MICROGRIDS – Novel Architectures for Future Power Systems, Paris, France, 29 January 2010

Field Tests on Actual Microgrids

Highlight results from the case of the BORNHOLM island

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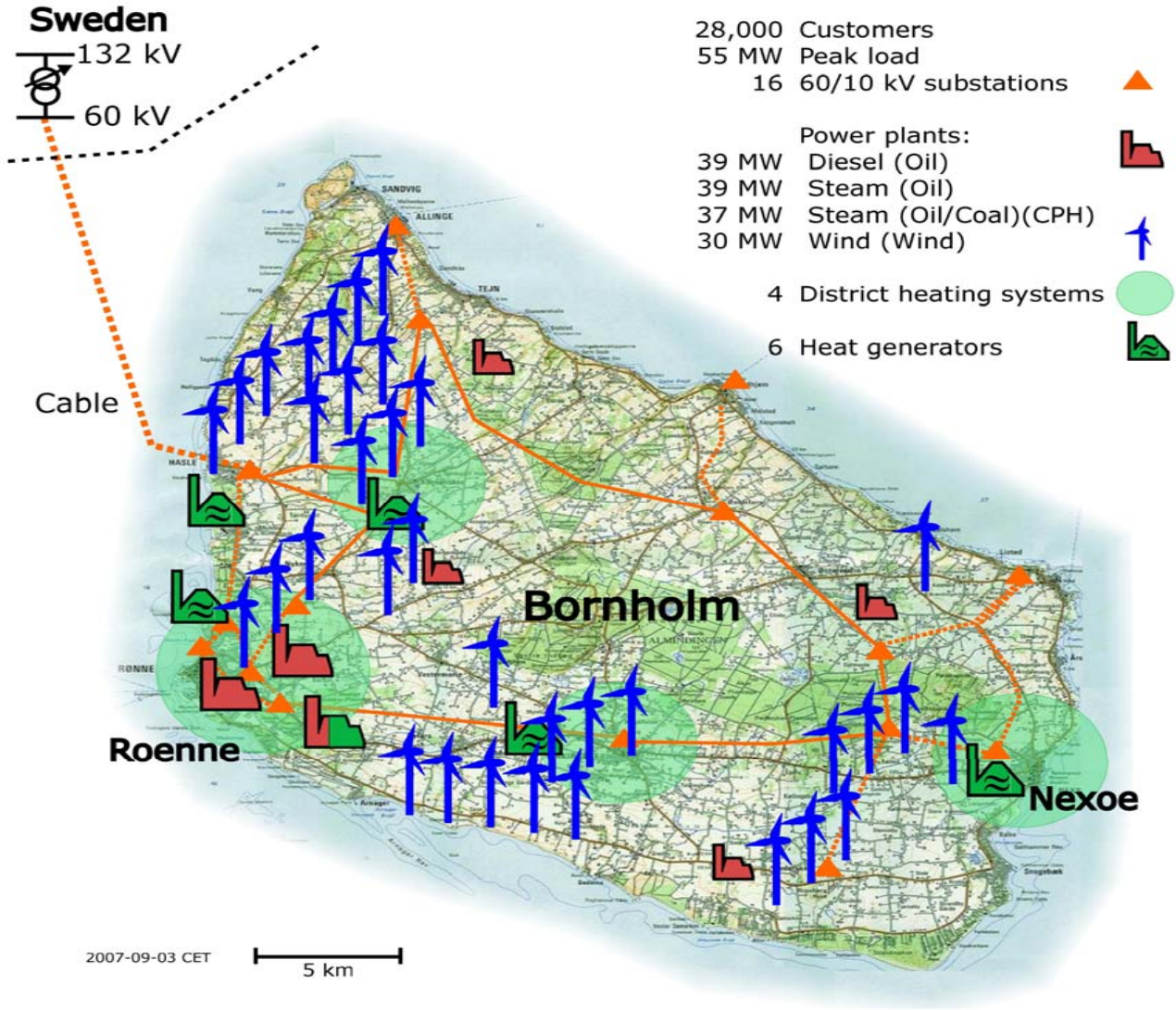
Description of the Microgrid



