

CITIES PhD and PostDoc Meeting: An overview of electricity markets

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Market Definition

- Market is a structure that allows buyers and sellers to interact in order to facilitate the exchange of any type of goods, services and information
- The various goods are usually exchanged for money
- A market includes the mechanisms to determine the price and facilitate the transactions



Electricity

- Constant **balance between generation and consumption**
- **Homogeneous product**, meaning that it has the same characteristics (e.g. voltage and frequency) for all the consumers
- Electricity is a commodity **one of a kind**, meaning that there is no commodity that could substitute it equivalently
- Electricity transmission and distribution are performed through **power systems**, imposing specific **physical constraints**
- **Storage** limitations (as of today)
- A large part of electricity demand is of **must-serve nature** (residential, hospitals, etc.)



Players

- System operation:
 - TSO – Transmission System Operator
 - Disco – Distribution Company / Distribution System Operator (DSO)
- Sell and buy:
 - Genco – Generating Company
 - Retailer
 - Consumer
- Market operation:
 - Regulator
 - Market Operator



Markets and their Purpose

- Futures markets

The time horizon is up to six years. The financial contracts can be daily, weekly, monthly, quarterly and annual contracts. They are used for price hedging and risk management

- Day-ahead market

The market that usually the highest volume of energy is traded. A two sided auction market, where producers, retailers and large consumers submit their offers



Markets and their Purpose

- Intra-day market

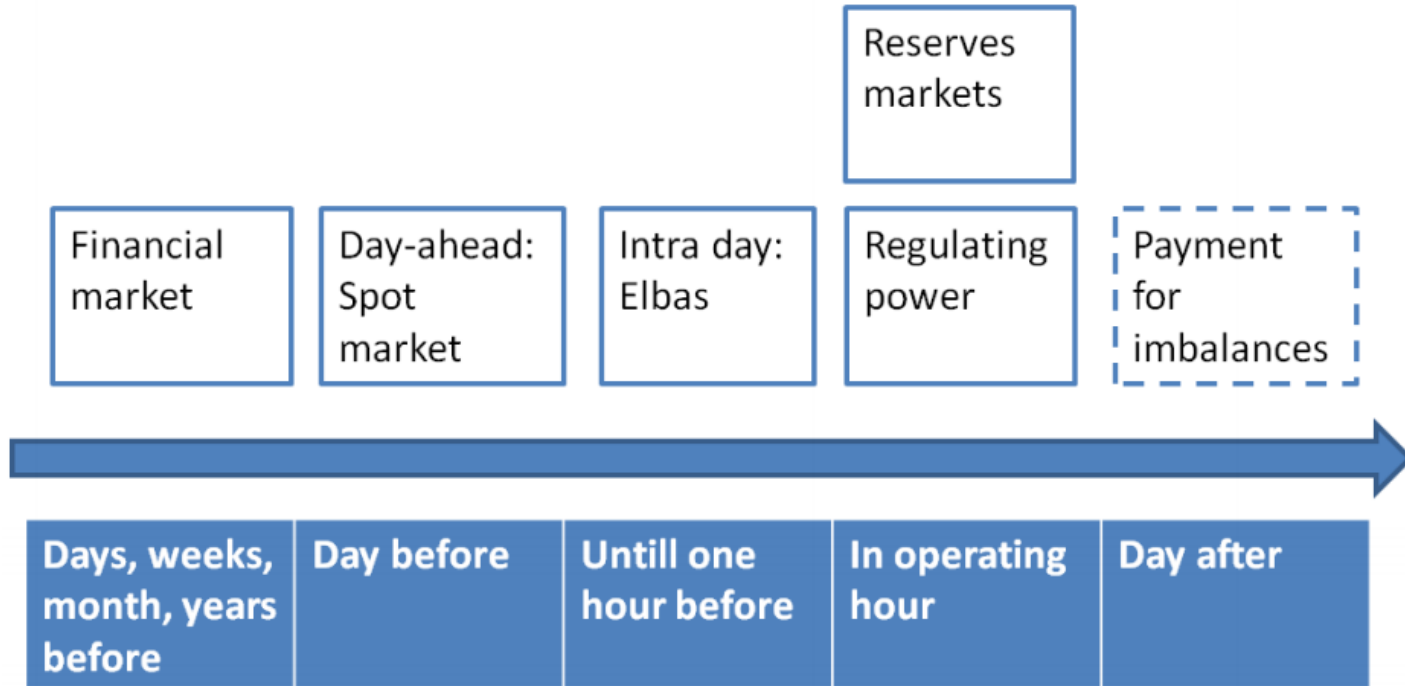
The purpose of this market is to deal with any possible deviations in production or consumption that could result from forecast errors in production (e.g. wind power production) or demand

- Balancing market

This market exists to ensure the matching of production and consumption at any time of the day. The system operator is the main buyer/seller of energy. It also acts as a penalization mechanism for those not respecting their supply/offer contracts



