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Price Coupling of Regions (PCR): A pragmatic step towards the IEM

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Florence School of Regulation Summer School
Florence| 29-06-2010

Agenda

1. EPEX Spot vision on market integration: The role of Power Exchanges in Market Coupling

2. Towards pan-European Price Coupling: How PCR can lead to pan-European market integration?

3. „Deliver it“: Next steps for the implementation of PCR

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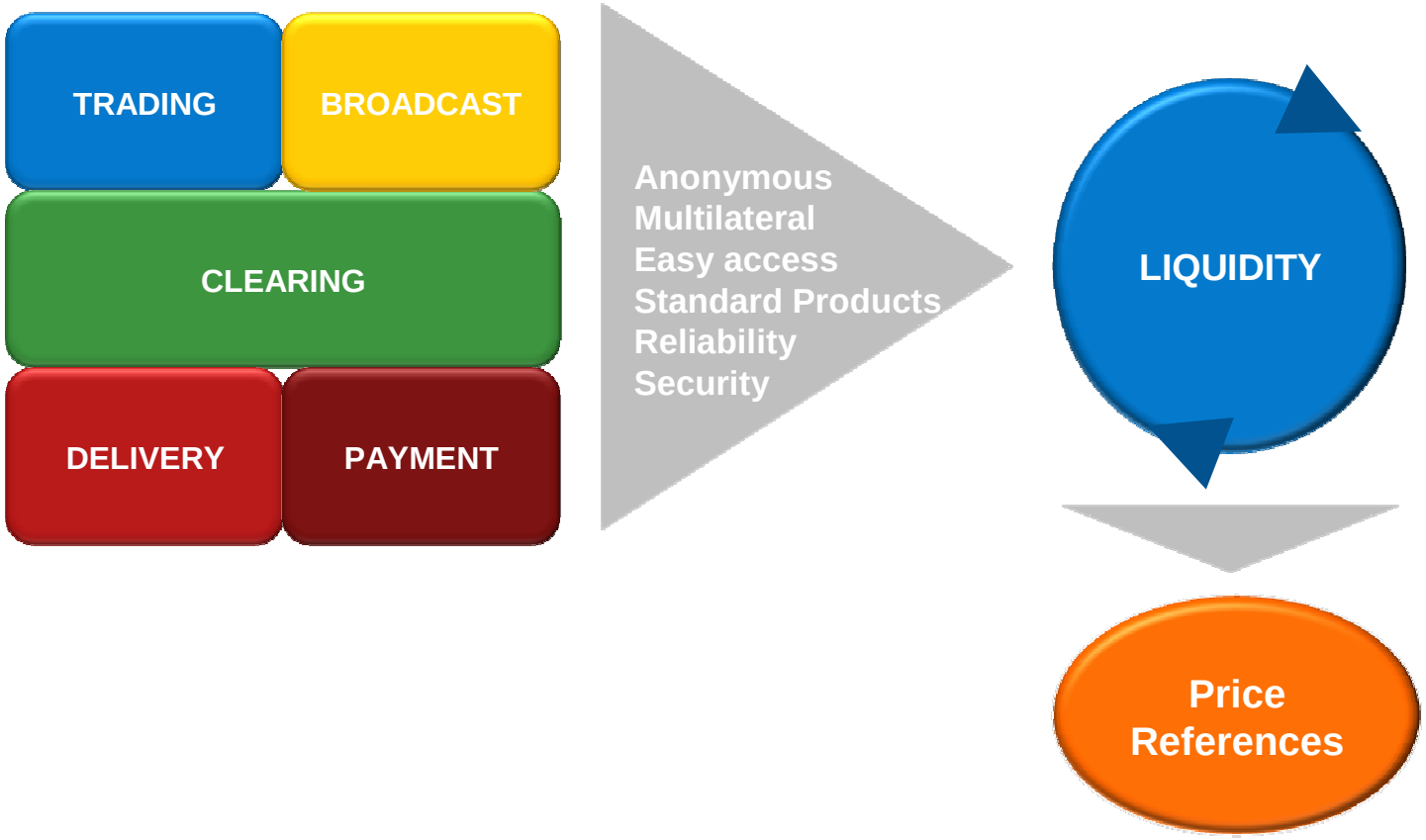
Power Exchanges: A Model to create liquidity and price references

- PXs functions in the Market: What? What for?



