

The role of Nordic hydropower from a European perspective

Lisa Göransson

Chalmers University of Technology



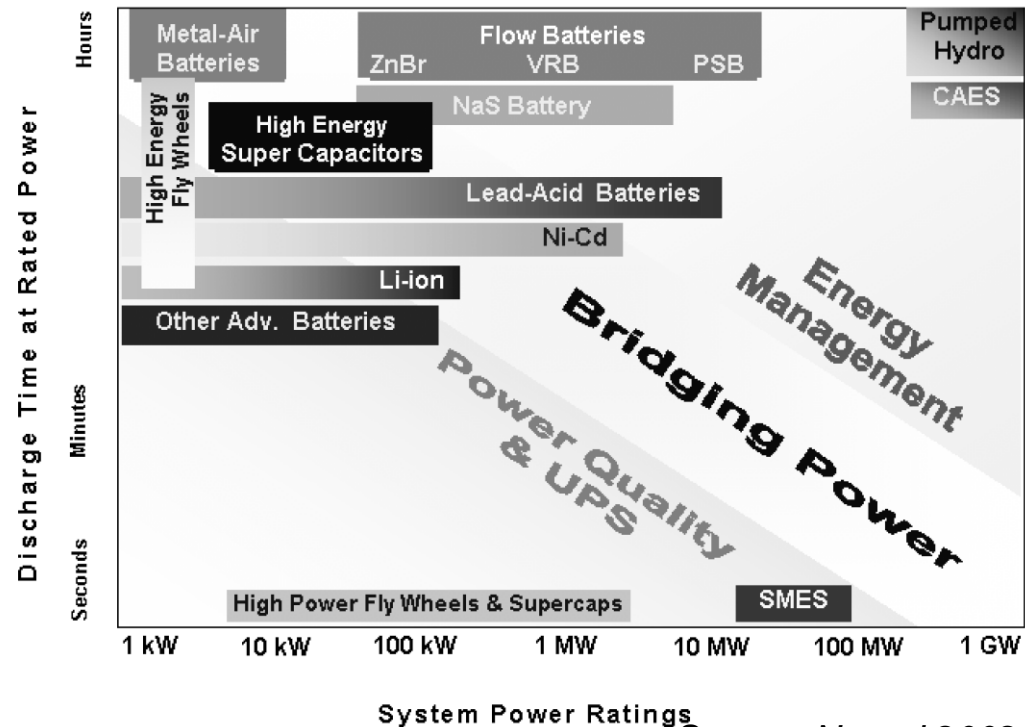
Renewables and the grid

- The geographical allocation of renewables is different from that of thermal generation.
- Variations in renewable generation is reduced as the geographical scope increases.
- The grid can provide access to flexibility already in place, such as hydropower.



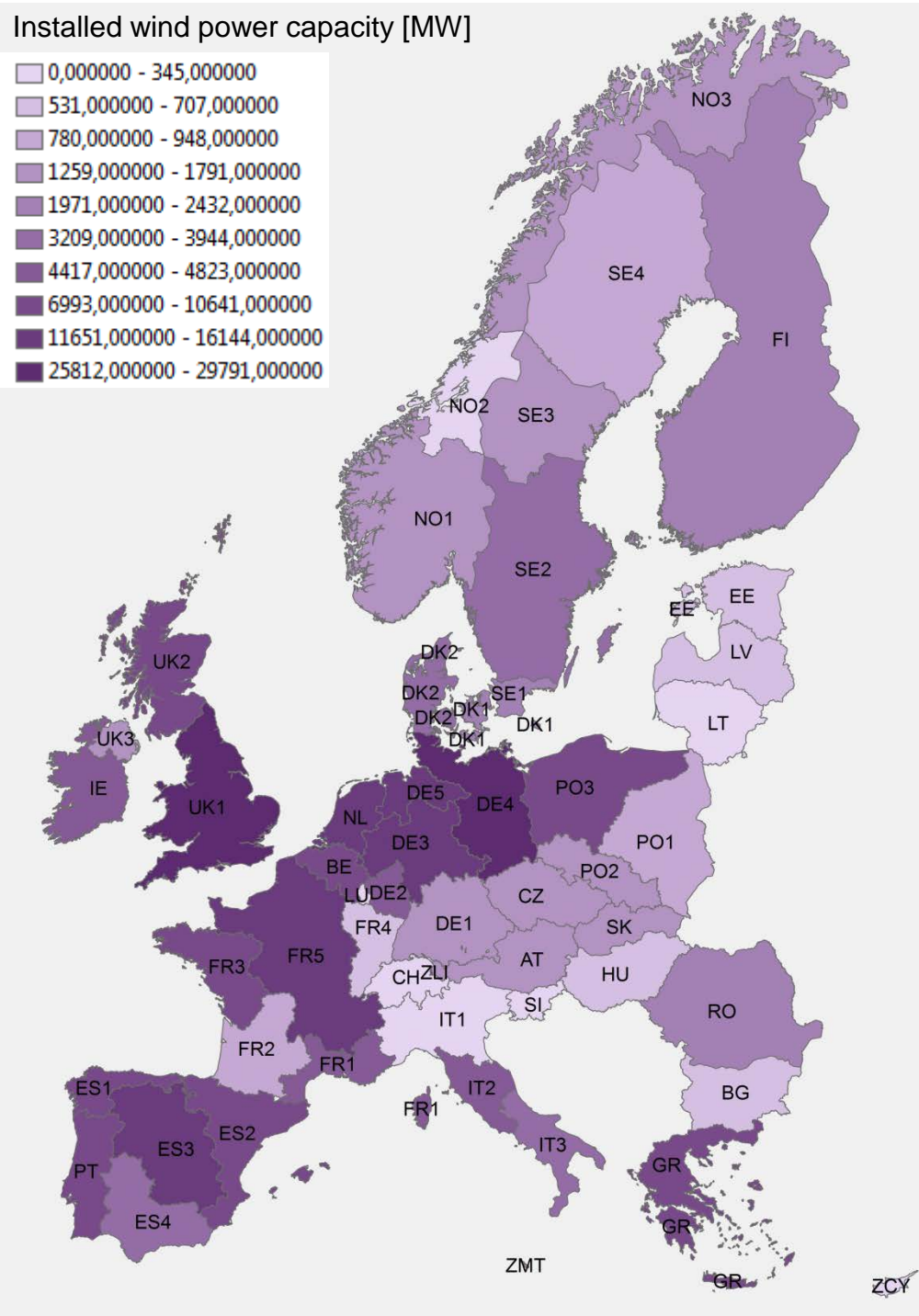
Hydropower and wind power -a perfect match?

