



Grid interconnections and power markets

BRINGING NORDIC SOLUTIONS TO THE
EASTERN AFRICA POWER POOL

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Nordic power system

Mix of hydro, nuclear, wind, thermal and geothermal generations

High per capita electricity consumption

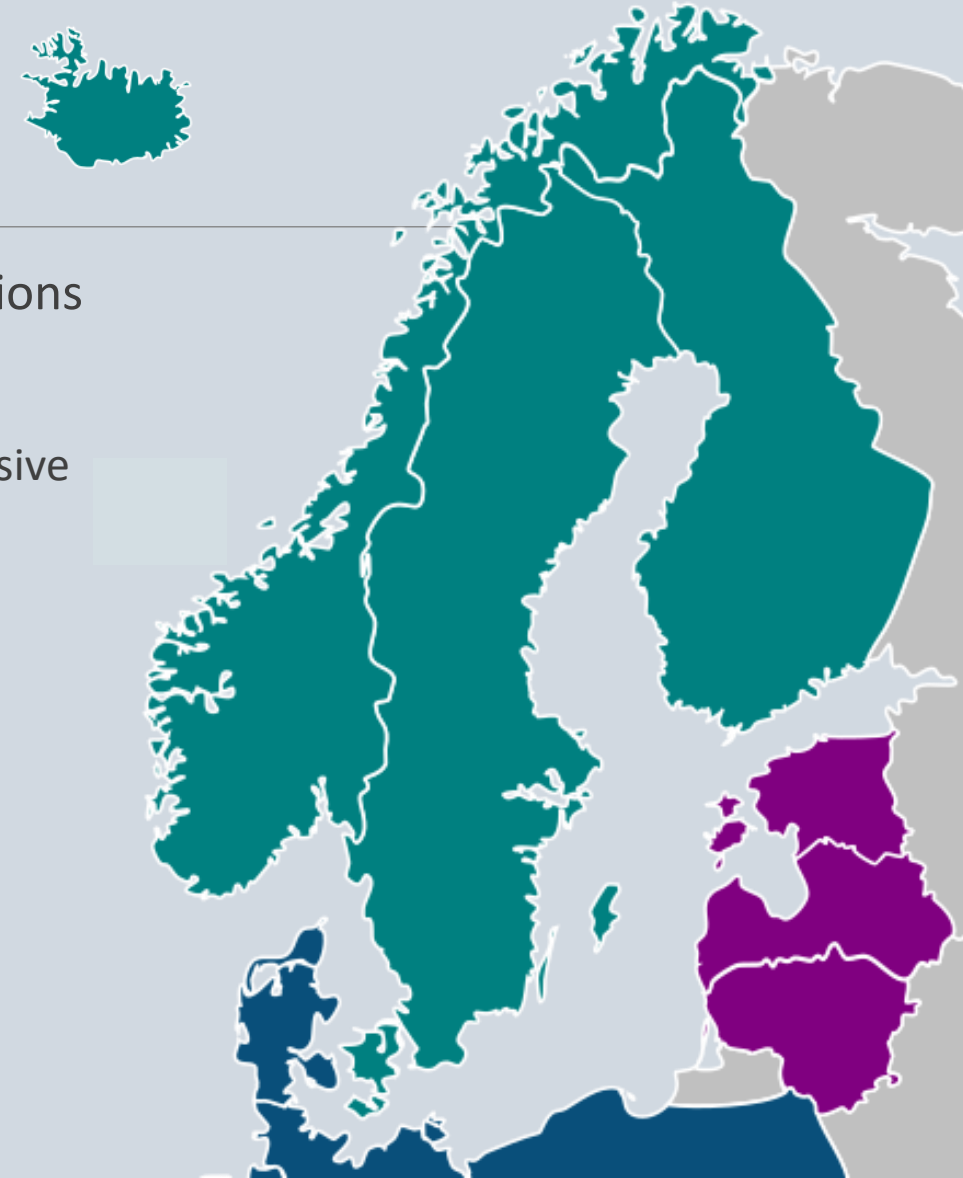
- cold winter, electricity heated houses, relatively low prices, Intensive industries