Power Exchanges: A Model to create liquidity and price references

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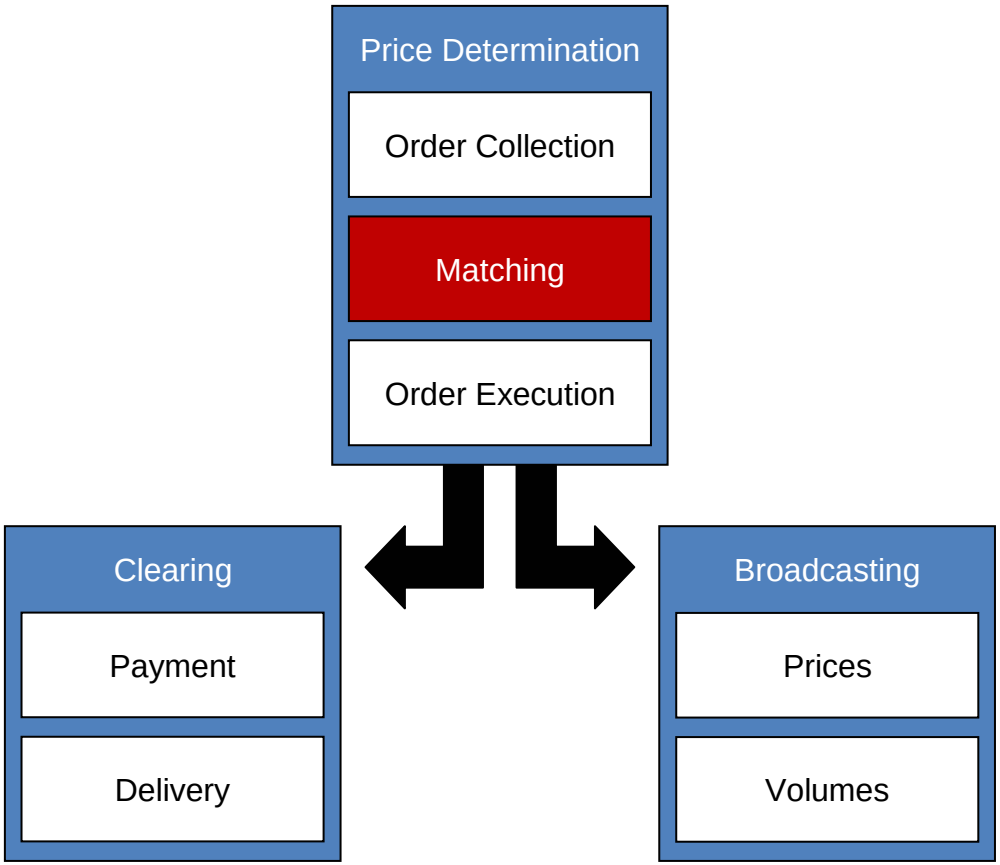
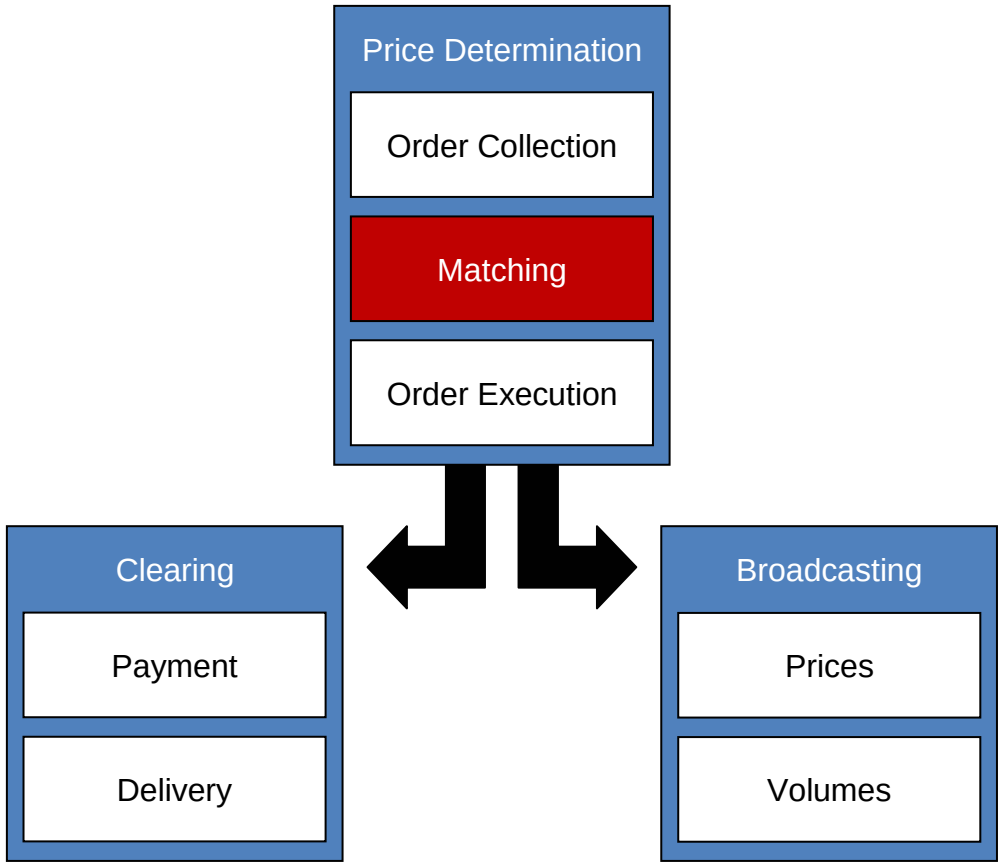


- PXs core functions are supported by other important functions :
- Market and product design
- Customer relations
- Legal and technical implementation…

- Supported by these functions, PXs price calculation is done in a **transparent** and **accepted manner**, encouraging that **quantities of demand and supply are the highest possible**

Power Exchanges: A Model to create liquidity and price references

- PXs functions in the Market: What? What for?

