Nord Pool Spot 2013-10-03

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Agenda

- ITVC vs NWE
- Technology
- Processes and timings
- Price cap harmonization
- Second auction
- Euphemia differences
- Summary for the members

Comparison ITVC vs. NWE

ITVC

- Two separate Market Couplings (Nordic + CWE) linked by a volume coupling entity (EMCC)
- Sequential calculation approach
- Possibility of scheduling non-optimal adverse flows
- No common algorithm applied

NWE

- Full coupling with GB
- One single price coupling based on a single calculation
- Adverse flows will only occur if they are welfare-optimizing
- One single common algorithm to allow for a sound and robust price formation

First came the algorithm...

The new PCR algorithm **Euphemia** was designed and developed by 6 PX´s to cover the following (high-level) requirements:

1. **Input**
   a) Network data (capacities, ramping limits, losses, etc.)
   b) Order book data (aggregated curves, additional supported products)
2. **Calculation**
   a) Objective function: welfare maximization
   b) Limited by constraints (requirements), and time!
3. **Output**
   a) Net export positions and flows/nominations
   b) Clearing prices, aggregated accepted quantities and acceptance status for additional products

In NWE tests on historical data have been performed covering:

27 bidding areas

a) Average of 6.2 TW submitted quantity (per day)
b) 1,800 block orders (per day)

38 lines (interconnectors)

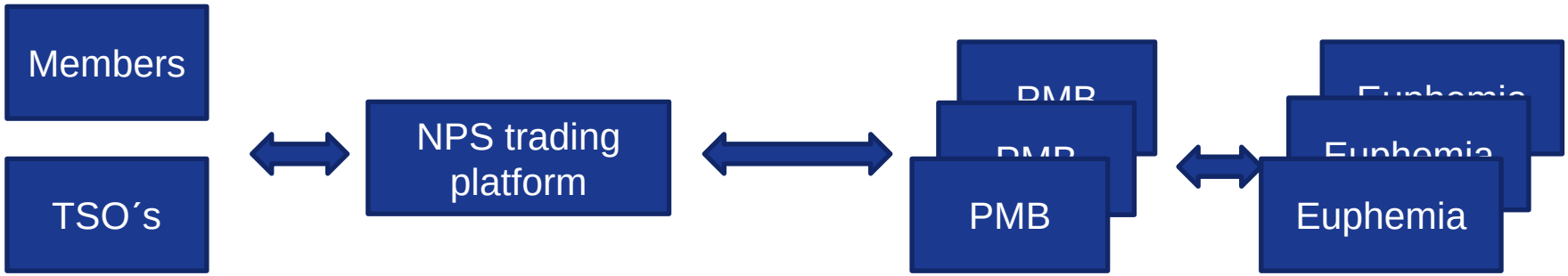
a) Ramping limit for 8 lines (Nordic)
b) Losses for 3 lines (IFA, BritNed and Baltic)
c) Tariff for BritNed (first part of 2012)

...then Price Matcher Broker...

Price Matcher Broker, **PMB** was developed to operate the PCR process in a secure and flexible way performing the following tasks:

- Validation of input data from the PX´s
  - Required information(constraints) on all interconnectors for which the PX is responsible
  - Order data in line with algorithm requirements
    - Supply- and demandcurves including volume on min and max prices for example
- Synchronization of data between the PX´s
- Works as an interface to the algorithm:
  - Creates the input
  - Follows the progress of the calculation
  - Reads the output
- Sends the results to the PX´s
- Receives confirmations
- Sends global confirmations