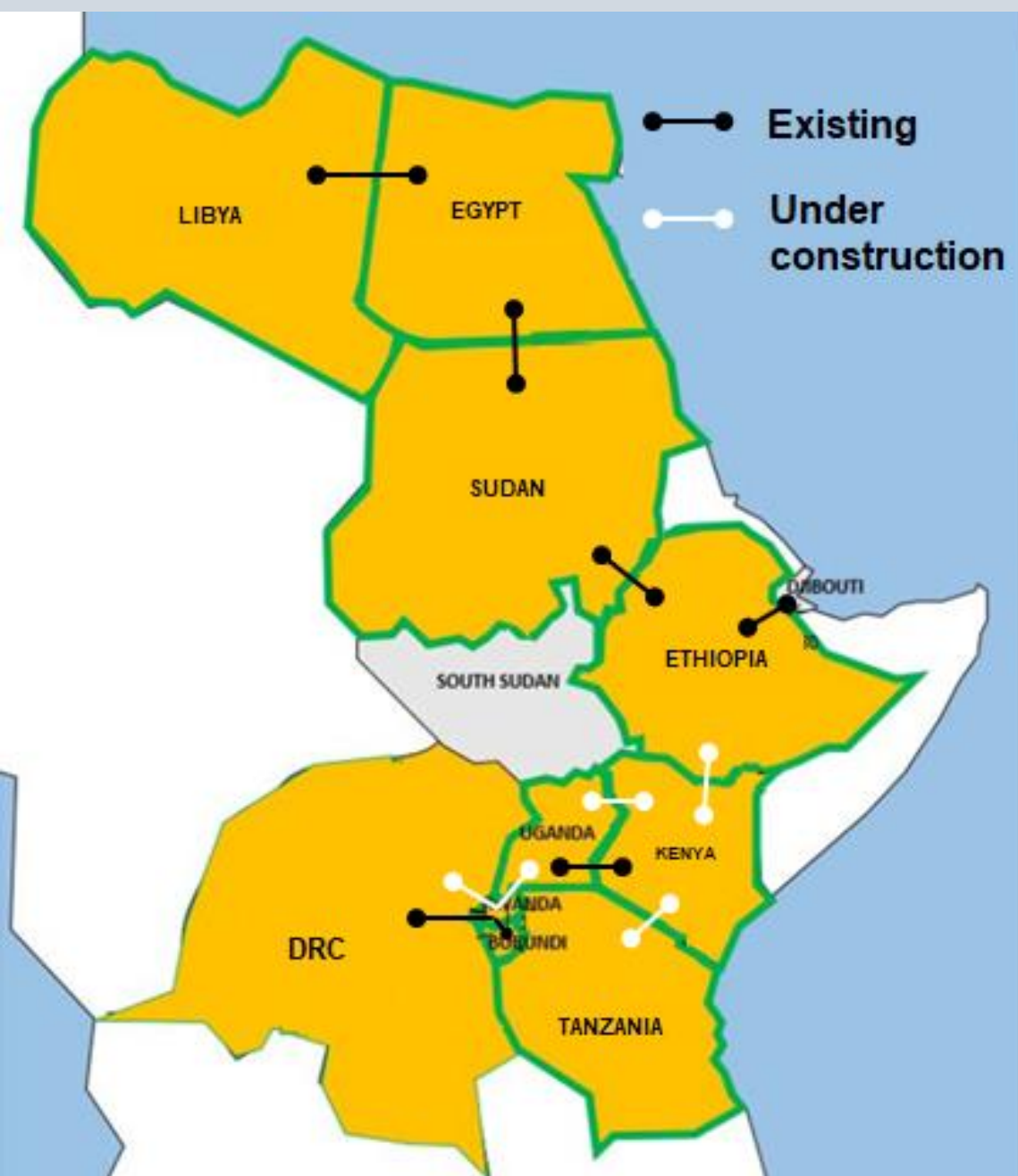
Nordic synchronous power system

- Norway, Sweden, Finland and Eastern Denmark
- AC connections at different voltage levels

