Module 5 – Impact of Renewables on Electricity Markets

5.4 The impact of renewables: from simulation to reality

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Simulating the impact of wind power on the Nord Pool

- **Reference year:** 2011 (26% penetration, i.e., share of wind power to meet demand)

- Simple model using the system supply curves for the Nord Pool day-ahead market

- Implying no transmission constraints (irrealistic, but well...)

- Supply curves are shifted around for different ratios of increased wind power penetration: 1.2, 1.4, ..., 4

- Resulting prices are collected for the whole year
Series of prices

- Maybe not that visible because of the range... but, there are substantial differences from one curve to the next!
General statistics

- **Mean price**: steadily decreases

- **Most importantly**: min and max prices change significantly

- **Potential impact on investment in new capacities**
From simulation to reality!
The observed mean impact on day-ahead prices

The mean day-ahead price as a function of wind power penetration forecasts and hour of the day (Nord Pool, Western Denmark, 2007)

Overall qualitative impact on day-ahead prices

- With increasing (forecast) wind power penetration:
  - the average price decreases
  - distributions concentrate on lower values
  - extreme (high) prices disappear, but... zero prices appear!!
Impact of wind penetration on day-ahead prices

- The impact of wind power penetration forecasts on day-ahead market prices for Denmark (Nord Pool DK-1) and Germany (EEX)

- Similar analysis were performed to qualitatively and quantitatively assess the impact on regulation market prices, sign and volumes
The impact of wind on EU cross-border power flows

Map of the **nonlinear impact** and **sensitivity of EU power flows** to predicted wind power penetration in Germany... here if within 10-15% of installed capacity

Use the self-assessment quizz to check your understanding!