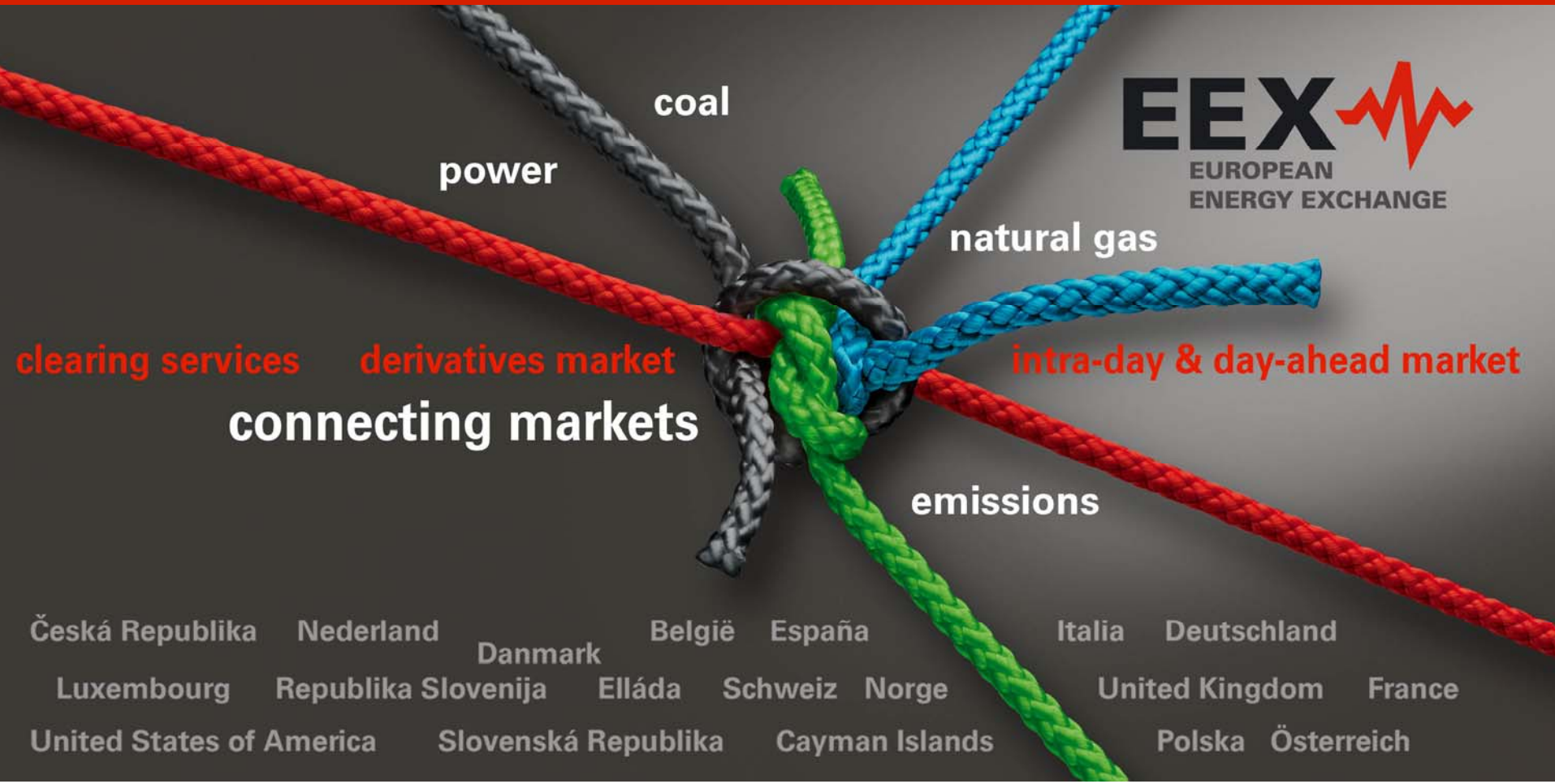
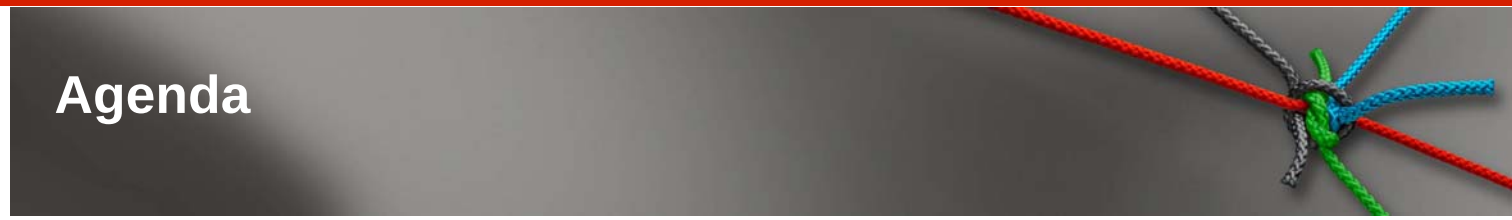


Market Coupling

21. Juni 2007, Leipzig

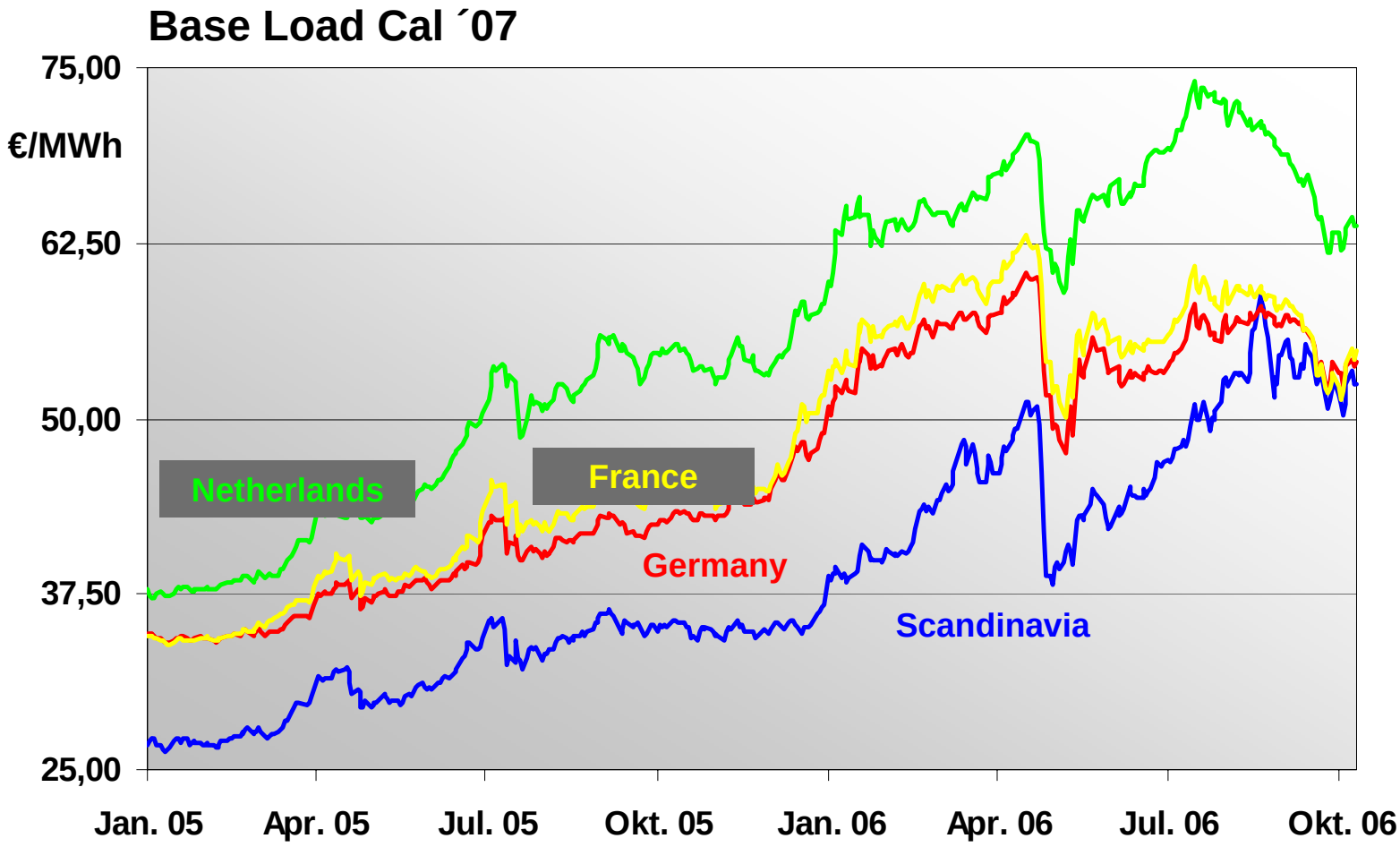
Dr. Jan Sierig, Director Business Development, European Commodity Clearing AG (ECC)