Strongly connected to neighboring systems

- 10 GW transmission capacity





Eastern Africa power system

Mix of resources

- Natural gas, hydro and oil are primarily used
- Large untapped hydro, geothermal, wind and solar potential

Strong growth in demand

- increasing electrification and economic growth

Focus has been on national grids

Interconnections

- Existing: 0.9 GW
- Under construction and committed: 4.6 GW

Special features of electricity

Real-time balance between generation and consumption

- Reserves and demand responses are used

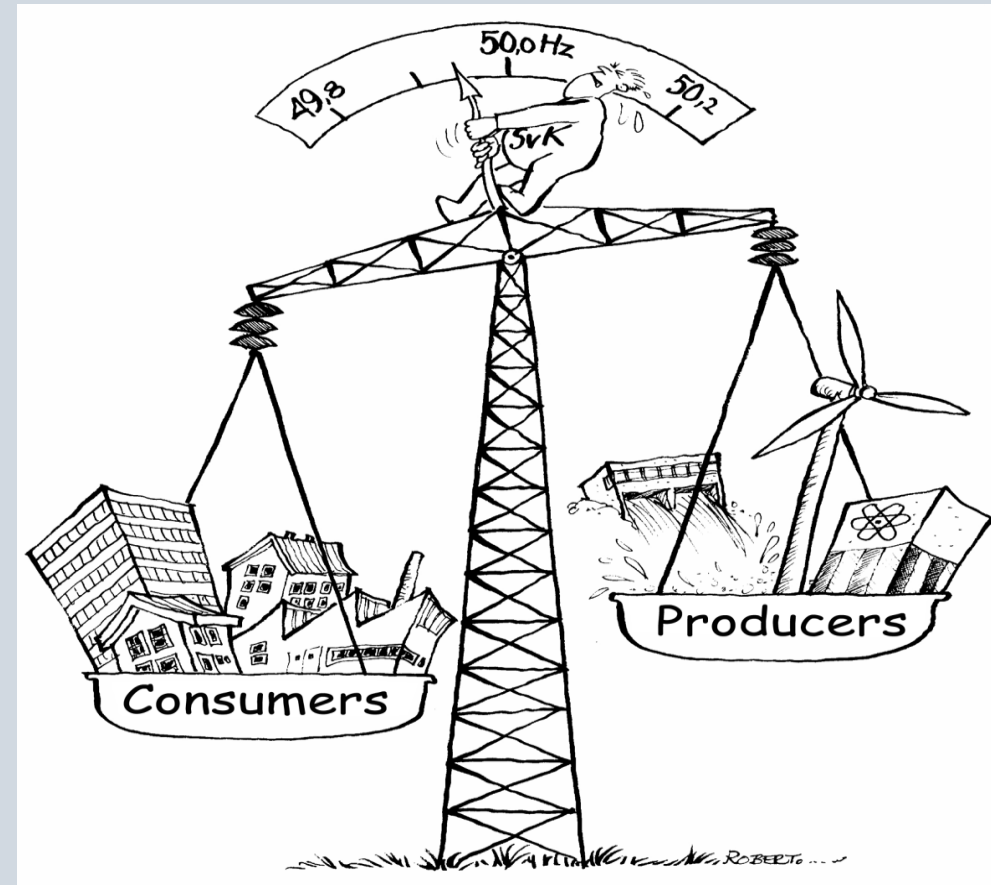
Variable consumption (daily, weekly and annually)

Low price elasticity of consumption

Essential to the community and industrial growth

Possibility of a blackout

- Affects a large geographical area
- Has a huge economic consequence



Source: Statnett

Types of electricity exchange

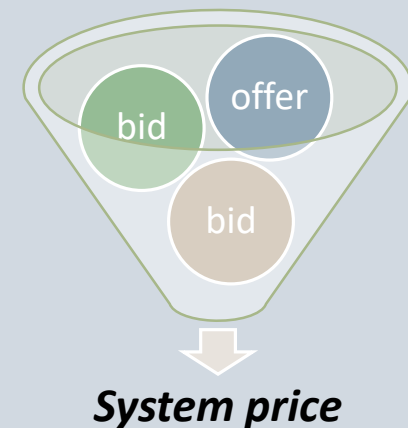
Bilateral trading

- Direct exchange of power between a seller and a buyer
- Private agreement between the buyer and seller
- Price and quantity are negotiated directly - no “official” price
- Lack of transparency