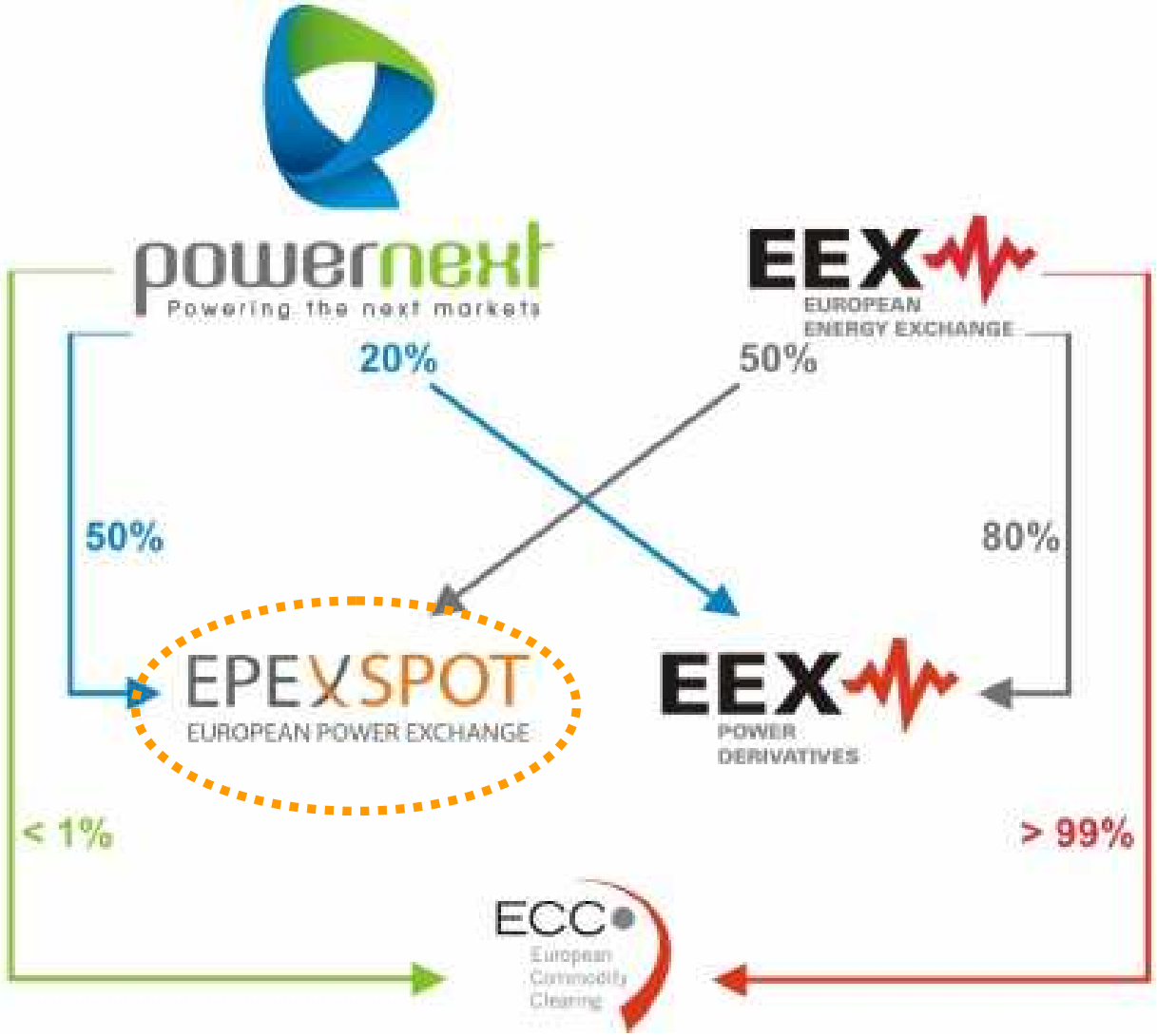


- **Prices quality increases with the growing of liquidity**: the higher the trading volume and the number of active participants, the better prices represent the current market situation

- Liquidity gathered by the PXs is the key input **to produce sound market reference-prices**

- **Liquidity and legitimate price references are the main outcomes of PXs business model and their main assets**