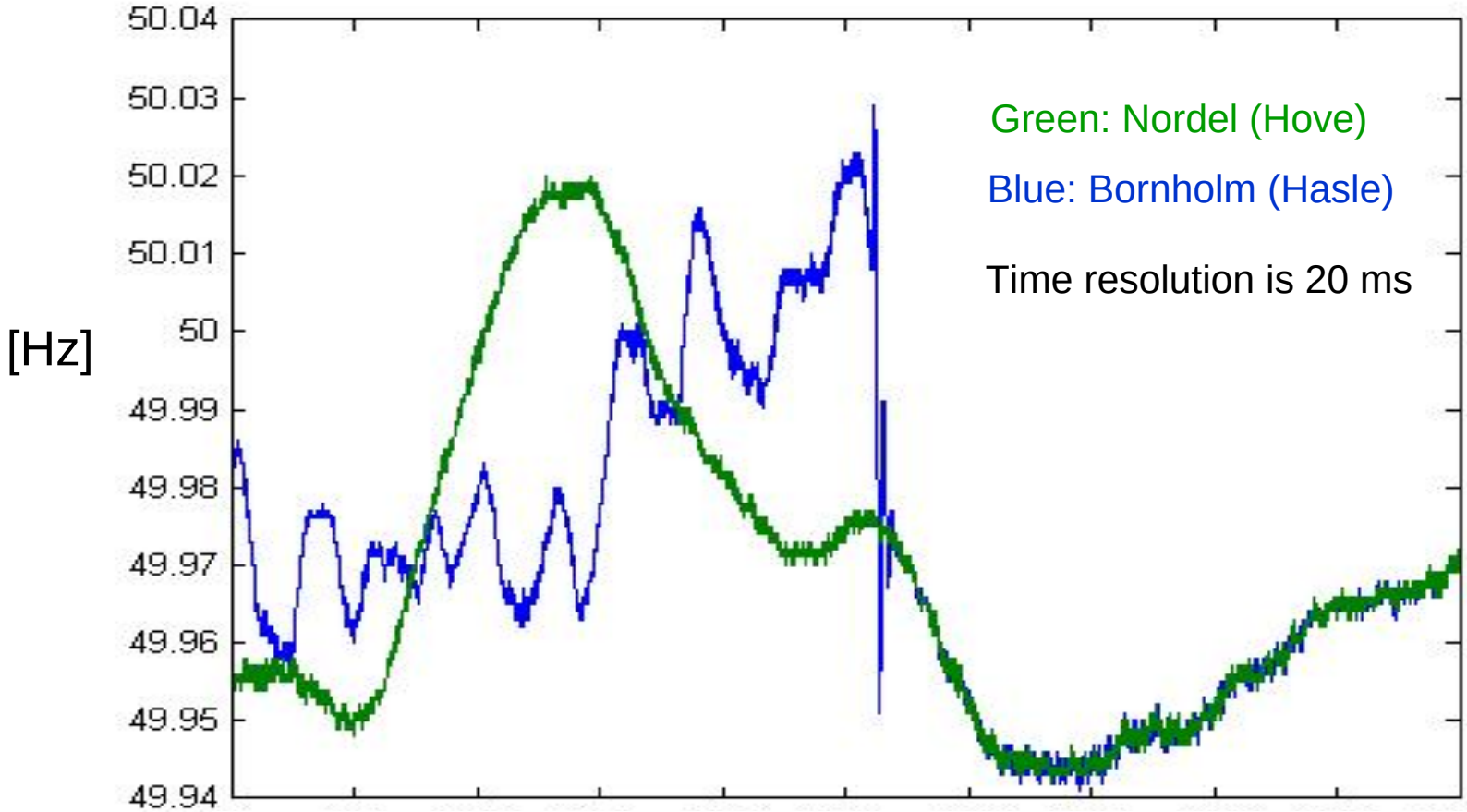
Objectives of the DEMO case

- Describe
  - all elements in a specific Multi-Microgrid f-ex.
  - Load, lines, sub-stations, CHP units, Wind turbines, Reactive resources
- Establish
  - A computer model for the multi-microgrid
  - the forecasting functions: Load and Production
  - the normal security functions (Based on loadflow calculations)
- Simulate
  - The operation of the Multi-Microgrid
- Describe
  - The Multi-Microgrids ability to
  - Balance the active and reactive power
  - to blackstart
  - to reconnect to the main grid
- Demonstrate
  - Island operation
  - Model estimation
  - « fuzzy » state estimation

