# IWES, Germany: Design-Centre for Modular Supply Technology (DeMoTec)

The DeMoTec promotes design, development and presentation of systems for the utilisation of renewable energies and the rational use of energy. IWES and the University of Kassel‘s Institute for Electrical Energy Technology (IEE) have joined forces with companies and other research institutions to perform experiments and demonstrate the state of the art.

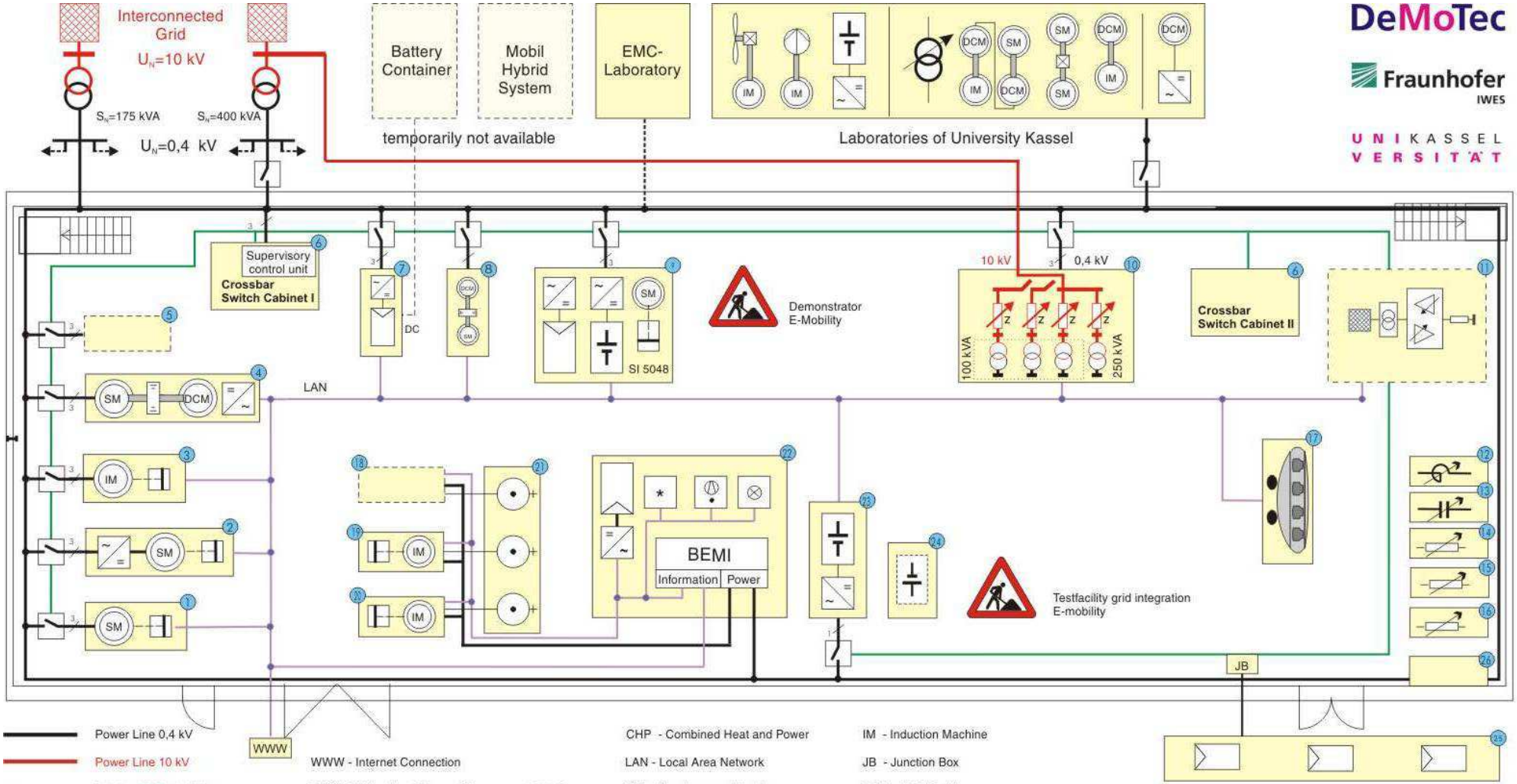
A supply technology, which allows series-produced modules from different manufacturers to be assembled together, is presented. By working closely together with companies, IWES develops the basic systems functions required and contributes to the standardisation of interfaces. In order to guarantee the suitability of the components, whole supply systems are set up in DeMoTec and compatibility tests are performed. IWES also checks and optimises power supply systems with dynamic load profiles and long-term tests, in order to improve reliability.

DeMoTec mainly focuses on electrification with renewable energies using modularly expandable and grid-compatible hybrid power supply systems. A step-by-step expansion of such power supply systems is demonstrated for applications in developing countries, starting with small isolated systems and progressing to grid connected power supply units. The supply units may be connected via a flexible crossbar distributor. This may lead to three island grids, which can be coupled with the help of a medium-voltage network simulator (10 kV), thus creating island systems with a total power of more than 200 kW.

Remote monitoring and control systems are developed and presented in DeMoTec, which allow the economic operation of such modularly structured supply systems – e.g. by independent power producers (IPP).

A DeMoTec master display is being used to monitor the operations of a widely dispersed wind power plant system, which comprises about 80 representatively, selected systems throughout Germany. In this master display, moreover, the monitoring of remote systems as well as the control of active low-voltage grids can also be demonstrated.

