

EMCC's Market Coupling Relaunch

- Our Background on Market Coupling
- EMCC's Market Coupling Task
- Evaluation of Test Setup und Results
- Conclusion and Outlook

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IAEW's Competence on Market Coupling

- Involved in development of first “Open Market Coupling (OMC)” concept in 2004
 - ➔ General methodology for market coupling involving several TSO's and power exchanges

- Expertise for German regulator on technical feasibility of OMC (2005/06)
 - ➔ Model of the underlying market coupling task described as a mixed integer problem
 - ➔ Implementation of a software tool, which can proof feasibility for realistic problem size

- Study on algorithms for flow-based, co-ordinate explicit auctions (2007)

- Support on discussions in CWE market coupling on algorithmic questions (2008)
 - ➔ Extension of existing optimisation tool with respect to market-related constraints

- Ongoing investigations, e.g. on interaction between increased cross-border trade and grid losses (2009)

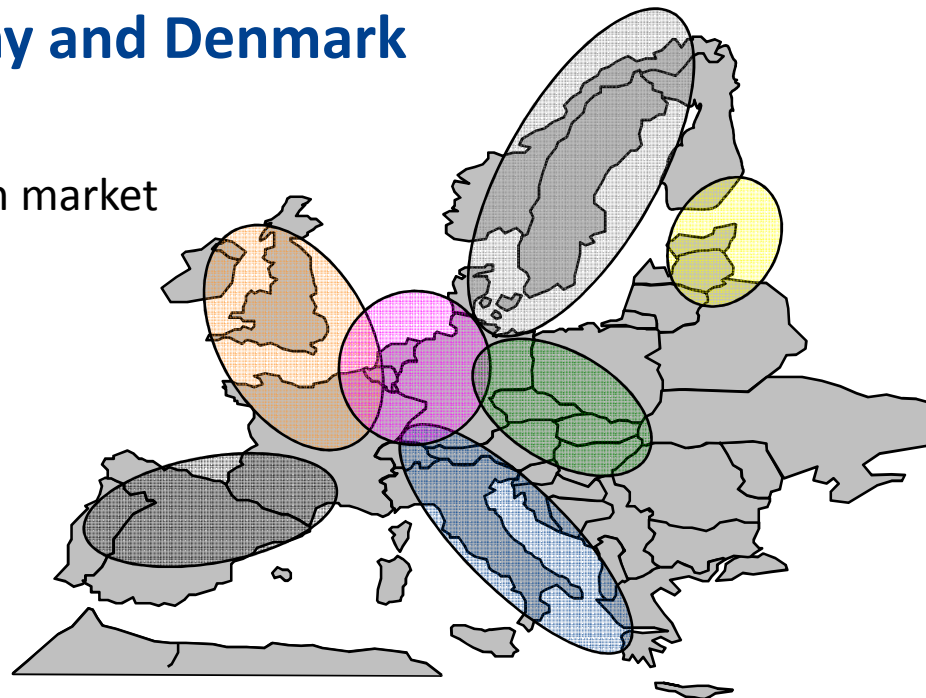
Market Coupling between Germany and Denmark as Part of a European Solution

- Overall aim: establishing a single European market
 - ➔ Increase overall social welfare in Europe

- Complex task is split into seven regional initiatives (ERGEG / 2006)
 - + Better manageable
 - Overlapping of regions creates problem of merging regional approaches

- EMCC part of northern region with its own specifics
 - ◆ Two major independent power exchanges with partially non-harmonised rules
 - ◆ Germany participates in 4 regions including CWE (other major MC project)

- Current congestion management methods in this area
 - ◆ Market splitting in Nordic countries (Nord Pool Spot)
 - ◆ Implicit auction of Kontek cable (creation of German price area "Kontek")
 - ◆ Explicit auction Germany / Denmark-West



Consequences for EMCC's task

- Significantly increase efficiency compared to current congestion management
- Comply with all rules of local power exchanges, also if not harmonised
 - ◆ Order types
 - ◆ Price determination (e.g. handling of vertical overlapping curves) and price caps
 - ◆ Technical constraints (e.g. ramping)
- No interference with activities in other regions

Possible solutions

Price Coupling

- + Guarantees optimality
- Large extent of harmonisation necessary
- Possible conflict with other price coupling projects

