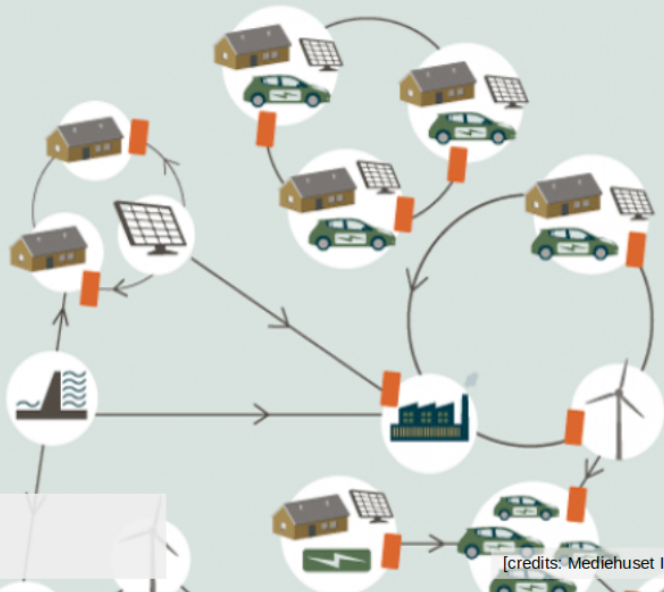
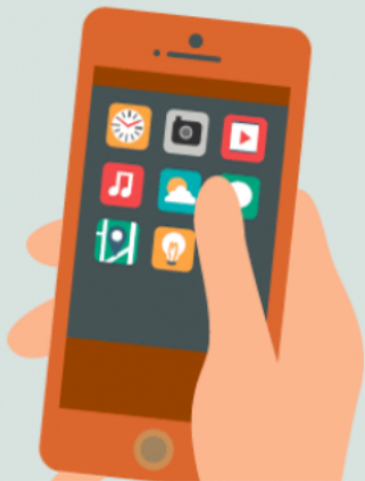


Module 4 – Ancillary Services

4.1 Why ancillary services?



Pierre Pinson
Technical University of Denmark

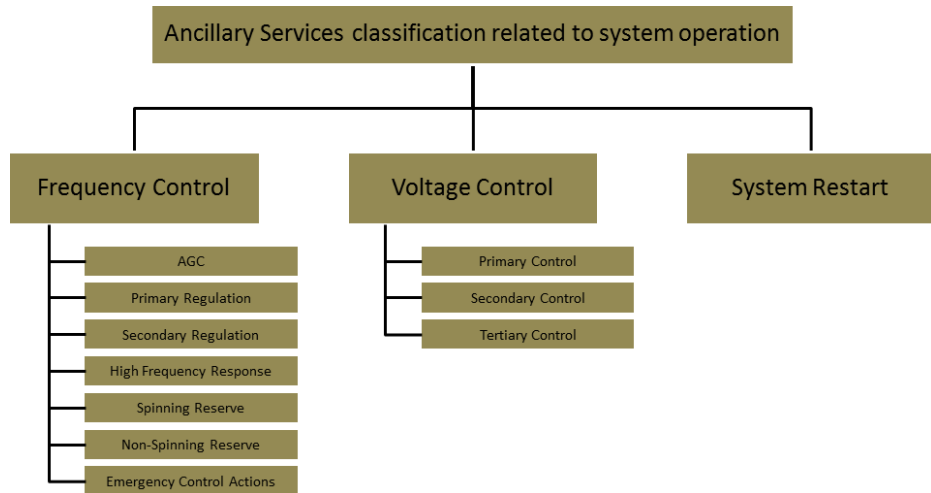
[credits: Mediehuset Ingeniøren]

What are ancillary services?

“Ancillary services are all services required by the transmission or distribution system operator to enable them to maintain the integrity and stability of the transmission or distribution system as well as the power quality.”

