Nord Pool

- The physical power market

44.09

NORD POOL

Overview of the electricity value chain

Power exchanges play an important role in the value chain



Nord Pool plays a part in the wider electricity market

How the power markets fit together

Physical delivery



The day-ahead and intraday markets

The day-ahead market is the main arena for physical power trading and is supplemented by the intraday market



Continuous trading

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The day-ahead market is the main arena for power trading

Auction-based power trading for physical delivery next day

Introduction to the day-ahead market

- The DA market is the main arena for power trading, representing 98% of Nord Pool's traded volume in 2018
- Hourly contracts with physical delivery
- Auction trading accumulated bids and offers form equilibrium via an implicit auction that also reflects available transmission capacities between bidding zones

Key order types

ORD

Single hourly orders	Price and volume given separately for each hour
Block orders	All or nothing condition in bid for at least three consecutive orders / hours
Exclusive groups	A cluster of sell or buy orders whereof only one can be activated
Flexible orders	Bid that may be accepted in an hour given if the price conditions are met (usually high price)

Supply / offer **Price formation** Demand / bid EUR/MWh Variable cost of Mostly inelastic demand production Consumption Retail volumes and 300 · Plant start-up and delivery obligations shutdown costs 250 • Weather conditions & Carbon price (EU ETS) seasonality 200 Hydrological situation Time of day / week Wind/sun conditions 150 Industrial activity Price New renewable energy • Fixed and variable costs 100 of consumers · Politics and regulation Startup and shutdown Guarantee of origin 50 Production costs • Volumes bound to PPAs Politics and regulation 0 El-certificate prices 10 12 14 0 2 4 6 8 Electrification MWh Cost of alternative sources of energy **Transmission capacity** Existing interconnectors • Unavailability of interconnectors (faults, maintenance, etc.)

Key factors affecting the day-ahead price formation

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Calculation of the Nordic system price and different area prices

Prices vary across regions because supply and demand balancing is restricted by transmission capacities



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Illustrative example of the price formation across bidding zones

Actual prices are calculated based on supply and demand between regions with capacity constraints



supply/demand balance

prices: Norway and Sweden = 125 EUR/MWh

convergence; prices vary between bidding area

Why cooperate across borders? The Nordic Model

Connecting the Nordic countries secures optimal use of natural resources and more stable prices



The intraday market allows for adjustments to actual conditions

Continuous buying and selling with delivery times as short as 15 minutes

Introduction to the intraday market

- The second power trading arena, allowing consumers and producers to continuously buy and sell 24/7/365
- Caters to differences between prognoses from the previous day and real-world conditions, providing balancing opportunities
- Important for participants to match traded and actual volumes produced/consumed in order to avoid imbalance fees imposed by the TSOs
- Hourly contracts with physical delivery gate closures (time to delivery) as low as 15 minutes in selected geographies
- Trading resembles that of stock trading; "what you see is what you get" not auction based

Key order types

Limit orders	Can be matched either in part or its entirety
Fill or Kill	Order is either filled entirely or cancelled
Immediate or cancel	Order is filled to the extent of the quantity that can be immediately filled at the requested price. The remainder of the order is cancelled
lceberg order	An order for which a total volume and a displayed volume (slice) are specified. When the entire slice is executed, automatically another slice is entered in the order book
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Why do we need an intraday market?



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Subject to national and EU regulations

Network Guidelines in CACM is the backbone

Overview of the relevant marketplace regulation



formally transposed into Norwegian law, but the NVE's practice is supplemented by CACM principles NRAs regulate exchanges according to CACM, which is the applicable law in all member states that have adopted the Third Energy Package