EPEX Spot and the EEX-Powernext cooperation

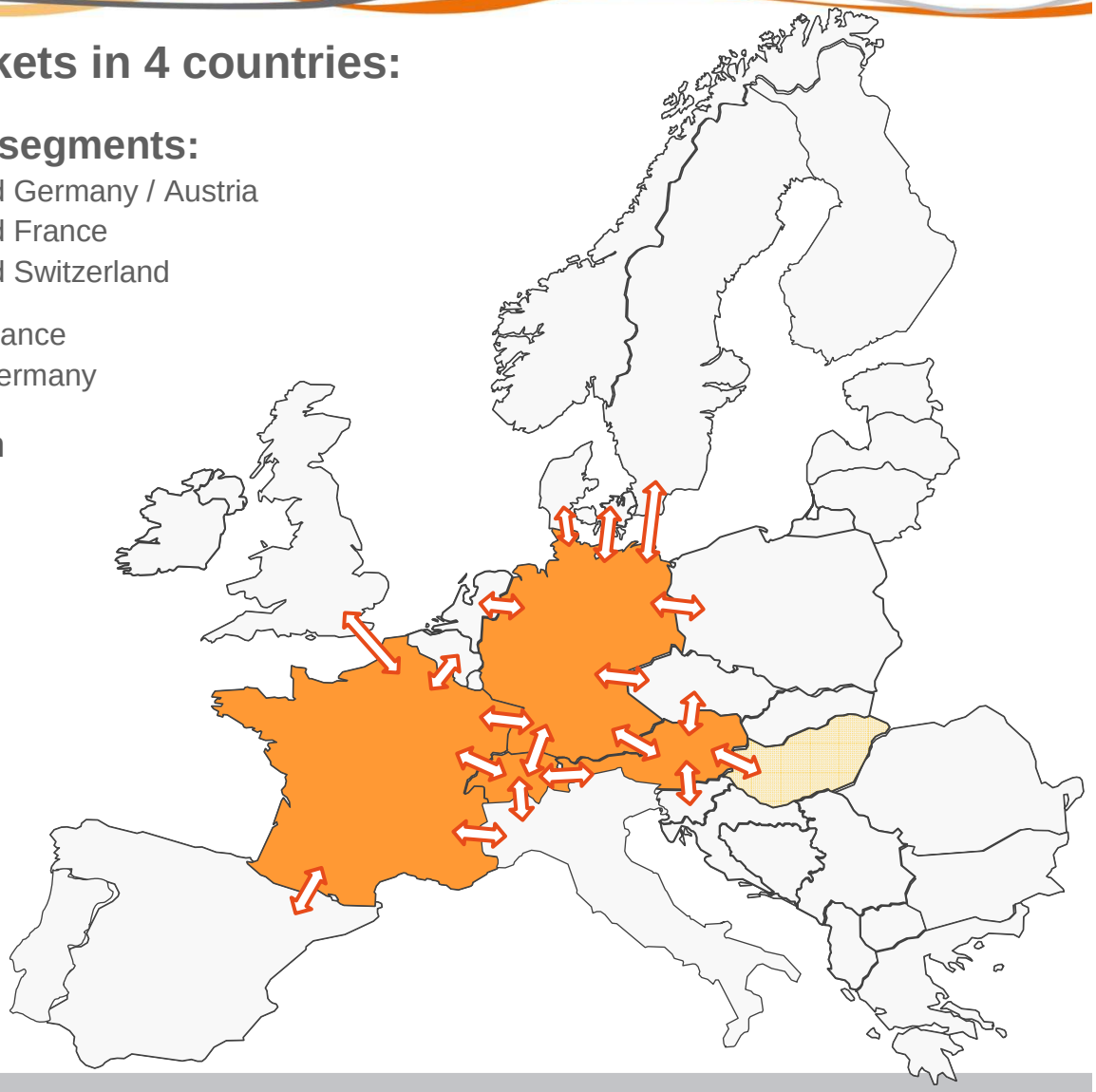


EPEX Spot markets: A pivotal role in Europe

- **EPEX Spot operates spot markets in 4 countries:**

3 hubs:
- Germany / Austria
- France
- Switzerland

5 market segments:
- Day-Ahead Germany / Austria
- Day-Ahead France
- Day-Ahead Switzerland
- Intraday France
- Intraday Germany



- These hubs cover an area of 1,200 TWh of yearly power consumption – **i.e. 1/3+ of the IEM**
- In 2009, **203 TWh traded** in EPEX Spot markets, by a community of **185 members - More than 260TWh** expected in 2010
- **19 interconnectors** with own and neighbouring market areas

→ **EPEX Spot is in a central position for the integration of European spot markets**

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Market Coupling: The optimisation of capacity allocation based on local market liquidity

The issue of Congestion Management

- How to facilitate cross-border power trading?
  - Increase physical cross-border capacity….
  - …. or, more pragmatically, better allocate the **existing** capacity (to solve the « economic congestion »)
- Major issues with capacity allocation today:
  - Capacity purchase and energy transactions are separate transactions
    - If allocated capacities are options, no « netting » of opposite transactions possible
    - Participants may need to hedge their risk by buying capacity in excess and in both directions
- Often suboptimal use of capacities …except with « **implicit auctions** »

