First World Wind Energy Conference - Berlin 2002

Operation and Planning of Grids with High Levels of Wind Power

Matthias Luther, E.ON Netz GmbH

Uwe Radtke, E.ON Netzt GmbH

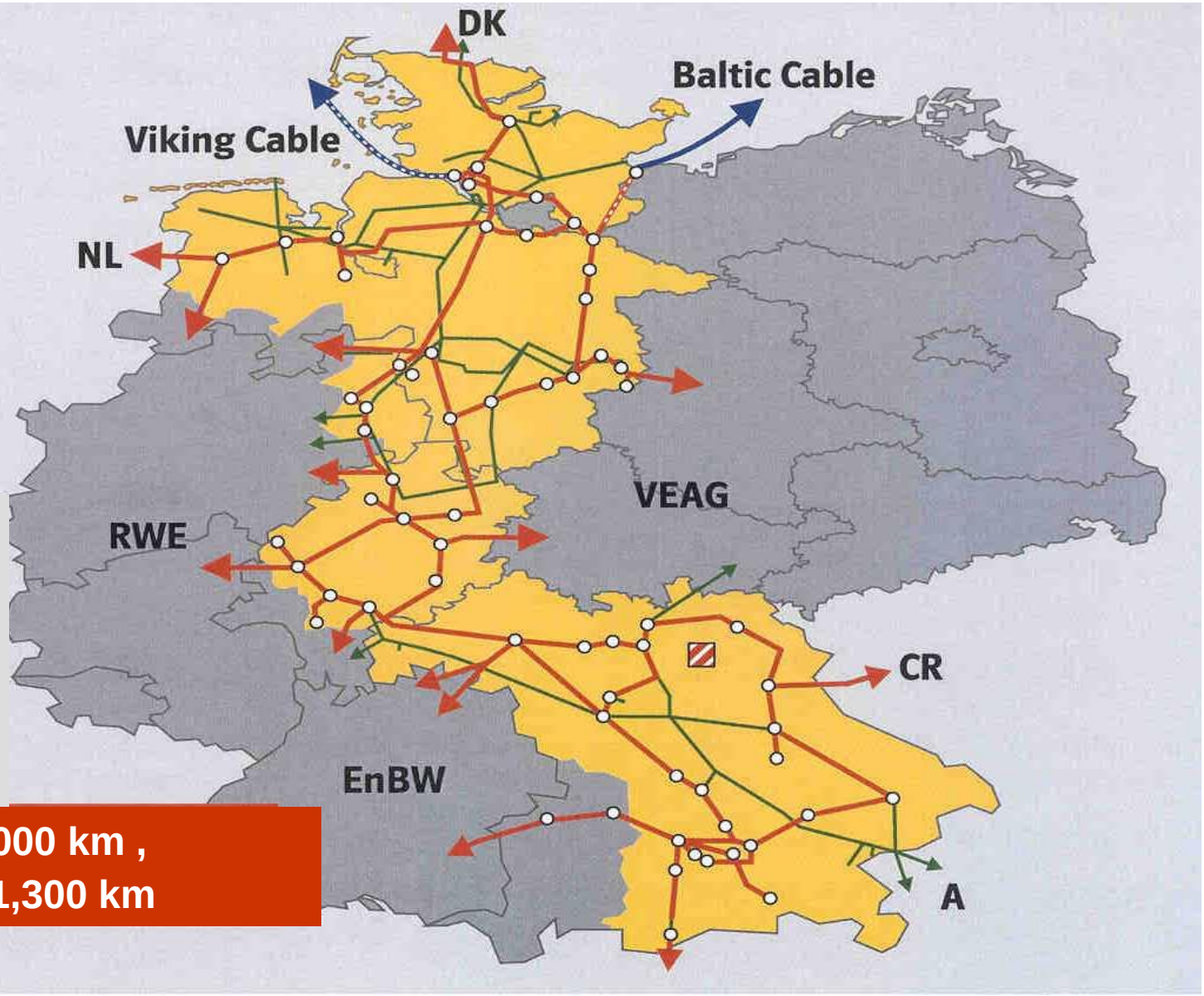
Operation and Planning of Grids with High Levels of Wind Power

Presentation subjects:

- Present use of wind energy in Germany
- Wind energy converters in the E.ON Netz control area
- System and bottleneck management
- Grid development and requirements of wind energy converters
- Maintenance of additional reserves from power stations
- Summary