Agenda



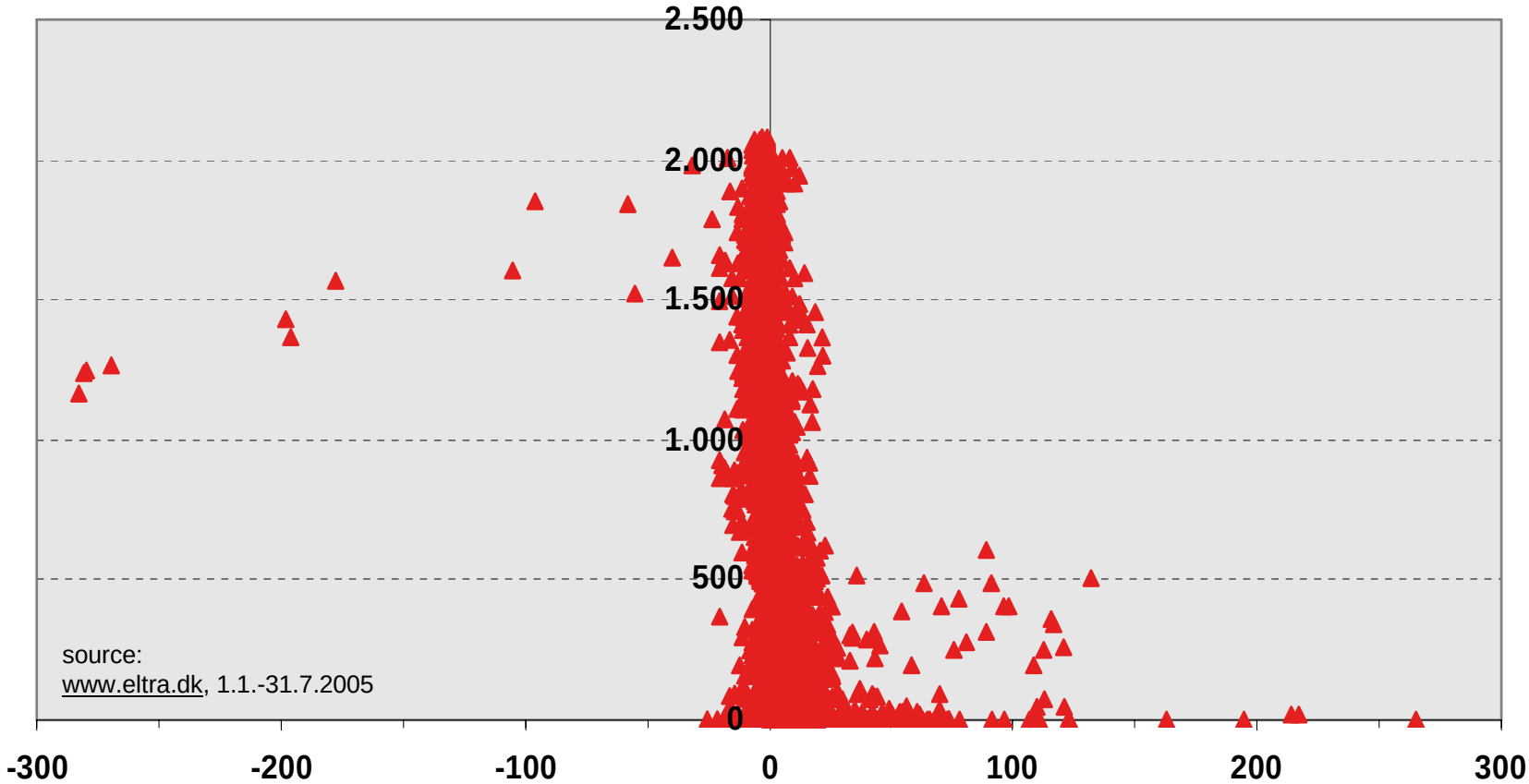
1. **Introduction**
2. The principle of Market Coupling
3. Market Coupling between Germany and Denmark

Cross border trading
Congestions and prices

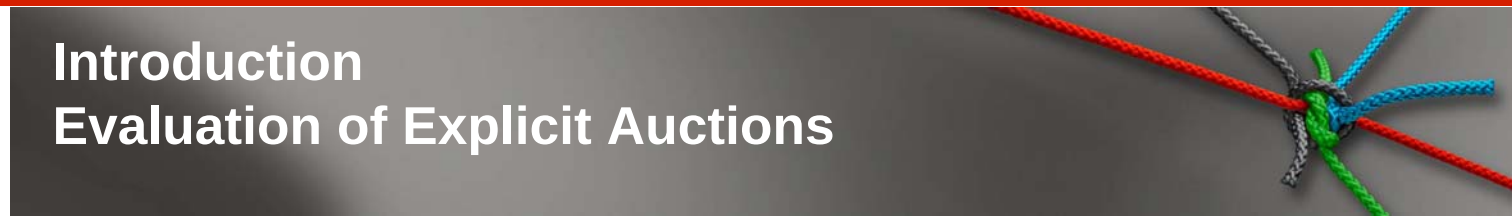


Introduction
Explicit Auctions at German/Danish-Border

Capacity not used [MW]
towards the country with the higher spot price



Introduction
Evaluation of Explicit Auctions



Futures/forward markets

- OTC trading and exchange trading
- Continuous trading with continuous price transparency
- Futures/forward market prices available for explicit auctions

➔ Explicit auctions provide an efficient cross boarder trading of forward/futures. ✓

Spot markets

- Almost only exchange trading, e.g. in Germany 90%
- Auction trading with ex-post price transparency
- Only forecast of spot market prices available for explicit auctions

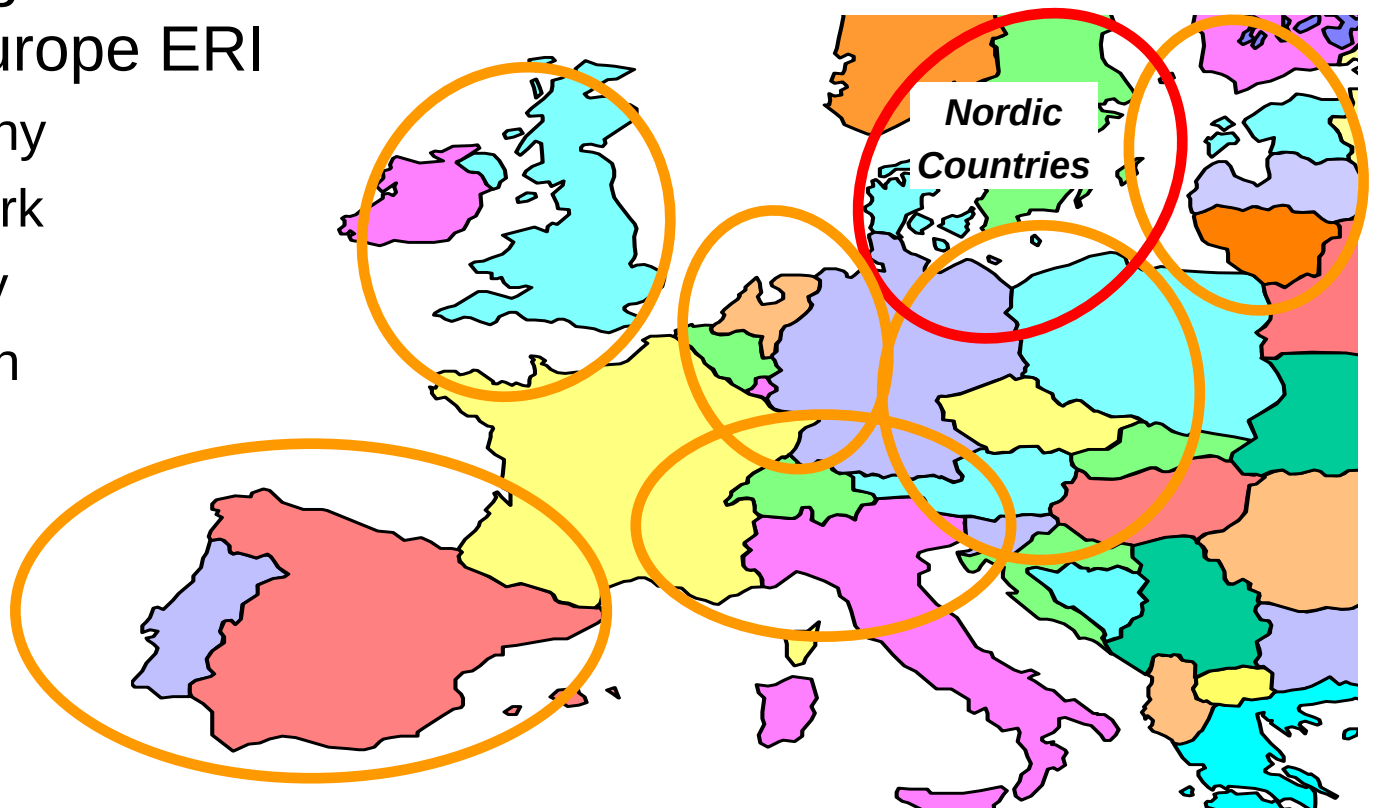
➔ The usage of capacity available (day-ahead) is limited to the quality of spot price forecast.