Demonstration of island operation

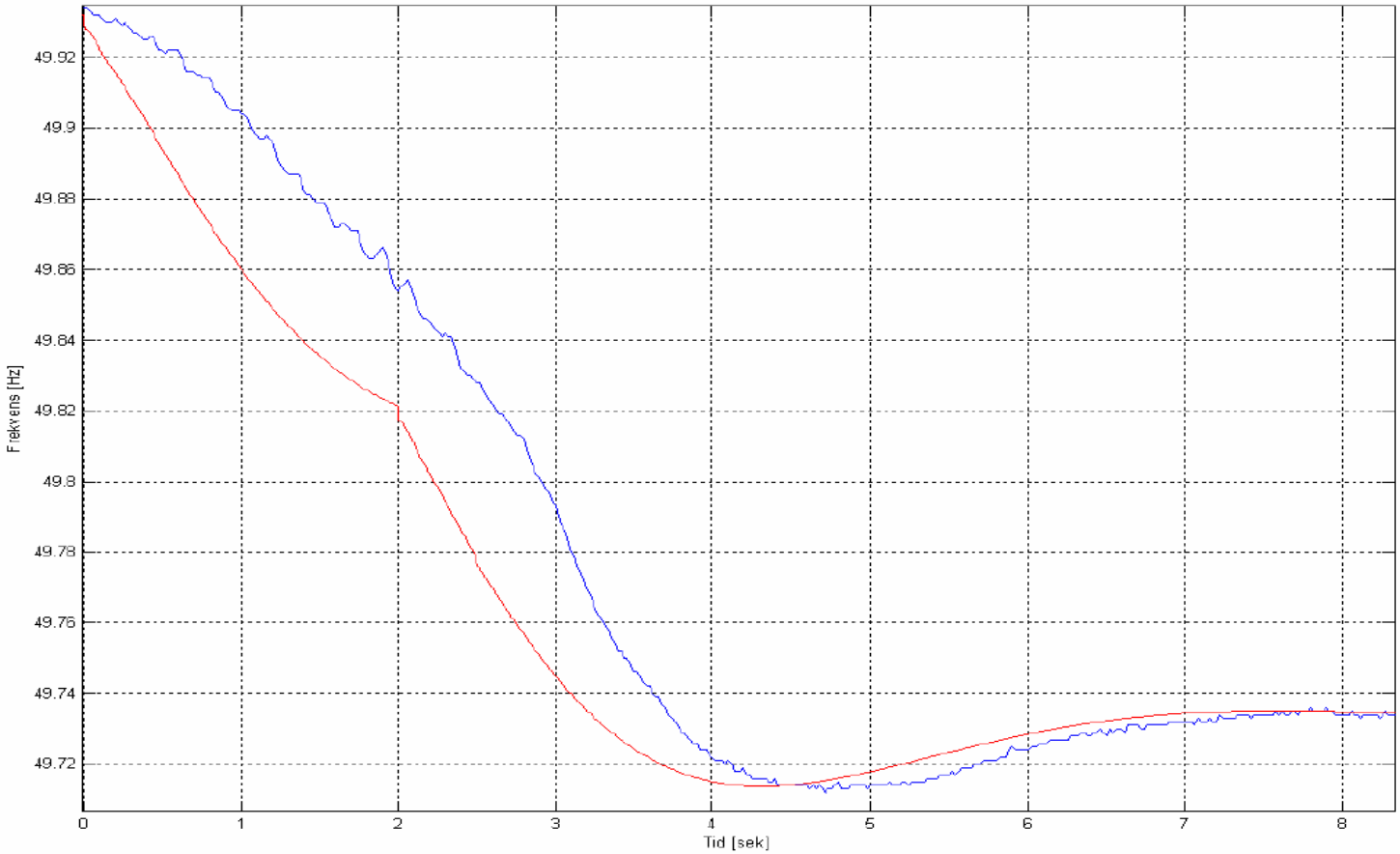
Succesfull Island operation

Reconnection 2007-09-14

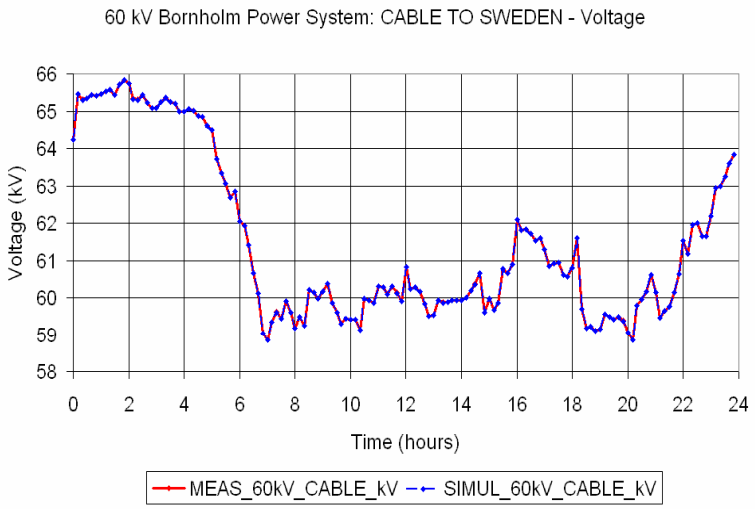