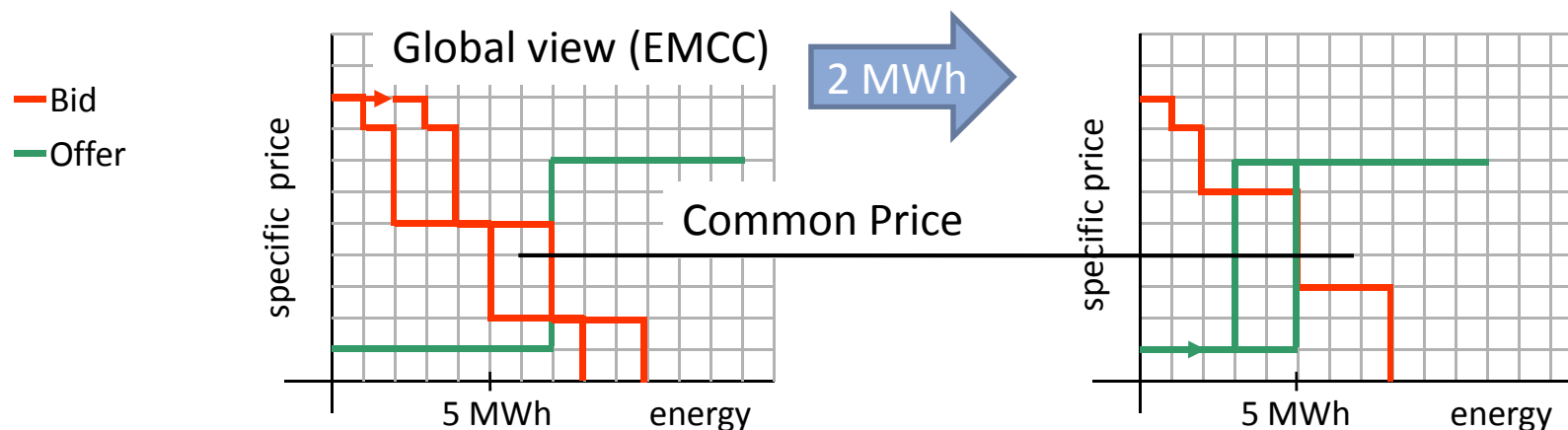
Volume Coupling

- Suboptimal solution possible
- + Handling of divergent rules at power exchanges possible
- + Gives scope for other projects

➔ Volume coupling can serve as first step where a balance in demand for optimality and necessary implementation efforts is needed

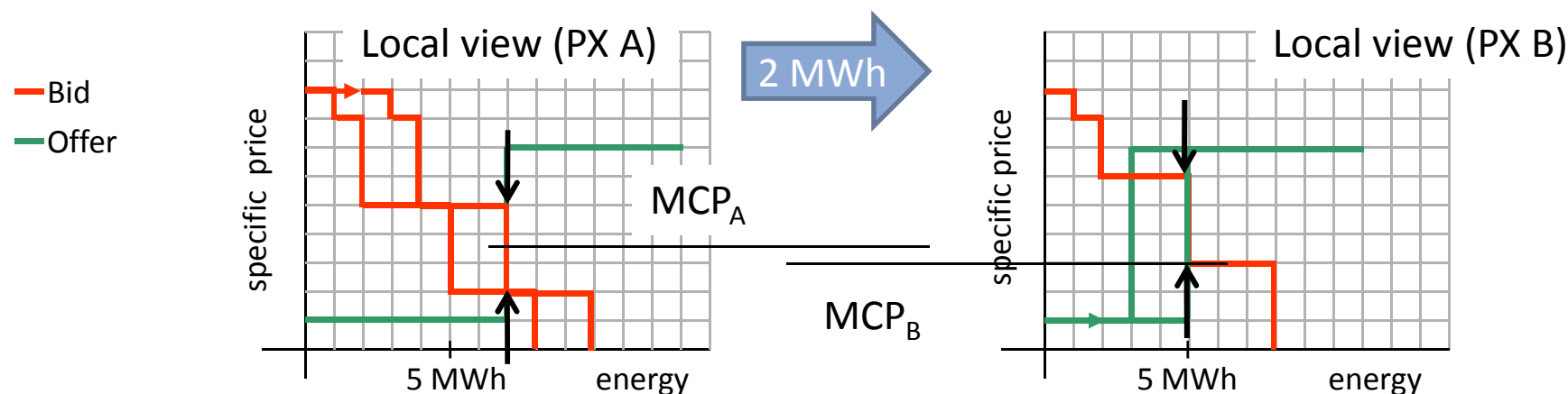
Impact of Volume Coupling

- Procedure in volume coupling
 - ◆ Centralised auction office (EMCC) performs system-wide optimisation
 - ◆ Only energy flows between coupled market areas are set by auction office
 - ◆ Local power exchanges perform clearing of their market considering determined flows
 - ◆ Prices determined by local power exchanges
- Second (local) optimisation may lead to seemingly suboptimal market results
- Example: adverse flows due to different handling of vertical overlapping curves



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- Auction office obtains solution without adverse flows
- In this example: adverse flows are a consequence of non-harmonised rules
- Extent of adverse flows depends on specific constellation of bid/offer curve

Our Task

- Consortium of FGH e.V. (research institute associated with RWTH Aachen University) and IAEW was assigned by EMCC in February 2009 to

Evaluate test setup

- ◆ What and how will be tested?
- ◆ Will results based on these tests support decision making on relaunch?

