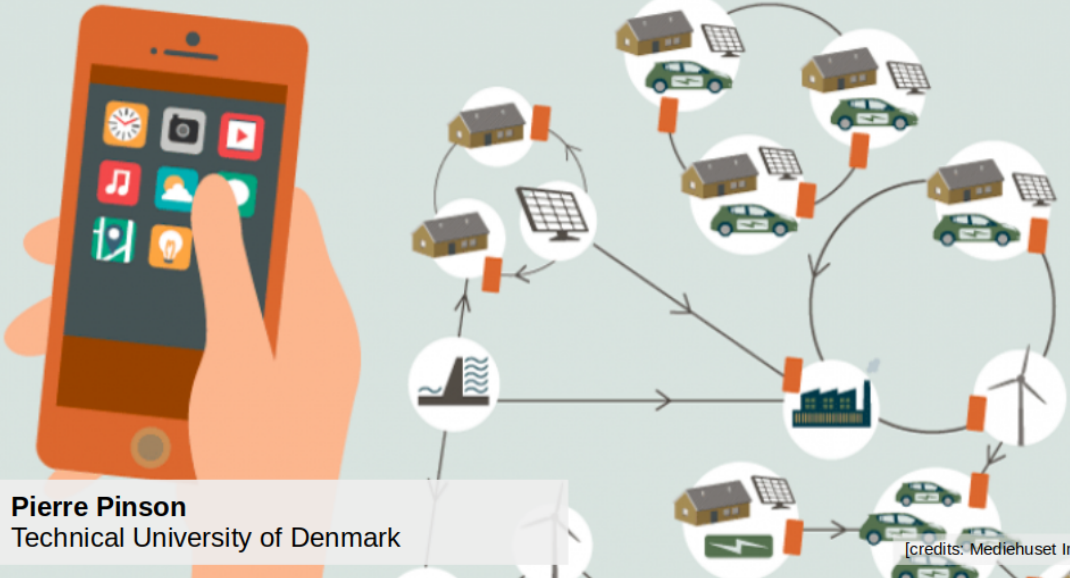
Module 3 – Intra-day and Balancing Markets

3.3 Balancing market and imbalance definition



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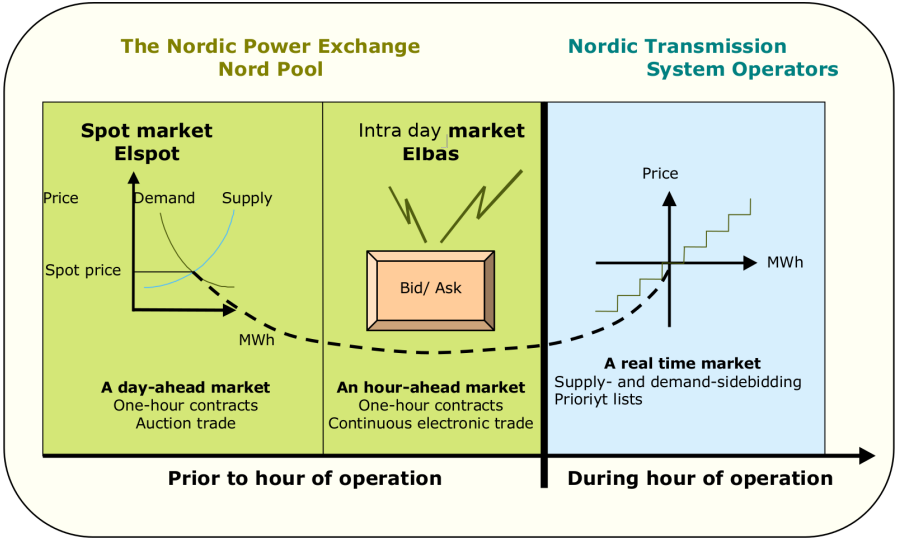
[credits: Mediehuset Ingeniøren]