Pool trading

- Generation bids and consumption offers are placed
- No one knows others' bids and offers
- Market operator determines successful bids/offers and the market price
- Full transparency



Eastern African Power Pool

Established in 2005 by seven countries

- Democratic Republic of Congo (DRC), Burundi, Rwanda, Kenya, Ethiopia, Sudan and Egypt
- Tanzania, Libya and Uganda joined later

Bilateral power trading between neighboring countries

Market operator of the integrated regional power market



Nordic Electricity market

Liberalization of the electricity market in 1990s

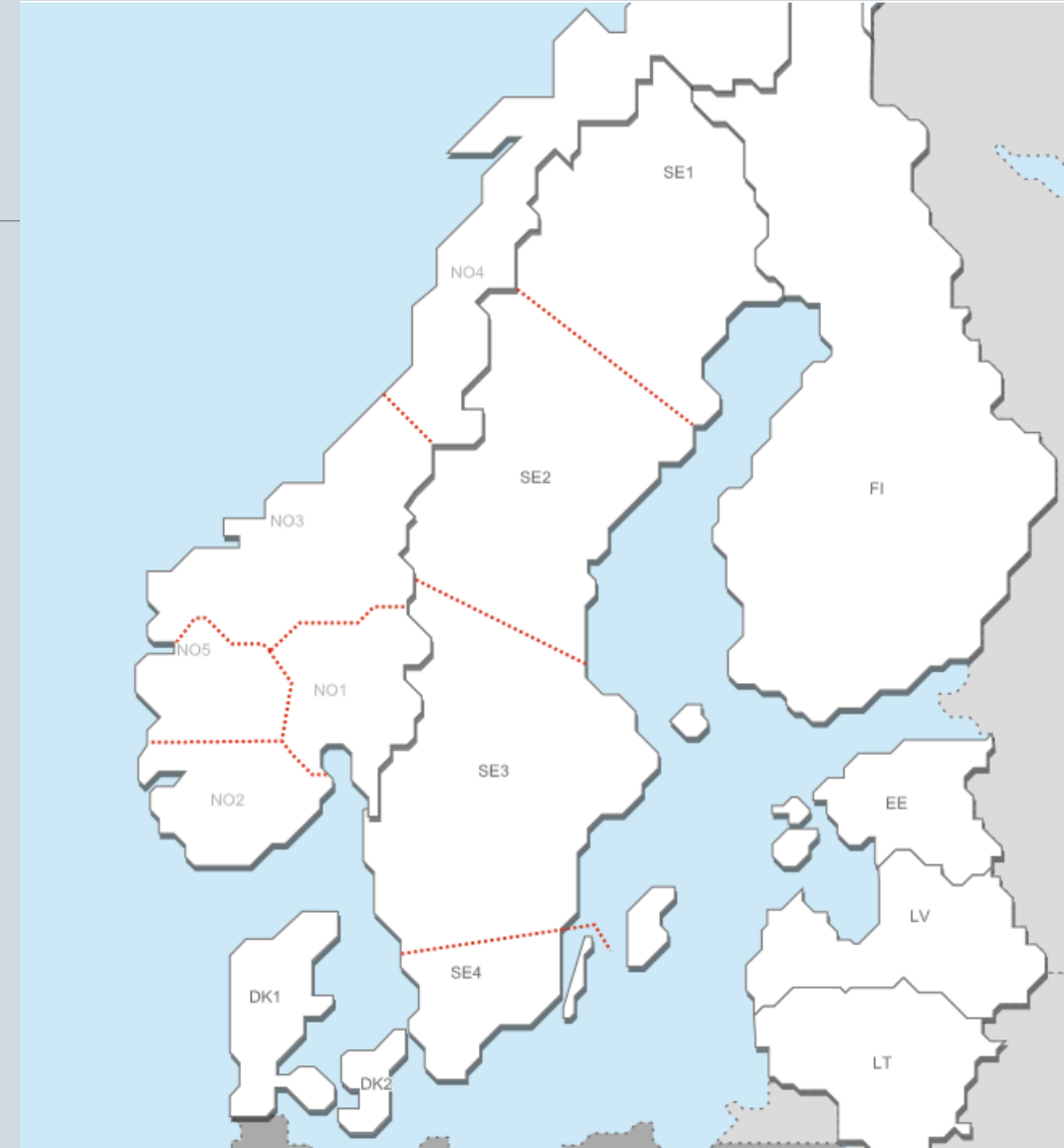
Nord Pool is the operator of the wholesale market