PCR Architecture – Nordic perspective



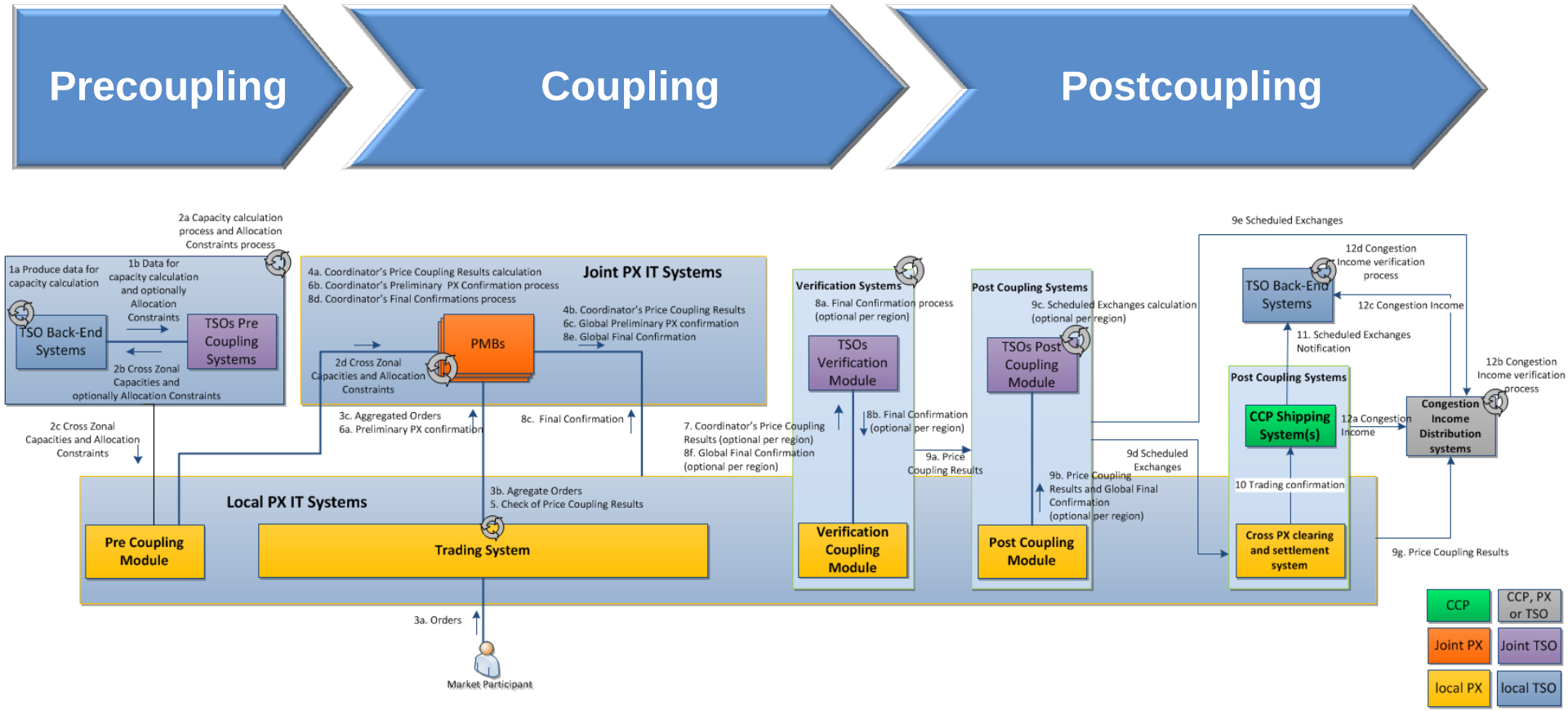
Market parties:
- Capacities
- Allocation constraints
- Orders

NPS trading platform:
- Receives input from Market parties
- Anonymizes block orders
- Aggregates supply- and demandcurves
- Validates and aggregates network constraints
- Performs portfolio allocation
- Sends results to market parties

Price Matcher Broker:
- Is the user interface for the coordinator
- Synchronizes data of all PX´s
- Ensures that all information is provided
- Creates input data for Euphemia
- Reads output from Euphemia and sends to PX

Euphemia:
- Matches demand and supply in the different markets
- Optimizes flows
- Calculates prices

NWE High-Level Architecture



Then came processes...