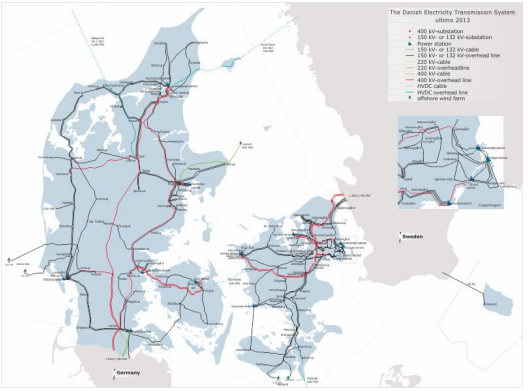
Passing the ball to the Transmission System Operator (TSO)



[source: *Nord Pool A/S*]

The balancing market(s)

- The TSO has the **ultimate responsibility** to keep its **transmission system in balance**
- For instance in Denmark, Energinet's transmission system covers
  - Transmission grid at the highest voltage level 400 kV
  - Regional electricity transmission grid on 132 kV east of the Great Belt and 150 kV west of the Great Belt



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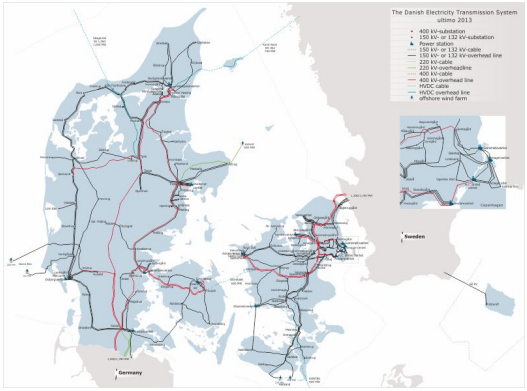


- The balancing stage combines (though we eventually see it as a single market mechanism):
  - *regulation market*, for the TSO to obtain necessary regulating power prior to the delivery hour
  - *balancing market*, linked to the real-time operations, and yielding balancing payments based on actual metering
- This also links to some *ancillary services* (i.e., tertiary/manual reserves) that the TSO purchases

[See, e.g., Energinet's regulation C2: The balancing market and balance settlement]

Who participates in these balancing market(s)?

- **Regulation market:**

  "A participant in the regulation market is offering to buy or sell regulating power, prior to the hour of operations"

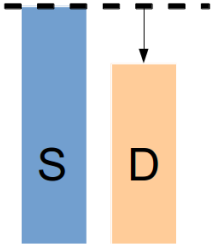
  - the TSO, aiming to purchase regulating power
  - actors of the power systems, who *voluntarily* propose regulating power
  - those who *committed* to provide regulating power (through the reserve provision mechanism)
  - for Scandinavia, these resources are shared through the **NOIS** list (**N**ordic **O**perational **I**nformation **S**ystem)

- **Balancing market:**

  "A participant in the balancing market is to cover the costs of his contribution to placing the system off-balance"

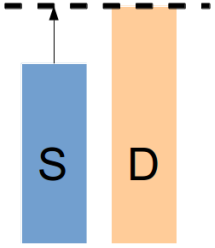
  - the TSO, responsible for the metering and settlement
  - all actors of the power system in the control area of the TSO

Is the system in imbalance?



Downward regulation

- There may be 3 possible situations, for the system as a whole:
  - **Positive imbalance**: Supply $>$ Demand $\rightarrow$ need for *downward regulation*
  - **Negative imbalance**: Supply $<$ Demand $\rightarrow$ need for *upward regulation*
  - **No imbalance**: Supply $\sim$ Demand $\rightarrow$ *no need for regulation*