For investigations in the test field a portable energy container can be used. With its PV-diesel hybrid system the operation of small wind mills at an island grid and the evaluation of the monitored data are possible.




1. 200 kVA Biodiesel Genset
2. 20kVA Variable Speed Genset
3. 5,3 $kW_{el}$ Rape-oil CHP
4. 80 kVA WEC / Grid Simulator
5. Load Terminal
6. Crossbar Switch Cabinet I
7. 100 kVA Multifunctional PV-Inverter and PV-Simulator (and optional Battery)
8. 15 kVA Mini Grid / WEC-Simulator (SM or ASM)
9. PV-Battery-Diesel-System
10. 10 kV / 1-30 km Hardware Grid Simulator
11. 90 kVA Hardware Grid Simulator
12. Mobile Inductive Load
13. Mobile Capacitive Load
14. Mobile Ohmic Load 210 kW
15. LV Hardware Cable / Overline Simulator
16. Mobile Ohmic Load 3 x 4 kW
17. Control and Visualisation Unit
18. CHP Unit Terminal
19. 1,2 $kW_{el}$ CHP Steam Engine
20. 1,0 $kW_{el}$ CHP Stirling Engine
21. Heat Storage
22. Household Simulators
23. Battery Bank / Inverter
24. Virtual Battery
25. Photovoltaic Facade
26. Test facility

The following components are available:

1. 200 kVA Biodiesel Genset
2. 20 kVA Variable Speed Genset
3. 5,3 $kW_{el}$ Rape-oil CHP
4. 80 kVA WEC / Grid Simulator
5. Load Terminal
6. Crossbar Switch Cabinet I
7. 100 kVA Multifunctional PV-Inverter and PV-Simulator (and optional Battery)
8. 15 kVA Mini Grid / WEC-Simulator (SM or ASM)
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Any new technology for interconnecting distributed generators in a stable, safe and reliable way must be verified and its feasibility must be proven. The DeMoTec provides test facilities which enable tests of generators concerning grid integration issues focussing on controllability, local generator control, power and communication interfaces.

The total available generation capacity is approximately 200 kW (see listing for details). All generators and loads can be connected via a central cross bar switch cabinet to a local grid. Up to three independent grids can be realised simultaneously. These grids may be coupled via a medium voltage network simulator to study the effect of interconnected micro-grids. Control of the connection of the components to the grid, data acquisition, and visualisation is managed by professional software for visualization and industrial process control. The communication needed for this purpose is done via an Interbus-S control line. Extra space is available to integrate custom devices on request.

These functional supply systems are also used for seminars and training courses. Qualified staff from around the world are familiarised with the implementation of new technologies and with the fields of application and modes of operation of these systems.

The access being offered includes the preparatory work: installation of the device including electrical connection and specific instrumentation, researchers and technicians are always present in the lab or the nearby office building, offering continuous support for using test equipment. Individual research topics and test configurations can be realized within technical specifications of the laboratories. You have full access to office devices. A cafeteria is in house, public transportation is easy to reach. Place of employment is near the city centre.

**IWES, Germany: Test Center for Smart Grids and Electromobility (IWES – SysTec)**

In its test centre for smart grids and electromobility, Fraunhofer IWES is developing and testing new equipment and operation strategies for smart low and medium voltage grids. In addition, investigations regarding grid integration and grid connection of electric vehicles and their power generated from renewable energy sources as well as photovoltaic systems, wind energy plants, storage and hybrid systems are carried out under realistic conditions here.

A large open-air ground of approx. 80,000 m² offers sufficient space and very good conditions for solar and wind energy. Furthermore, the open-air ground provides configurable distribution grid sectors (low and medium voltage), as well as a route offering the possibility to test inductive charging systems for electric vehicles.

In the eastern area of the premises there is a hall presently with two laboratory divisions: one of the labs includes a testing area for low and medium voltage converters, electrical machines or grid equipment. There it is possible to develop and test the electrical properties and in particular the ancillary services of remote generators in the power range up to 6 MVA. A mobile test container able to be used to measure the fault-ride-through of generation plants has been integrated into the laboratory. The second lab is equipped with facilities to test grid integration of electric vehicles and power storage. In addition to hardware simulators for batteries, bidirectional charging controllers, charging columns and grid simulators, there is a roller chassis dynamometer for electric vehicles to replicate operational profiles as well as a test facility to analyze inductive energy transfer.

## Services | Products (selection):

- Examination of generation plants in accordance with different grid connection guidelines (low voltage, medium voltage)
- Metrological examination of performance (tripping characteristic) of protection devices at distribution grid components
- Measurements of grid quality and analyses of performance
- Determination of energy yields and comprehensive characterisation of photovoltaic modules and systems under realistic operational conditions
- 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
- Investigation of electric vehicles in combination with virtual batteries, also when the vehicle is in operation (roller chassis dynamometer, temperature chamber)
- Real time distribution grid simulations to test control centres and the grid integration of distributed generators, electric vehicles and power storage (hardware-in-the-loop)

- Investigation of operating performance strategies for individual plants and hybrid systems (e.g. photovoltaic, storage facilities, heat pumps, combined heat and power)
- Investigation of inductive energy transfer systems

More information is available on

http://www.iwes.fraunhofer.de/en/labore/iwes_systec_testcenterforsmartgridsandelectromobility.html