PowerLabDK

1 Bornholm Power System

Test and demonstration in full-scale renewable energy laboratory

Test and demonstration of Smart Grid and other technologies under realistic and stressed conditions, corresponding to future renewable-based energy systems.

Fluctuating power test scenarios:

▶ Electric power distribution grid with 28,000 customers (55 MW peak)

▶ Approx. 30% wind power penetration (yearly average)

▶ Equivalent to 1% of Denmark with regard to area, population and energy consumption

▶ Distributed energy resources: Solar PV, combined heat and power, electric vehicles, biogas, district heating etc.

▶ Islanding operation capability

▶ Integration with Intelligent Control Lab at DTU

Applications

Full scale analysis, test and demonstration of:

▶ Distribution grid automation

▶ Customer behavior

▶ Electricity markets

▶ Wind turbine control

▶ Frequency control

▶ Wind power and PV integration

▶ Electric vehicle integration

▶ Islanding operation, loss of mains

▶ Energy forecasting systems

2 Bornholm Power System

Supervision and measurement systems

CONTROL ROOMS WITH SCADA SYSTEMS
Operational ABB NM SCADA at Østkraft
Experimental ABB NM SCADA at DTU
Measurements collected with 1 s time resolution
1,300 analogue signals 2,200 digital signals

ELSPEC G4430 BLACKBOX POWER QUALITY RECORDERS
All network parameters with up to 1,024/cycle resolution
10 units in the grid + 7 units in the power plant

PHASOR MEASUREMENT UNITS (PMU'S)
Voltage and current RMS + phase with 20 ms time resolution
Extremely accurate time stamping

INTERVAL METERS AT CUSTOMERS
Advanced 5 min interval meters

FORECASTING SYSTEMS
Wind power generation, PV generation, electricity and heat demand

Technical Data of the Bornholm Power System:

Property	Value
Customers	
Number of customers	~28.000
Number of customers (> 100.000 kWh/year)	~300
Total energy consumed	250 GWh
Peak load	55 MW
Generators	
1 CHP steam turbine (wood/coal/oil chips)	37 MW
35 wind turbines	30 MW
SOLAR PV (2012)	5 MW
2 gas engines (biogas)	2 MW
14 backup diesel generators (oil)	34 MW
1 backup steam turbine (oil)	25 MW
Electric vehicles (under roll-out)	

Property	Value
Grid	
60 kV grid	131 km
Number of 60/10 kV substations	16
10 kV grid	927 km
Number of 10/0.4 kV substations	1039
0.4 kV grid	1913 km
Communication	
Fiber network between 60/10 kV substations	131 km
District heating	
Number of district heating systems	5
Total heat demand (in 2007)	560 GWh
Normal operation mode	Interconnected Nordel