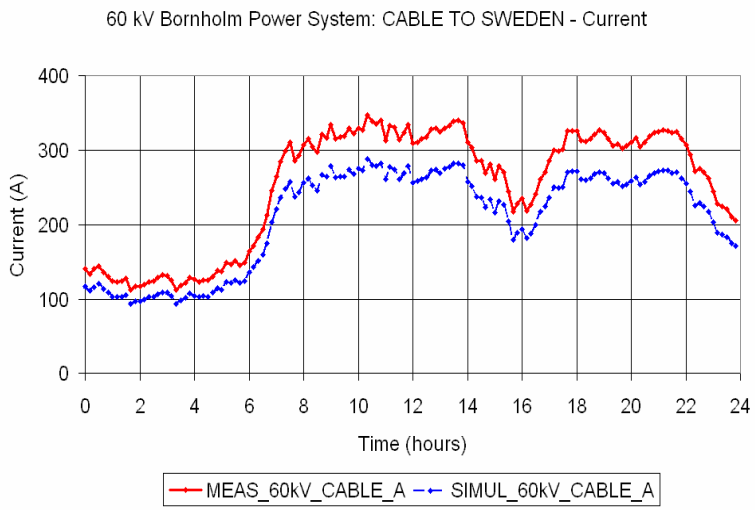
Demonstration of model estimation

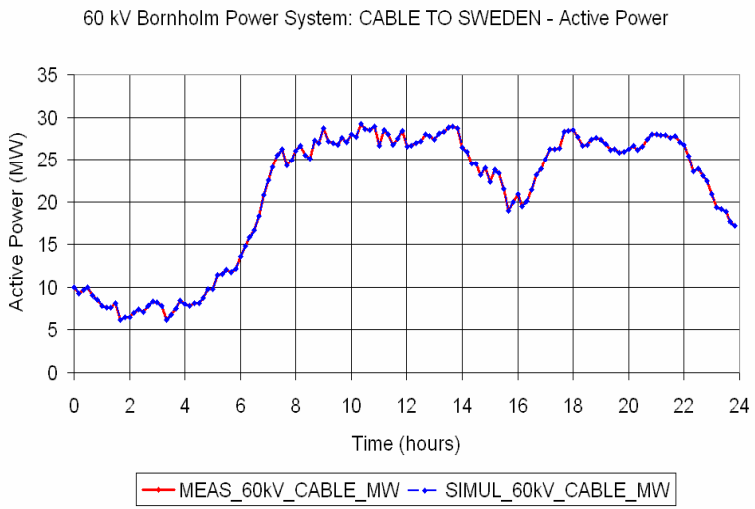
Drop of 1 MW Unit – 2007-09-12

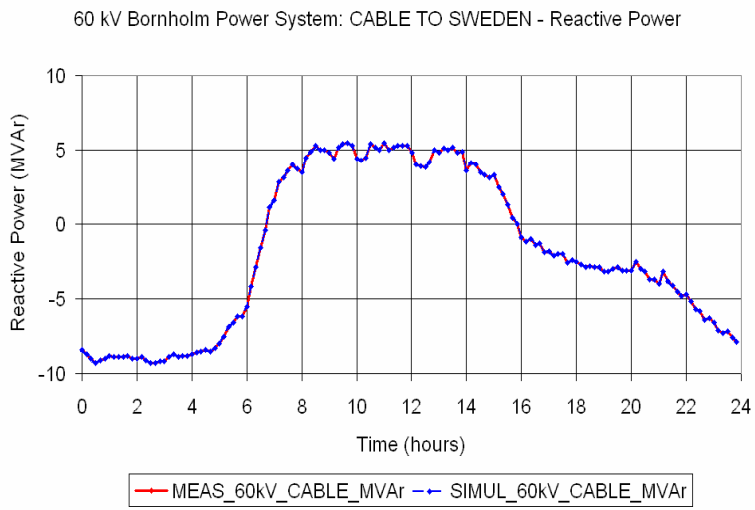