Upward regulation

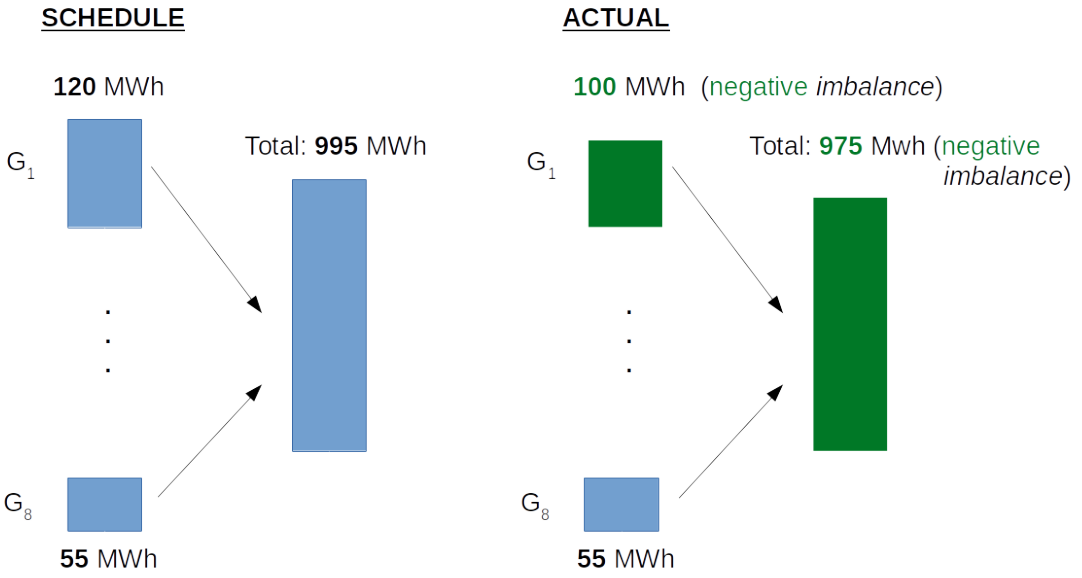
- Similarly, supply and demand participants may also have positive and negative imbalance:
  - **Positive imbalance**: Actual generation $>$ Scheduled generation (if supply) or ...
  - **Negative imbalance**: Actual generation $<$ Scheduled generation (if supply) or ...
  - **No imbalance**: Actual generation $\sim$ Scheduled generation (if supply) or ...

Starting from our day-ahead market clearing...

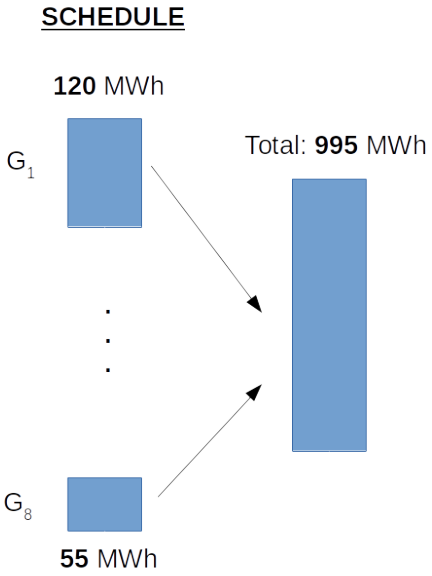
- After day-ahead market clearing, the supply and demand schedules are:

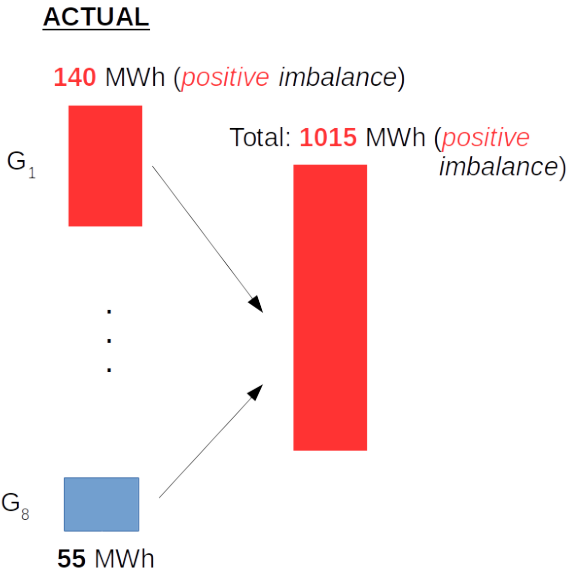
Supply id.	Schedule (MWh)	Demand id.	Schedule (MWh)
G_1	120	D_1	250
G_2	50	D_2	300
G_3	200	D_3	120
G_4	400	D_4	80
G_5	60	D_5	40
G_6	50	D_6	70
G_7	60	D_7	60
G_8	55	D_8	45
G_9-G_{15}	0	D_9	30
		D_{10}-D_{12}	0