- 100% owned by the Nordic and Baltic system operators
- provides equal access, accurate information and guarantees contract settlement and power delivery

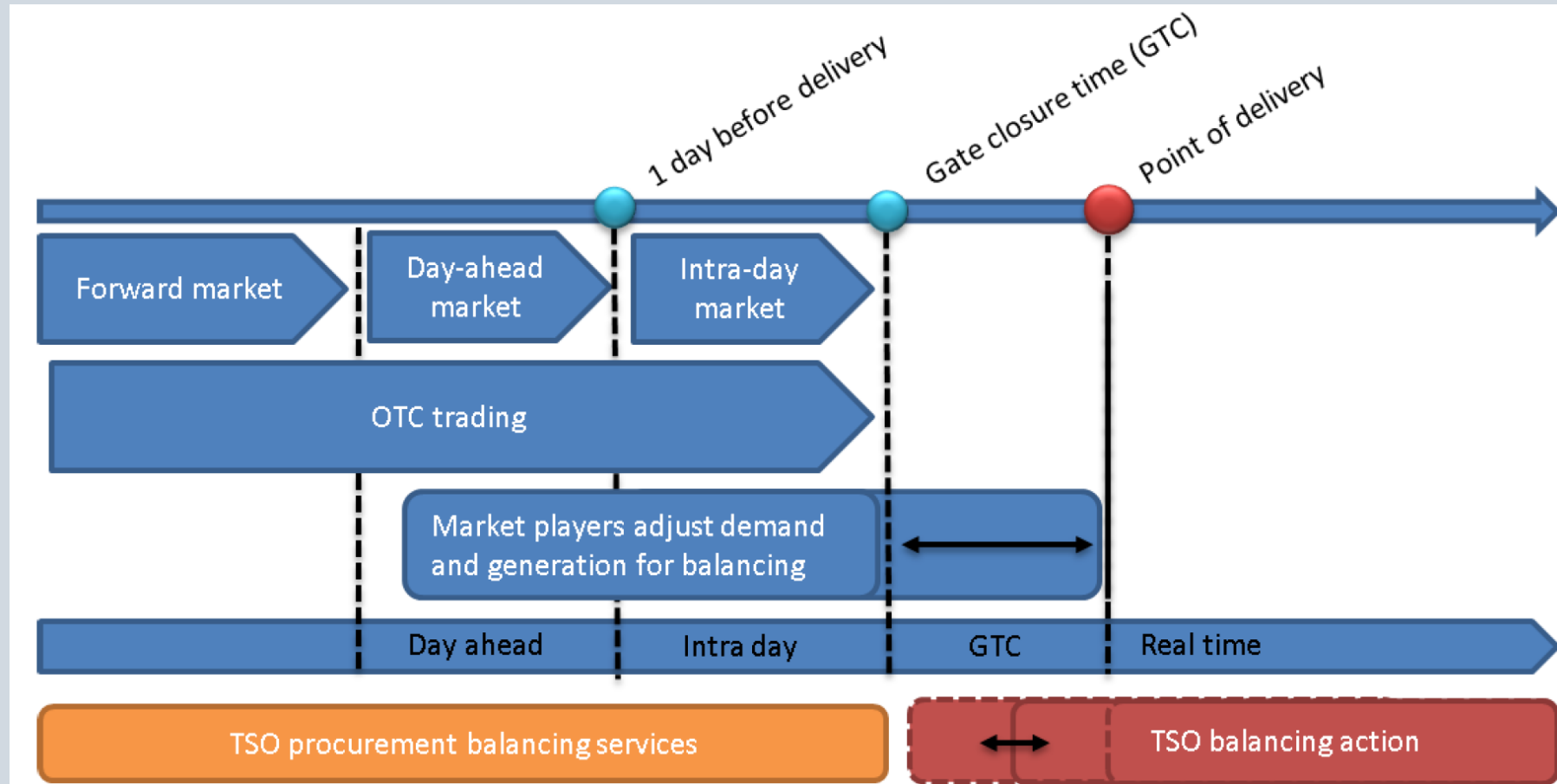
Bidding for purchases and sales of power takes place specifically for each spot market area for every hour