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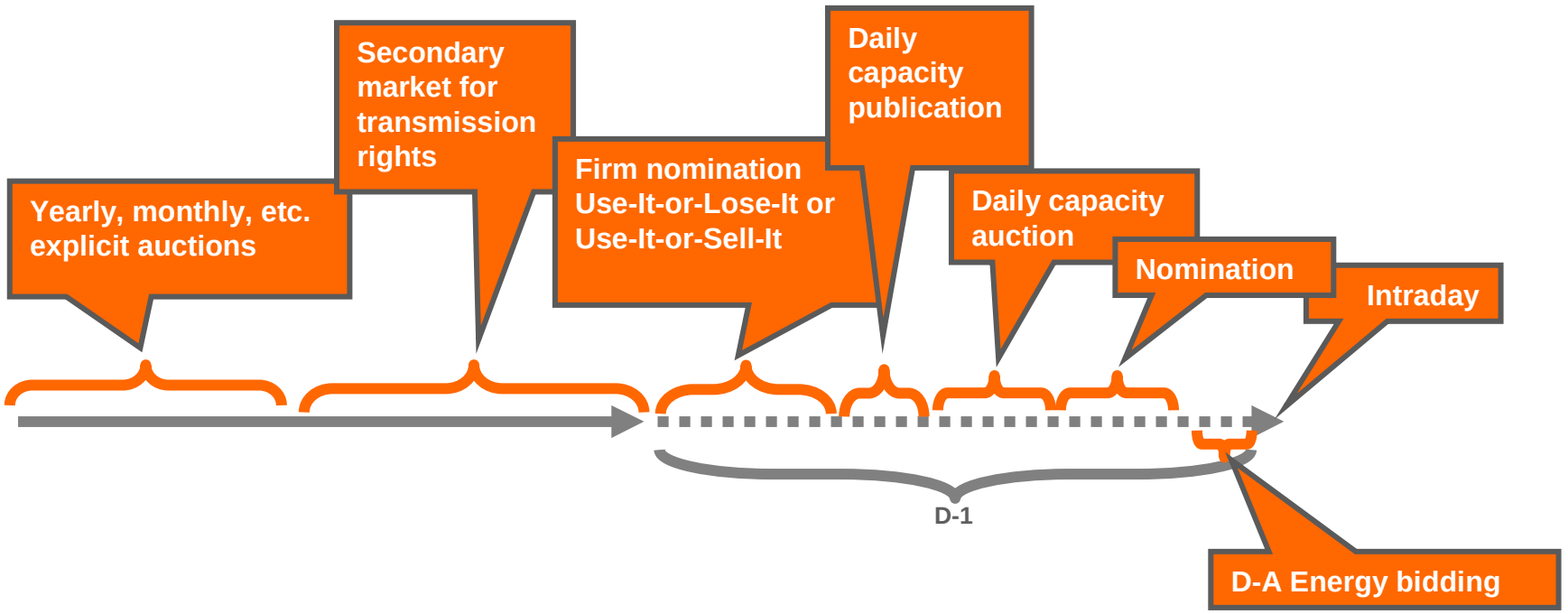
Market Coupling: The optimisation of capacity allocation based on local market liquidity

Operational complexity of explicit auctions



Market Coupling: The optimisation of capacity allocation based on local market liquidity

Implicit allocation allows the optimisation of capacity allocation based on local PX market liquidity

- In the 3rd Energy Package, policy-makers have emphasized the importance to allocate cross-border capacity in a market-based approach: **Market coupling**

- **Market prices produced by PXs** have been identified as the **right references** to which cross-border capacity allocation should be anchored
  - The capacity utilization is automatically and implicitly optimized, together with the optimisation of the energy orders matched by the PXs
  - The value of a marginal improvement of an interconnection is determined by the price difference between the connected market areas multiplied by cross-border volume

→ **The price-references calculated by the PXs are used to send the right investment signals to the markets and the TSOs**

