

# System Reliability and Ancillary Services

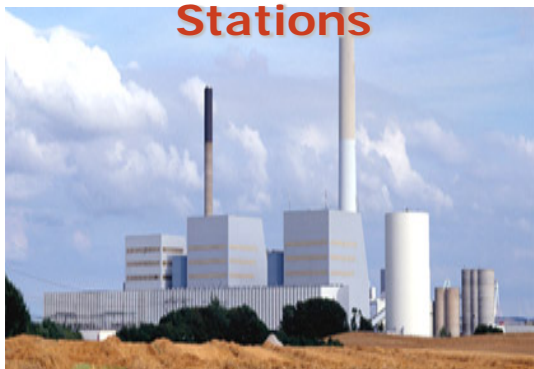
Presentation at Agora Energiewende, November 12 2015

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# Generation in the Danish electricity system\*

## 20 Central Power Stations



4.300 MW

## ~650 Local CHPs



2,500 MW



KILDE: ENERGISYRELSEN, ENERGIPRODUCENTSÅLLINGEN 2000, VINDMULLEKOORDINATER, KORT & MATRIKELSTYRELSEN 2001

## >5,000 Wind Turbines



4,900 MW

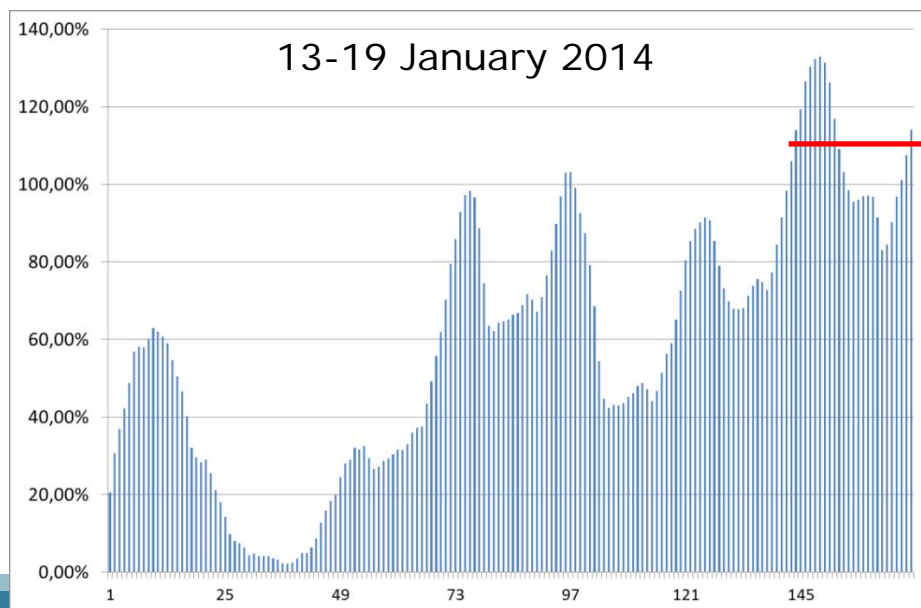
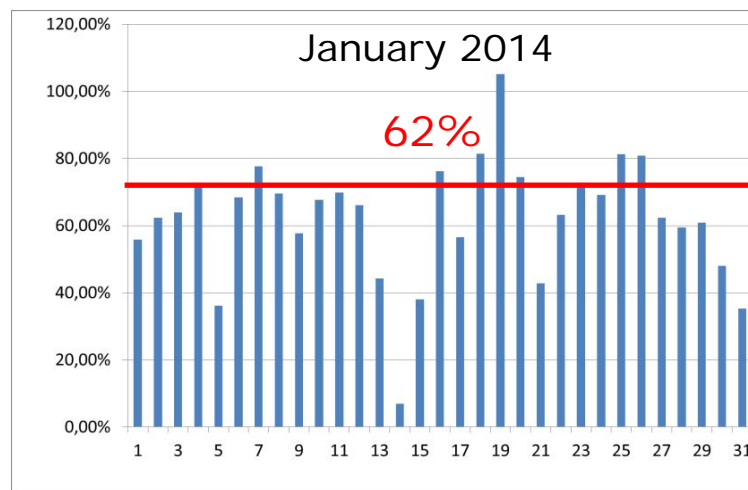
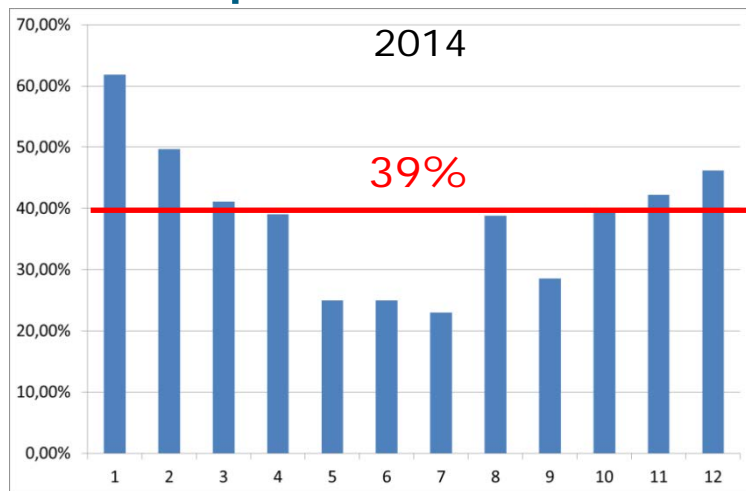
## ~90,000 Solar PV



