



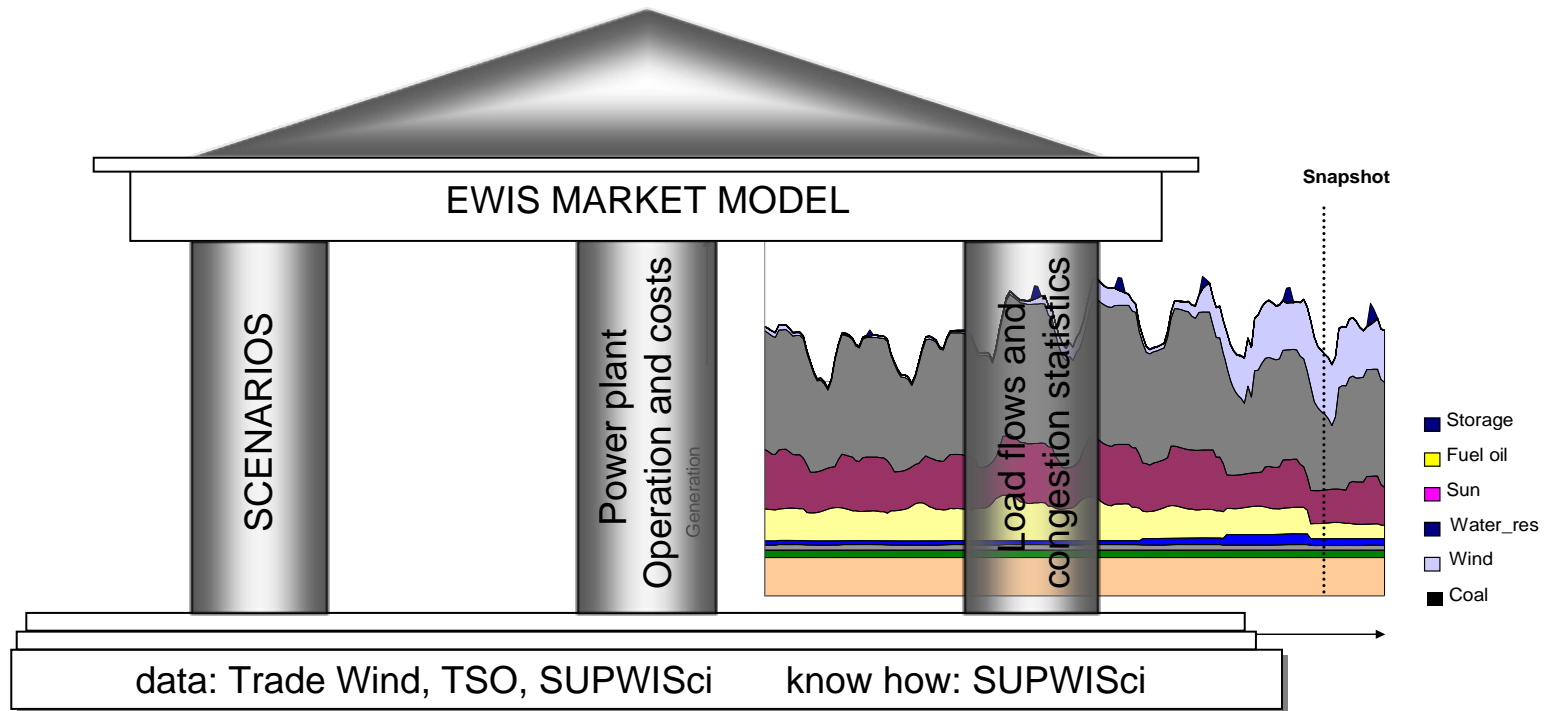
European Wind Integration Study (EWIS) Towards a Successful Integration of Wind Power into European Electricity Grids