Key comments

- Nord Pool has historically conducted its business in accordance with national energy regulations applicable in the markets it has had business operations, and pursuant to a marketplace licence issued by the NVE (the Norwegian NRA)
- CACM (The Network Guidelines on Capacity Allocation and Congestion Management), which is part of the Third Energy Package, was set forth by the EU in 2015 to harmonise European electricity markets and to ensure efficient single day ahead and intraday coupling across the continent
- CACM directly applies in all member states of the European Union (Member States) where a NEMO (Nominated Electricity Market Operator) licence is required to operate the market
- Pursuant to CACM, a designation as NEMO by the NRAs is required in order to operate the organised Single Day Ahead and Single Intraday Markets in a Member State. EMCO holds such NEMO designations, and Nord Pool and EMCO both fulfil individual requirements of the NEMO designations and the underlying CACM regulations, in combination fulfilling all requirements
- Neither the Third Energy Package, nor the CACM, have yet been formally adopted into Norwegian law. In Norway, EMCO and Nord Pool therefore operate in accordance with applicable Norwegian energy law, a marketplace licence issued to EMCO and a trading licence issued to Nord Pool. When practicing its regulatory authority, NVE takes into consideration the principles of CACM
- The various European NRAs have the regulatory responsibility for their respective markets and are responsible for the nomination of NEMOs
- EMCO has since the implementation of CACM obtained NEMO licences in 15 European countries in addition to its Norwegian marketplace licence. Passporting an existing NEMO licence to another Member State is an alternative to obtaining an actual NEMO licence in the respective country, which is what EMCO has done in Ireland
- As for other NEMOs, the term of EMCO's first NEMO licences will expire in 2019 and 2020. EMCO has
 initiated the renewal process in collaboration with relevant NRAs
- Over the past year, the TSOs, NRAs and exchanges have worked on establishing multiple NEMO arrangements in the various EU markets, which allows for multiple exchanges to operate in the same dayahead market
- This process has been complex and tedious, but most Member States in Europe are estimated to "go live" during 2019

Expected timing of various European markets to "go live"

Multi NEMO Agreements (MNA) expected to enter into force during 2019, triggering competition

Key characteristics and status of implementation of MNA · The Nordics has been one market for the last two decades and regulation is harmonised across the countries Nordics and The Baltic market was developed on the same principles as the Nordic market and is largely Baltics harmonised with the Nordics Expected go-live late 2019 The UK has been competitive since 2014 on the day-ahead market, unique in a European context · As one of few non-XBID participants in Europe, there is no shared intraday order book dynamics in UK UK - could potentially change in 2020 • In a "no-deal" Brexit-scenario CACM will likely no longer apply Markets in Central and Western European countries are largely operated by EPEX Spot and has gradually harmonised regulation over the last decade in the wake of EPEX Spot' geographical CWE expansion, albeit not to the extent done in the Nordics and Baltics Implementation of MNAs expected to become effective during Q2 2019 · CACM has made exception for certain countries including Spain, Portugal and Italy, to remain state Spain, monopolies under certain conditions Portugal, Italy · The duration of the exception is commonly two years, but the conclusion is not expected to change in the foreseeable future, which means that these countries will not be subject to competition · Hungary, Romania and Bulgaria, among others, defined as natural monopolies according to local South East regulators - similar to the situation in Spain, Portugal and Italy Europe · Competition in Croatia and Slovenia, while most other countries in the region are not EU members ORD

Expected go-live timing for MNA across Europe



Source: Nord Pool 11

A journey towards a single integrated European electricity market

From local to national to regional to European – there have been continuous efforts to integrate markets to strengthen security of supply, cater for optimal use of natural resources and even out prices for the benefit of the end consumers

Pre 1980s: The local era	1980s-1996: The national era	1996-2014: The regional era	Post 2014: The European era
Since the early days of electricity, the local power utilities were responsible for security of supply and balancing in their area Limited or no capacity to transport electricity over larger distances Large economic inefficiencies in local hydro plants as they were over dimensioned to be able to maintain power supply in worst-case scenarios	 Local utilities grew in size and the grid was continuously improved The national grid was further developed Cooperation between power plants nationwide to share supply and demand This led to the deregulation of the Norwegian power trading market in 1991, and Nord Pool was established 	 Building on Norwegian experience, Sweden deregulated its market and formed a joint electricity market with Norway in 1996 Finland joined the market in 1998 and Denmark in 2000, completing the integration of the Nordic market Cooperation with Baltic and German power markets during this period laid the foundations for PCR 	 New EU regulation paves the way for European integration through the Price Coupling of Regions (PCR) and Cross-Border Intraday (XBID) initiatives, conceptualised and advocated by Nord Pool The end goal is a single European market with complete integration of all countries – aligned with EU's stated energy and climate targets

European market integration – day-ahead and intraday efforts

Shared order books make liquidity available to all participants

Single day-ahead coupling (SDAC)



Price Coupling of Regions (PCR) Launch 2014

Initiated by five power exchanges, including Nord Pool, in 2010 to develop a single day-ahead price coupling solution and algorithm for NWE and SWE. Currently co-owned by eight power exchanges