600 MW

\* January 2015

# Wind power share in Denmark



Sunday 19 Jan  
105%

# Strong grid and interconnectors

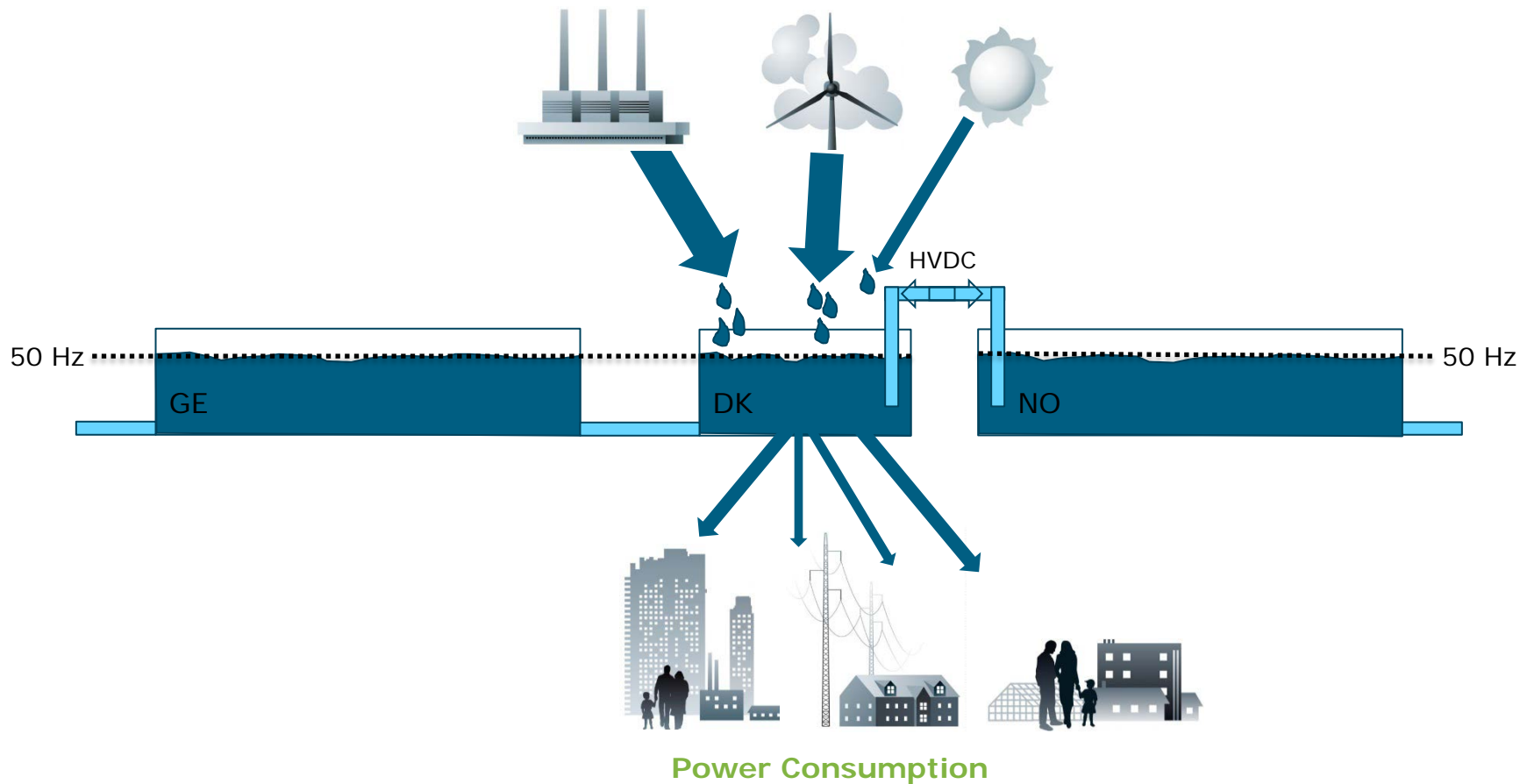