**EWIS Concluding Discussion
13th April 2010, Brussels**

Market Model

Prof. Christoph Weber – SUPWISci Consortium

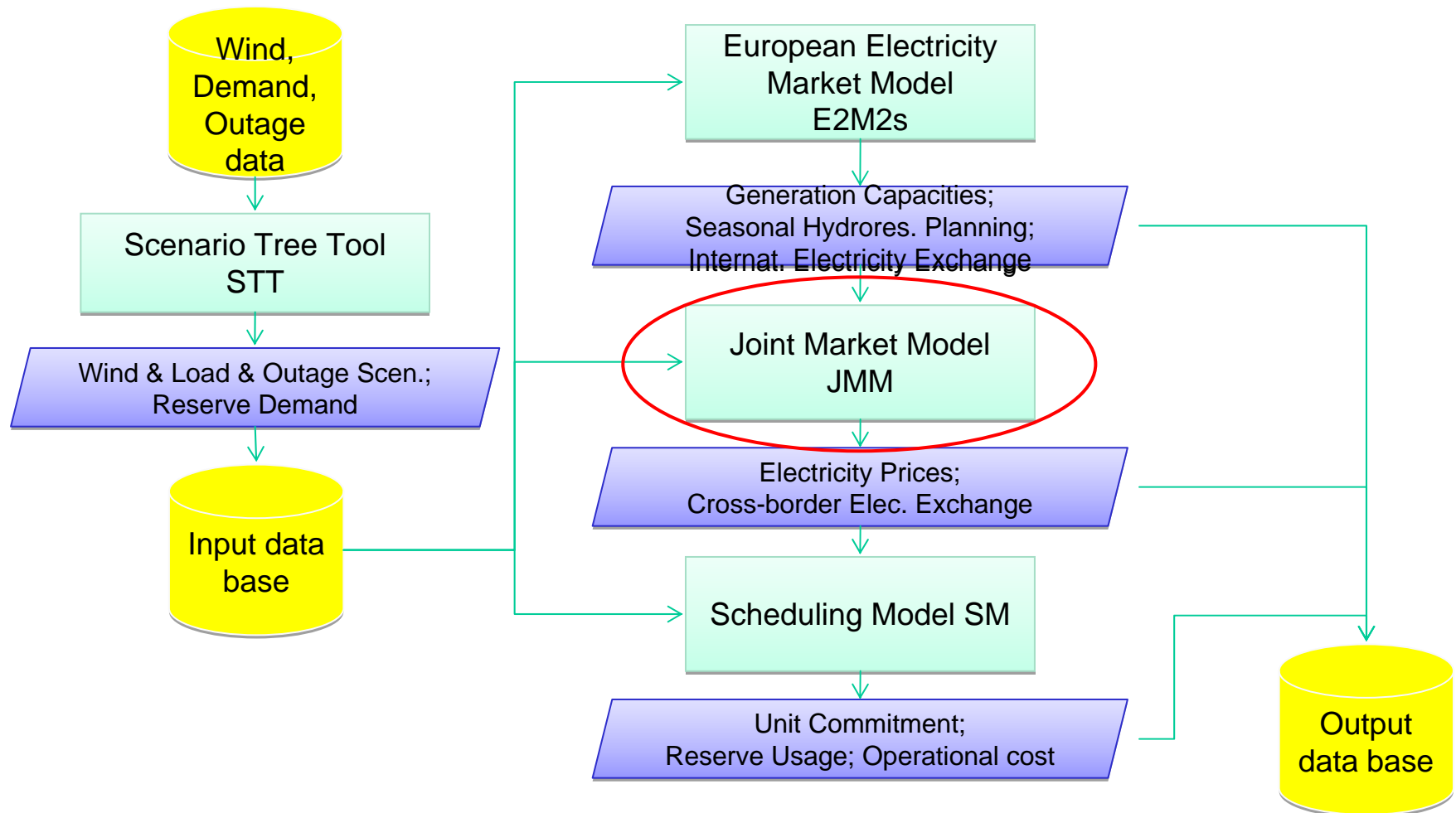
European-wide Market Model with unique results



Point-in-time snapshot scenarios & Year-round scenarios

- Modelling market operation
- Taking into account forecast errors
- Including DC load flow approximation