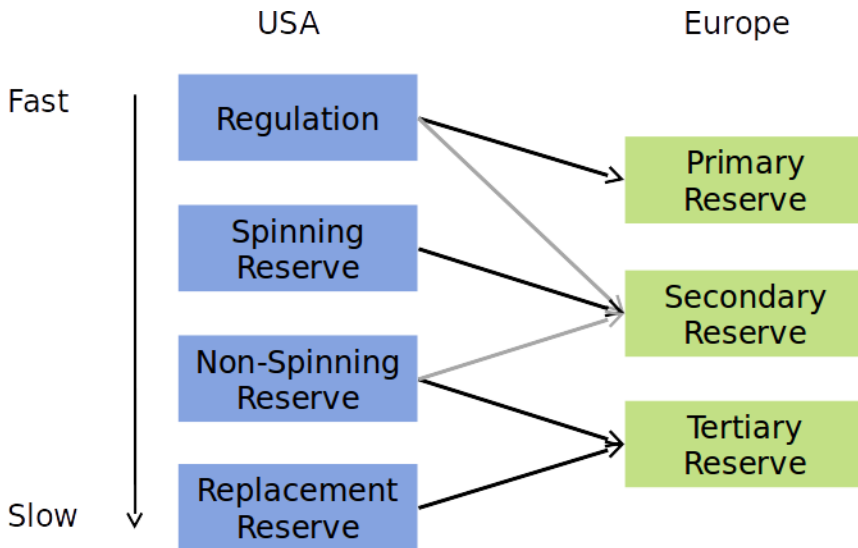
EURELECTRIC, “Ancillary services – Unbundling electricity products – An emerging market”, February, 2004 ([link](#)).

EURELECTRIC, “Connection Rules for Generation and Management of Ancillary Services”, May, 2000 ([link](#)).



We will focus on frequency-related services in the following, as they directly relate to system balance

Beware of naming conventions



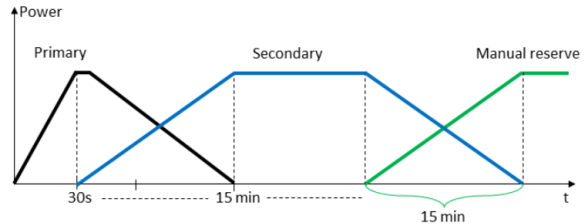
Same issue goes for Denmark, as the country is split between 2 different power systems with varied operational practice

Activation sequence

Two main approaches:

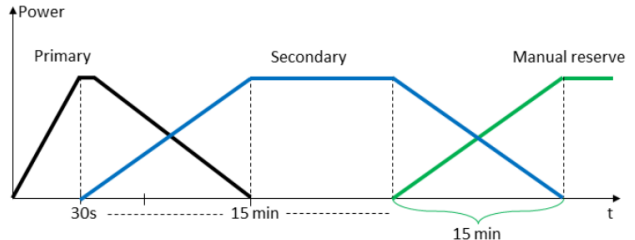
- Reactive (/corrective) approach

Order of consideration



Order of consideration

- Proactive (/preventive) approach



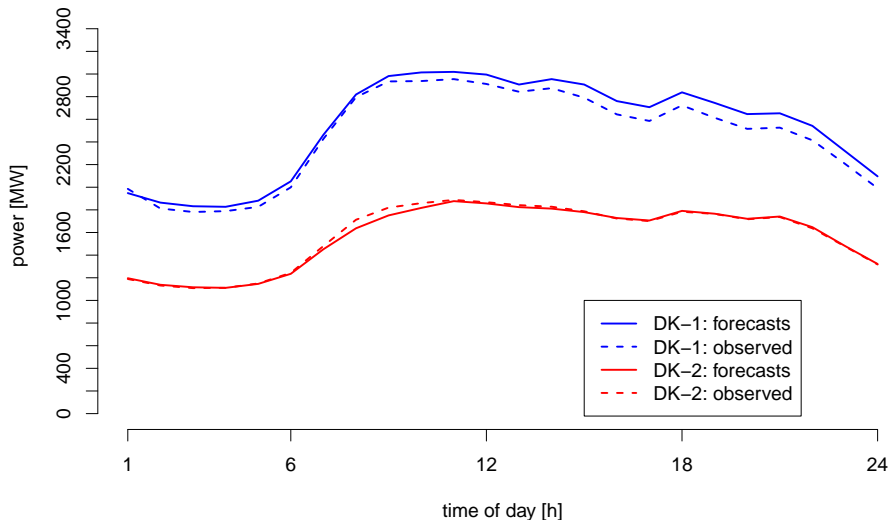
Why would the power system be off-balance?

Why would the power system be off-balance?

- A sample of potential causes:
 - **Electric load** is greater or less than foreseen at the time of market-clearing
 - **Renewable energy generation** is greater or less than foreseen at the time of market-clearing
 - **Outages** (/operational difficulties) of production units
 - **Outages** (/operational difficulties) of transmission equipments
 - **Internal congestion** (within market/balancing zone)
 - others?

