

Research Infrastructure

SYSLAB

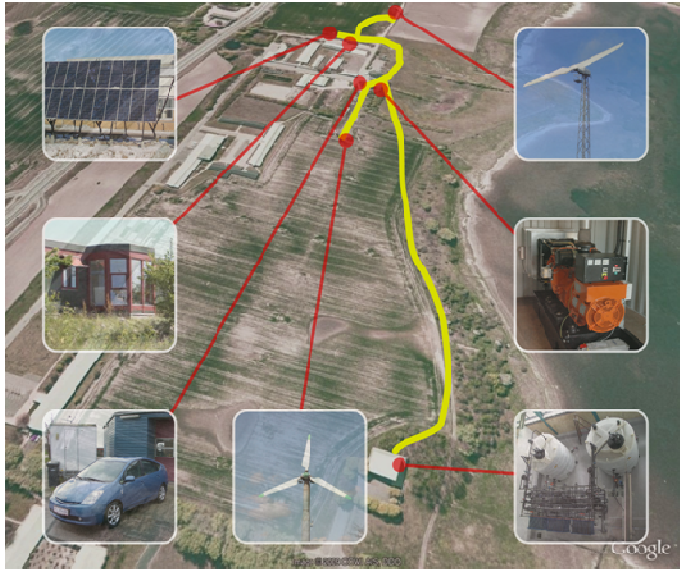


Figure 1 Geographical layout of SYSLAB on the Risø Campus

The SYSLAB facility is spread across multiple locations around the former wind turbine testing site, making use of Risø's spacious premises. Its backbone is formed by a 400V grid with six busbars at three substations. A central crossbar switch with tap-changing is allowing meshed operation and power flow control.

All units on the grid – generators, loads, storage systems, switchgear – are automated and remote-controllable. Each unit is supervised locally by a dedicated controller node. The node design combines an industrial PC, data storage, measurement and I/O interfaces, backup power and an Ethernet switch inside a compact, portable container. All nodes are interconnected via redundant high-speed Ethernet, in a flexible setup permitting on-line changes of topology and the simulation of communication faults.



Figure 2 Node computer in SYSLAB

The result is a decentralised setup that does not enforce a particular physical location for the supervisory controller – the whole system can be run centrally from any point on the network, or serve as a platform for decentralised control, for example through software agents.

