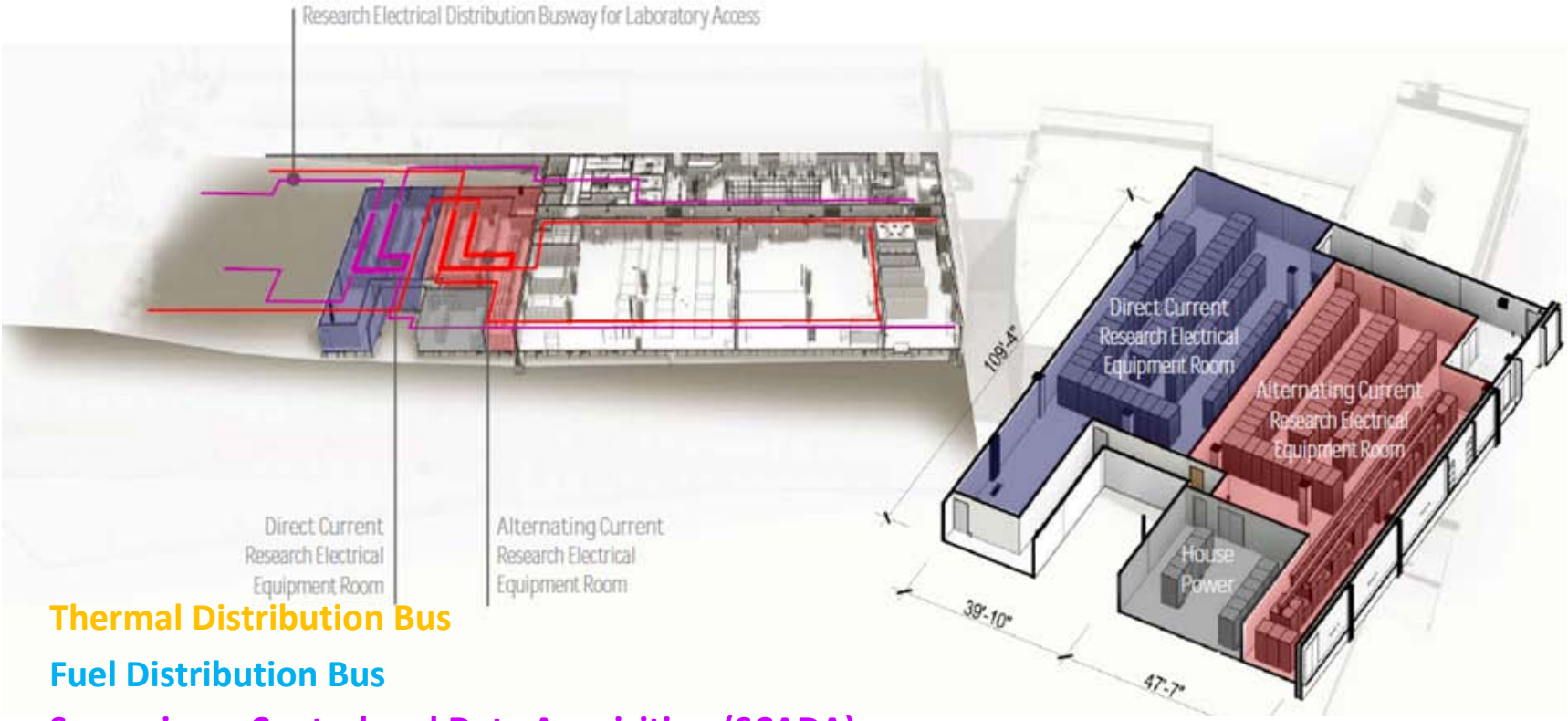
- Distributed Energy Resources Test Facility (DERTF)
  - Testing microgrids up to 200kW
  - Grid Simulators, Load Banks, actual wind turbines and PV systems available
- Energy Systems Integration Facility (ESIF)
  - Opens October 2012
  - Low Voltage (600V and Under) and Medium Voltage (15kV and Under) 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