Exemple of achievements in market coupling projects: The TLC project

The success of the TLC project

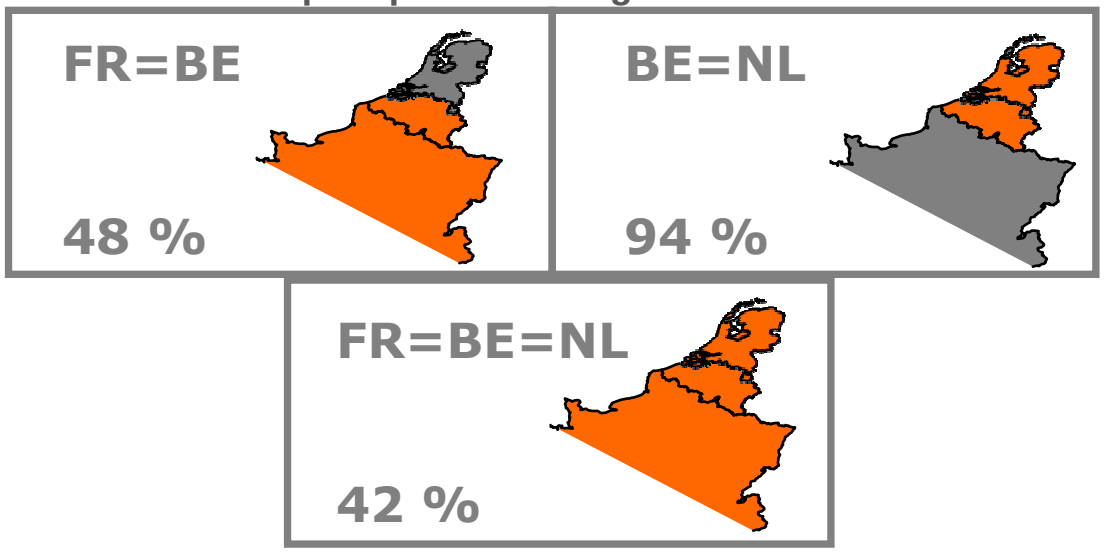
- **What?**
  - **T**rilateral **P**rice **M**arket Coupling between France, Belgium and the Netherlands, improving market integration
- **How?**
  - International cooperation between:
    - Power Exchanges: Powernext (France), APX (The Netherlands), Belpex (Belgium)
    - TSOs: RTE (France), ELIA (Belgium), Tennet (The Netherlands)
  - **Project force mainly at PXs level**

Exemple of achievements in market coupling projects: The TLC project

The success of the TLC project

- Price coupling mechanism since November 2006
- No operational incident during the last two years
- Market results are published in average 15' after Gate Closure Time
- Average full price convergence of 69 % in 2008

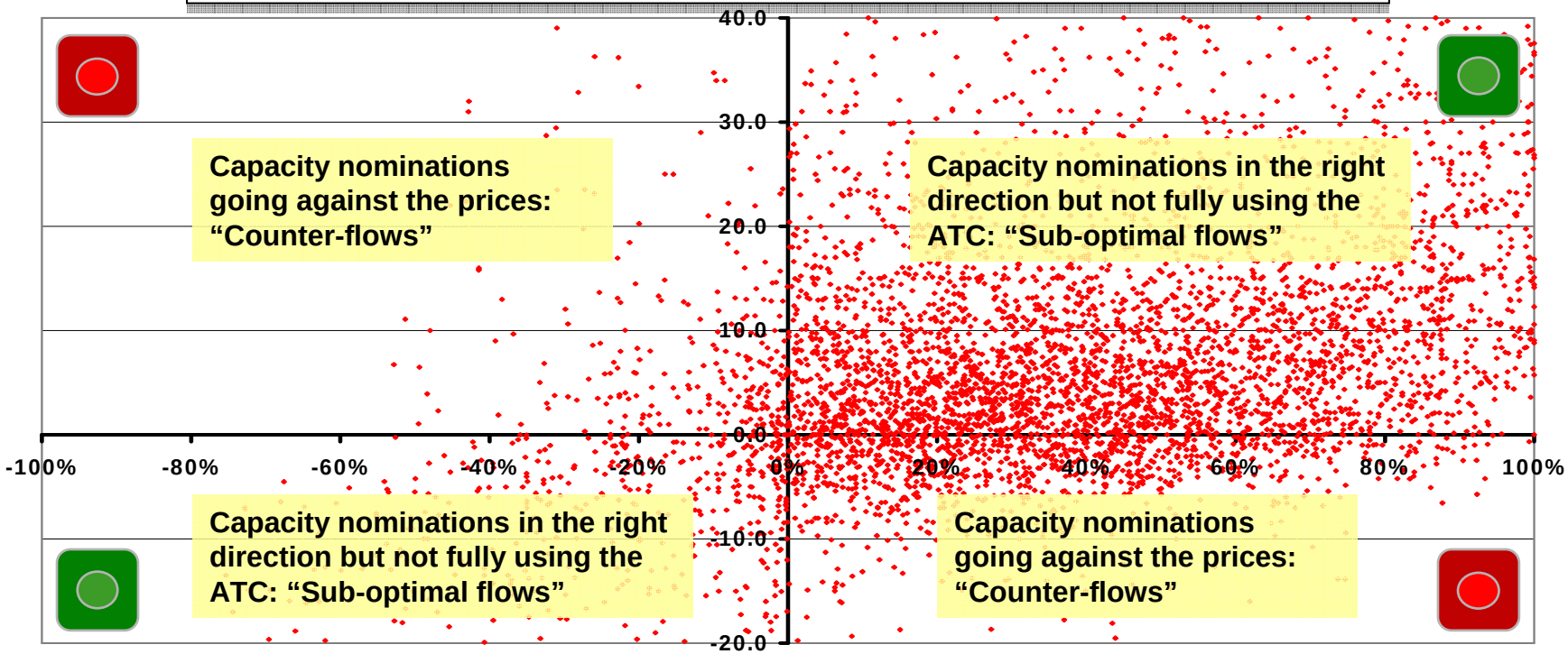
Example : price convergence in Oct. 09



The TLC experience: Optimized capacity allocation anchored on PXs price-references