Interconnector capacity:  
~5.800 MW

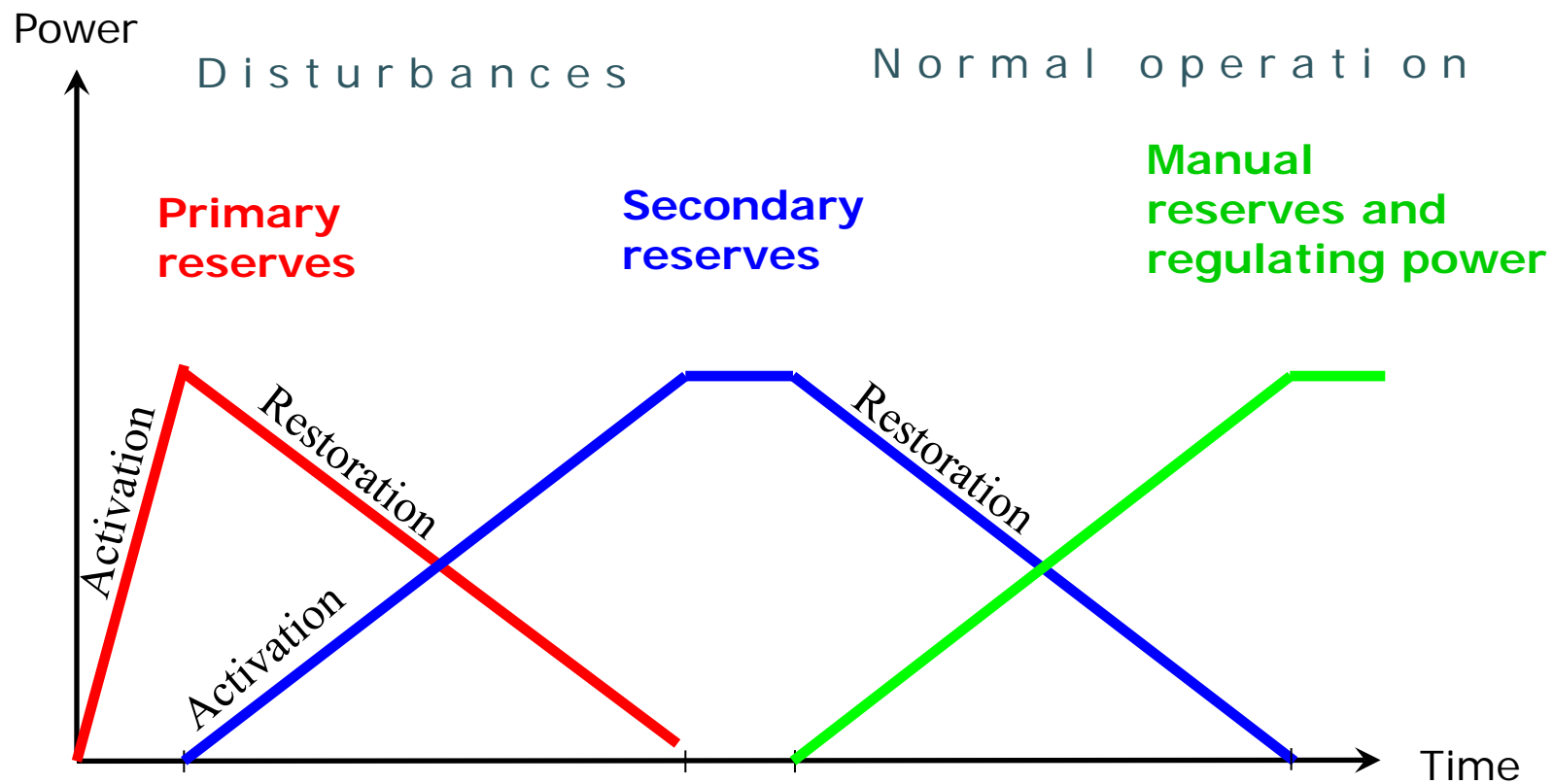
Maximum electricity consumption  
~6.000MW