- Hydropower can provide everything from compensation for forecast errors to seasonal variation management.
 - Options for short term var:
 - Curtailment
 - Batteries
 - DSM
 - Trade
 - Options for long term var:
 - Cycling of thermal
 - Long distance trade
 - Pumped hydro
 - Electrofuels



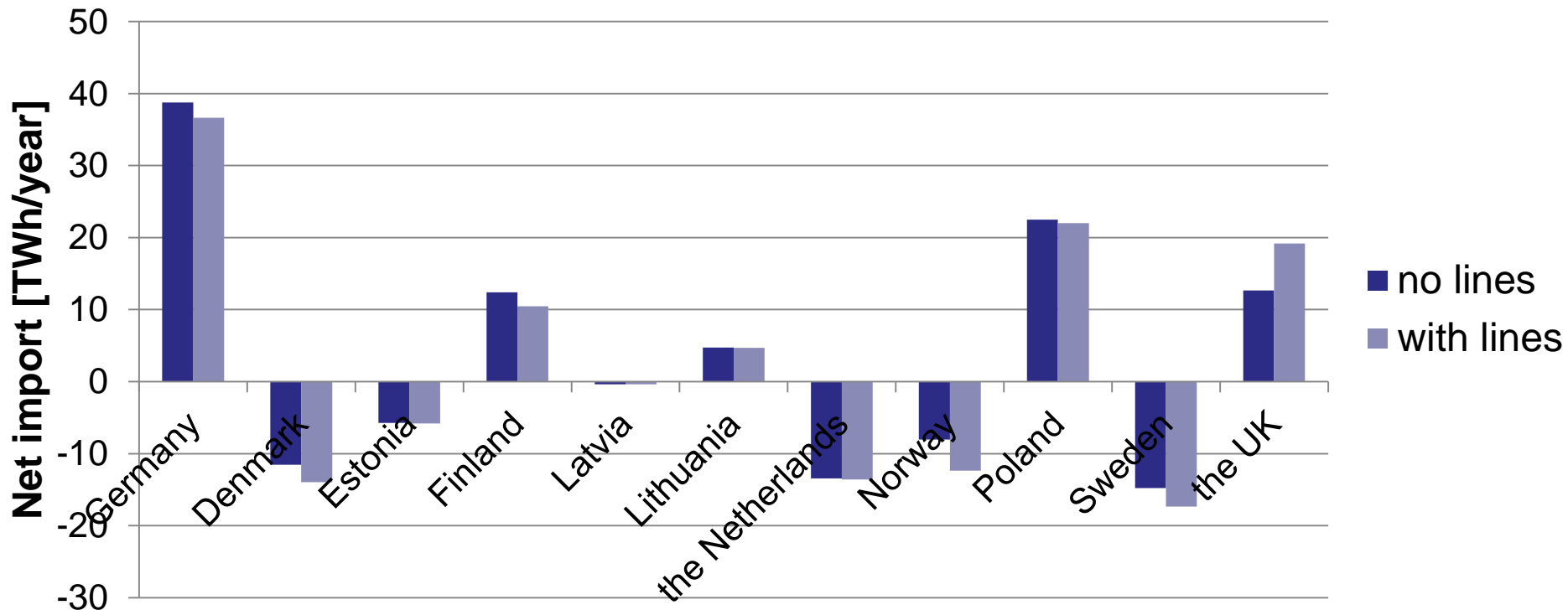
Neighboring regions have some of Europe's best wind conditions