Before TLC: Severe sub-optimisation of cross-border capacity

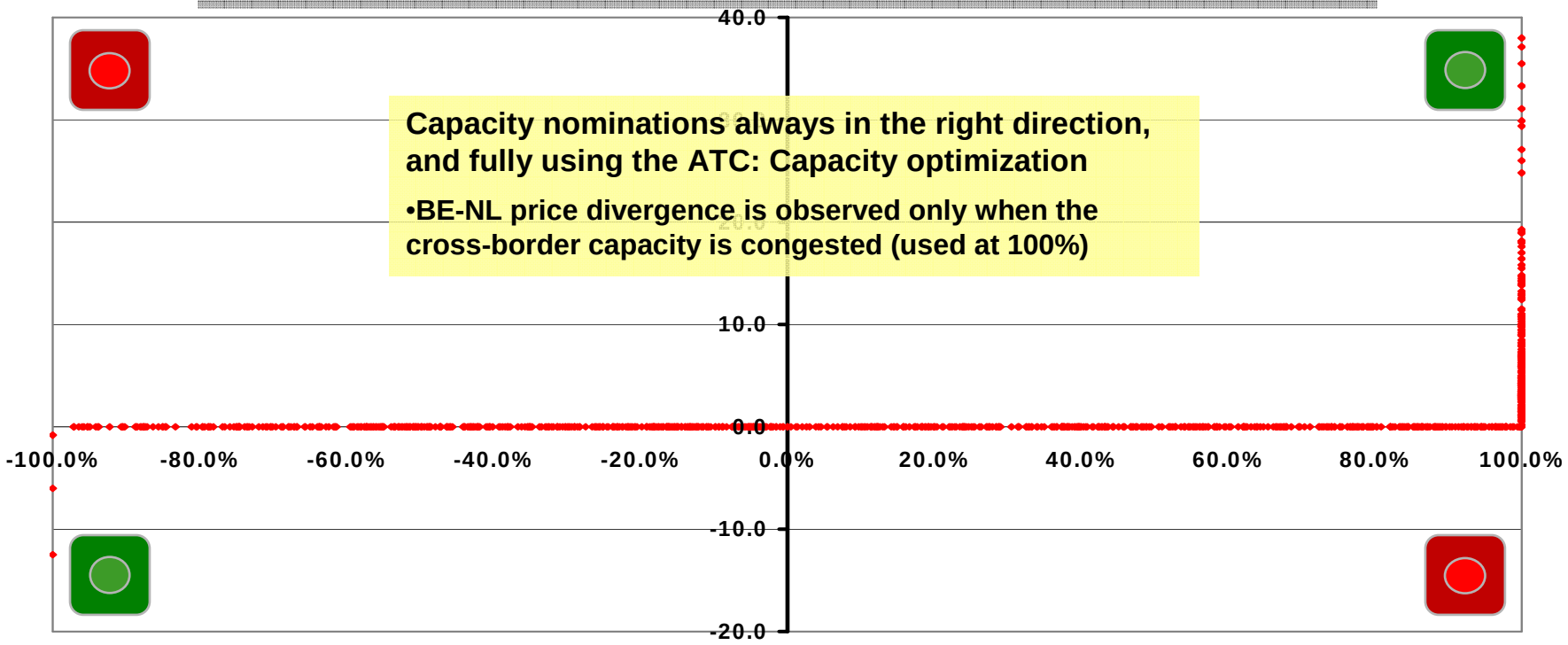
Use of BE-NL « Capacity » (% of av. capacity) *versus* PXs price difference (€), before Market coupling



The TLC experience: Optimized capacity allocation anchored on PXs price-references