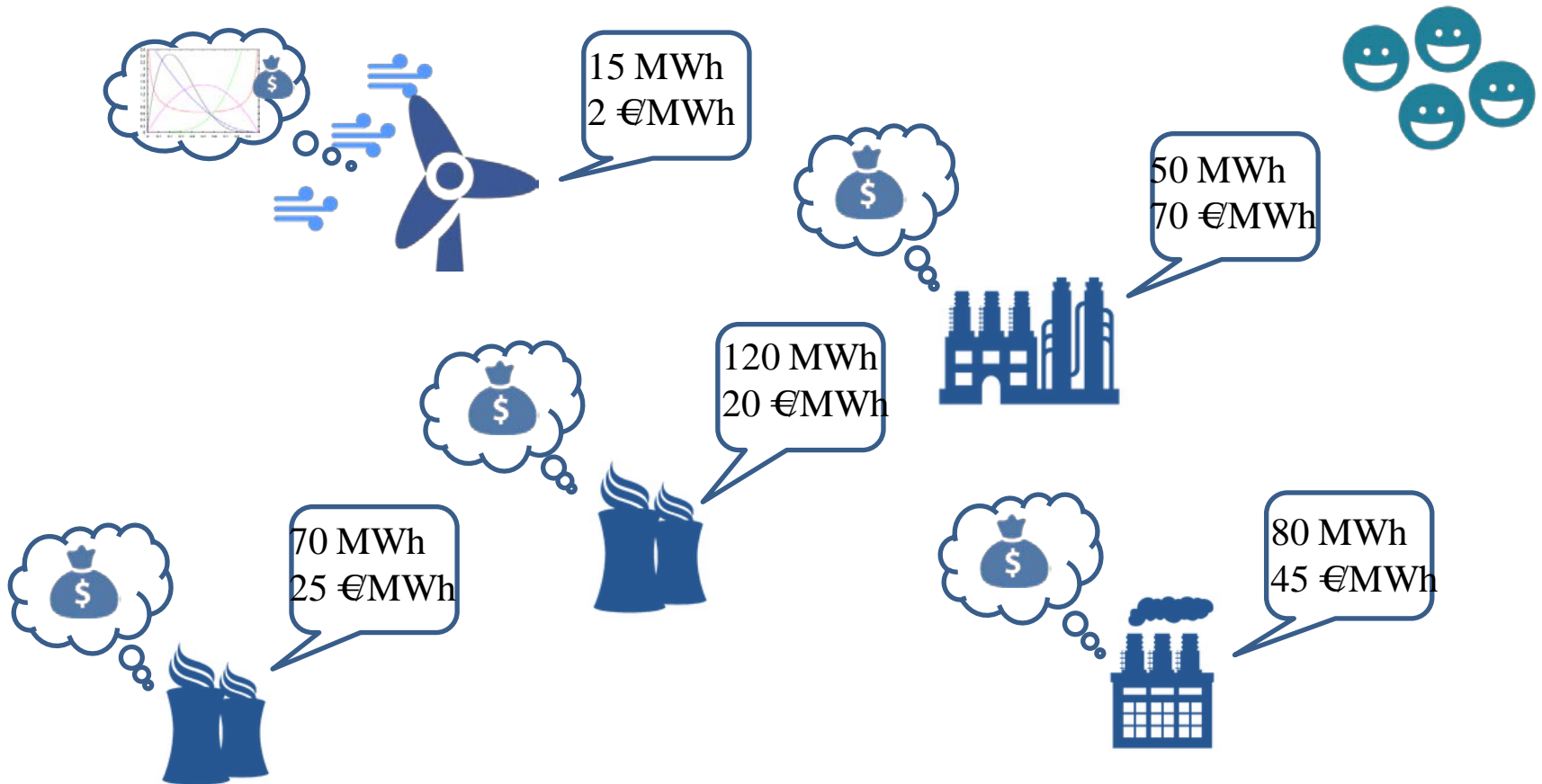
The Danish Electricity Market



C. Bang, F. Fock, M. Togeby (2011). The existing Nordic regulating power market
FlexPower WP1 – Report 1. Ea Energy Analyses