# Keeping the system balanced

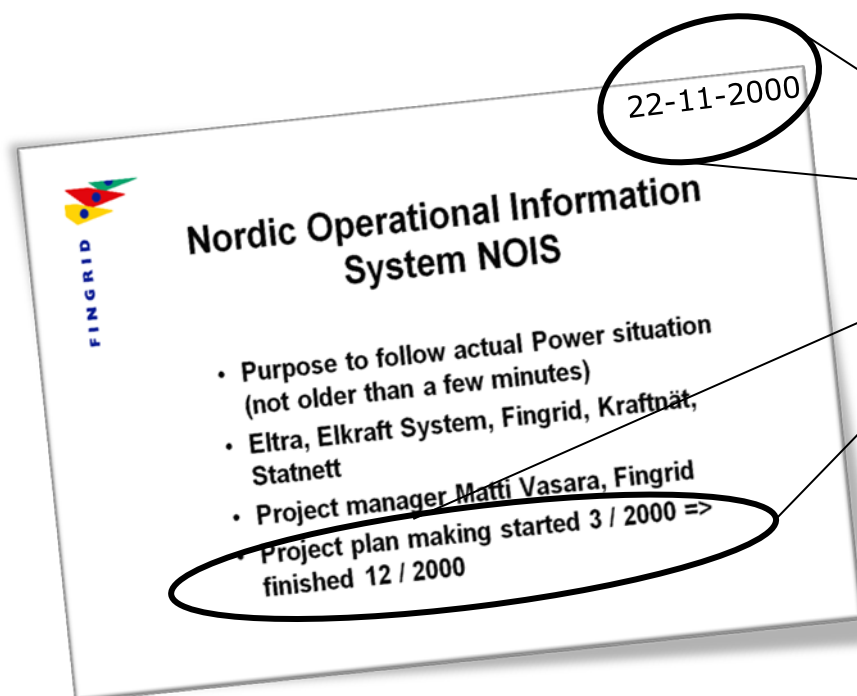
## Power Production



# Balancing philosophy



# The Nordic regulating power market (RPM)



- The setup is now around 15 years old
- Implemented quite fast only appr. 9 months
- Most of the rules from back then still apply today
- Harmonization of settlement in 2009
- Participation of wind parks since 2011
- NOIS has developed to be an IT tool, that is used to operate the **Nordic Regulating Power Market (RPM)**