Pre-coupling => 12.00 CET

- Capacity and network constraints gathering
- Receival of orders

Coupling 12.00 => ~12:42 CET

- Aggregation of supply and demandcurves at PX
- Sending or curves and anonymized block orders to PMB
- Price calculation
- Distribution of results to PX
- PX portfolio allocation and validation of results
- **Preliminary confirmation(PX) of results**
- Publication of preliminary prices to the market
- **Final confirmation(TSO) of results**

Post-coupling ~12:42 => 14:30

- Sending of schedules and prices to members and TSO´s
- Calculation of congestion revenue
- Clearing and settlement

PCR coordinator

PX vs. Coordinator tasks

Coordinator tasks

- Keep track on the Price-Coupling process as defined in procedures
- Notify relevant party when an issue is detected
- Inform the parties of the progress or possible incidents
- Call for incident committées

- The Hot-Backup takes over in case of problems at the coordinator site

PX tasks

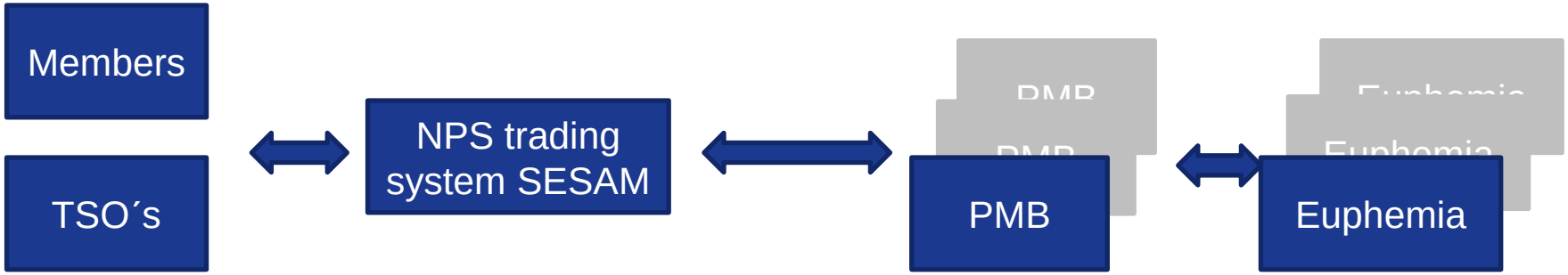
- Keep the local market aware of the progress of the Price-Coupling process
- Solve problems reported by the coordinator
- Participate in incident committée

The PCR coordinator is changed every two weeks between the three NWE PX´s

Full decoupling – Nordic perspective

Full decoupling

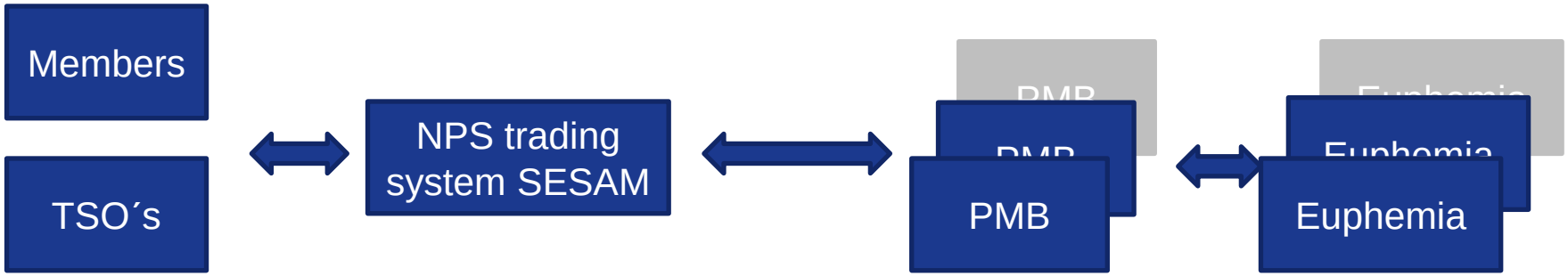
- Can happen due to technical or other problems until **13:50** which is the full decoupling deadline
- Local (Nordic) procedures apply
- Members are informed by NPS
- Shadow auction is performed on the following interconnectors:
  - NO2-NL
  - DK2-DE
  - DK1-DE
- Nordic order books are re-opened when there is decoupling
- In case of full or Nordic decoupling PMB + Euphemia will be used in the decoupling mode enabling calculation using the same rules as in Price-Coupling