- A 2025 scenario with and without transmission expansion
 - Fulfilled efficiency targets
 - Only slight increase in demand
 - Fulfilled NREAP:s
- Planned transmission reinforcements
 - Norway - UK
 - Norway - Germany
 - Norway – Denmark
 - Denmark-the Netherlands
 - DC corridors in Germany
 - DC corridor in UK

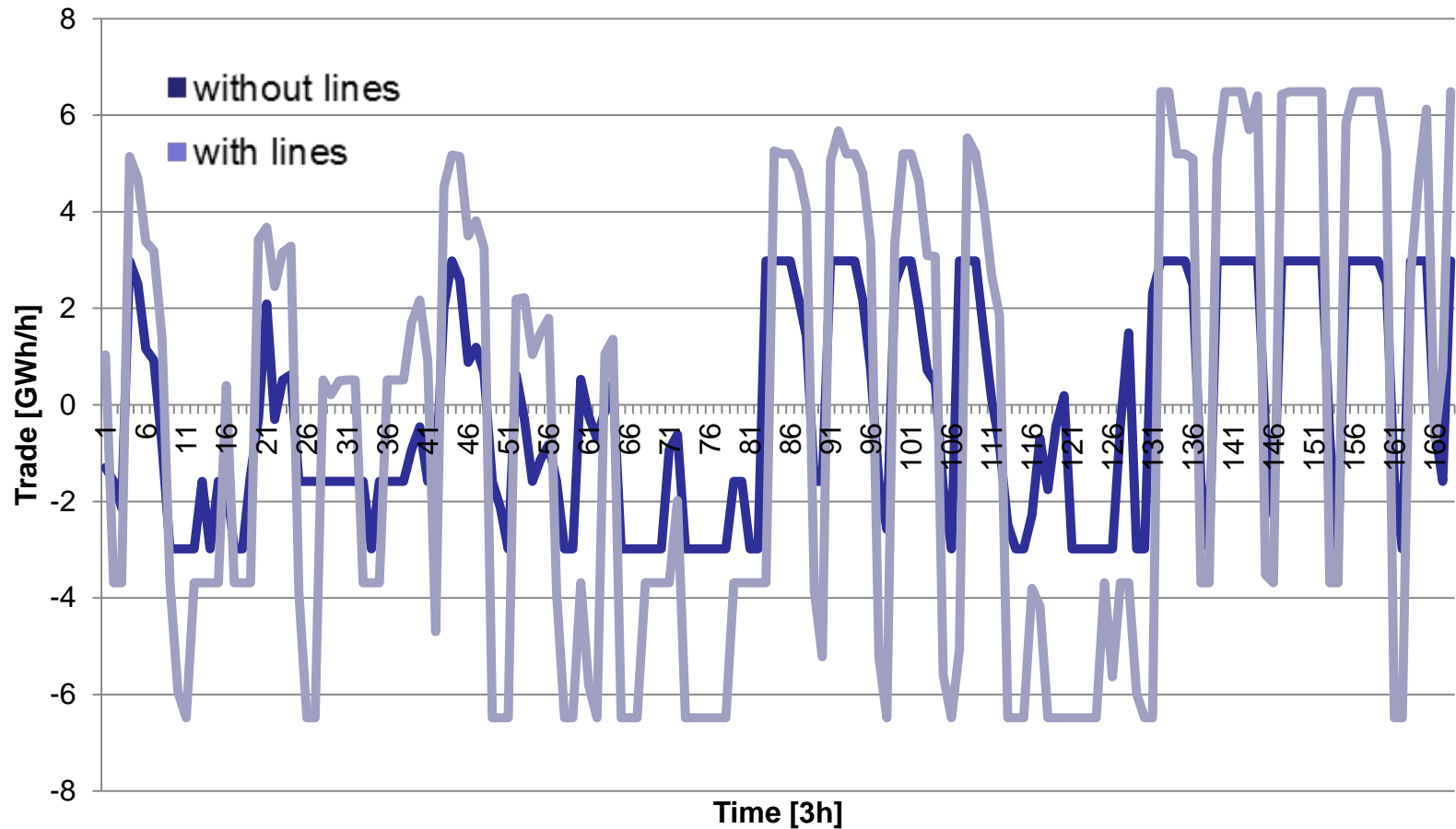


Low increase in net export

- Main trade flows from regions with low load and large natural resources to high load regions in same country.
- With lines: 40 TWh/year net export from Nordic countries
- Without lines: 30 TWh/year net export from Nordic countries