## How the RPM works

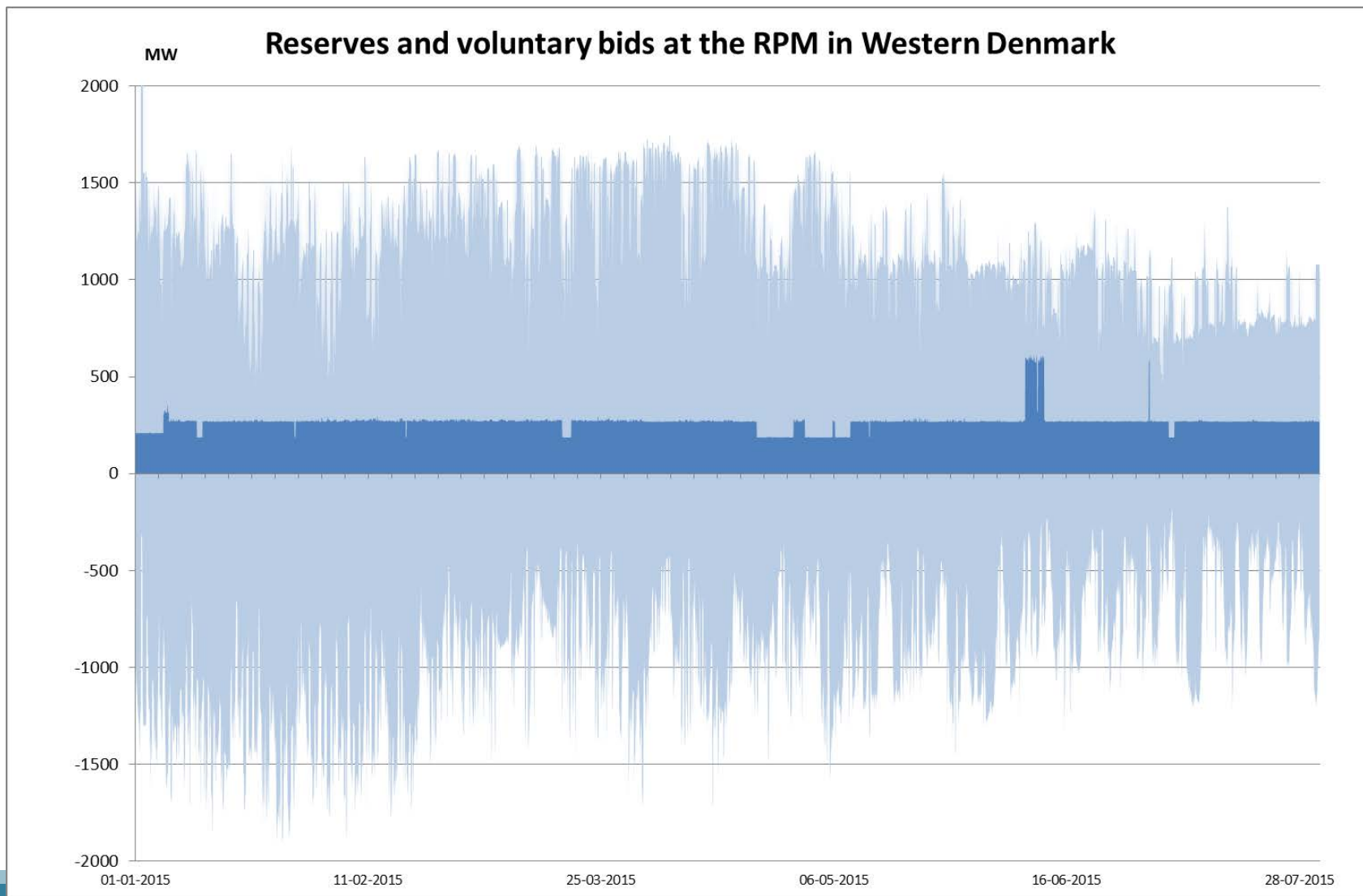
- Capacity contracts **and** voluntary bids
- Common Nordic merit order list
- Activation of cheapest, Nordic bids unless there's a congestion
- Most expensive, activated bid sets the imbalance settlement price
- Used to ease grid constraints e.g. redispatch with Germany