➔ Implicit auctions allow an optimal usage of capacity (day-ahead). ?

Electricity Regional Initiatives (ERI)

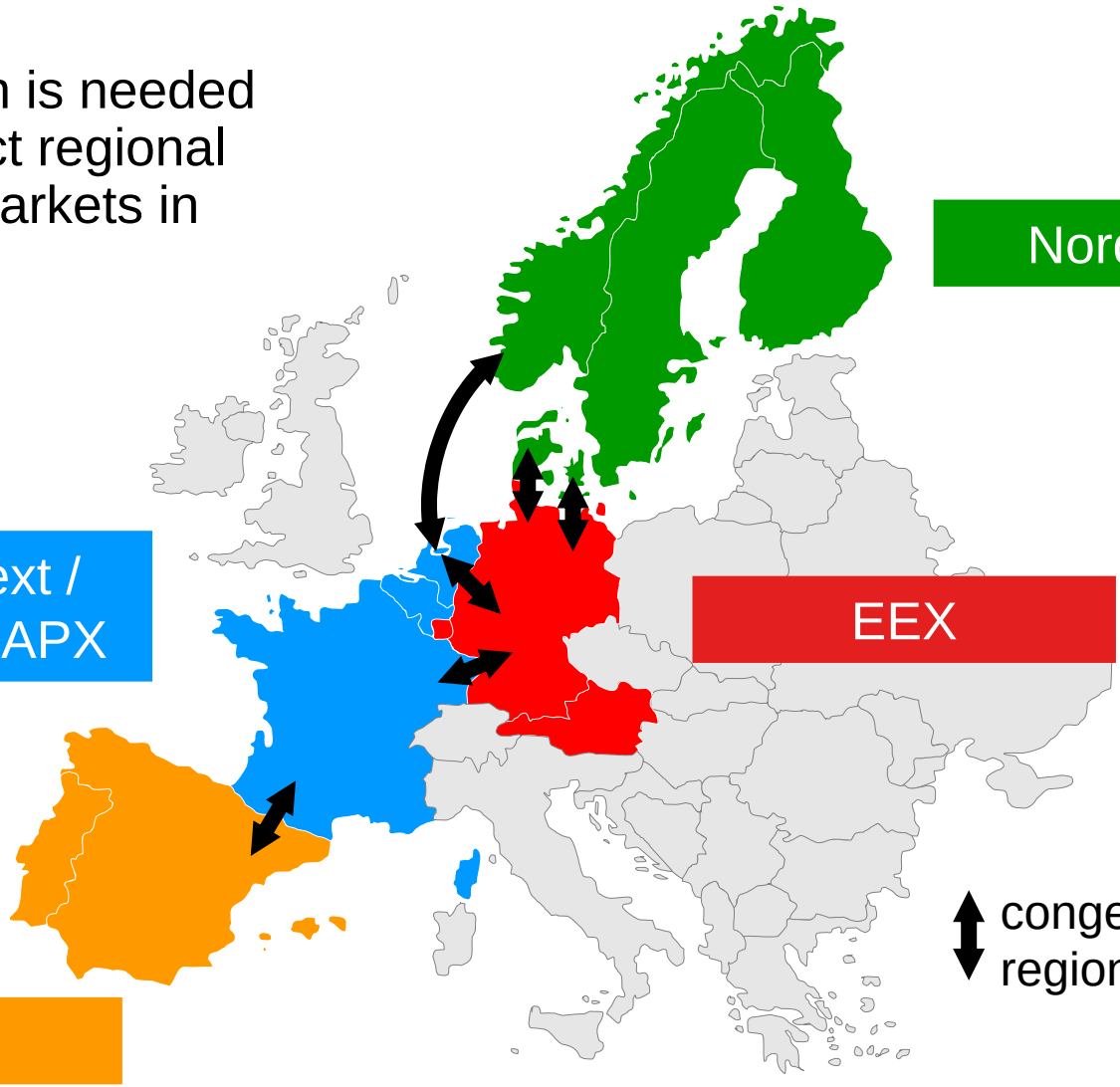
Participating countries in Northern Europe ERI

- Germany
- Denmark
- Norway
- Sweden
- Finland
- Poland

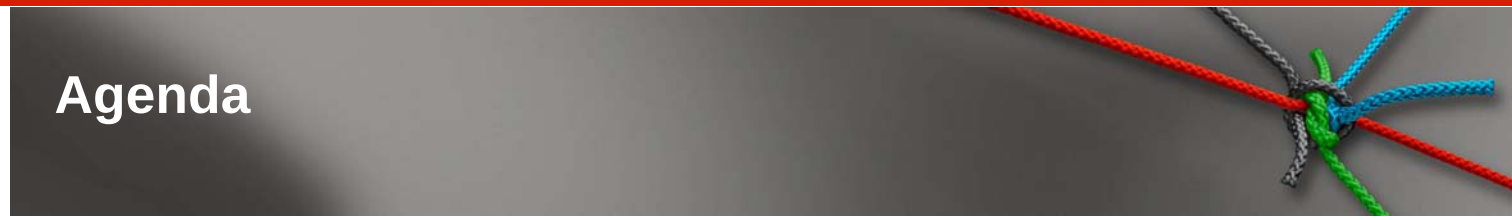


Introduction
Connecting European Power Markets

- A solution is needed to connect regional energy markets in Europe!



Agenda

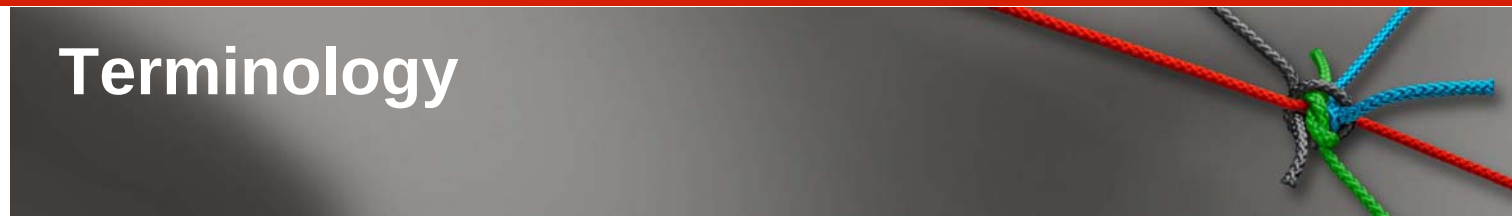


1. Introduction

2. **The principle of Market Coupling**

3. Market Coupling between Germany and Denmark

Terminology

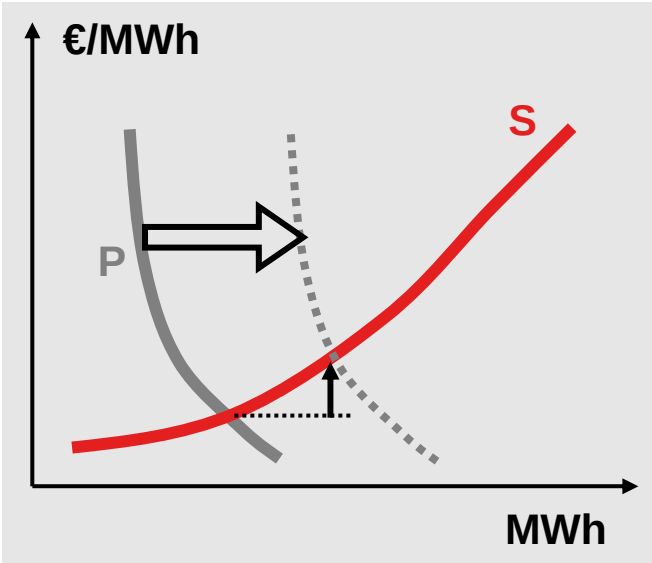


- Market splitting: When one power exchange manages the cross-border power flows in its own area
  - Example: The Nordic area where its done by Nord Pool Spot

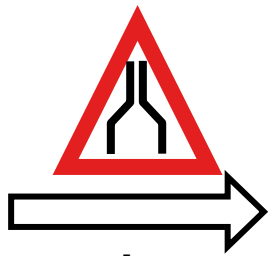
- Market coupling: When at least two power exchanges manage the cross-border power flow at a border where the power exchanges meet
  - Done in a cooperation between more than one power exchanges
  - Example: The Trilateral Market Coupling France-Belgium-Netherlands
  - Presently many projects are under way in Europe