E.ON Netz GmbH

control area

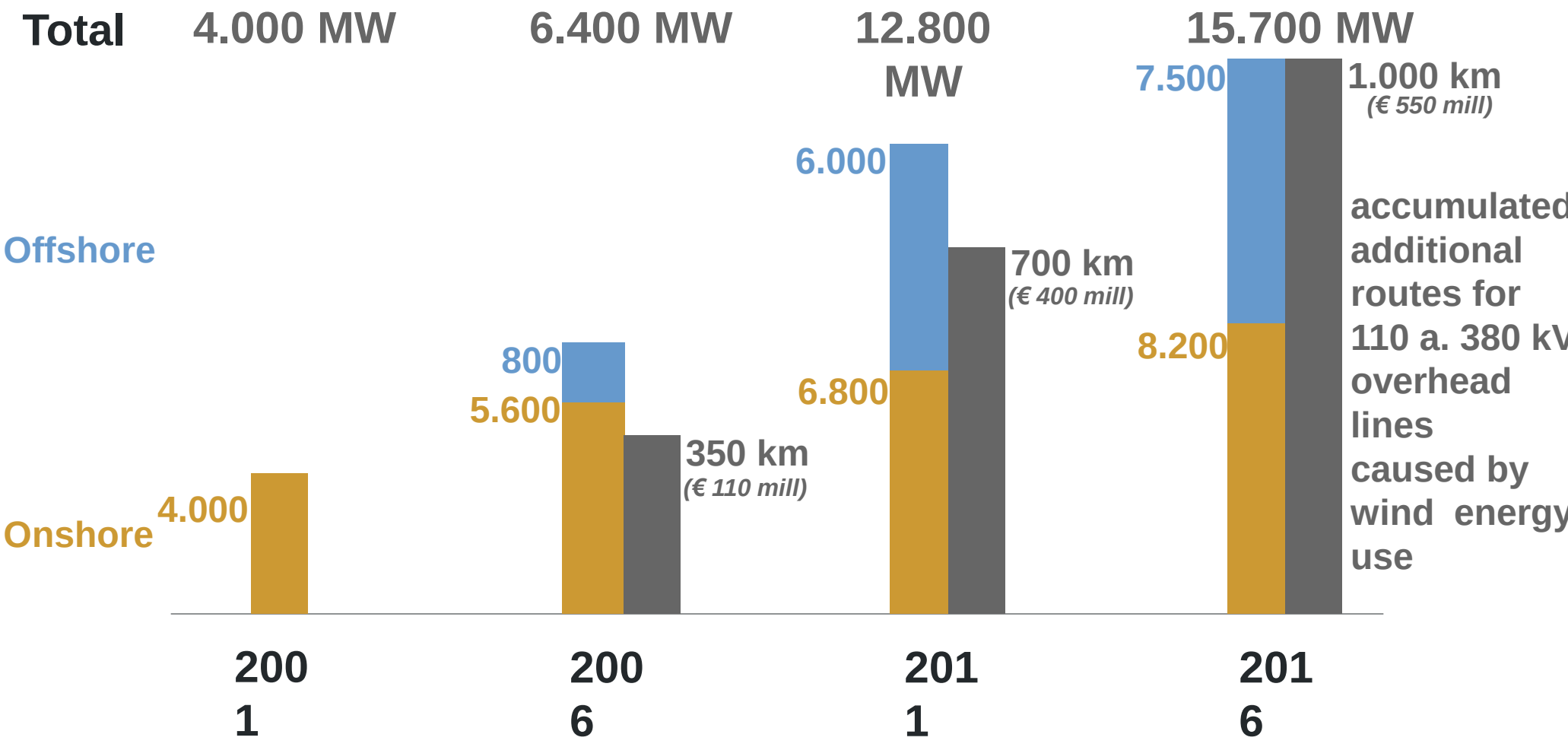


- head office
- substations
- overhead line 380 kV
- overhead line 220 kV
- direct current link
- planning state