Source: Nordpoolspot

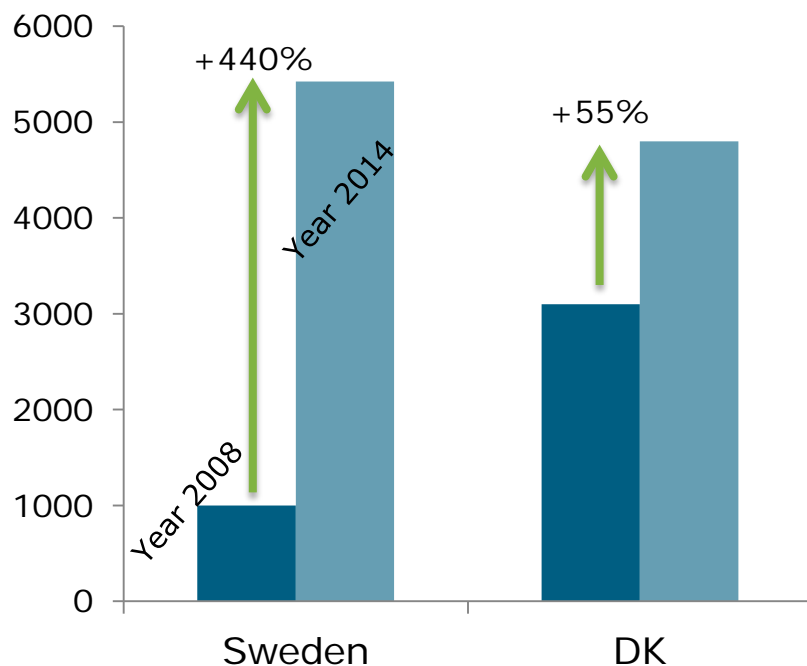


# Available resources on the RPM



## Example: wind integration in the Nordics

### MW Wind



#### **Fact:**

Significant increase in installed wind capacity in the Nordic in the period from 2008-2014

#### **Questions of interest:**

Has this affected imbalances ?

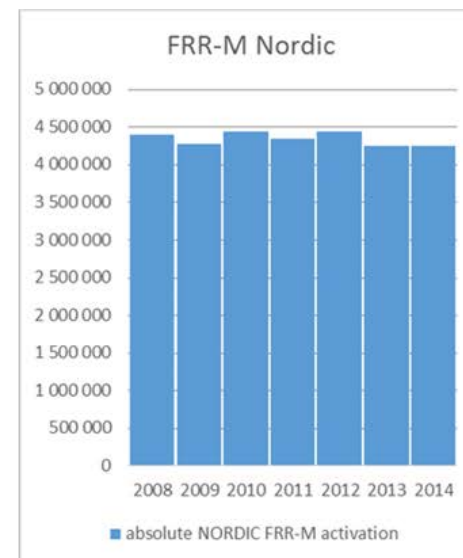
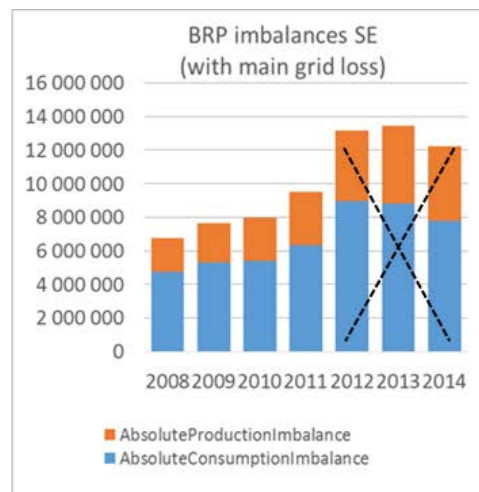
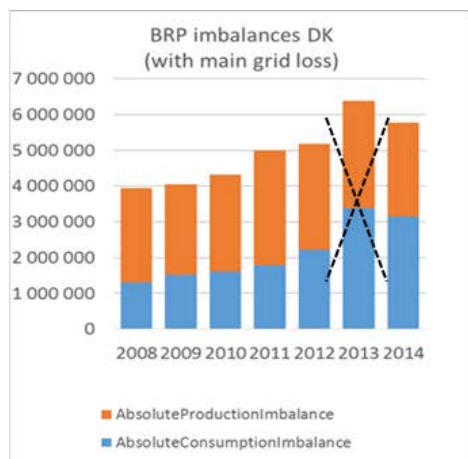
Has this affected the Regulating power market ?

