Market Code Consultation WS 6

International Trade International experiences



International regional markets



Role of regional markets in facilitating energy transition / decarbonization / greening the grid



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ENERGY CRISIS

Market and prices: the way forward in EU

PRICE SIGNALS REFLECTING THE REAL COST OF ELECTRICITY



Prices should **drive power usage**, dispatch and investments Prices should thus **reflect the actual situation** of the system

Enable scarcity prices in all market timeframes (DA, ID, Balancing)

Imbalance prices to be more costreflective (up to VOLL in times of scarcity)

Introduce dynamic pricing at retail level Markets should value flexibility and all system services Allow development of risk-hedging products to protect oneself against price volatility

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Subject to national and EU regulations

Network Guidelines in CACM is the backbone



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
- The various European NRAs have the regulatory responsibility for their respective markets
- Over the past year, the TSOs, NRAs and exchanges have worked on establishing multiple arrangements in the various EU markets, which allows for multiple exchanges to operate in the same day-ahead market



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The EU target model contains several power market segments for individual purposes

	Whole	sale Electricity Marke	ts	TS System O	O operation	TSO Imbalance Settlement Imbalance Settlement	
	Bilateral (financial) Markets Bilateral long term OTC contracts Financial Contracts Hedging and Trading Future prices are "fixed" (as per PPAs with CfDs) DAM price available for use as reference	PX Physica Day Ahead (DAM) Physical Contracts Assets' production and consumption balance is achieved BRP's initial balance is achieved Reference production	Il Markets Intraday (IDM) Physical Contracts Level out deviations between original and revised plans/forecasts BRP's balance is tuned tuned	Real-Time System Balancing Market Physical Contracts Balancing the system System balance	tem Balancing System Operation Physical Contracts Ancillary services Frequency control	 Deviations on scheduled actions and real actions are trued up BRPs' "financial balance" based on their actions 	
1	Self-balancing of I	Balance Responsible P	arties (BRPs)	Oper	ational Responsib	ility of TSO	
	1 - 10 years	24 hours	Intraday	Operation day	Intrahour Physical	1+ month deliver	

CRISIS

The BRPs are self-balancing the portfolio through the different market segments

- BRPs need to plan how to sell or cover their needs for electricity in the different market segments
- Own production and bilateral long-term contracts will provide a **baseline** of their planning
- DAM and IDM allow for self-balancing before physical delivery
- The BRPs need to forecast and execute the portfolio balancing activities as their daily routine & responsibility



Selling the difference between long term contracts and estimated total supply to DAM/IDM = self-balancing



Why cooperate across borders? The Nordic Model

- Connecting the Nordic countries secures optimal use of natural resources and more stable prices
- Connecting markets with differing production profiles provides stability to the system



European market integration – day-ahead

SDAC - Single day-ahead coupling

The aim of SDAC is to create a single pan-European cross-zonal day-ahead electricity market. Single day-ahead coupling is the auction process where collected orders are matched and cross-zonal capacity is allocated simultaneously for different bidding zones in the day-ahead market.

How SDAC works

- Day-ahead market coupling requires:
 - processing offers, network capacities and constraints from all involved NEMOs and TSOs
 - matching them by operating one single algorithm,
 - validating and sending matched trades, clearing prices, and scheduled exchanges to NEMOs and TSOs.
- SDAC makes use of a common price coupling algorithm, called PCR EUPHEMIA, to calculate electricity prices across Europe and to implicitly allocate auction-based cross-border capacity.
- PCR EUPHEMIA matches energy demand and supply for 24 hours simultaneously.
- This process maximises social welfare and considers price limits of orders and network constraints.



Day-ahead market - main arena for power trading

Introduction to day-ahead

- The day-ahead 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

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 of which 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)	

Key factors affecting day-ahead price formation

Supply / offer

- Variable cost of production
- Plant start-up and shutdown costs
- Carbon price (EU ETS)
- Hydrological situation
- Wind/sun conditions
- New renewable energy
- Politics and regulation
- Guarantee of origin
- Volumes bound to PPAs
- El-certificate prices



Transmission capacity

- Existing interconnectors
- Unavailability of interconnectors (faults, maintenance, etc.)

Demand / bid

- · Mostly inelastic demand
- Retail volumes and delivery obligations
- Weather conditions & seasonality
- Time of day / week
- Industrial activity
- Fixed and variable costs of consumers
- Start-up and shutdown costs
- · Politics and regulation
- Electrification
- Cost of alternative sources of energy

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Transmission Pricing – National Tariffs

- Individual EU member states set their own national transmission tariffs
- However, there are common EU-wide regulations that are relevant:

Directive (EU) 2019/944 on common rules for the internal market for electricity

• Tariffs are set or approved by National Regulatory Authorities (NRA)