Toolbox used: Overview on databases and models



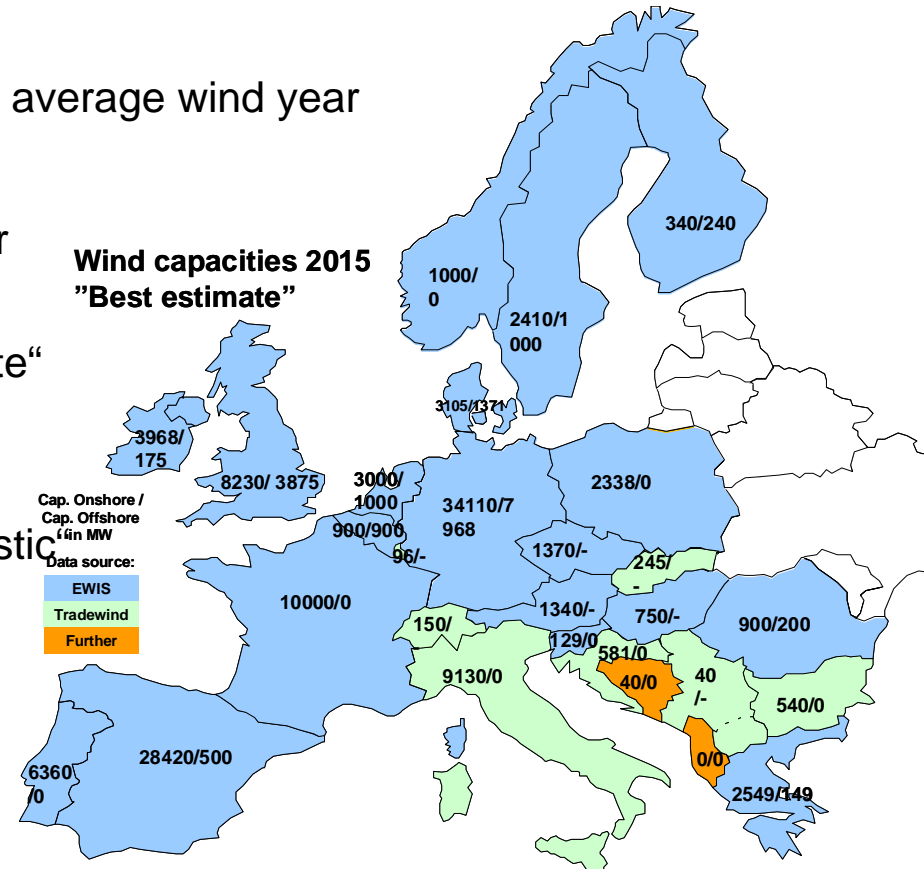
Geographical Coverage and Wind capacities

- **Time-series on wind power production**

- Measured wind power time-series in countries with high impact of wind power used for quality increase: Denmark, Germany (on-shore), Netherlands, Ireland and Spain
- Adjustment of wind power production to average wind year