Market Coupling
Principle for Allocation

Exchange A
Order Book A
Market Area A

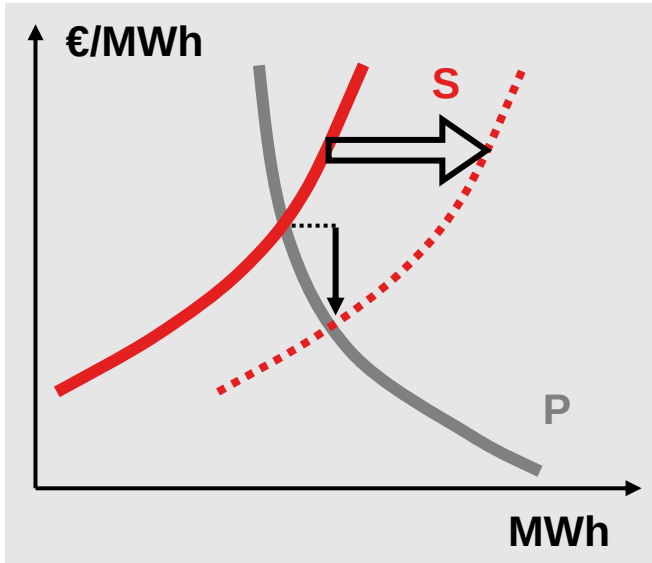


Transmission



Maximum Capacity

Exchange B
Order Book B
Market Area B



Legend

P Purchase Orders

S Sale Orders

⇨ Capacity Used = Additional Purchase and Sale Order

→ Spot Price Movement

Types of Market Coupling

- So called "**Volume Coupling**"

  The Auction Office calculates the cross-border power flow only. Thereafter each power exchange itself calculates the clearing price in its area and the traded volumes per participant

- So called "**Price Coupling**"

  The Auction Office calculates not only the cross-border flow, but also the prices and the traded volumes per participant

⟹ Volume and price coupling can co-exist, each side must make its choice

Market Coupling
Technical Model for Capacity Allocation

- Input
  - Exchange order books
  - Maximum capacities
- Objective
  - $\max\left(\sum_{t=1}^{24}\sum_{MA=1}^{n}\left(\sum Sale_{MA,t} - \sum Purchase_{MA,t}\right)\right)$
- Subject to
  - Energy balance for each market area
  - Maximum capacities
  - Block orders
- Result
  - Capacity used = additional purchase and sales orders
  - Market area prices

➔ Mixed integer-linear problem

Market Coupling
Principle for Settlement

Sale of 1.000 MWh

1.000 MWh x 40 €/MWh = 40.000 €

Purchase of 1.000 MWh

1.000 MWh x 30 €/MWh = 30.000 €

Congestion
1000 MW

Exchange B

40 €/MWh

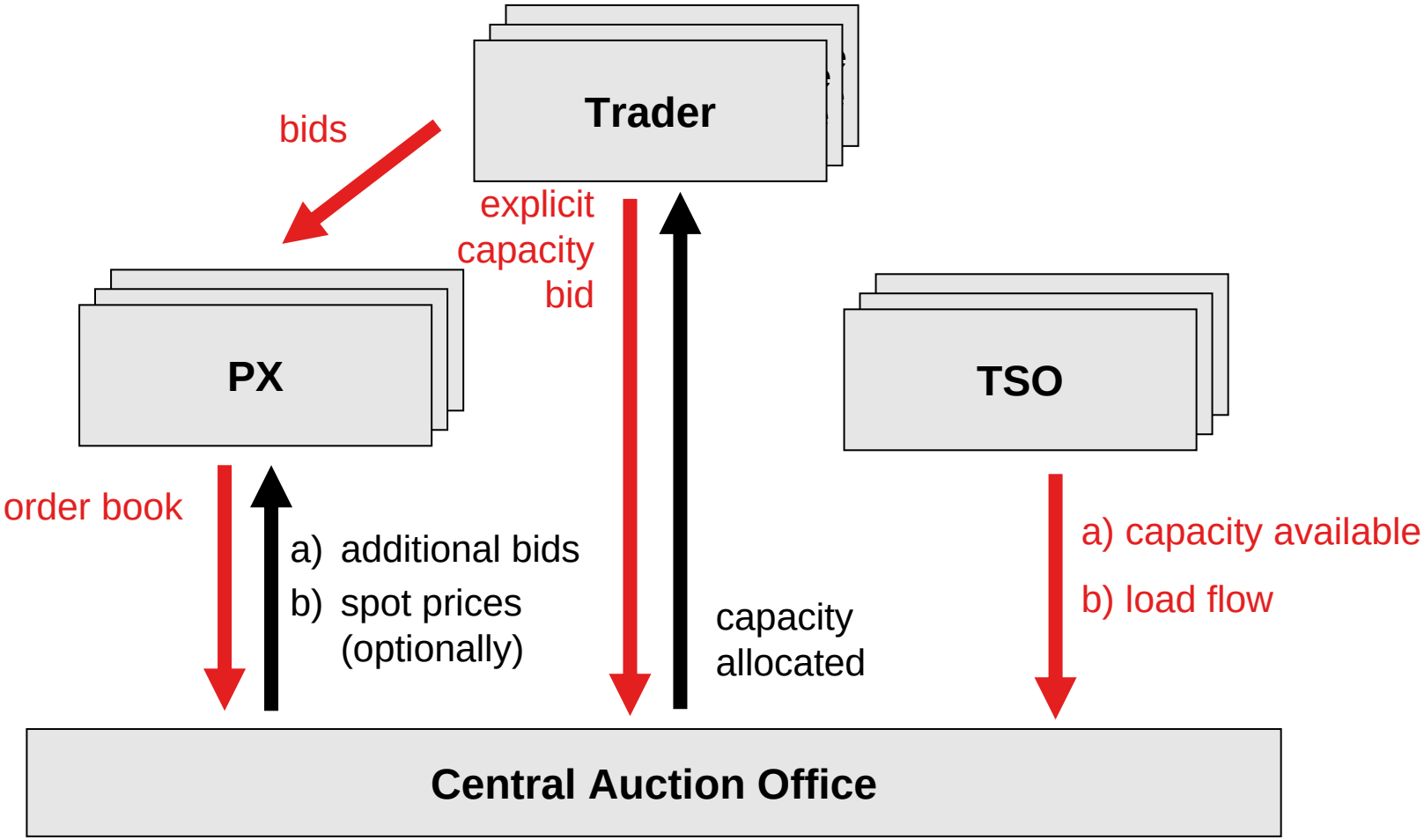
Exchange A

30 €/MWh

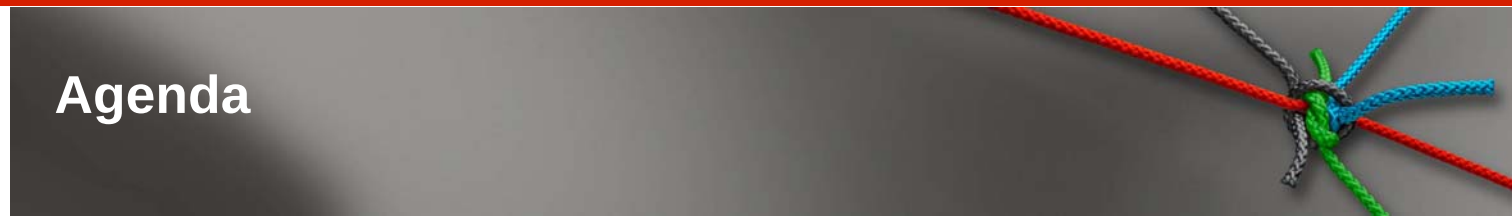
Revenues for TSOs:

1.000 MWh x (40-30) €/MWh = 10.000 €

Market Coupling
Central Auction Office

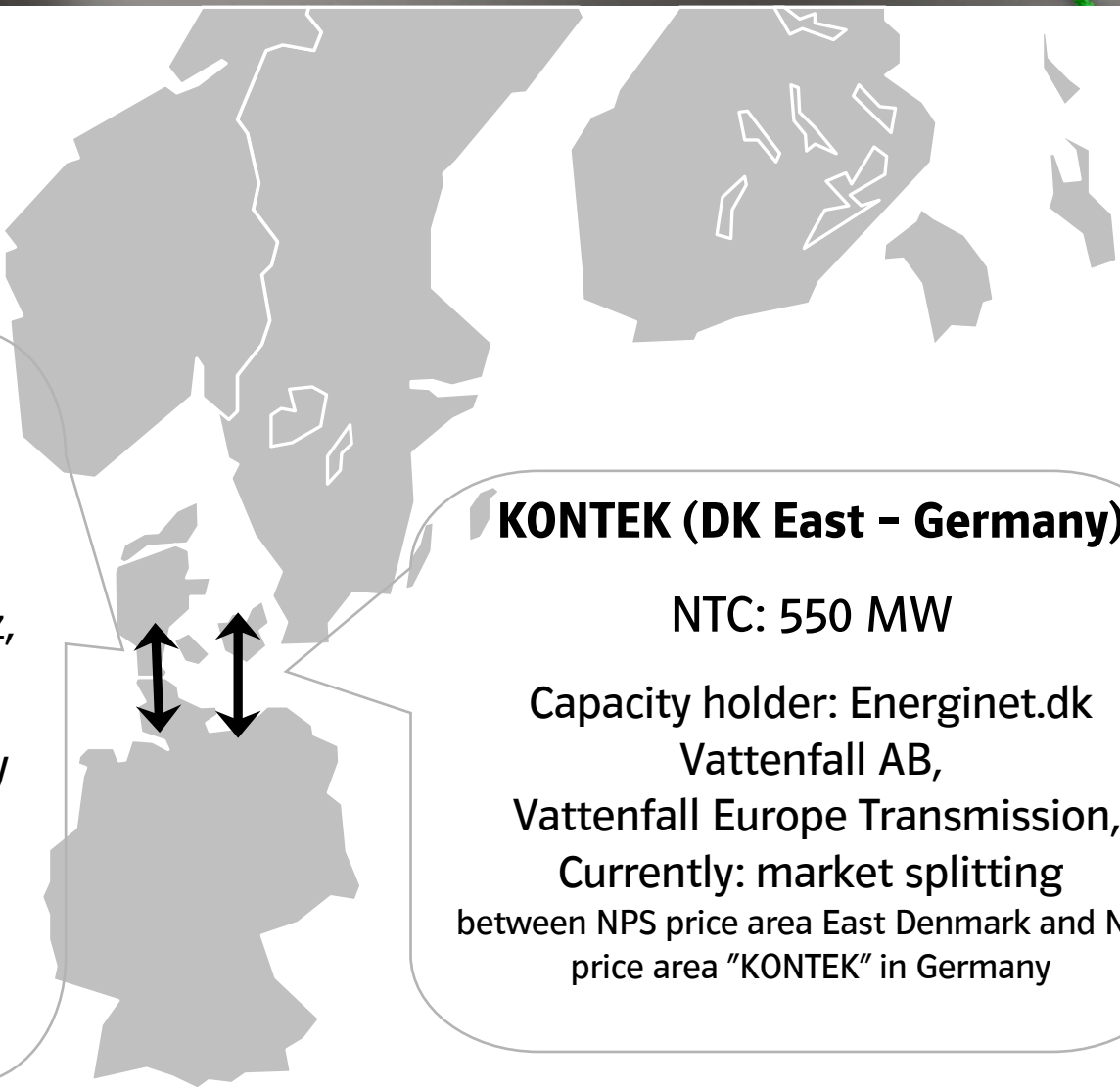


Agenda



1. Introduction
2. The principle of Market Coupling
3. **Market Coupling between Germany and Denmark**

Overview



Interconnector
DK West – Germany

NTC: 1500/950 MW

Capacity holder: E.ON Netz, Energinet.dk

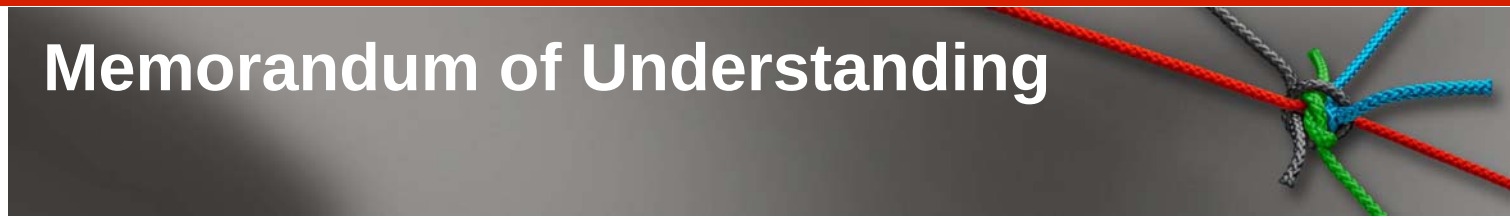
Currently: annual, monthly and daily explicit auctions

KONTEK (DK East – Germany)

NTC: 550 MW

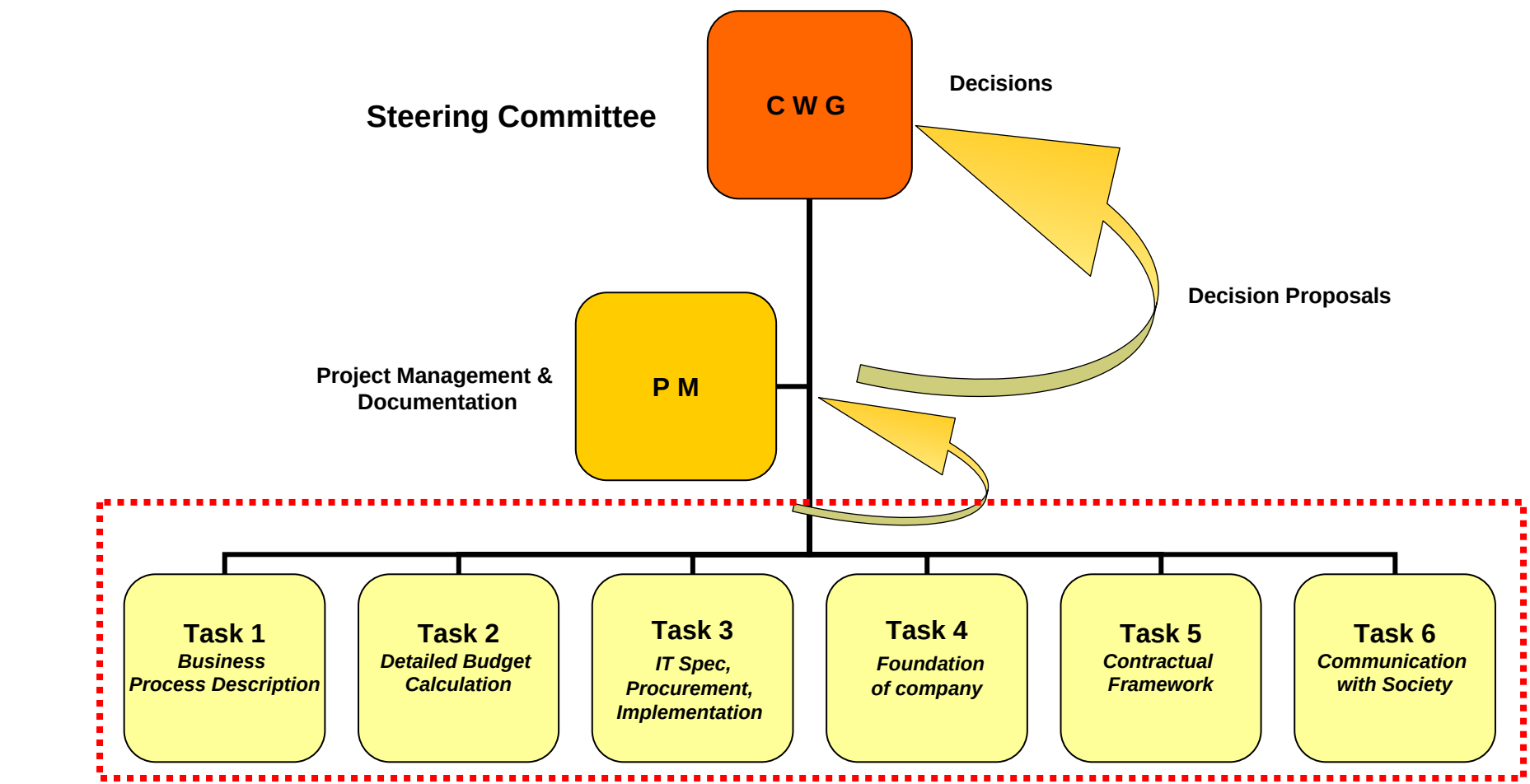
Capacity holder: Energinet.dk
Vattenfall AB,
Vattenfall Europe Transmission,
Currently: market splitting
between NPS price area East Denmark and NPS price area "KONTEK" in Germany

Memorandum of Understanding

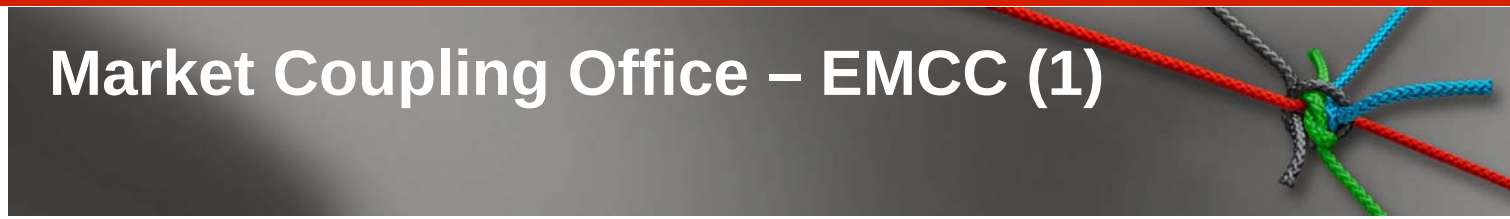


- In line with the EU regulation 1228/2003 and the subsequent guidelines the involved parties adopted a **Memorandum of Understanding** on 27th of October 2006
- Aim is to introduce an **implicit auction** for the daily cross-border capacity allocation for both interconnectors **between Germany and Denmark**
- Co-operation **shall be open** to other TSOs and power exchanges according to predefined rules
- **Central auction office** shall be responsible for the operational tasks
- This “Market Coupling” shall operate by the **4th quarter 2007**