Do we have to change the balancing incentives for the BRP's ?

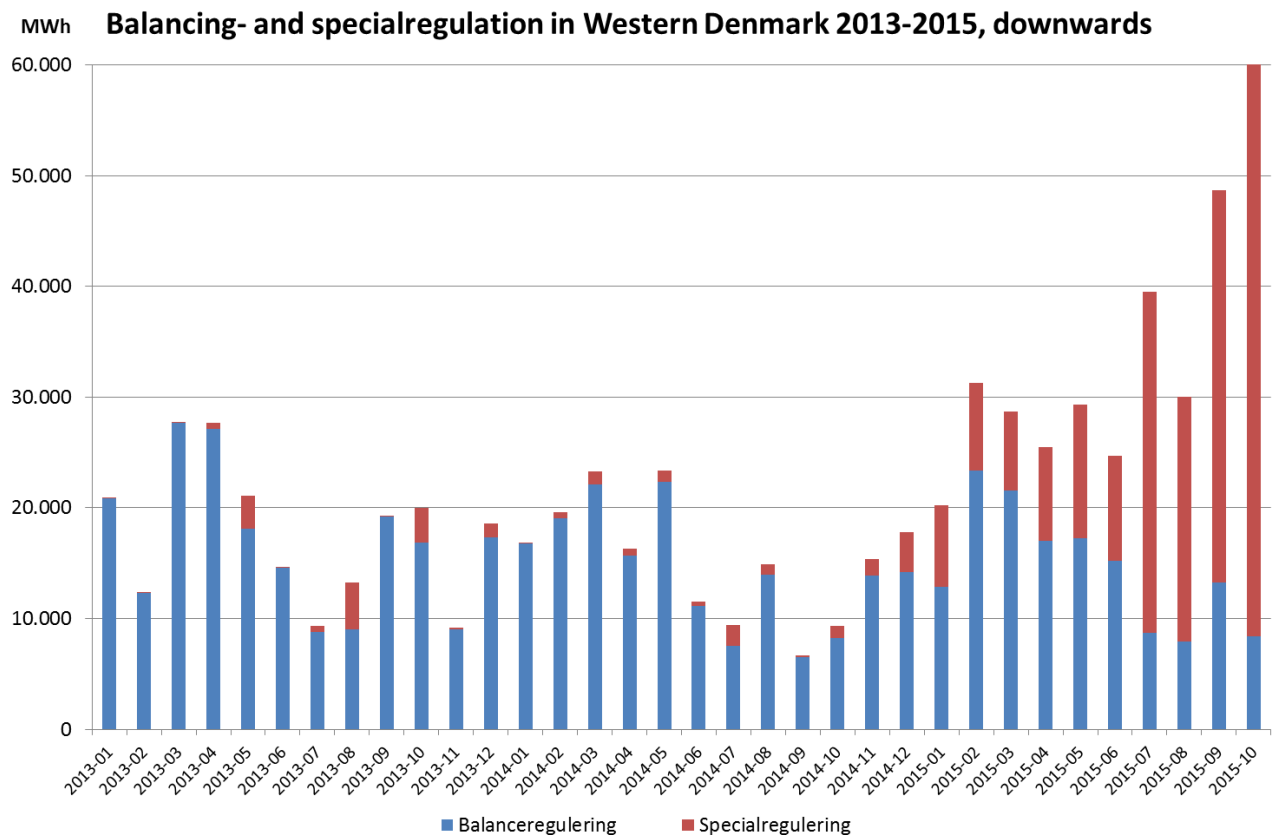


## Example: wind integration in the Nordics

- BRP's imbalances have increased significantly in DK and SE
- Increased wind power production is the main reason.  
(Structural changes another, crossed in graphs)
- Production imbalances are moved to consumption imbalances
- **However, yearly regulation volumes have not increased but decreased.**



# Grid constraints – redispatch with GE



Regulation process in GE:

1. Available German resources are regulated
2. Neighboring countries are asked if they can regulate
3. German wind parks are regulated

Thank you for your attention

Questions?