Renewables in Electricity Markets

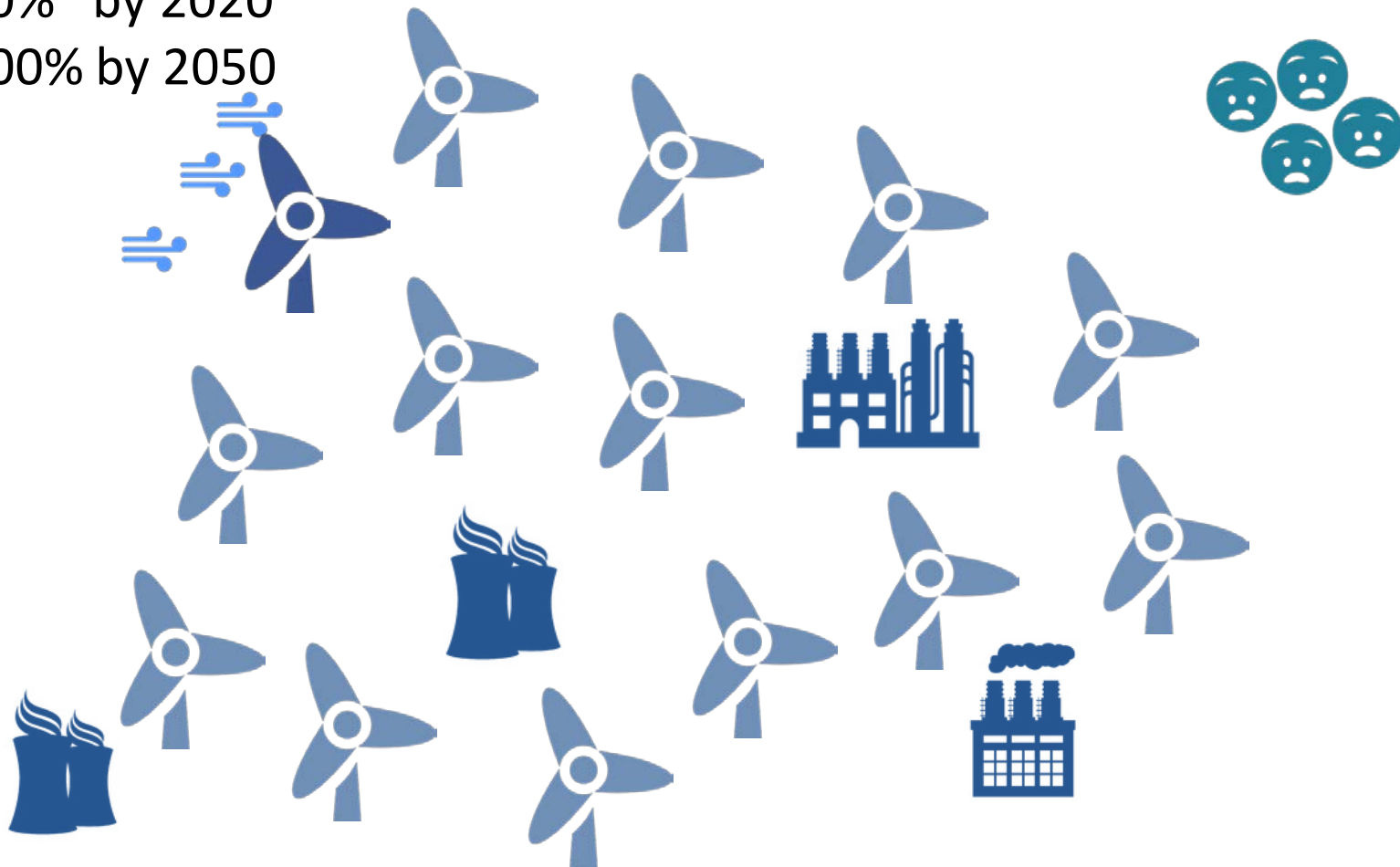




Renewables in Electricity Markets

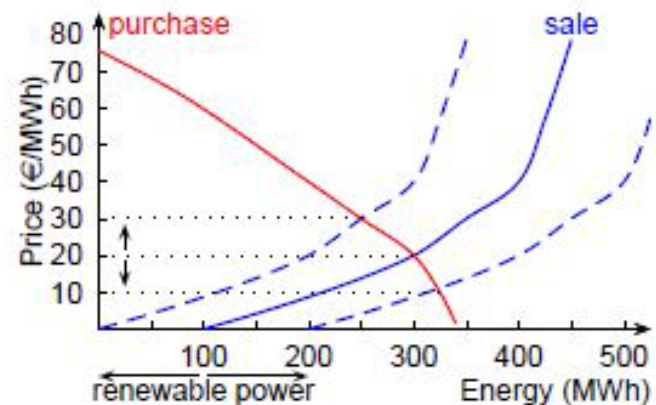
50% by 2020

100% by 2050



Renewables in Electricity Markets

- Increased renewable penetration affects the way electricity markets are operated
- Merit-order effect
 - Consumption offers are ranked in decreasing price order
 - Supply offers are ranked in increasing price order
 - Equilibrium point: maximize social welfare



Renewables in Electricity Markets

- Coordination
 - Time
 - Space
- Tools
 - OR/Optimization techniques
 - Modeling/Forecasting
- Existing ideas under investigation
 - Price maker: wind power producer
 - Robustness of market-clearing to misspecification of the stochastics



Thank you for your attention !