Negative imbalances

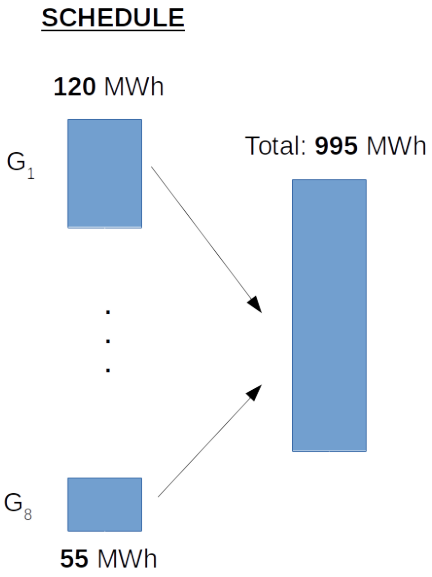


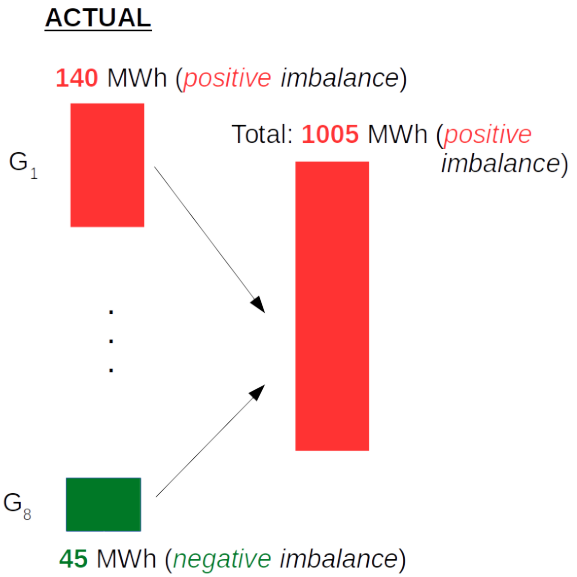
Positive imbalances



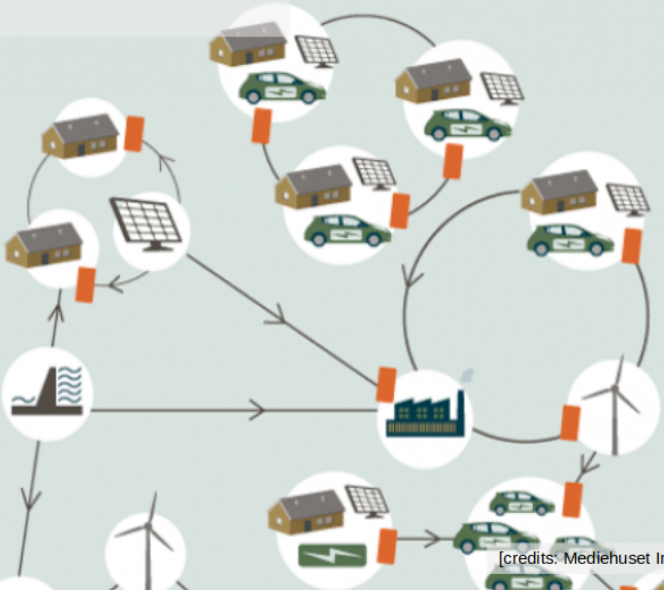


Positive and negative imbalances





Use the self-assessment quizz to check your understanding!



[credits: Mediehuset Ingeniøren]