Design Elements for Implicit Intraday Auctions
The Future of Power Markets

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Ways of trading power on European Wholesale markets

- **Wholesale Market**
  - **Organized Market:** Exchange
  - **Over-The-Counter (OTC)**

- **Derivatives Market**
  - Futures/Options
  - Mainly financial fulfillment

- **Spot Market**
  - Physical fulfillment

- **Day-Ahead market**
  - Auction

- **Intraday Market**
  - Continuous trading

- **Ancillary Services**
  - Balancing
  - Other system services (e.g. primary reserves, restoration reserves)

- **Power commercialization**
RES development has boosted need to balance on the Intraday market

Solar and Wind Installed Capacity in Germany

Source: Statkraft
The German IDM liquidity has been boosted by iRES penetration
Balancing needs exacerbated by forecast errors

- **Generation ramps** handled with quarters
- **Forecast deviations**: Wind/solar forecasts can vary significantly from Day-ahead forecast to last Intraday Forecast

Day-ahead PV forecast inaccuracy and Intraday price impact

Source: 50 Hertz, EPEX SPOT
The wholesale energy trading process

- **Hourly Day-Ahead auction** coupled EU-wide
- **EPEX SPOT 15-Minute Auction (DE)**
- **EPEX SPOT continuous 15-Min Intraday**
- **EPEX SPOT continuous hourly Intraday**
- **Start of Intraday Nominations**
- **30 Min before delivery**
- **Hourly optimization**
- **15-min optimization**
- **Continuous Hourly & quarterly rebalancing**
The market depth of the auctions shows participants willingness to offer flexibility.
European power exchange as a component of security of supply during the solar eclipse

Source: EPEX SPOT, TSOs
Intraday auctions as a complement to continuous trading for a flexible target model

- **A short-term price signal** to reward flexibility
- **A question of liquidity**: Concentrating liquidity during times of varying market conditions can help ALL market players!
- **The power exchange can facilitate trading/Valuing of flexibility**: Decreased lead-time, 15mn products, local DE Auction

- **Some pros/cons of Intraday auctions Vs Continuous**
  - Liquidity (15mn auction ≈10-15GWh/day)
  - Uniform pricing Vs Pay As Bid
  - Continuous Vs Discrete
  - Transmission capacity pricing
  - Problem complexity (15/30/60mn+Block products, Smart blocks, multi-part bids)
  - Level-playing field: no arms race
  - Reliability

- **Regulations have an important role to play**
  - Flexible regulatory framework
  - **Target model** needs to be flexible enough to accommodate the evolution in market conditions

Source: EPEX SPOT
HH DAM Auction Results in GB very encouraging since launch

- Some of the highlights of the HHDAM auction held everyday at 3:30pm UK time:
  - Increased liquidity & participation
  - Low market concentration (HHI index)
  - Relatively high market Depth
- Blocks would allow participants to put greater volumes of to the auction

![Graph showing average daily participation and volume](image)

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<th>Accepted Quantity</th>
<th>Submitted Quantity</th>
<th>Ratio</th>
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The rationale for implicit Intraday auctions

- Auctions allow to increase market complexity level in a discrete process that is based on a powerful algorithm (not instantaneous)
- Optimization can be achieved at the Day-ahead stage but rebalancing is still needed with continuous trading
- Allows pricing capacity more easily
- Allows integrating network constraints
- Success of 15 auction confirms market interest for optimization products Intraday.
- Empirical evidence suggests MPs behavior different between continuous and auctions
- Active/liquid markets are a prerequisite
- Legal framework not that clear on this topic and prone to free-riding problems.
Some design options for implicit cross-border Intraday auctions (not exhaustive)

Rules & Regulations

Day-ahead
Intraday
Local
Cross-border

XB capacity allocation
Borders concerned by the Auction

Timing
Frequency
Market clearing
Algorithm
Products

Second-auction
OBK open/close
Max-Min prices
Uniform/Pay-as-bid
15/30/60mn, Blocks, Complex

Trading system
Clearing arrangements

Blind/visible auction
Objective function
Bid types

Stepwise Vs Linear
#Price/Quantity pairs
Areas