Single day-ahead coupling (SDAC)

An implicit cross-zonal capacity allocation mechanism, with all EEA countries' TSOs and PXs as either full or observational members, laying the foundation for a fully connected Europe. Previously called Multi-Regional Coupling

- Prices and flows for each area are calculated by the common algorithm Euphemia PCR members (eight including EMCO) take turns running the algorithm and communicating the results to the other members
- Each power exchange is responsible for own operations, including market (customer) interfaces and pre / post processes, including bidding, result distribution, clearing/settlement
- Prior to launch of PCR in 2014, Nord Pool operated a Nordic market based on the same principles (the "Elspot" market)
- Allows for optimal socio-economic electricity flow, which was formerly based on less accurate prognosis and explicit auctions
- New exchanges must either buy MCO services from existing PCR members or buy into the common project by covering pro-rata share of historical development costs

Single intraday coupling (SIDC) initiatives



Cross-Border Intraday Project (XBID) Launch 2018

Initiated in 2012 by four power exchanges, including Nord Pool, with TSOs from 12 countries joining in 2013, to enable continuous cross-border trading across Europe

1st wave comprising the countries in dark green, most other European countries, light green, are due to take part in the 2nd wave go-live with XBID in 2019

- Common, live trading platform continuously matching orders within the XBID's reach, as long as transmission capacity is available
- Algorithm is owned and run by Deutsche Börse
- Each power exchange receives orders via its own trading solution and send anonymised orders to the XBID shared order book, matching the order with any suitable order irrespective of geography within XBID and prior to local gate closure decided by local TSO
- Prior to launch of XBID, Nord Pool operated a Nordic model (the "Elbas" market) the first international intraday market as well as intraday trading in UK and Germany
- Observations made post XBID launch indicate that most Nordic intraday trading happens cross-border

Nord Pool actively lobbying for a level playing field in Europe

EMCO is designated this responsibility including an obligation to protect Nord Pool's commercial interests

Nord Pool lobbies directly towards stakeholders as well as towards the broader market and all participants

- Nord Pool is an active proponent of the integration of European power markets having developed the blue-print model for European integration in the Nordics
- An important premise for continued European integration is a level playing field for all market participants
- Nord Pool contributes in a range of relevant European and global discussion forums and industry organisations to work for a continued healthy development of European power markets
 - APEx Association of Power Exchanges; Nord Pool represented on the Board
 - Europex Association of European Energy Exchanges; Nord Pool is represented on the Board and has the Head of Working Group Power Markets
- EMCO continuously lobbies governments, regulators and market participants for a fairer and better market for power exchanges

Key topics Nord Pool is focusing on

Intraday access to the last trading hour

- The sharing of intraday orderbooks does currently not include the last hour before delivery
- Thus incumbents have a competitive advantage by operating their own proprietary last-hour market

Renewable energy in Germany

 All subsidised German renewable energy must be traded via "the most liquid power exchange" according to regulation, appointing EPEX Spot as a monopolist in all but name for these volumes

Harmonised cost recovery rates across Europe

- Recovery rates for costs related to cross-border project development are currently regulated by NRAs, with substantial differences between countries
- Generally currently more favourable for EPEX Spot due to location of its costs

Energy > Energy Policy > CACM in need of reform? Nord Pool's take on the current NEMO regulation CACM in need of reform? Nord Pool's take on current NEMO regulation Published on 18th March 2019 sosition paper Nord Pool, one of the leading power exchanges (PXs) in Europe, argues that the Commutation (EU) 2015/1222 establishing a Guideline on Capacity Allocation and Congestion Management (Ca rin need of reform. paper suggests various measures should be implemented in CACM in order to resolve, or at least tallevia mits of interests which indemine the implementation of efficient pan-European market coupling. A major uses of in the paper is the current governance of the (joint) market coupling operator (MCO) function. Nord sea for full ownership unbunding of the MCO operations from the businesses of competitive PXs. Besides awing the governance of MCO operations, several other measures are deemed necessary. Equidity shari upper bigling into an MCO task. paper strongly advocates for the implementation of the above measures and argues that only a "combine tage" will ensure that single European market coupling is implemented in the most efficient and cost-effect	tion the nission ACM) is in ACM) is in ACM) is in ate, concern d Pool s ng in fully
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