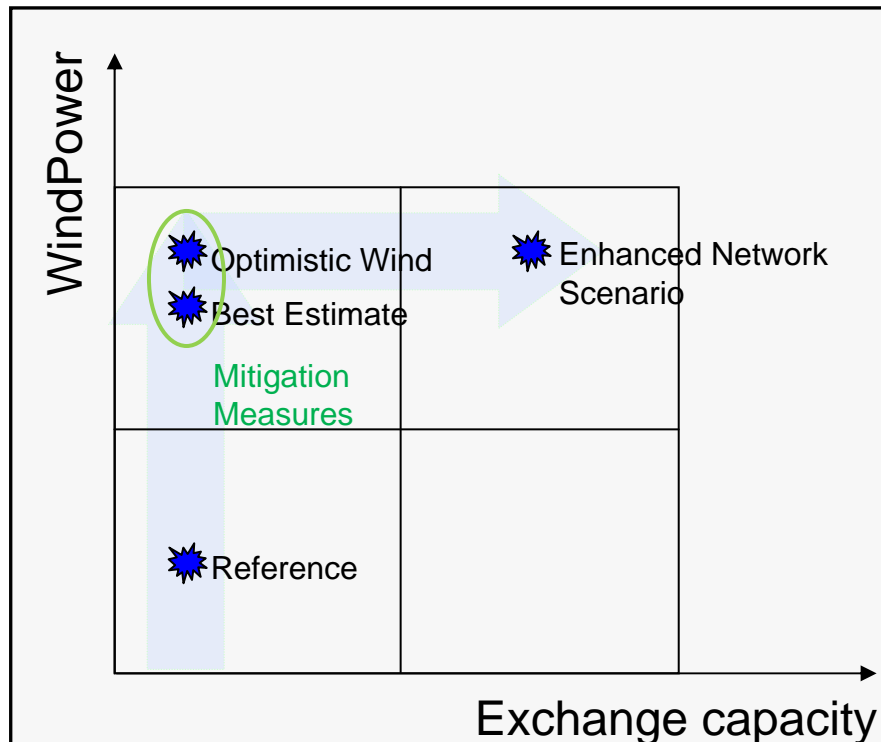
- **Wind power capacities**

- Information given by individual TSOs for most of European countries
- Total wind power capacity „Best estimate“
 - EWIS: 138.880 MW
 - TradeWind: 139.346 MW
- Total wind power capacity „Wind optimistic“
 - EWIS: 180.841 MW
 - TradeWind: 179.146 MW



EWIS scenarios 2015

EWIS scenario classification



Further differentiation: Boundary conditions

LC: Low Fuel and CO₂ prices

HC: High Fuel and CO₂ prices

Point-in-Time investigations with market and grid models:

- **Best Estimate Wind scenario 2015(,BE')** with the planned wind power generation capacity as well as future power plants in 2015: reasonably credible
- **Optimistic Wind scenario 2015 (,OW')** corresponds to TSO's most optimistic (but not really impossible) capacities of wind power

Year-round investigations with market models

- **As above +**
- **Reference** on installed wind power capacities of 2008;
- **Mitigation Measures** Wind capacities as before, yet additional mostly operational measure, e.g. flexible line management
- **Enhanced Network Scenario (,EN')** for investigation of further grid reinforcements beyond 2015, based on WO

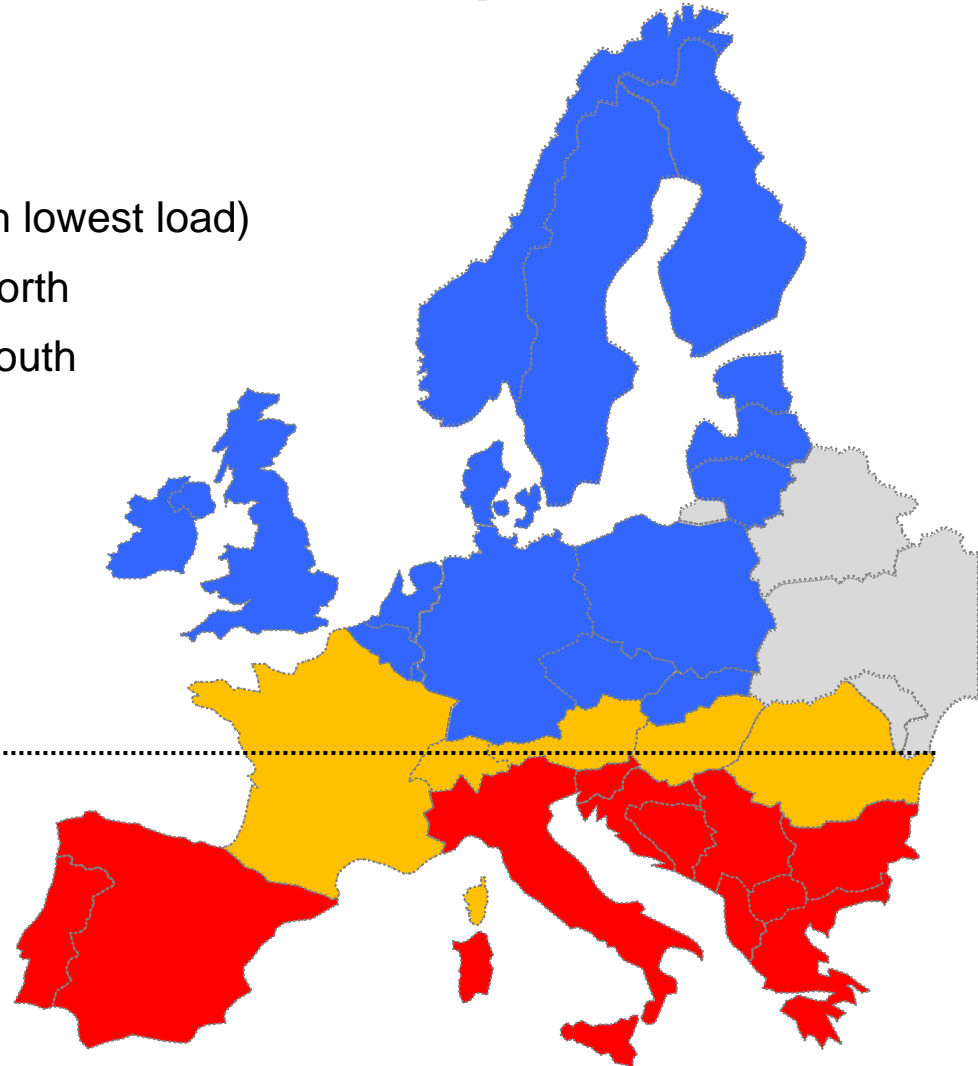
EWIS selected two wind patterns for realistic and challenging point-in-time snapshots