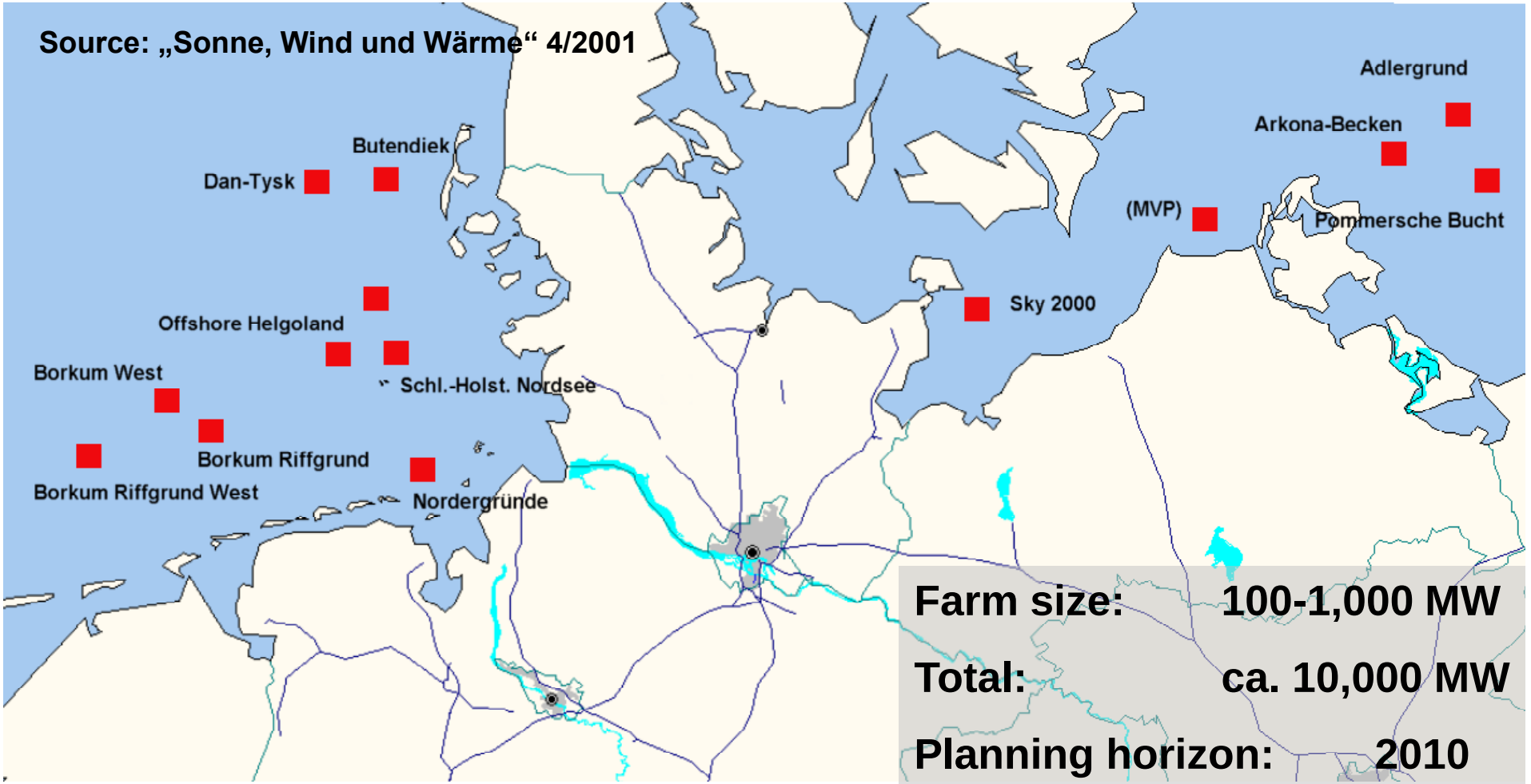
total network length 36,000 km ,
transmission network 11,300 km

State: 2000
without 110 kV system

Expected development of wind energy use in the E.ON co area (in MW) and additional overhead lines (in km)