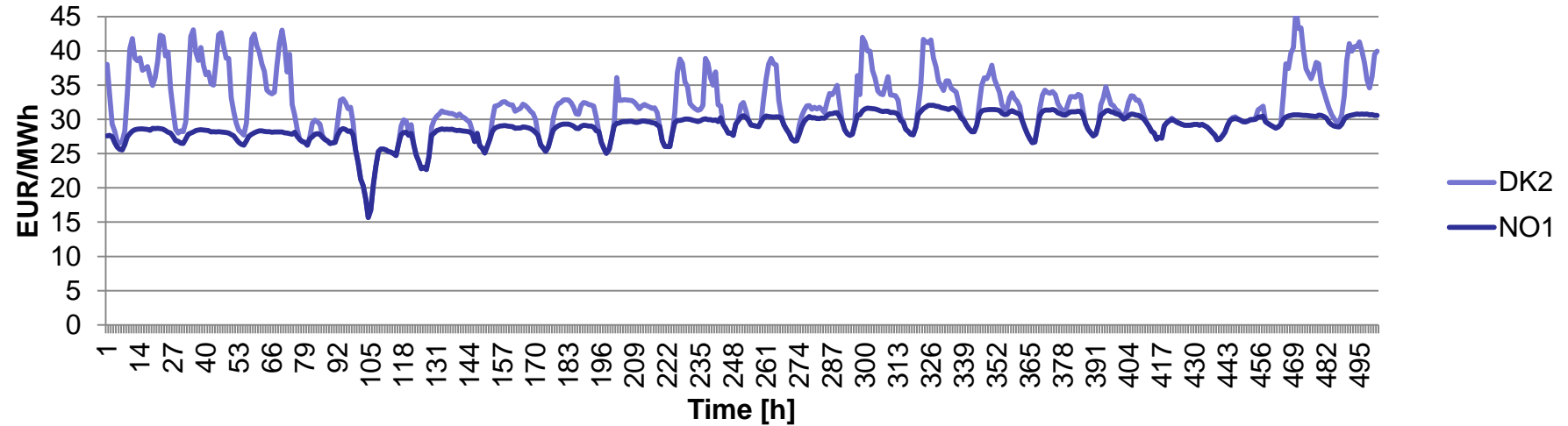


20 TWh reallocated in time by Norwegian hydropower

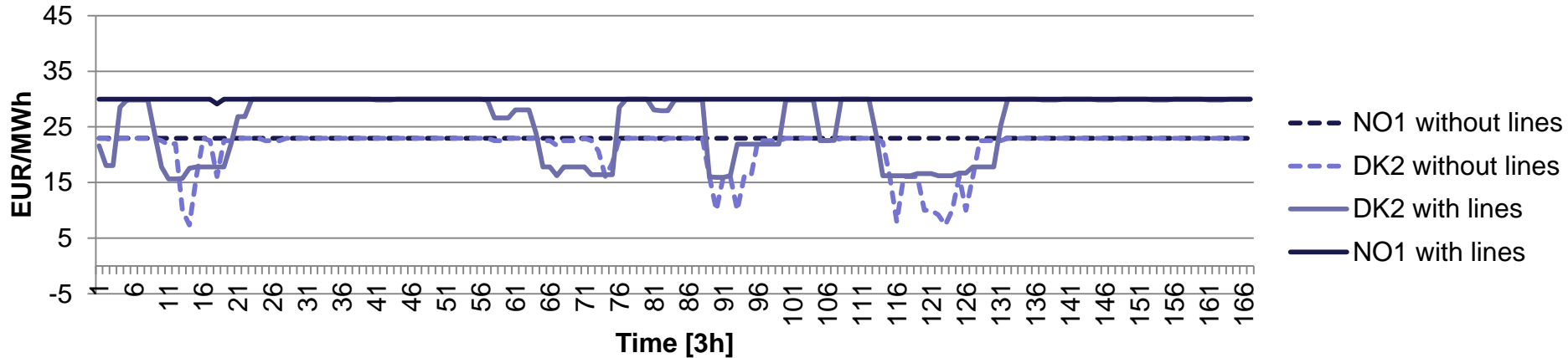


Counteract cost reduction in the Nordic countries

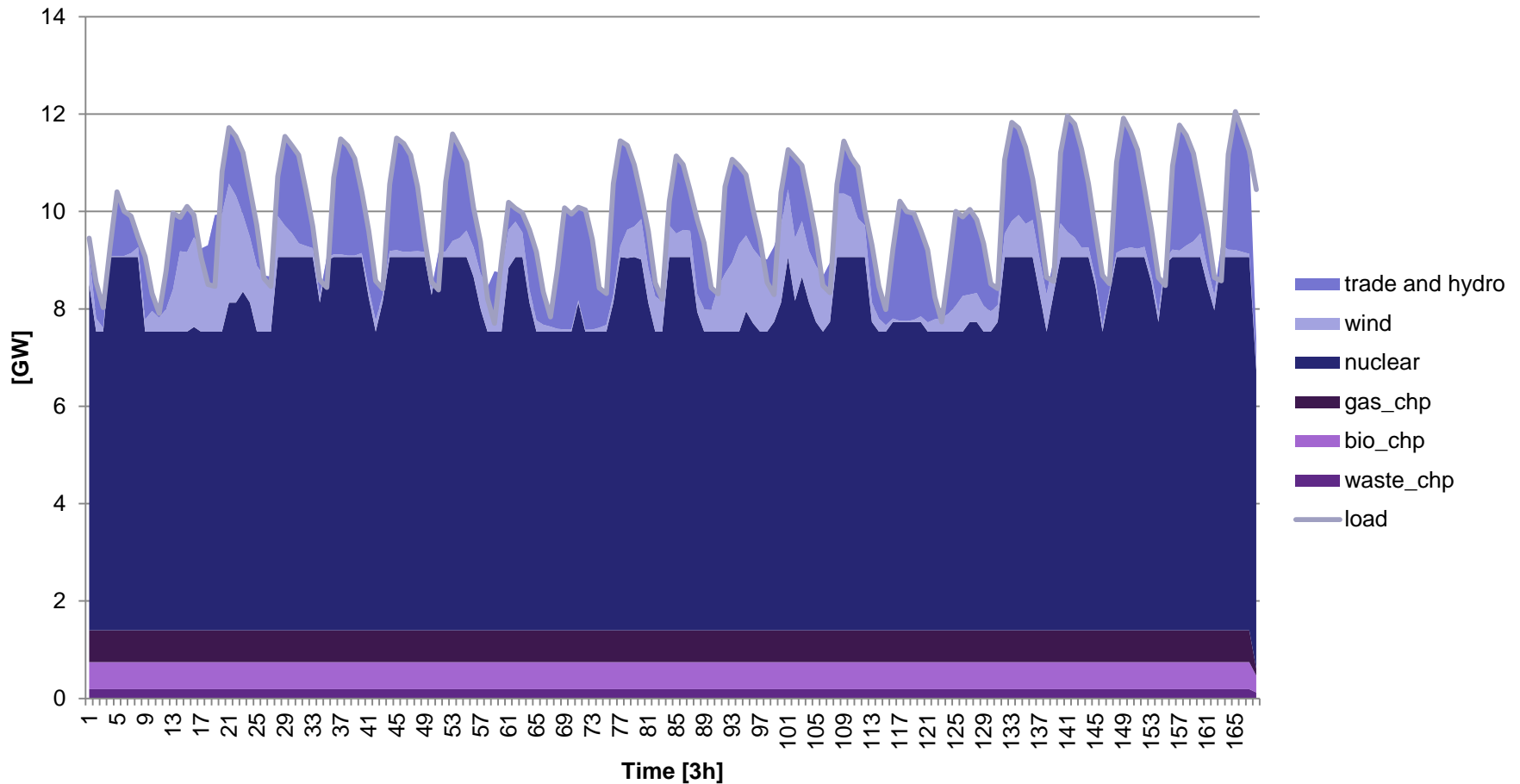
2014 data



Modelled 2025