- Low load cases (20% hours with lowest load)
- Hours with high wind power in North
- Hours with high wind power in South

High wind situation in North



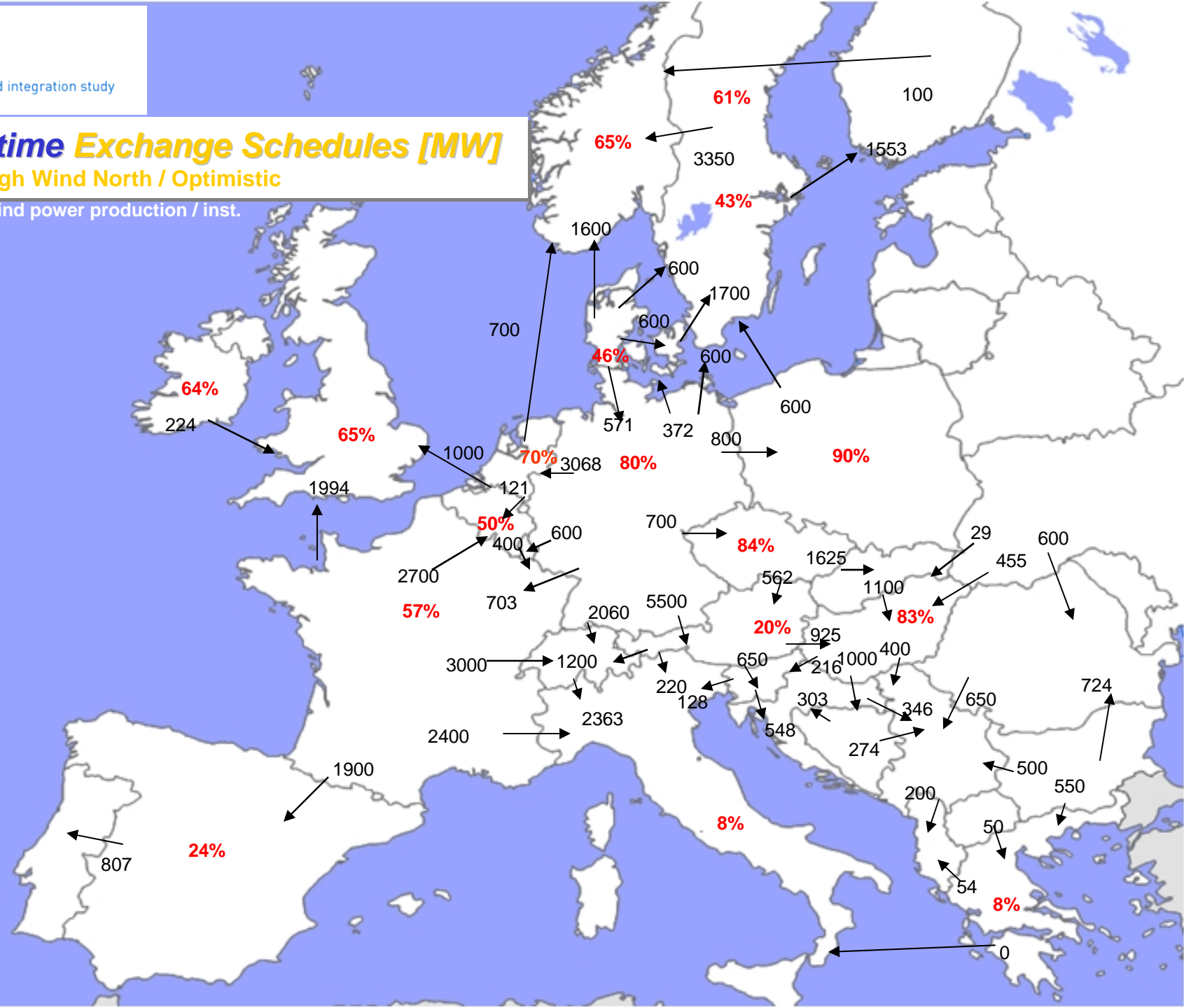
High wind situation in South



point-in-time Exchange Schedules [MW]

Low load / High Wind North / Optimistic

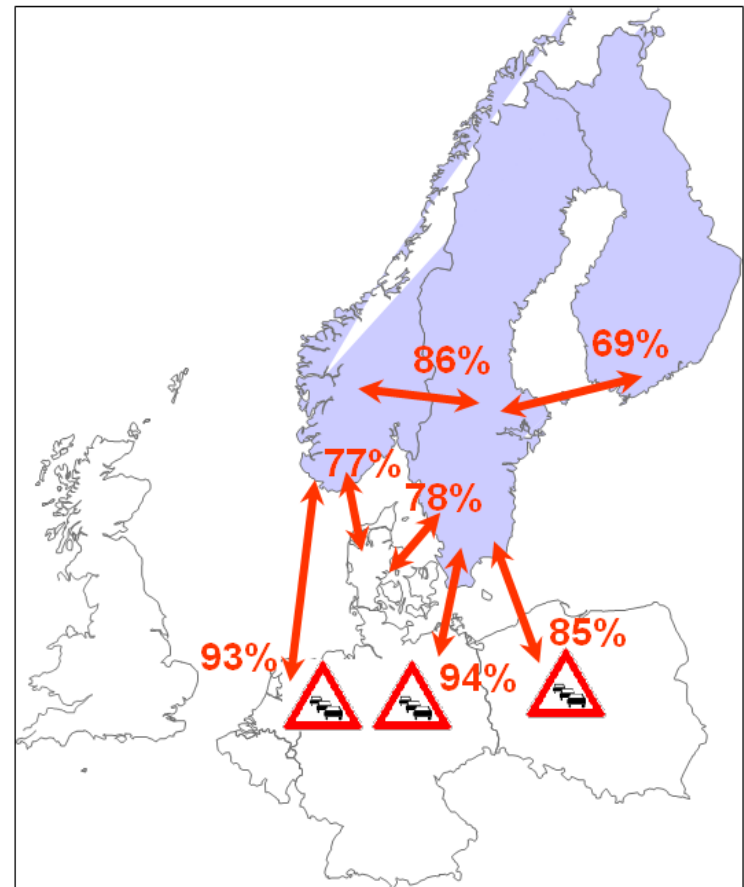
X %...Share of wind power production / inst. wind power cap.



Key results Year-round runs

- **Operation of power plants**
- **Congestion statistics**
- **Costs**
Differentiated by categories
- **Benefits of wind energy**

Example congestion statistics: Nordic countries



Key results – Mitigation Measures

Annual cost savings through

- **Operational measures, including**
 - Wind Power management 20 Mio. €
 - Flexible line management - one border 27 Mio. €
 - Demand side management 89 Mio. €
- **Storage investments**
about 500 Mio. €
- **Network investments (cf. below)**
About 2 bn. €