A practical example: Load impact (1)

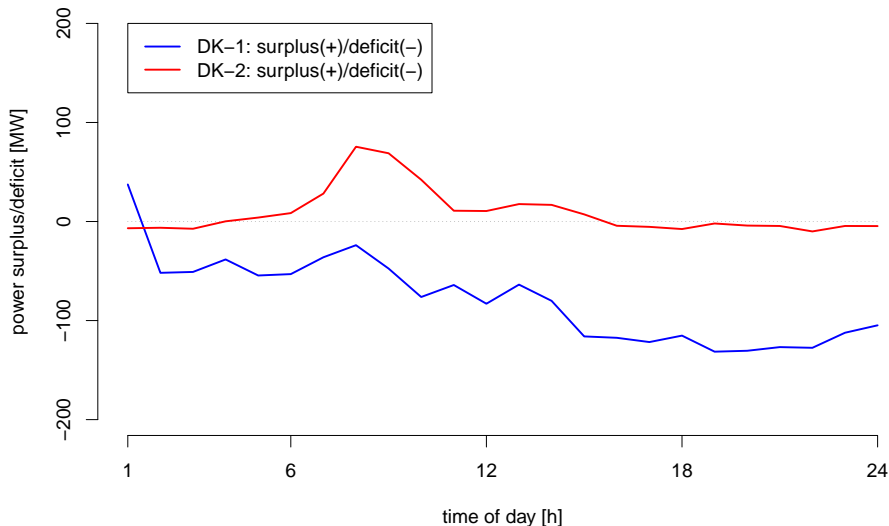
- **1 April 2014** - Nord Pool & Energinet data:



- Comparison of forecasts (at the time of market clearing) and actual electric load, both for DK-1 and DK-2

A practical example: Load impact (2)

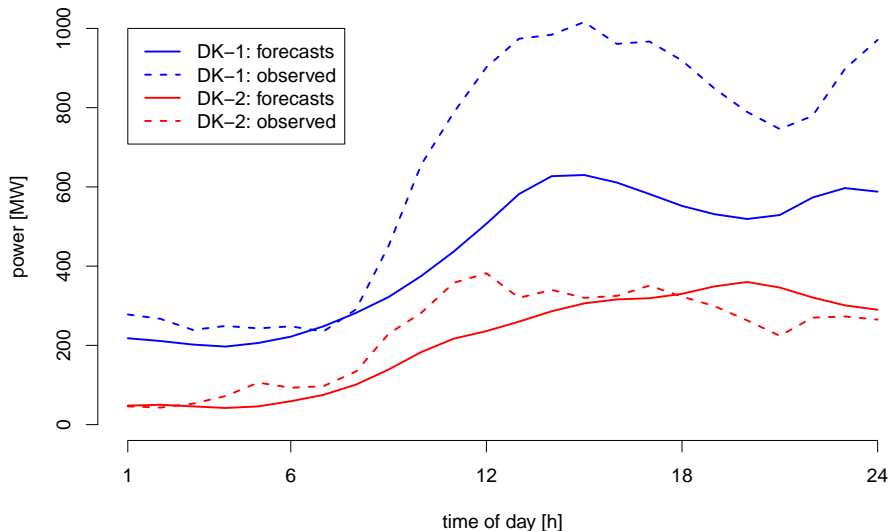
- **1 April 2014** - Resulting volumes to balance because of load forecasting errors:



- The resulting balancing needs are fairly low, though there is a clear deficit of power in DK-1

A practical example: Wind impact (1)

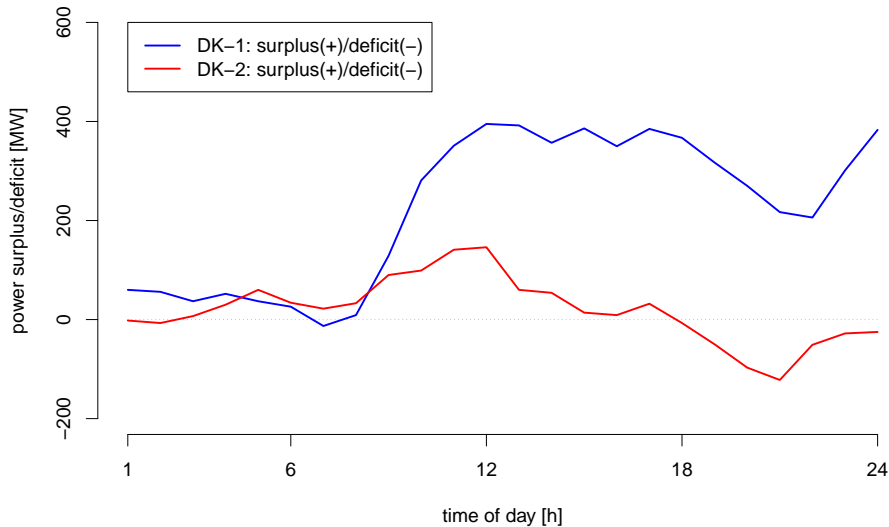
- **1 April 2014** - Nord Pool & Energinet data:



- Comparison of forecasts (at the time of market clearing) and actual wind power generation, both for DK-1 and DK-2

A practical example: Wind impact (2)

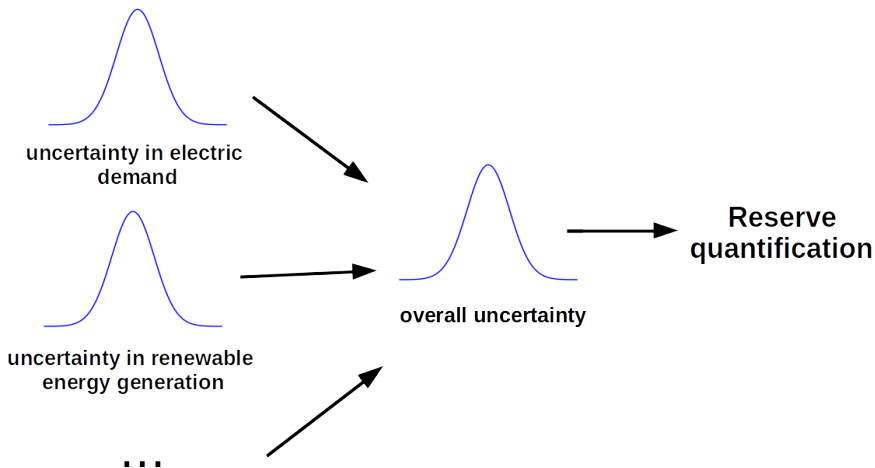
- **1 April 2014** - Resulting volumes to balance because of wind power forecasting errors:



- The resulting balancing needs look high for DK-1 and reasonable for DK-2

Quantifying the need for ancillary services

- Quantify and combine all uncertainties to eventually estimate necessary “reserves”

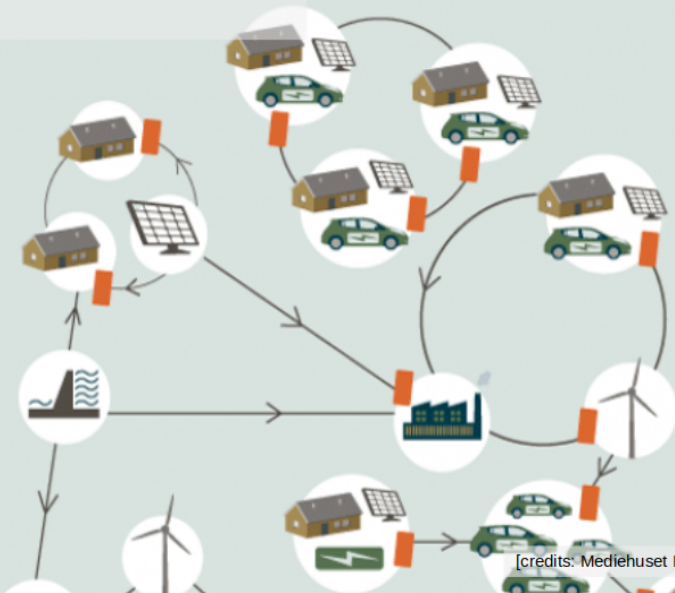


- In practice, this may also involve accounting for a number of operational constraints, e.g. commitment, ramping capabilities, etc.

Where to find information about the system balance (and regulation)?

- For Scandinavia (and more precisely Denmark):
 - *historical* data at Energinet's page: 'Download of market data'
 - *real-time* data at Nord Pool's page: 'Regulating volumes' (also lots of other data)
- Some other examples:
 - *real-time* (and historical) data for France (RTE) at RTE's page: 'Daily balancing energy volume'
 - *historical data* for the Netherlands (TenneT) at TenneT's page: 'Export data'
 - A very nice *App* for Spain (REE) at REE's page: 'Electricity demand tracking in real-time'
 - etc.

Use the self-assessment quizz to check your understanding!



[credits: Mediehuset Ingeniøren]