Demonstration of « Fuzzy » state estimation

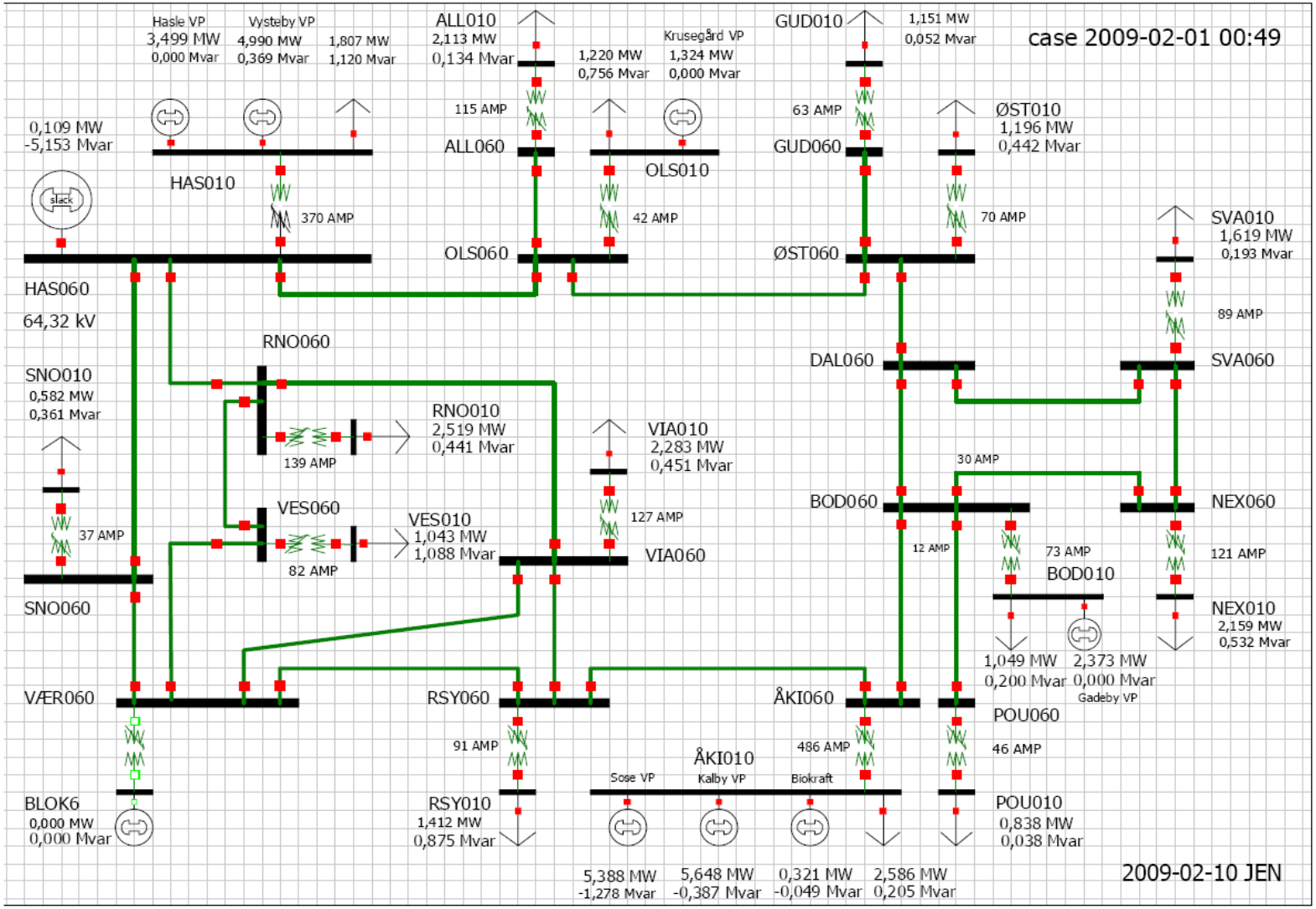




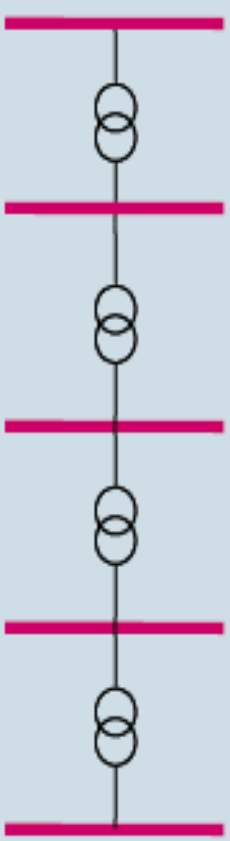




Demonstration of « Fuzzy » state estimation



Generators and voltage level in DK West



400 kV

4 central CHP units (1488 MW)

150 kV

6 central CHP units (2014 MW)
Horns Rev offshore wind farm (160 MW)

60 kV

17 dispersed CHP units (569 MW)
34 wind turbines (41 MW)