Project Organisation



Market Coupling Office – EMCC (1)

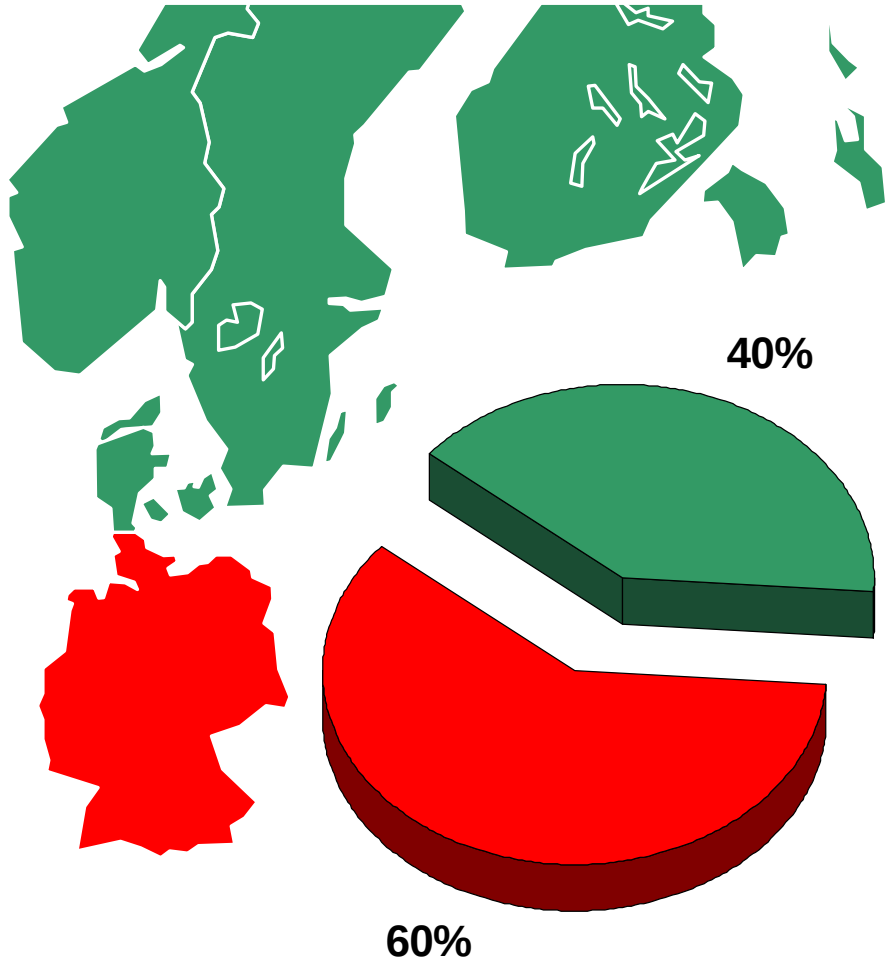


- EMCC - European Market Coupling Company
- EMCC will be structured as a private limited company (GmbH), with both the TSOs and the exchanges as shareholders
- EMCC will be located in Hamburg

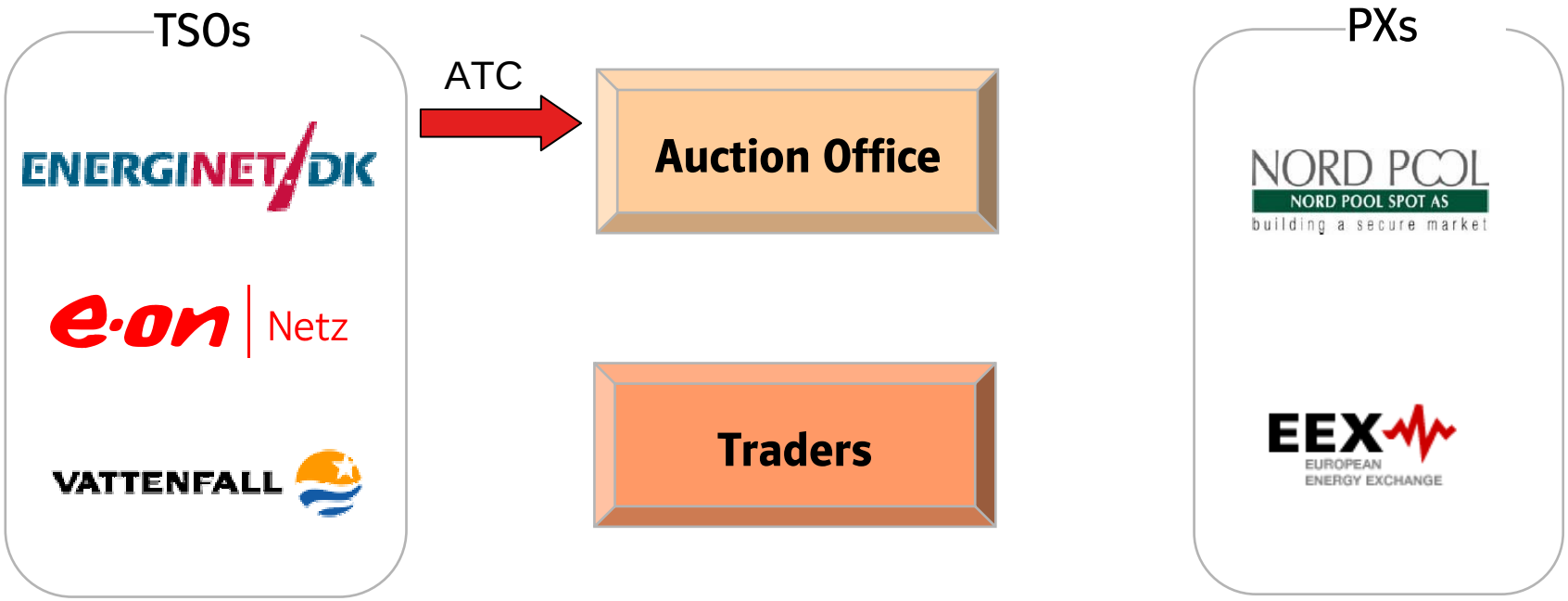
Market Coupling Office – EMCC (2)

Principals of ownership:

- The market size is the key factor to divide shares between different markets
- The market size is characterised by the consumption on condition of a reasonable transmission capacity
- The split of shares within one market between the shareholders can be done separately between TSO's and PX

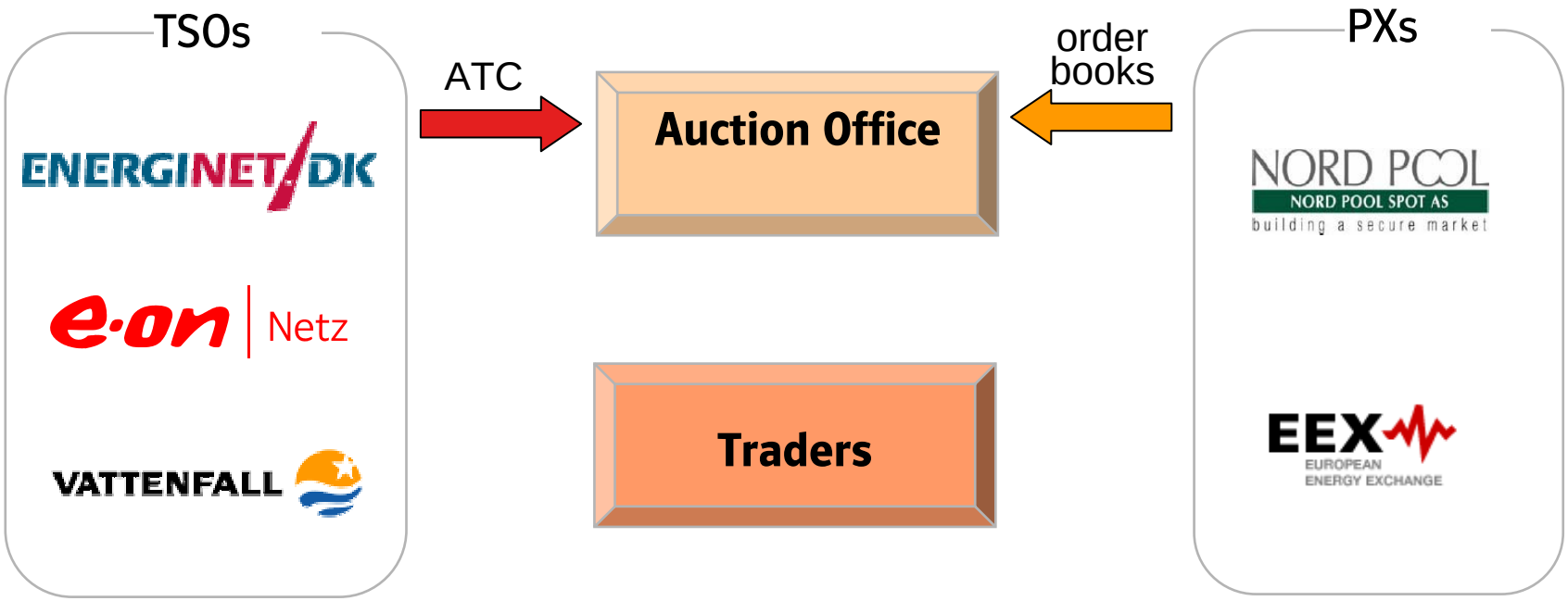


Daily operations of EMCC (1)