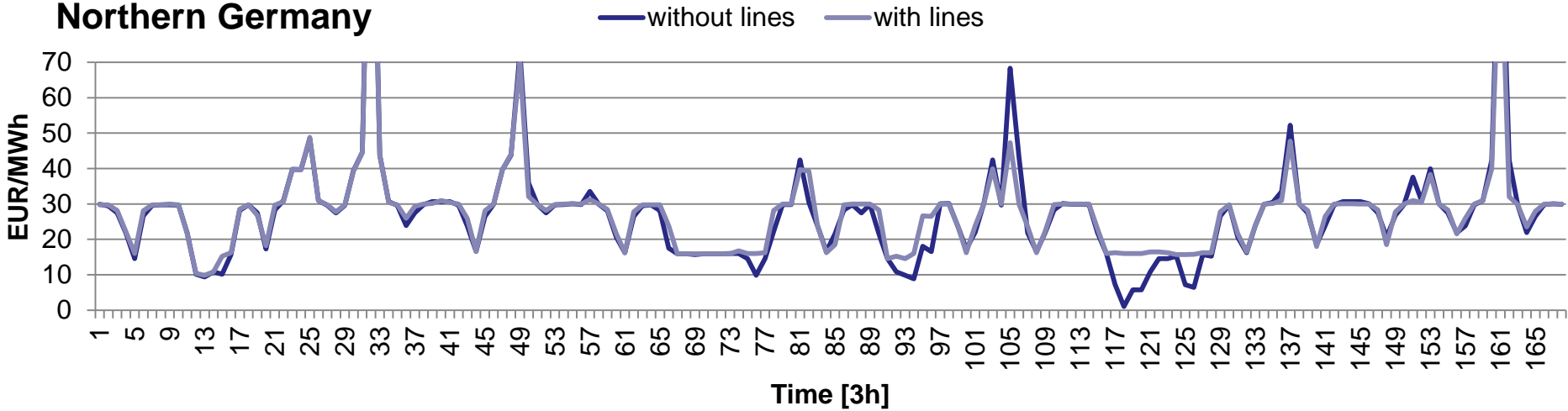


Low impact on Swedish generation pattern

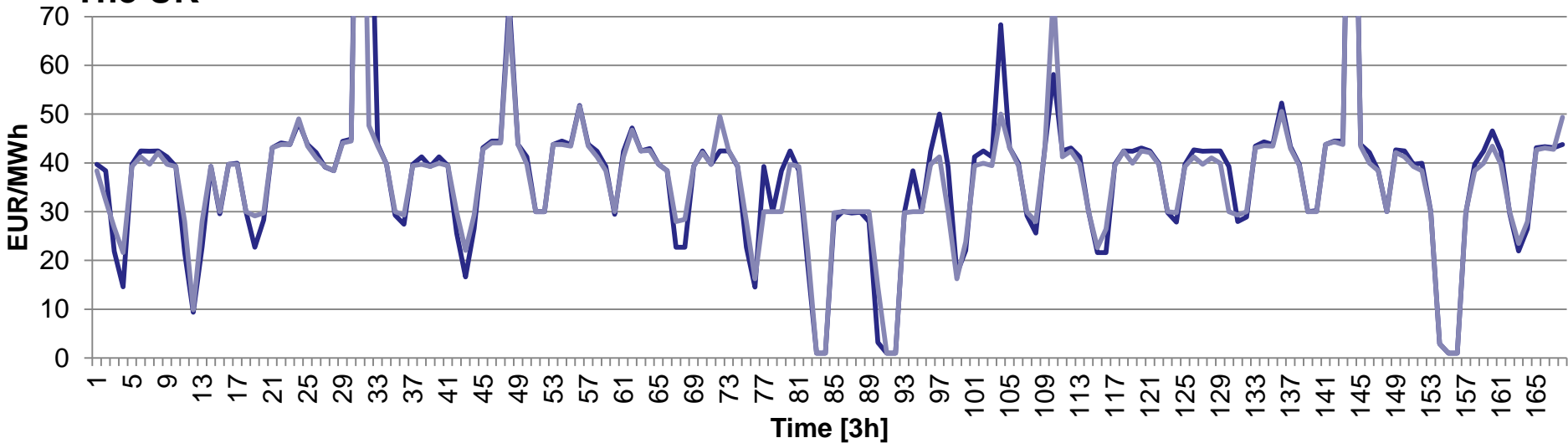


Cut peaks and lows

Northern Germany

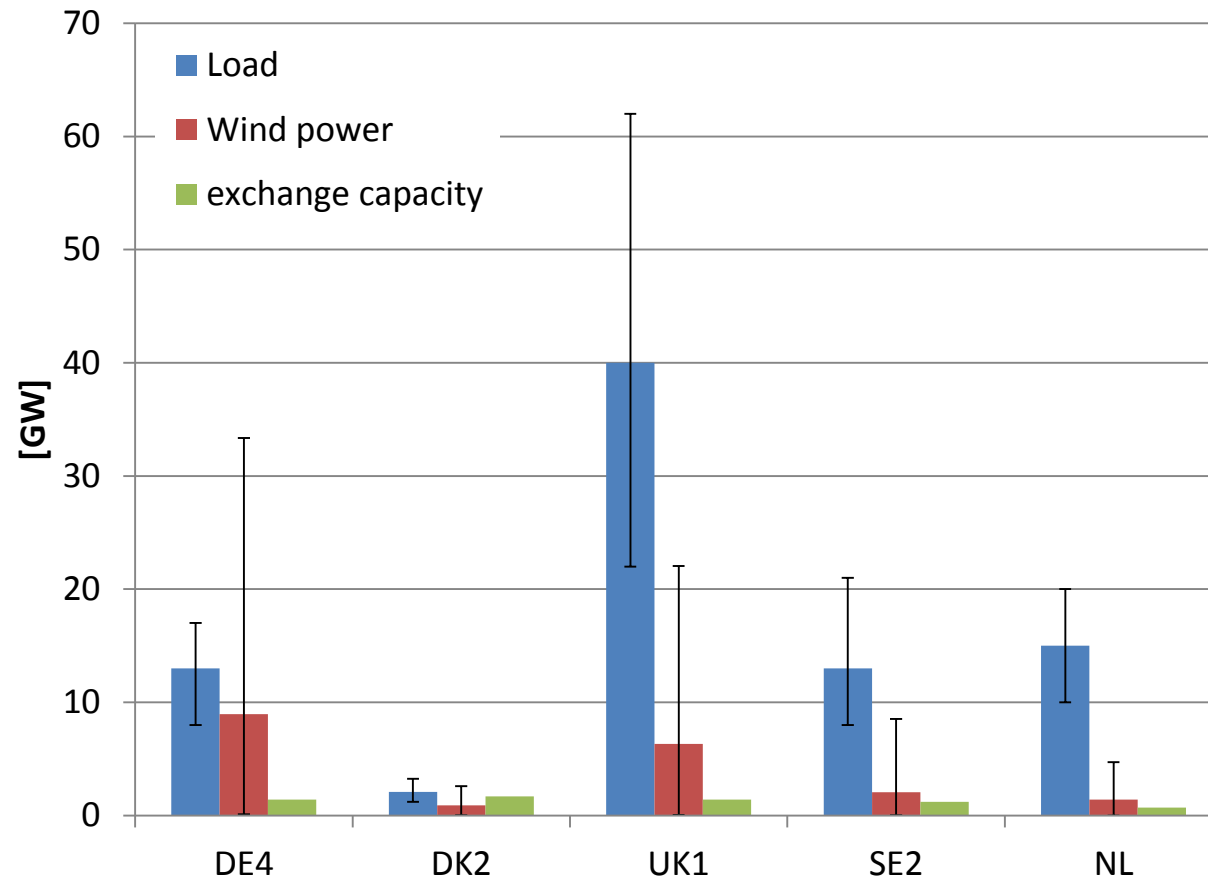


The UK

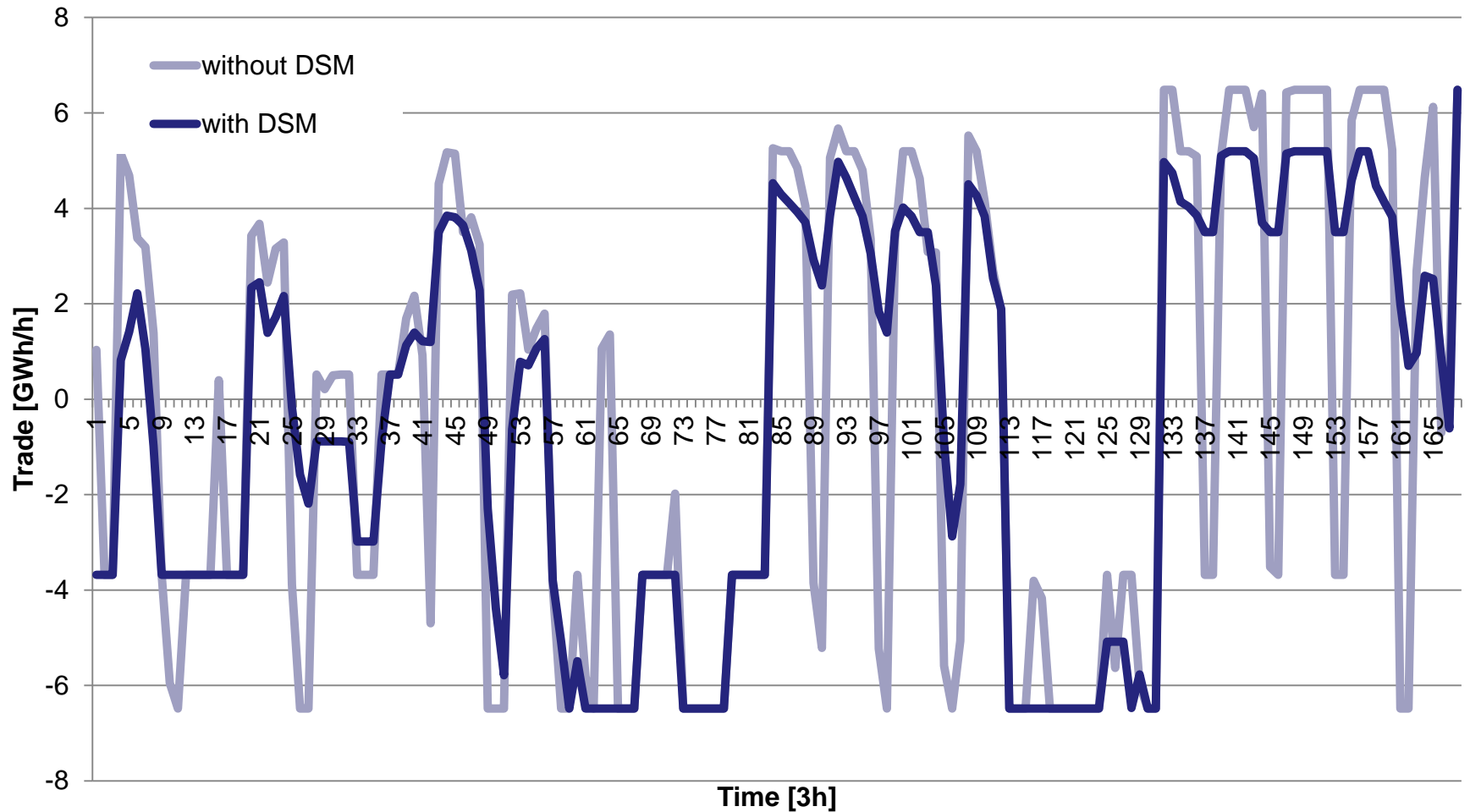