Partial coupling – Nordic perspective

Nordic or interconnector decoupling

- When one or more bidding areas and/or interconnectors are temporarily not participating in the price coupling
- Can happen due to technical or other problems until **12:40** which is the partial decoupling deadline
- Members are informed by NPS
- Shadow auction is performed if it affects any of the following interconnectors:
  - NO2-NL
  - DK2-DE
  - DK1-DE
- Nordic order books are re-opened when there is decoupling related to the above mentioned interconnectors
- Target is to keep as many markets coupled as possible



NWE example timings 1

PCR Normal process – “best scenario” process 55 min

PCR Normal Process 55 min

Notification Process **60 min**

12:00	OBK GCT
12:08	Check + send OBK
12:10	Reception of all OBK in PMBs -> Start of Calculation
12:27	End of Calculation
12:28	Reception of Results in all PX Systems
12.29	Start of 10 min preliminary validation
12:39	End of preliminary PX validation process -> Generation of Preliminary PX Confirmations
12:40	Reception of all Preliminary PX Confirmations in PMB -> Sending of Global Preliminary PX Confirmation
12:41	Reception of Global Preliminary PX Confirmation in every PX IT System
12:42	Publication of preliminary results (incl. market clearing price) to the market and sending of the results to TSOs
12:42	Start of 10 min Final Confirmation process
12:52	End of final validation process -> Generation of Final Confirmations
12:53	Reception of all Final Confirmations in the PMB -> Sending of Global Final Confirmation
12:54	Reception of Global Final Confirmation in the Local PMBs
12:55	Publication of Final Results (incl. market clearing price) -> Start of Notification Process
13:55	End of Notification Process

13:55

NWE example timings 2

Special case 2B: Nordic Special Routine
98-110 min (55 + 43->55)