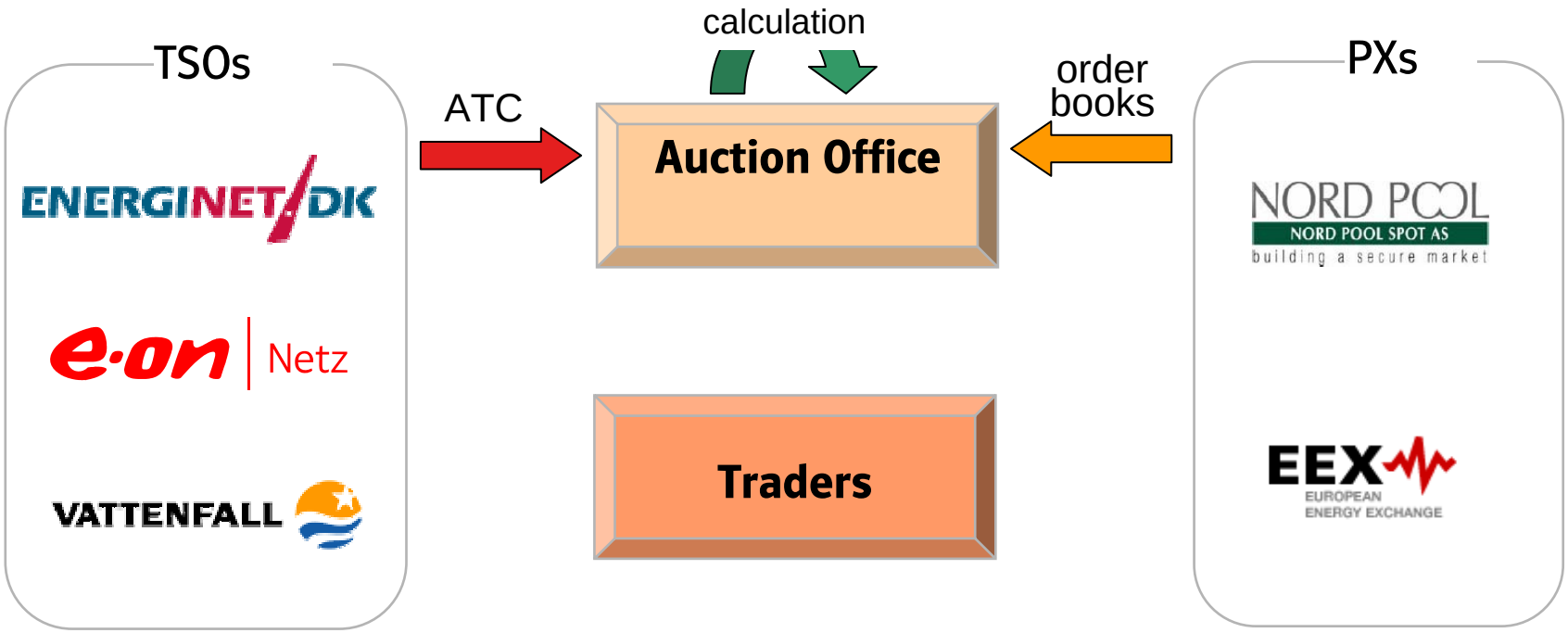
9:30 Collecting ATC from the TSOs per interconnector

Daily operations of EMCC (2)



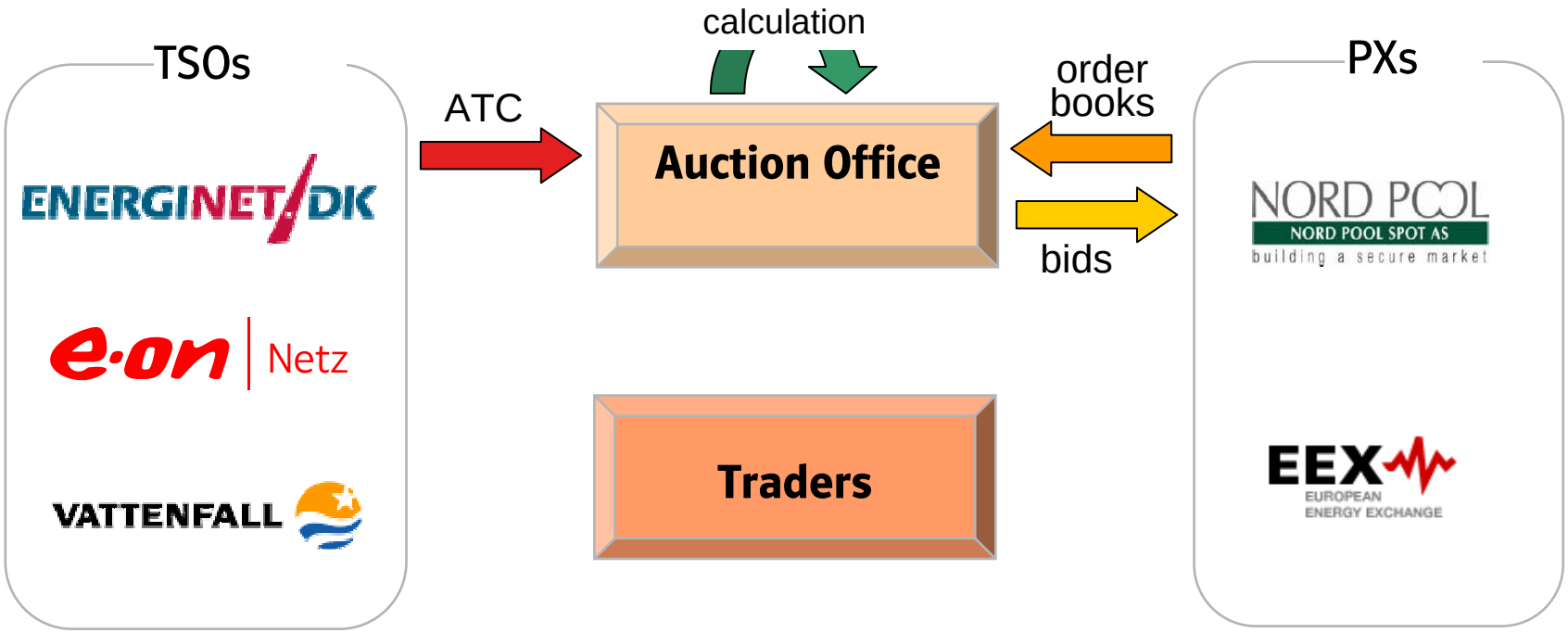
Around 12:10 Collecting anonym order books from the PXs

Daily operations of EMCC (3)