Exchange capacity vs. variations

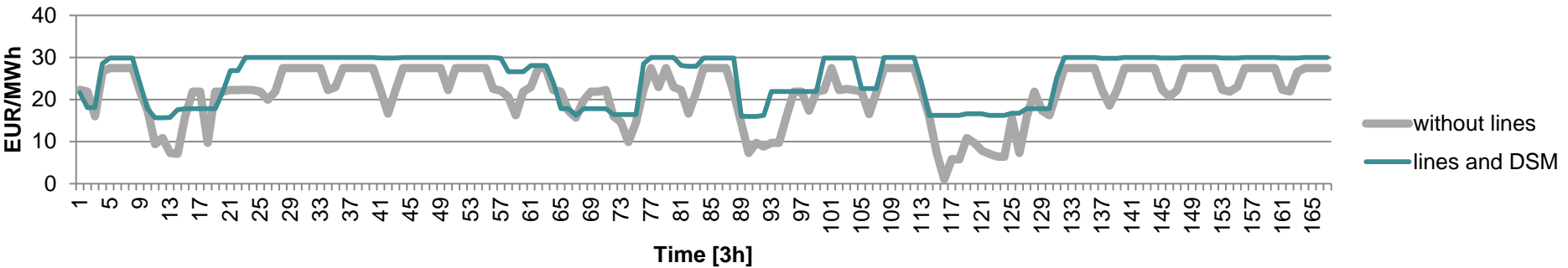
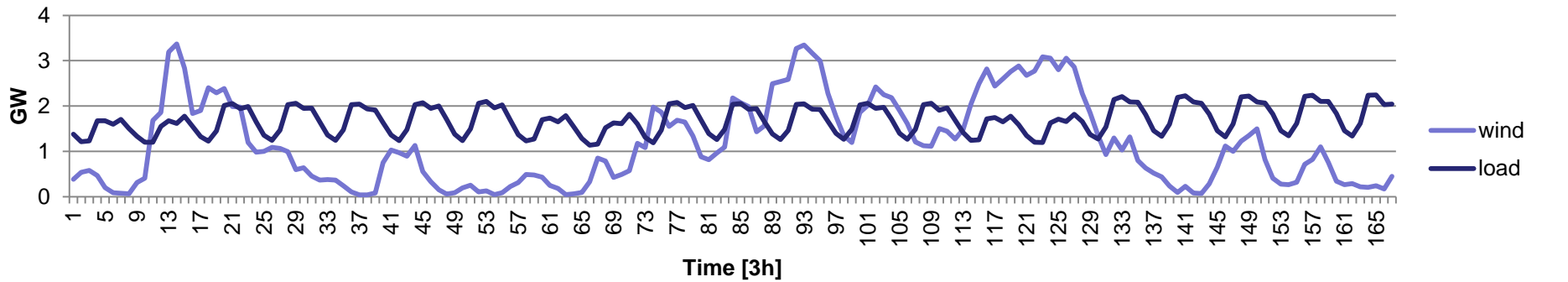
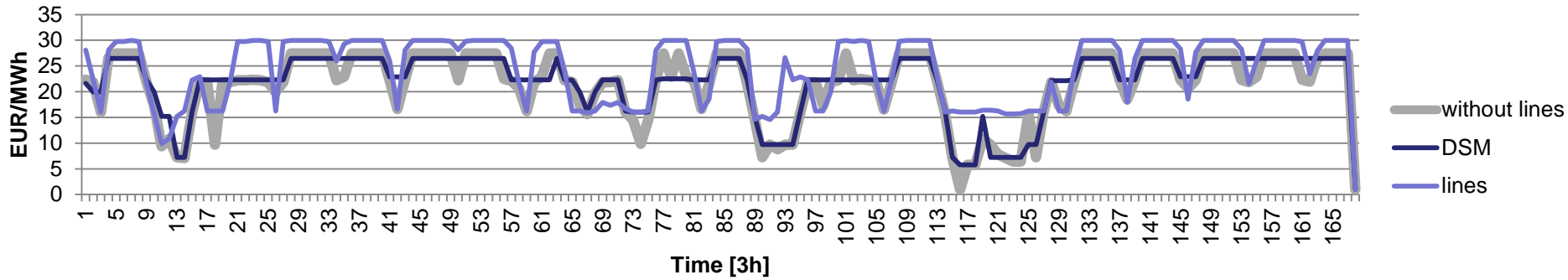
- Wind power and load with max/min based on data for one year only
- Exchange capacity to Norway



Short term variations managed by DSM



DSM and Hydropower



Summary

- Large amounts of wind power in and around the Nordic countries.
- Planned connections mainly used for variation management.
- Counteract reduction in marginal costs in the Nordic countries.
- Reduce hours of high and low marginal costs
- Low impact on marginal costs in continental Europe and the UK
- Planned capacity is low compared to expected size of variations
- Unique ability to manage long term variations
 - Complement to other variation management strategies