What?

10 days of EMCC's original operation
34 consecutive days (12/29/08 – 01/31/09)
17 typical days (spring, summer, fall)
19 special days (++) / -- prices, curtailment)

How?

Original order books received from PXs
Corresponding ATC data from TSOs
Calculation with prospective EMCC algorithm
Final price calculation by NPS / EPEX

→ Tests were conducted under realistic conditions

→ Amount and selection of test days gives reliable evidence of functionality

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Evaluate and supervise execution of test

- ◆ Were tests conducted in the proposed way?
- ◆ Were tests analysed in a correct and meaningful manner?



Evaluate test results as well as proposed improvements in algorithm and methodology

- ◆ Do results justify a relaunch EMCC's Market Coupling?
- ◆ What are remaining risks?
- ◆ Give input regarding further improvements and document findings

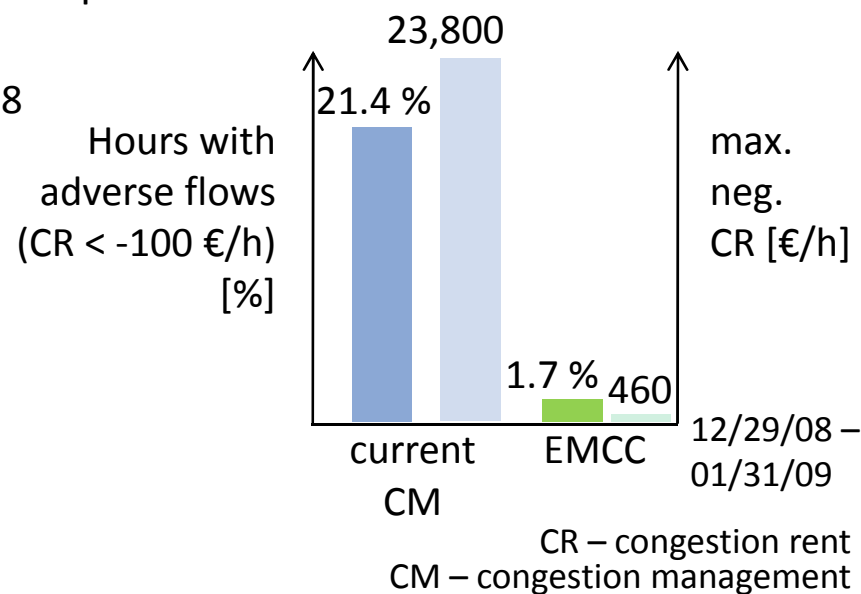


Evaluation of Test Results – Main Findings (I)

- Test results were mainly analysed with respect to
 - ◆ Adverse flows, i.e. flows from high to low price area
 - ◆ Suboptimal utilisation, i.e. unused capacity despite difference in prices from PXs

 - Considering flows **and** prices from EMCC: no adverse flows, no suboptimal utilisation
 - ➔ Results from EMCC’s system completely plausible (“price coupling ready”)

 - Real conditions (flows from EMCC, prices from PXs)
 - ◆ Number and magnitude of adverse flows / suboptimal utilisation significantly decrease compared to
 - operation of EMCC’s Market Coupling in 2008
 - current congestion management methods
- ➔ Relaunch of EMCC’s Market Coupling will significantly increase efficiency / welfare compared to current situation



Evaluation of Test Results – Main Findings (II)

- ➔ Relaunch of EMCC's Market Coupling will significantly increase efficiency / welfare compared to current situation

- However . . .
 - ◆ Adverse flows and suboptimal utilisation still occur
 - highest negative congestion rent in tests: approx. 4,800 € in one hour
 - ➔ System inherent when performing volume coupling
 - ◆ Reasons for remaining inefficiency
 - global vs. local view problematic
 - rounding
 - currency conversion
 - diverging price caps and their handling

- ➔ Volume coupling's inherent adverse flows / suboptimal utilisation remain

- ➔ Perspectively, the aim should be a more global price coupling solution

Conclusion and outlook

- EMCC's Market Coupling task for the German / Danish border
 - ◆ Increase efficiency compared to currently applied congestion management methods
 - ◆ Handle non-harmonised rules of power exchanges and possible interference with other comparable projects
- ➔ Introduction of a volume coupling, as a first step, balances demand for optimality and necessary implementation efforts

- EMCC performed thorough tests under realistic conditions
 - ◆ Significant increase of efficiency compared to former system and to currently applied methods
 - ◆ Remaining chance for adverse flows / suboptimal utilisation
- ➔ IAEW / FGH recommend relaunch of EMCC's market coupling as a first step to improve efficiency
- ➔ Further improvements possible and necessary in the future