Off-shore wind power - present projects in Germany

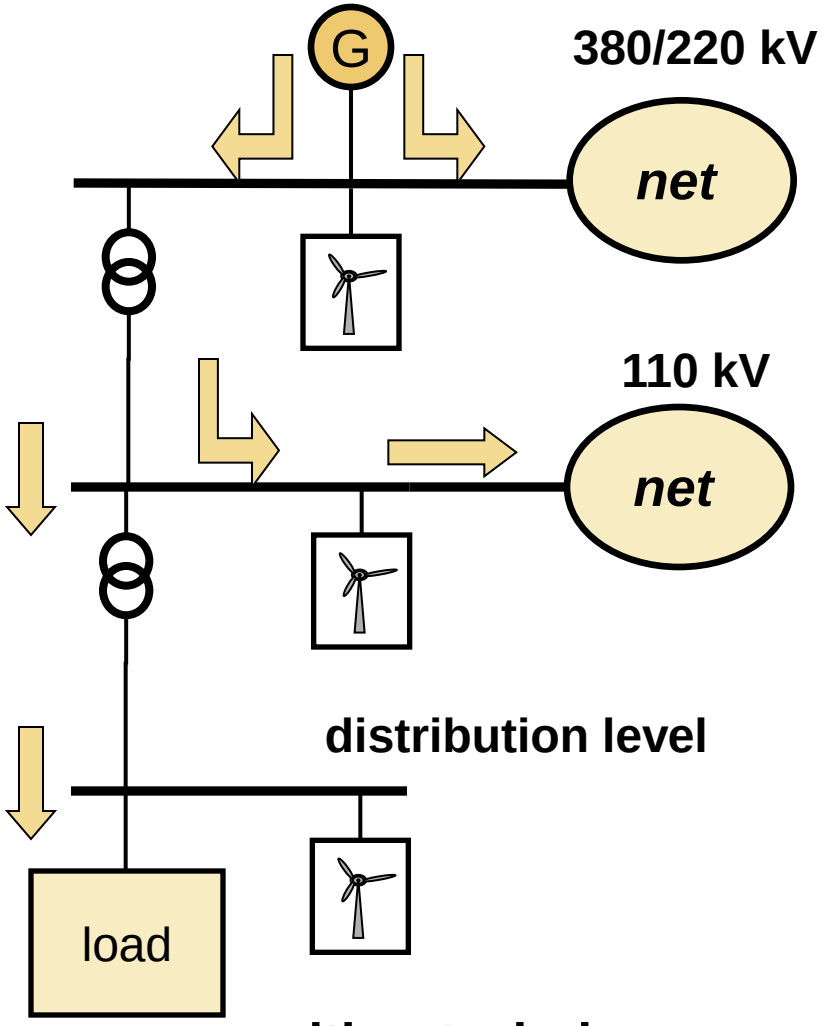


Technical limits considering large scale wind power

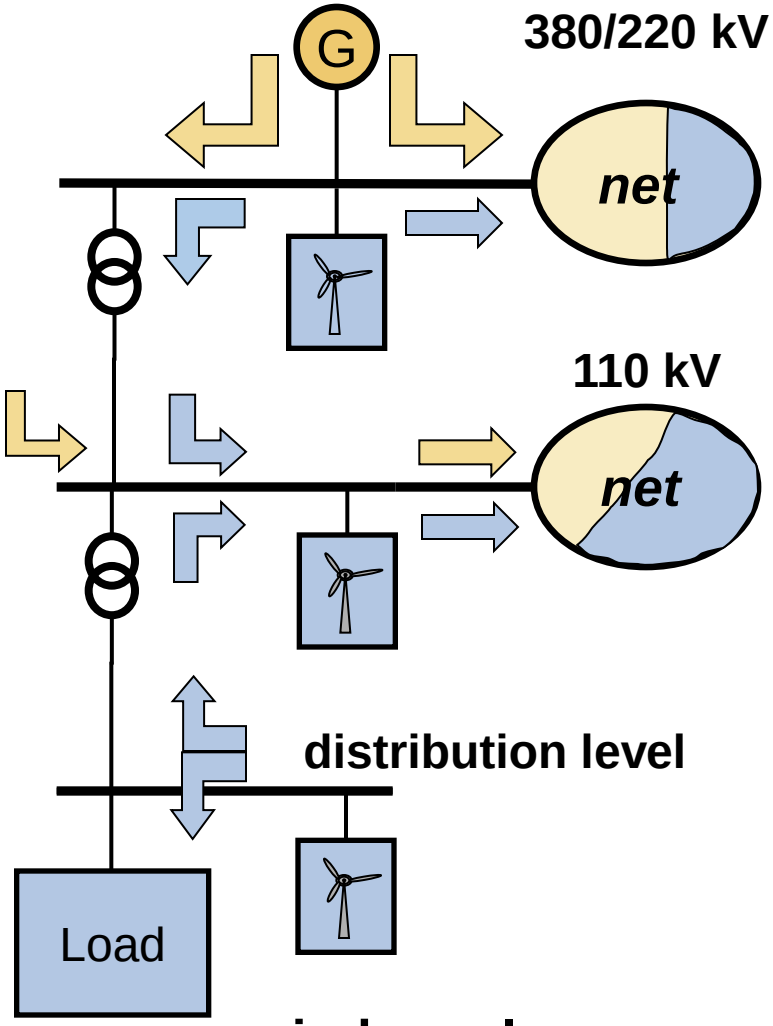
- thermal overload of electrical equipment
- loss of voltage stability
- loss of frequency stability