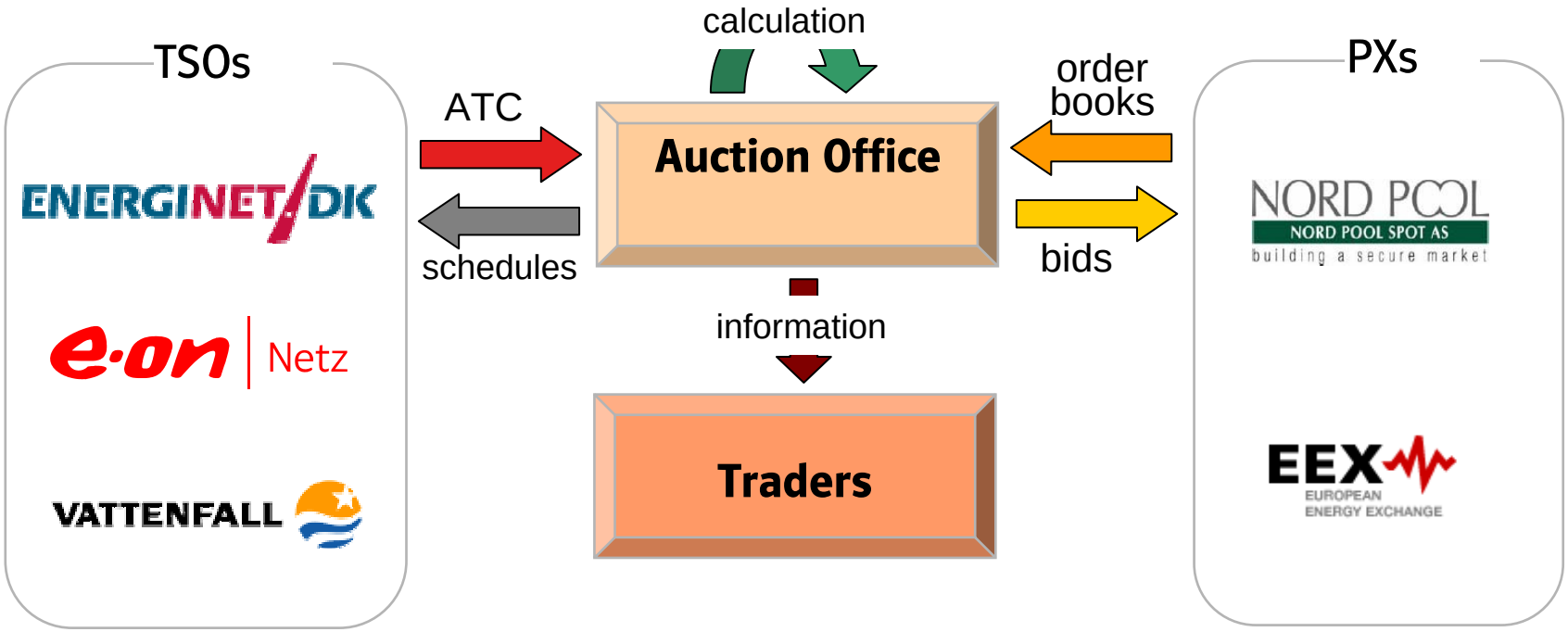
Until 12:30 Market Coupling Calculation

Daily operations of EMCC (4)



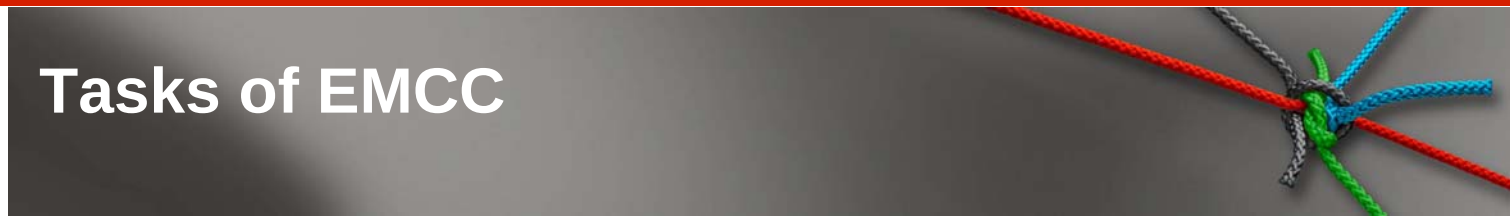
Before 12:30 Placing additional bids at the PXs

Daily operations of EMCC (5)



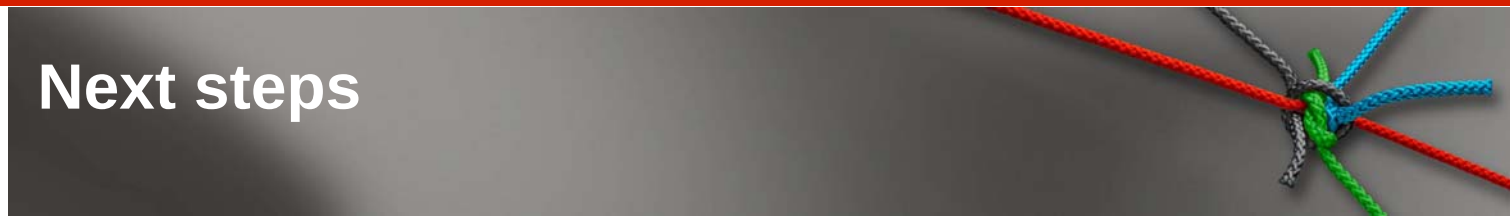
Afterwards Scheduling and publication of market coupling results

Tasks of EMCC

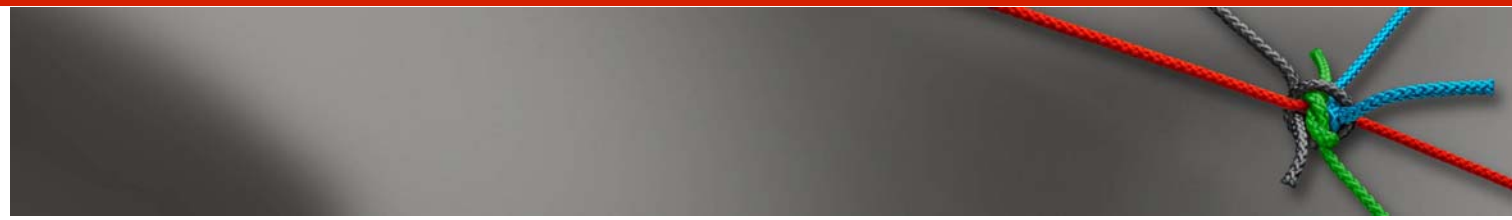


- Collecting ATC from the TSOs per interconnector
- Collecting anonym order books from the PXs
- Market coupling calculation
- Placing additional bids at the PXs
- Scheduling
- Financial settlement between EMCC and PXs
- Settling the congestion rent & distribution
- Management and administrative tasks
- Publish and maintain information

Next steps

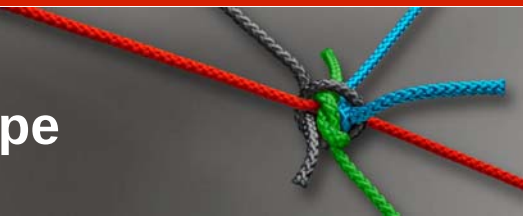


- Development business case
- Specification of the IT-system design
- Legal approval of EMCC, e.g. notification by regulators and EU commission
- Articles of Associations
- Founding of EMCC
- Contractual framework
- Implementation of the IT-system
- Regularly information of the market (press releases, establishment of a website, events etc.)



Backup

Introduction
Implicit Auctions in Continental Europe

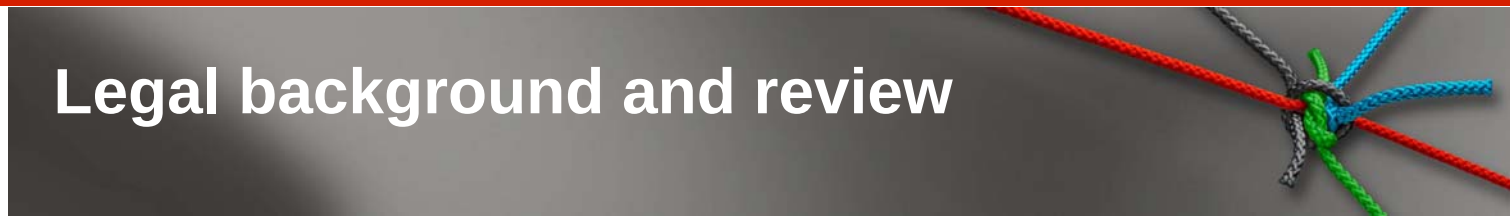


Nordic Market (role model for implicit auctions)	Continental European Markets
Single PX PX owned by TSOs Monopolistic PX	National PXs Different ownership of PXs Partly competing PXs (D, A)
Harmonized regulatory framework (role of regulators, TSOs and PX)	Different regulatory framework (role of regulators, TSOs and PXs)
Pure financial forward market	Mainly physical forward markets (> 70%)
Single TSO per country	1…4 TSOs per country
Partly meshed transmission system	Highly meshed transmission system

➔ For continental Europe

- hybrid model (explicit for forward markets & implicit for spot markets)
- Implicit auctions require coordination between many PXs and TSOs.
- It is recommended to consider load flows within implicit auctions.

Legal background and review



According to the EU legislation, specifically the EU regulation 1228/2003/EC and the subsequent guidelines the EU member states shall reach for an efficient use of cross-border capacities by the introduction of day-ahead co-ordinated market based mechanisms such as auctions.

- Border between Germany and West Denmark
  - has been fulfilled by introducing an explicit auction held on yearly, monthly and daily basis since 1999

- Border between Germany and East Denmark
  - explicit auctions on monthly and daily basis were introduced in 2001
  - replaced by an implicit auction using the new bidding area KONTEK in October 2005

Congestion Management Guideline

- Annex to Regulation (EC) No 1228/2003 was replaced by the „Guidelines on the management and allocation of available transfer capacity of interconnections between national systems“, so called Congestion Management Guideline, of 9th November 2006

  Point 3.4:

  “Compatible congestion management procedures shall be defined in all these seven regions with a view to forming a truly integrated Internal European Electricity Market. Market parties shall not be confronted with incompatible regional systems.”