

## REACTIVE POWER BALANCE IN A DISTRIBUTION NETWORK WITH WIND FARMS AND CHPS

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### ABSTRACT

In Denmark, a large part of the electricity is generated by wind turbines and combined heat and power plants. Most of them are connected to the distribution systems. In periods with high wind speeds, large flows of reactive power have been observed between the 150 kV and the 60 kV systems. The transfer of reactive power reduces the capacity of the lines, causes thermal losses and can in some cases reduce the voltage stability margin of the system. To identify the origin of the problem, an actual distribution system with a high penetration of wind power and distributed generation has been thoroughly investigated. Active and reactive power measurements for transformers and production units have been inserted in a detailed system model. With intervals of 15 min and a total period of over 5 months, the measured situations have been reproduced with load flow calculations. The simulations have been validated by comparing measurements which have not been used as input for the model with the simulated values. The reactive power losses in different components have been analyzed in situations with high reactive power surplus and deficit of the system.