Main task of the transmission system operator:
Provision of secure system performance without any reduction of service reliability

Power flow and wind power supply

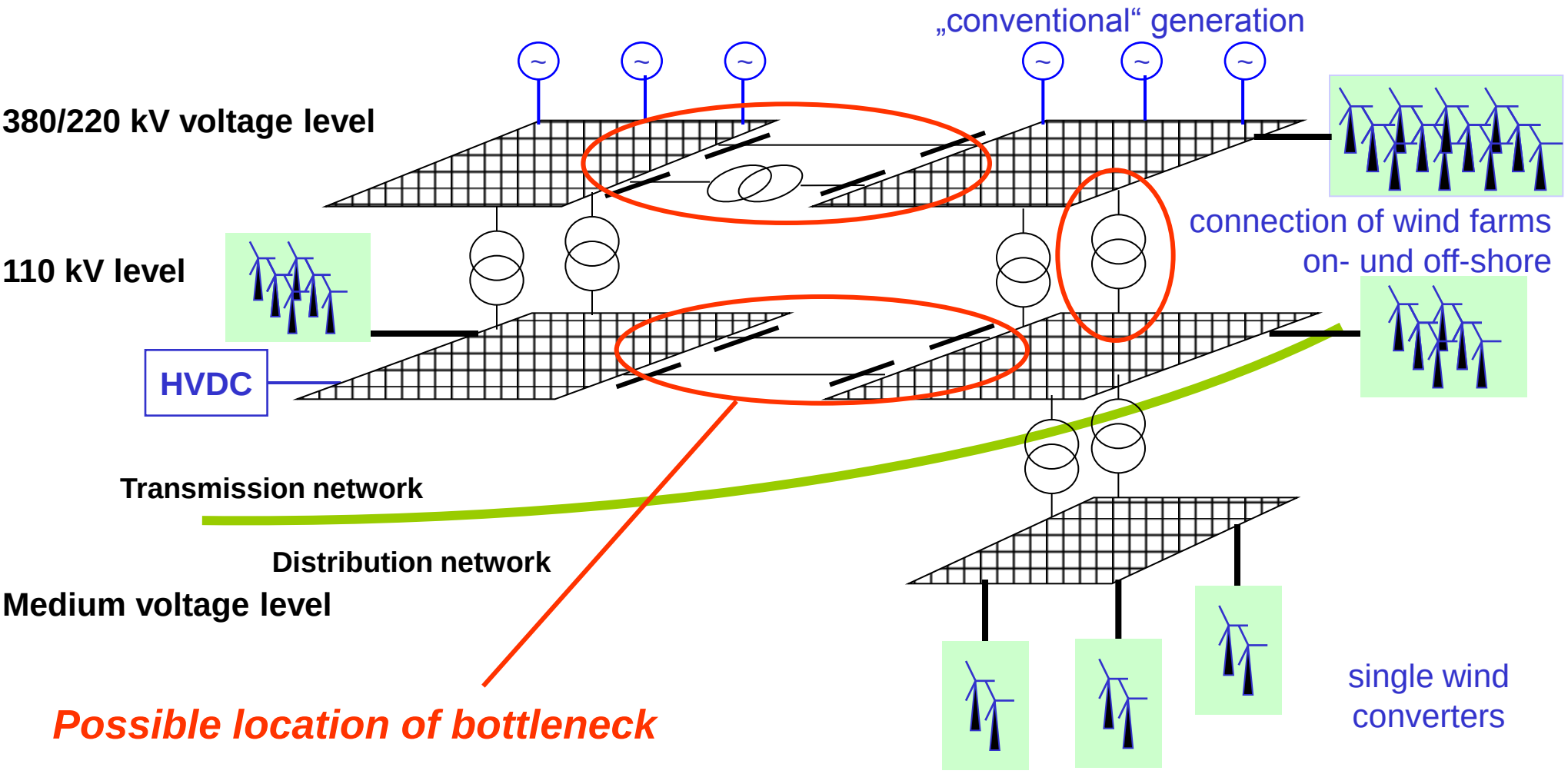


without wind

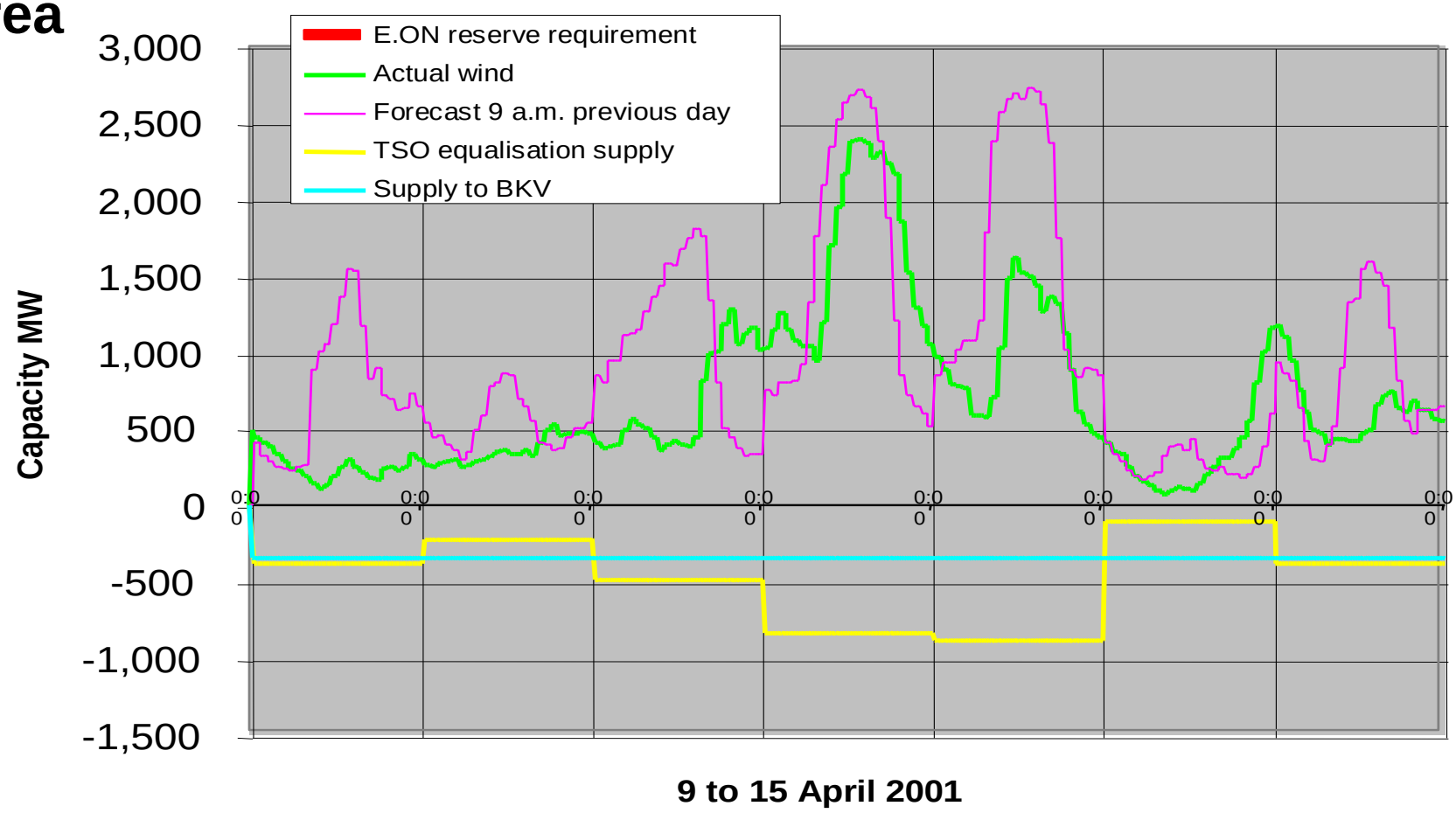


wind surplus

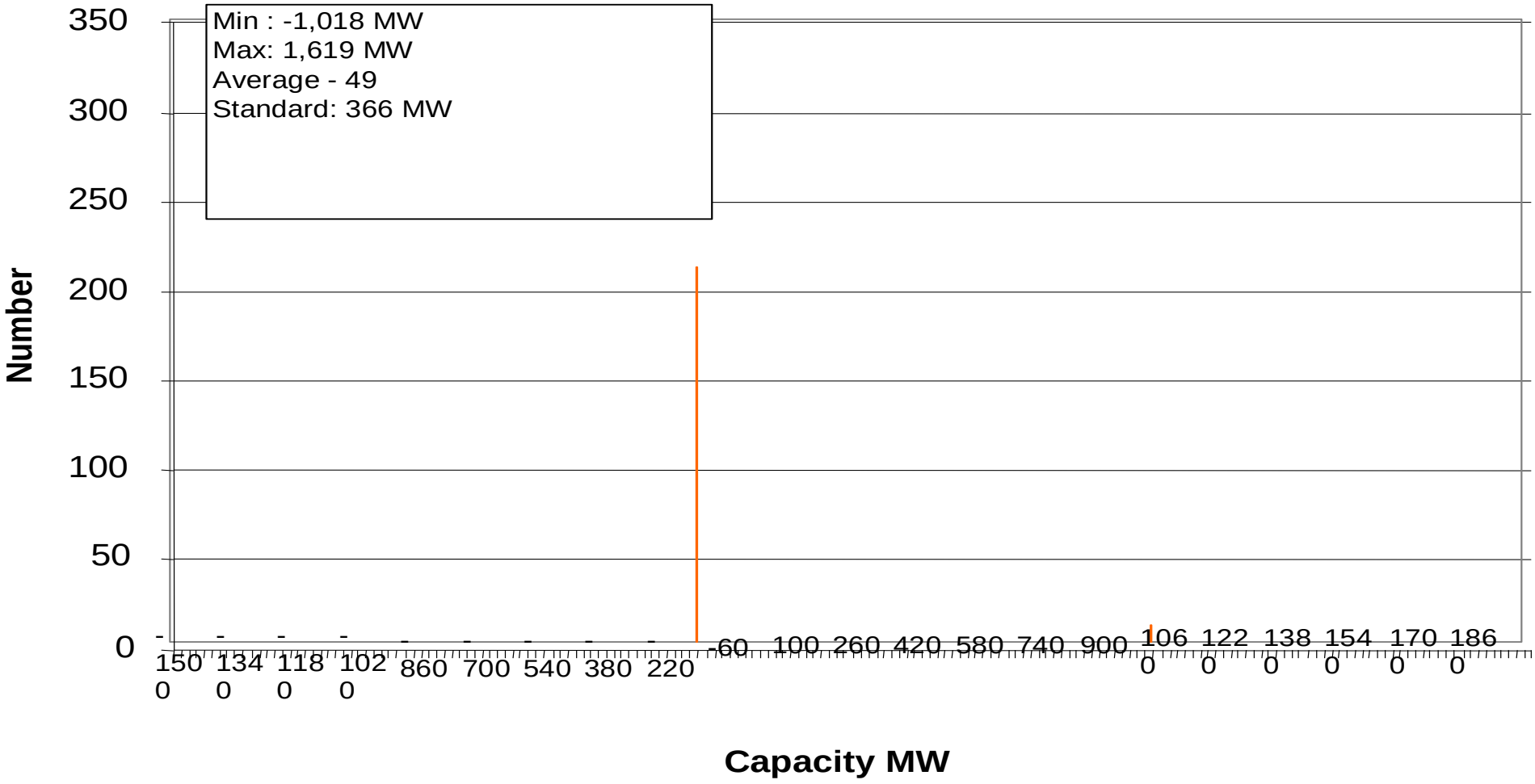
Re-dispatching and local generation management



Wind power equalisation requirement at E.ON Netz control area



Frequency distribution of wind power equalisation, March to May 2001



Summary

The transport and distribution of this power is reaching its technical limits and causing bottlenecks in the system. These bottlenecks can be avoided by the use of local generation management for a temporary period.

In the medium and long term the development of wind power will require extensive reinforcement of the high and extra-high voltage systems if they are to satisfy the requirements placed on adequate quality of supply in the future.

The considerable increase in the supply of wind power requires a higher power station reserve capacity. This reserve is always needed when the actual wind power supplied deviates from the forecast wind power supply.