Website URL:http://www.der-lab.net/members/nrel.html

NREL Microgrid laboratory

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

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



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

SIRFN Subtask 2.4

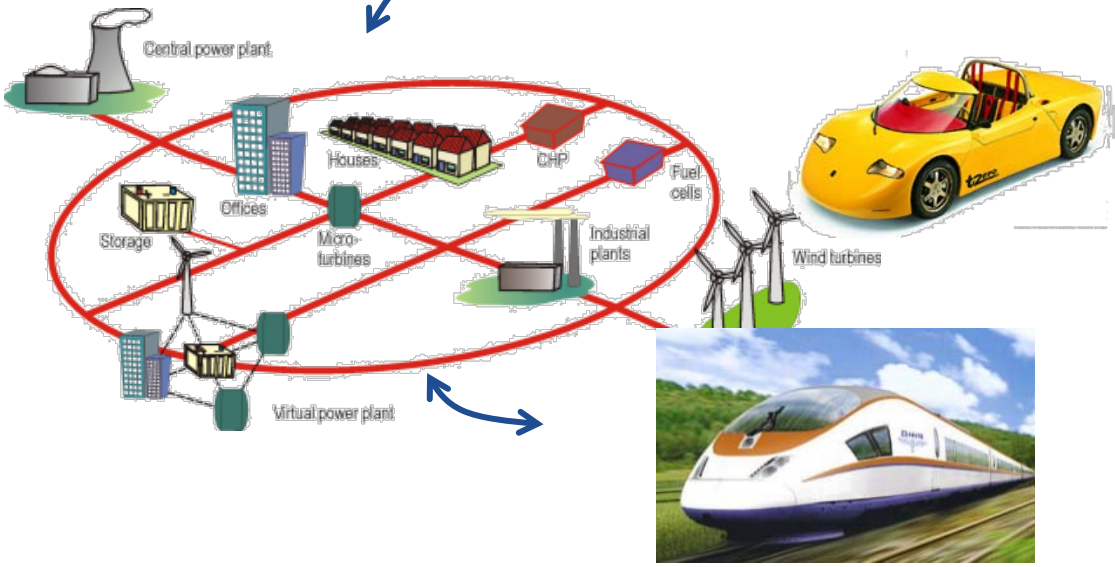
KEMA Microgrid laboratory (FPGLab)

Description of laboratory capabilities

- 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

- 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, 1MVAr)

applications



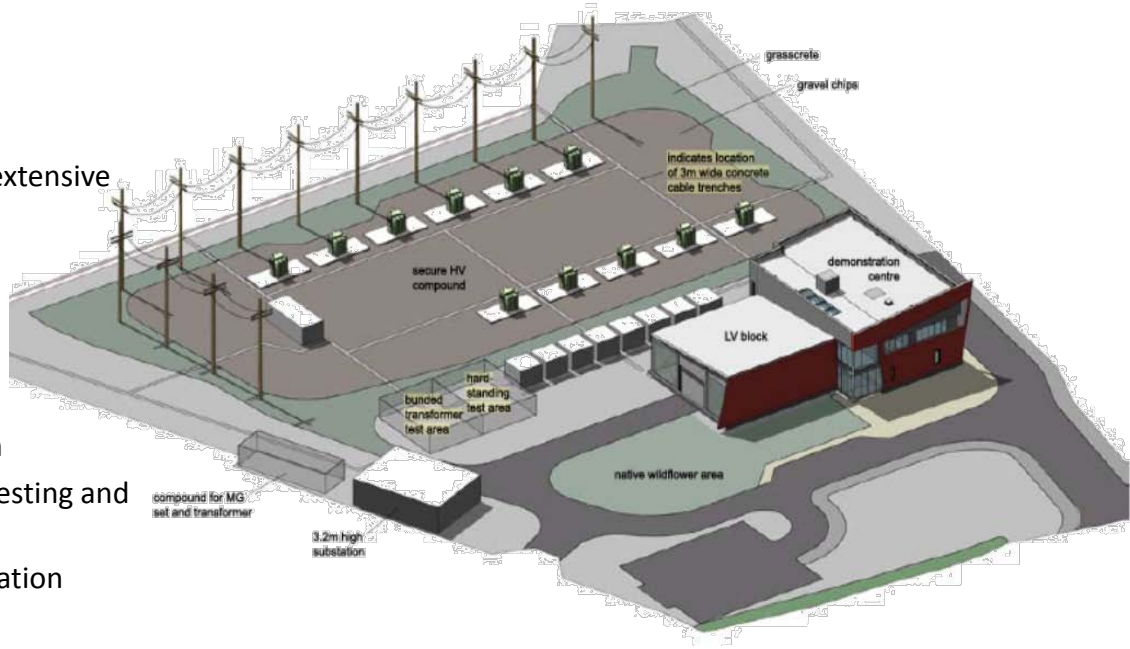
Website URL: http://www.der-lab.net/members/kema.html