PCR Normal Process 55 min

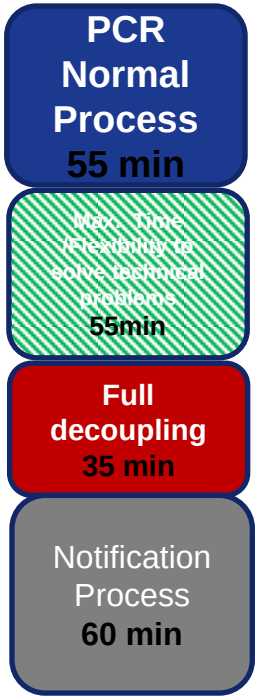
Special Routine Nordics 42-55 min*

Notification Process 60 min

12:00	OBK GCT
12:08	Check + send OBK
12:10	Reception of all OBK in PMBs -> Start of Calculation
12:27	End of Calculation
12:28	Reception of Results in all PX Systems -> PX identification of thresholds/curtailment reached
12:30	Activation of PMB Max-Price Plug-In to perform the needed steps linked to NPS Special Procedures
12:33	IC opening to inform about that the NPS Special Routines for Max Price handling has started
12.42	PCR message sent from PXs to TSOs and MPs: Inform about the delay in market results publication (optional) TSO message to MPs: Inform Market to update shadow auction bids
12:50 - 13:11	PMB Max-Price Plug-In process in accordance with NPS Special Routines finalized
12:52 - 13:13	Reception of updated Nordic-Baltic OBK and or ATCs in PMBs -> Start of Calculation
13:09 – 13:30	End of Calculation
13:10 - 13:31	Reception of Results in all PX Systems
13:11 – 13:32	Start of 10 min preliminary validation
13:20	PCR message sent from PXs to TSOs and MPs: Inform about delay and risk of decoupling (optional) TSO message to MPs: Inform Market to update shadow auction bids & shifting of notification deadline
13:22 - 13:33	End of preliminary PX validation process -> Generation and sending of Preliminary PX Confirmations
13:23 –13:34	Reception of all Preliminary PX Confirmations in PMB -> Sending of Global Preliminary PX Confirmation
13:24 – 13:35	Reception of Global Preliminary PX Confirmation in every PX IT System
13:25 – 13:36	Publication of preliminary results (incl. market clearing price) to the market and sending of the results to TSOs
13:26 – 13:37	Start of 10 min Final Confirmation process
13:36 - 13:47	End of final validation process -> Generation and sending of Final Confirmations
13:37 – 13:48	Reception of all Final Confirmations in the PMB -> Sending of Global Final Confirmation
13:38 – 13:49	Reception of Global Final Confirmation in the Local PMBs
13:39 – 13:50	Publication of Final Results (incl. market clearing price) -> Start of Notification Process
14:39 – 14:50	End of Notification Process

NWE example timings 3

Special case 4: Full Decoupling
150 min (55 + max. 55 + 35)



12:00	OBK GCT
12:08	Check + send OBK
12:10	Reception of all OBK in PMBs -> Start of technical issues
12.42	PCR message sent from PXs to TSOs and MPs: Inform about the delay in market results publication (optional) TSO message to MPs: Inform Market to update shadow auction bids
13:20	PCR message sent from PXs to TSOs and MPs: Inform about delay and risk of decoupling (optional) TSO message to MPs: Inform Market to update shadow auction bids & shifting of notification deadline
13:50	IC declares the Full Decoupling PCR message sent from PXs to TSOs and MPs: Inform about Full decoupling (optional) TSO message to MPs: Inform Market about shifting of notification deadline
13:55	Start reopening of OBK for 20 min
14:15	OBK GCT -> Start of local auction (*CWE local auction timings taken in consideration*)
14:25	Publication of local results (incl. market clearing price) -> Start of Notification Process
15:25	End of Notification Process

Price cap harmonization

Risks associated

- Unlogical flows possible when price caps are reached
  - happened in Denmark<>Germany on 25.12.2012

=> Decision to harmonize price caps

Process to decision

- A market survey was done by the NWE project to get input from the markets
- A decision was made to set price caps between historical prices and price levels which provide real economic incentives:
  - -500 - +3000€/MWh

Implementation

- Latest at NWE go-live, target data currently set for 26th of November
- Implementation also in EMCC for easier go-live and rollback pending agreement

Effects on members

- Hourly orders need to include the new price caps
- Other orders need to be within the price caps
- Receiving of Reqote possibly problematic depending on when the new price caps are implemented

Second auction

What is Second auction?

- When thresholds are reached in certain markets **second auction** is performed
- Threshold are currently: -150 and +500€/MWh
- Order books in affected markets are re-opened to ”give the market a second chance”

Where?

Second auction is implemented in the following markets:

- APX
- BELPEX
- EPEX
- N2EX

Euphemia differencies to SESAM

High-lighted differences

- Mid-price rule when vertical overlap on two adjacent non-congested areas, currently lowest price on vertical overlap is chosen. Has not occurred on a regular basis in the Nordic-Baltic market

- Losses implementation
  - Only in use on IFA, Britned, NorNed and Baltic Cable

Summary for the members

In full or Nordic decoupling order books are re-opened

Price cap change!

Prices are preliminary until confirmed to be final

Prices to be published earliest at 12:42

Losses implementation will be notable as different prices also between uncongested areas