Price is not regulated by the authorities

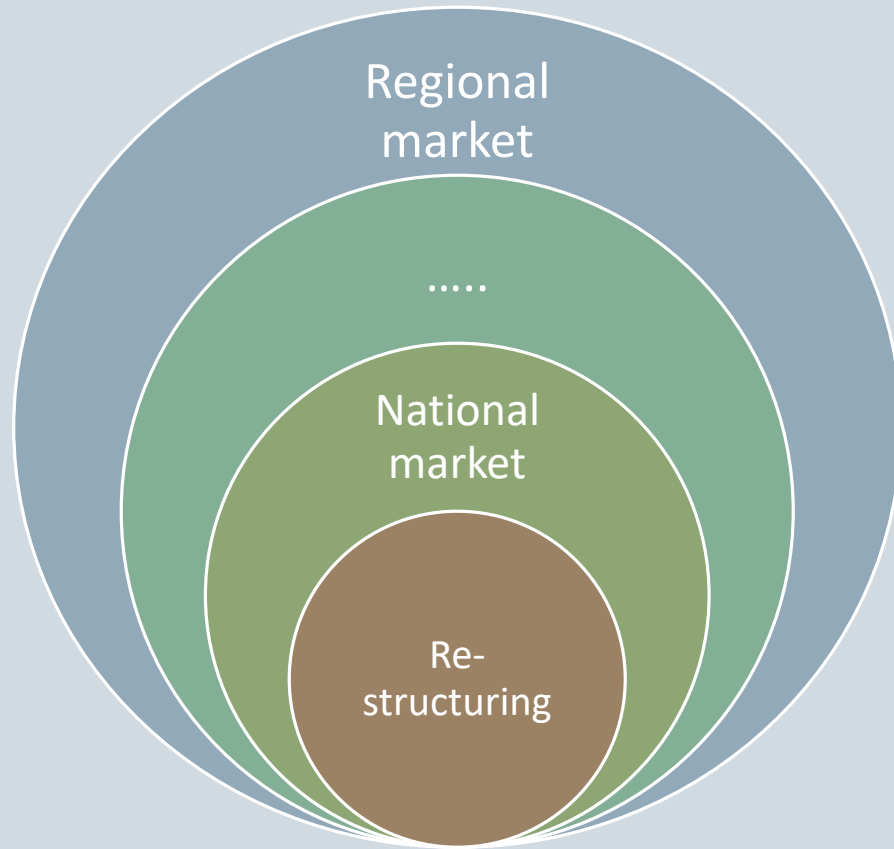
Different markets and time windows



Time-line in the Nordic electricity market



Policy and Regulatory frameworks



Unbundling of the vertically integrated power companies

- Generation and Transmission (TSO, ISO, or ITO)

Independent and impartial regulatory authority

- Sets tariffs, settles on cross-border issues, monitors system operator, etc

Institutional cooperation: ENTSO-E, NordREG

- Platform for development of transmission grids, integrated market, legal harmonization

Integrated power market

- From national -> country-to-country -> regional market

Summary: Key takeaways

Restructuring of the power companies

Regulatory

- develop regional and national regulations that facilitate and guide the development of the common market

Infrastructure

- investments in strengthening national grids and transnational transmission capacity

Data driven planning

- Marginal “fuel” price, accurate load forecasts, forecast for variable generation (wind, solar)

Operation

- Keep sufficient reserve capacity, respect reliability margins, comply with network codes, and operational guidelines