SIRFN Subtask 2.4

University of Strathclyde Power network demonstration centre

Description of laboratory capabilities

- 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

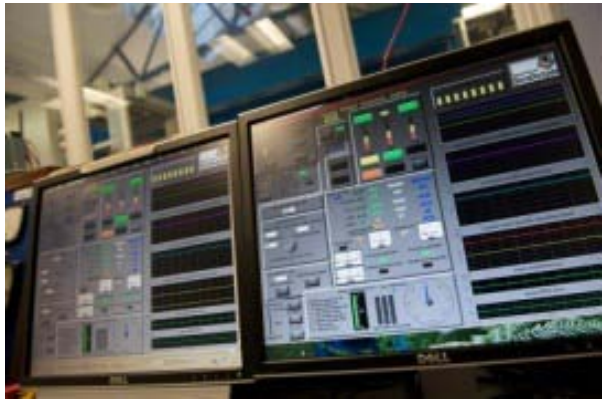
Website URL: http://www.der-lab.net/members/ustrath.html

SIRFN Subtask 2.4

University of Strathclyde Power network demonstration centre

Description of laboratory capabilities (Smart Grid Facilities)

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



Distribution Automation

Desired Level of SIRFN Participation: 1

- 1 = Low 2 = Med 3 = High

Description of Activities

Describe activities in this subtask area with an emphasis on nature of research/testing. Include relevant information on current clients/customers and highlight any unusual capabilities, major accomplishments or relationships.

SIRFN Site Focus Area Lead(s):

Name
Title
E-mail:
Phone:

Name
Title
E-mail:
Phone:

Area for photos, diagrams or other graphic material.

Website URL: http://

Cybersecurity

Desired Level of SIRFN Participation: 1

- 1 = Low 2 = Med 3 = High

Description of Activities

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SIRFN Site Focus Area Lead(s):

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E-mail:
Phone:

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Summary of Capabilities for Simulation and Testing

<u>Loads:</u>

DERlab member laboratories cover cover the full range from LV to HV and up to the MVA range

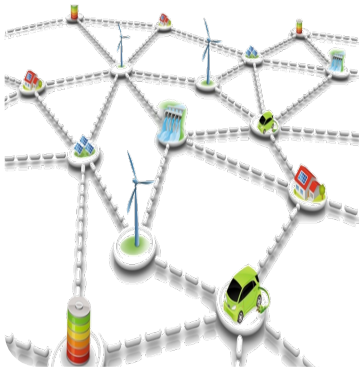
(e.g. Fraunhofer IWES: LV up to 1.25 MVA, MV up to 6 MVA; KEMA: HV up to 1 MVA)

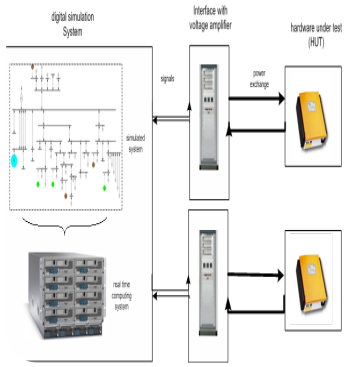
<u>Storage:</u>

Several DERlab member laboratories offer a wide range of energy storage (e.g. CRES: 40kWh) / storage simulation capabilities. (e.g. Fraunhofer IWES: Virtual Battery: Bi-directional power supply with battery characterteristic

<u>Controls:</u>

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





Summary of Capabilities for Data Acquisition and Analysis

Energy Management:

- Embedded Multi-Agent System (NTUA) operating java applications on Windows CE
- OGEMA: Open Energy Management Gateway (Fraunhofer IWES)

Test Configurations:

Please see the individual DERlab member laboratories