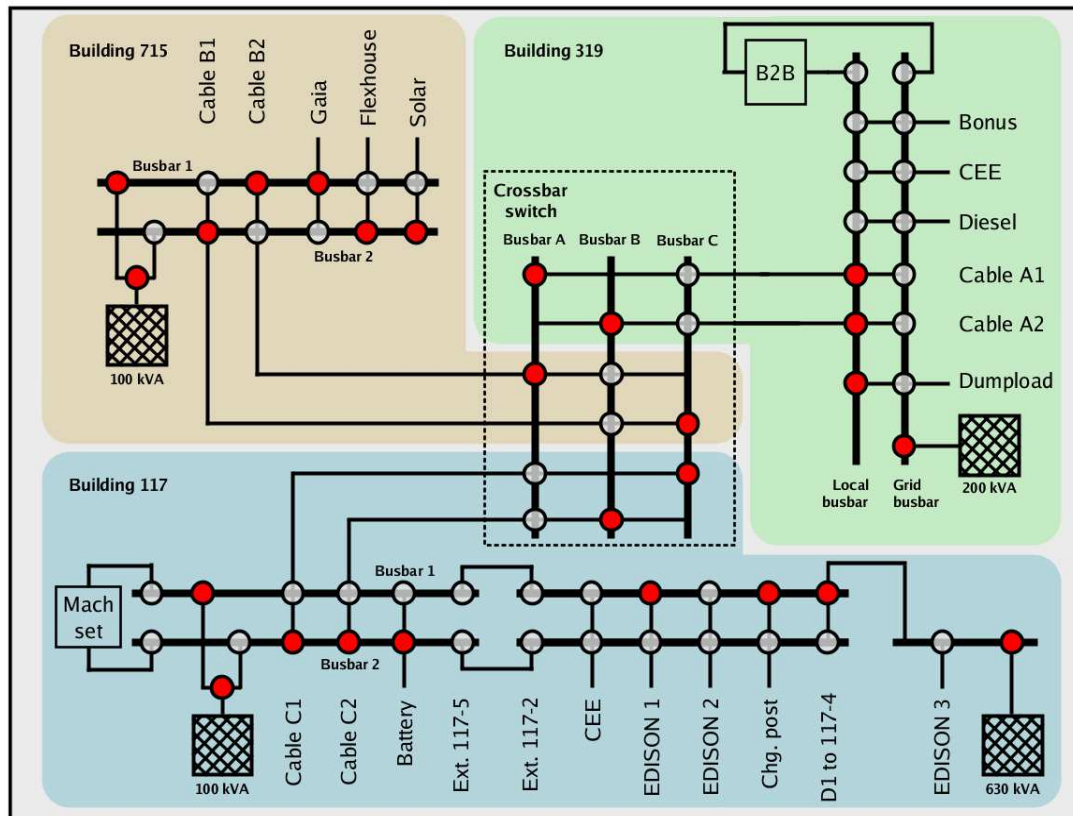


Figure 3 Layout of SYSLAB power system

Energy resources on the SYSLAB grid:

- Photovoltaic (7 kWp)
- Gaia wind turbine (11 kW)
- Bonus wind turbine (55 kW)
- Diesel generator set (48 kW/60 kVA)
- 4 controllable load banks (180 kW total)
- Back-to-back converter (30 kW/45 kVA)
- Office building (20 kW)
- Vanadium battery (15 kW/120 kWh)
- Motor-generator set (30 kW)
- Plug-in hybrid car (9 kWh)
- Capacitor bank (46 kVAr)
- Test benches (300+2x50 kVA)

FlexHouse

The Risø FlexHouse is a small office building which has been converted into a live experiment on active load management, to explore the technical potential for actively controlled buildings in intelligent power grids. Unlike most other buildings at Risø, its energy supply is purely electrical.

With a peak load of around 20kW, the building is well-sized for parallel operation on the SYSLAB power grid. All loads can be controlled by the central building controller which receives data and events from wireless switches and sensors. In each room, a small touch-screen user interface can be used to influence the controller policy. Through its own grid control node, the building controller can get information on the status of the power grid, and adapt its control strategy accordingly. Active policies, measurement data and user settings can be communicated back to the grid.



Figure 4 FlexHouse with associated PV installation

Offered Services

The SCADA system provides a platform for research in distributed systems control and communication and it provides infrastructure for making access to the high number of control signals available for controllers.

- Control platform for access to DER units and enabling system wide control
- Infrastructure for supporting different concurrent communication standards
- Data logging and retrieval
- Remote and automated operation
- Access to meteorological data
- Interfacing to other control platforms such as Matlab

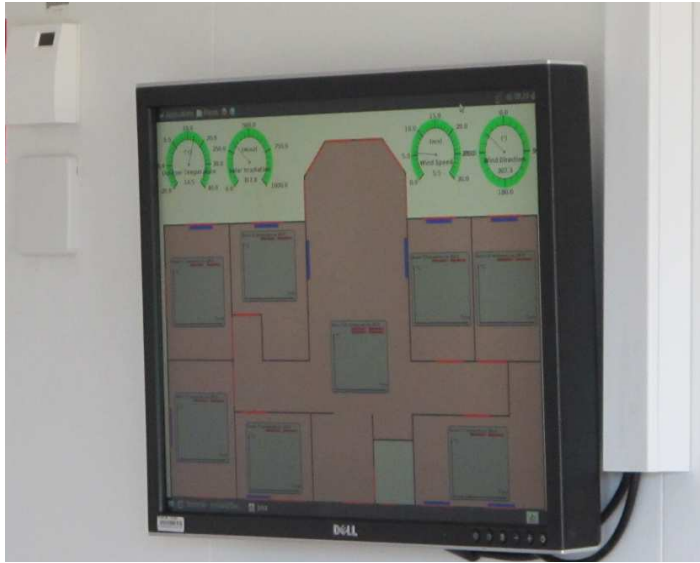


Figure 5 Monitor displaying state of operation of FlexHouse