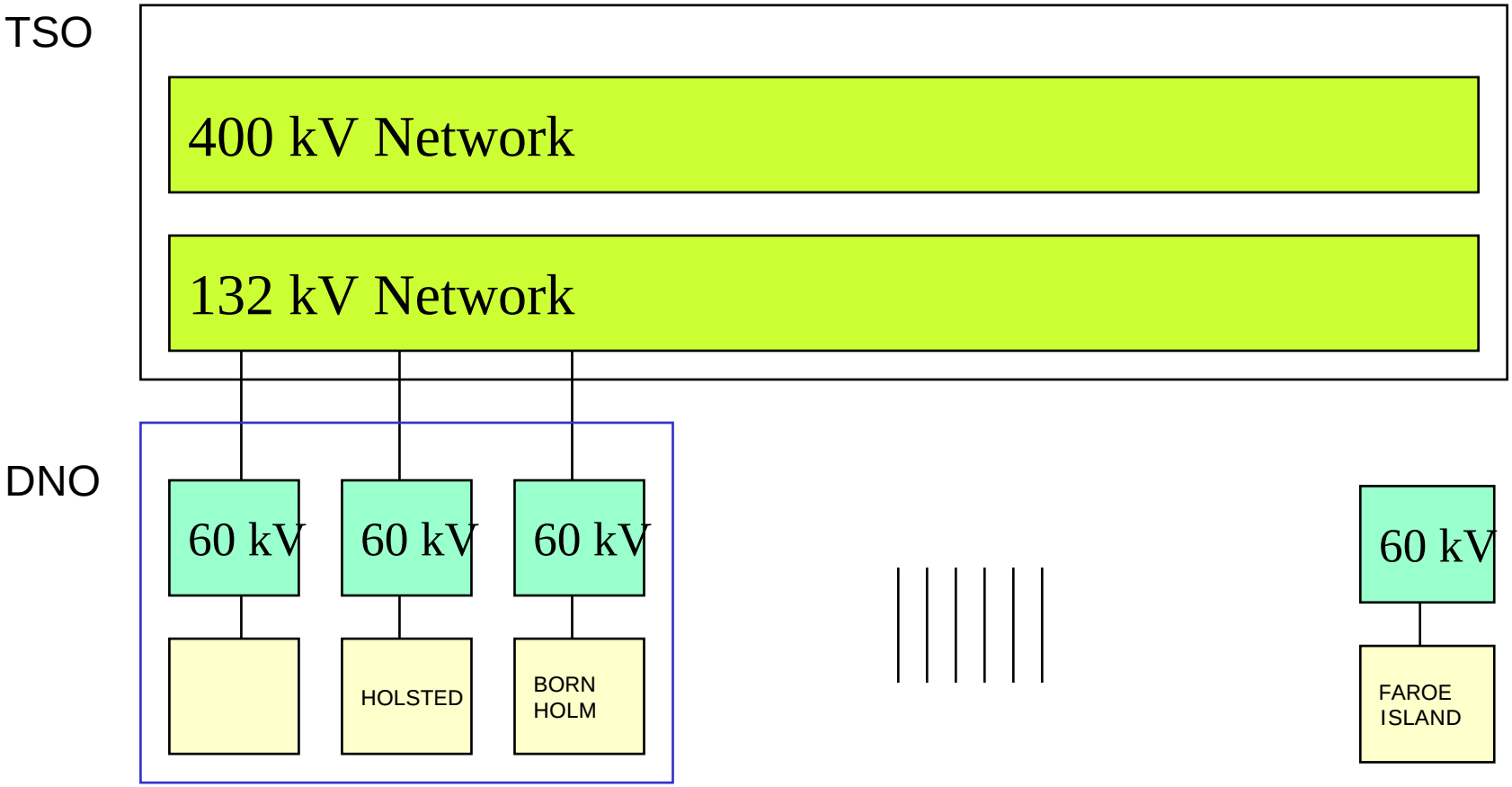
10-20 kV

475 dispersed CHP units (991 MW)
2180 wind turbines (1597 MW)

0,4 kV

260 dispersed CHP units (83 MW)
1860 wind turbines (576 MW)

Network structure in DK



Things to remember

A DNO do not normally have

- An IT database for the MV and LV system, they have maps
- MW and Mvar measurements, they have Amps (Current)
- Computer network model, they have spreadsheets
- Measurements in the range of 0-60 minuts, they have 1 hr values

Some DNO's have

- a Computer model for design, but not for operation

Many vendors are not aware of the possibility for two-way flows

Ships outside Bornholm 2010-01-20

« Snow hit Bornholm » has the power back

Sneramt Bornholm har strøm igen

Søndag d. 10. jan. 2010; kl. 16:36 af Jeppe Lykke Hansen for TV 2 Nyhederne

Foto: TV 2

End

Photo: Aircraft carrier MIDWAY, San Diego, 2009