Regulation (EU) 2019/943 on the internal market for electricity

- Use of system (and connection) charges shall be cost-reflective, transparent, non-discriminatory and shall take into account the need for network security and flexibility
- ACER (the European Union Agency for the Cooperation of Energy Regulators) published a Practice Report on Transmission Tariff Methodologies in Europe in December 2019
- The report compares national transmission tariffs on a range of issues



Transmission Pricing – Inter-TSO Compensation (ITC) Mechanism

- The mechanism is defined by *Regulation (EU)* 838/2010
- Its objective is to compensate TSOs through a Fund (ITC Fund) managed by the European Network of Transmission System Operators for Electricity (ENTSO-E) for the costs of:
 - (1) making infrastructure available (amounting to €100 million in the ITC Fund 2018)

(2) transmission losses resulting from hosting cross-border flows (amounting to €156.5 million in the ITC Fund 2018)

• Countries that provide a transit role are compensated from the fund and those that are sources (generation) or sinks (demand) contribute to the fund

ITC Parties = Parties participating in the scheme

Perimeter countries = Parties who are not part of the scheme but are connected to ITC Parties



Cross-border transmission capacity

- The Capacity Allocation and Congestion Management (CACM) guidelines allow two approaches to calculating cross border transmission capacity:
 - 1. Flow-based
 - 2. Coordinated Net Transfer Capacity (NTC)
- The flow-based option should be used <u>unless</u> TSOs can demonstrate that the flow-based approach would not be more efficient than the Coordinated NTC approach.

Flow-based method (compared with NTC method)

- ✓ Takes better account of physical flows / constraints
- ✓ More accurate determination of available capacity important for increasing interdependency between countries (e.g. renewable generation export)
- * Increased data requirements and complexity
- × Less transparent



Congestion

- Congestion should be reflected in the cross-zonal capacity charge (the capacity element of the implicit allocation results) as the **difference between the corresponding clearing prices of the relevant bidding zones** (CACM guidelines).
- Central counter parties or shipping agents collect congestion income and transfer it to the TSOs within two weeks after the date of settlement.
- TSOs are to develop a detailed methodology for congestion income distribution (CACM guidelines set out high level principles)
- Revenue collected from congestion income used for:
 - 1. Guaranteeing the actual availability of the allocated capacity, and
 - 2. Maintaining or increasing interconnection capacities through network investments, and in particular in new interconnectors.



Treatment of Existing PPAs

- Long-term PPAs fall within the Forward Markets element of the European electricity market model and may be negotiated directly between buyers and sellers as "over the counter" (OTC) contracts.
- PPAs are increasingly viewed as an attractive option for the developers of renewable projects, providing certainty to buyers and sellers regarding energy prices.
- The European market is exhibiting significant growth in the numbers and volumes of energy covered by PPAs for this reason.
- The CACM guidelines state that the capacity allocation calculation approach shall take into account a number of factors, including "previously allocated cross-zonal capacity" which is how capacity is reserved for long-term bilateral contracts.



North American Independent System Operators



Source: Federal Energy Regulatory Commission (FERC), energy-primer.pdf

Market segments in the design





Definition: Locational Marginal Pricing

Cost of supplying **next MW** of load at a specific location, considering generation marginal cost, cost of transmission congestion, and losses.



Cost of Marginal Losses is not currently implemented



PJM - unit commitment and security constrained dispatch timelines



Source: PJM presentation, 20170224-item-04-commitment-process-and-uplift-drivers.pdf, www.pjm.com

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PJM Transmission Pricing

Financial Transmission Rights (FTRs)

- FTRs are the **financial instruments**
- Based on hourly congestion price differences
- FTRs are **hedging mechanisms** to cover price risk
- FTRs are financial rights irrespective of energy delivered and **not physical rights**, traded separately from transmission service
- FTRs can take the form of an **option** or **obligation**

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POOL

• PJM conducts monthly, quarterly, annual auctions and subsequent long-term auctions covering three planning years ahead



Congestion Change = 100 MW * (30 - 15 \$) = 1500 \$ FTR Obligation Credit = 100 MW * (30-10\$) = 1500 \$



FTR Obligation is a Benefit

USA regulatory environment - Federal Energy Regulatory Commission (FERC) & North American Electric Reliability Corporation (NERC)

FERC's responsibilities for electricity are:

- **Approval** of rates for wholesale sales of electricity and transmission in interstate commerce for jurisdictional utilities, power marketers, power pools, power exchanges, and independent system operators.
- **Oversight** of the issuance of certain stock and debt securities, assumption of obligations and liabilities, and mergers.
- **Review** of officer and director positions.
- **Review** of rates set by the federal power marketing administrations.
- **Review** of exempt wholesale generator status.
- **Certification** of qualifying small power production and cogeneration facilities.

NERC is a not-for-profit international regulatory authority whose mission is to:

- Assure the effective and efficient reduction of risks to the reliability and security of the grid.
- Develop and enforces Reliability Standards;
- Annually **assesses** seasonal and long-term reliability;
- **Monitors** the bulk power system through system awareness; and
- Educates, trains, and certifies industry personnel



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