After TLC: Full optimisation of cross-border capacity allocation

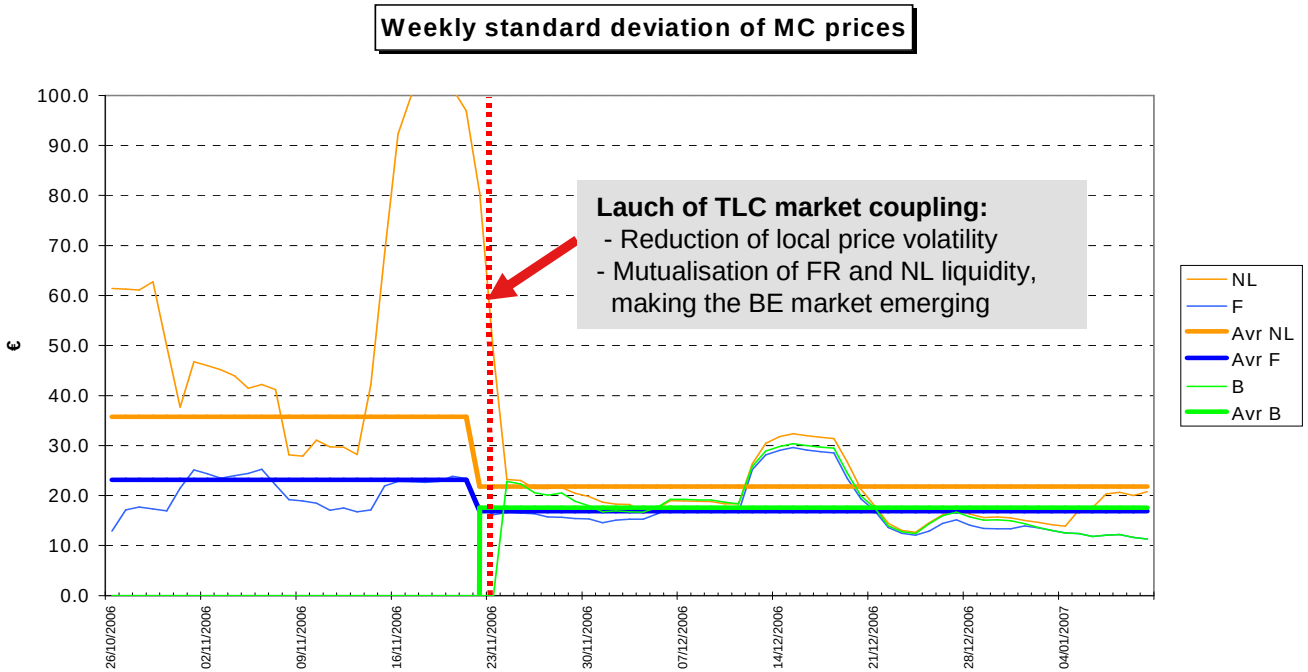
Use of BE-NL « Capacity » (% of av. capacity) *versus* PXs price difference (€), during Market coupling



Market Coupling: Bundle liquidity, building on liquidity

The virtuous circle: Bundling liquidity enhances price quality

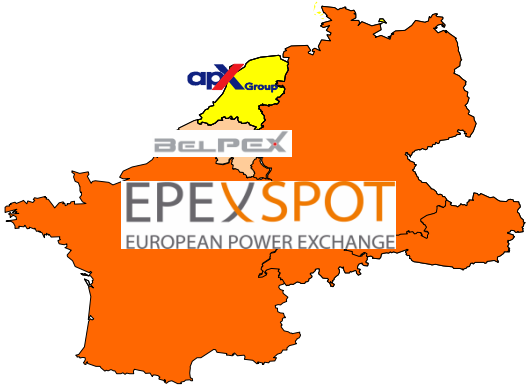
- Market coupling leads also to a clear enhancement market resiliency…



- **… based on the mutualisation of the existing liquidity!**

Exemple of achievements in market coupling projects: The CWE project

CWE market coupling to be delivered



- Project involving 3 PXs & 7 TSOs
- Price coupling between BE-NL-FR-DE hubs using ATCs
- Gate closure time will be harmonized at 12:00
- Target publication of market results at 12:45
  - Accomodating sequential volume coupling CWE-Nordic
- Spot price convergence expected to be higher
  - In the range of 60 % - 80 % for the region, based on simulations
- Project currently in integration test phase
- Go-live date as close as possible to 7 September 2010 and coordinated with EMCC

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What is the European Target Model of power markets integration?

- On the basis of the previous success of market coupling in Europe, **pan-European price market coupling** is now clearly the official goal to reach
- **A single matching algorithm** for Europe has to be delivered **by the Power Exchanges**

Definition of the DA Target model

DEFINITION:

- The Target Model (TM) is to implement Single Price Coupling (SPC) all over Europe
- In the TM, one single matching algorithm is able to establish prices and volumes across all borders between the "PX market areas" and/or bidding areas compatible with capacity calculation

IMPLICATION:

- Pan-European Price Coupling (the TM) implies that a single algorithmic solution is used by all the Power Exchanges responsible for the matching
- All day-ahead bids and offers information necessary for the Pan-European Price Coupling need to be matched with this single algorithmic solution, jointly with all the cross-border capacity information across Europe
- Such bids and capacity information must thus be fully and equally available to the matching algorithm

The Day-Ahead "Target Model" as defined during the XVII Florence Forum (ERGEG)

Make it real: PCR answers to pan-European coupling challenges

Project Management

- Manage a project of a pan-European scale
- Ensure a time-to-market project delivery
- Optimize the conception and implementation costs of the project

Governance

- Provide a sound and flexible cooperation framework for PXs, TSOs and Regulators involved in the project, and ensure dedication from all parties

Technical

- Implement a single algorithmic solution for the spot pan-European energy and capacity optimization
- Ensure the robustness and the security of a wide and impacting market mechanism

Make it real: PCR project management solutions

Project Management

- Manage a project of a pan-European scale
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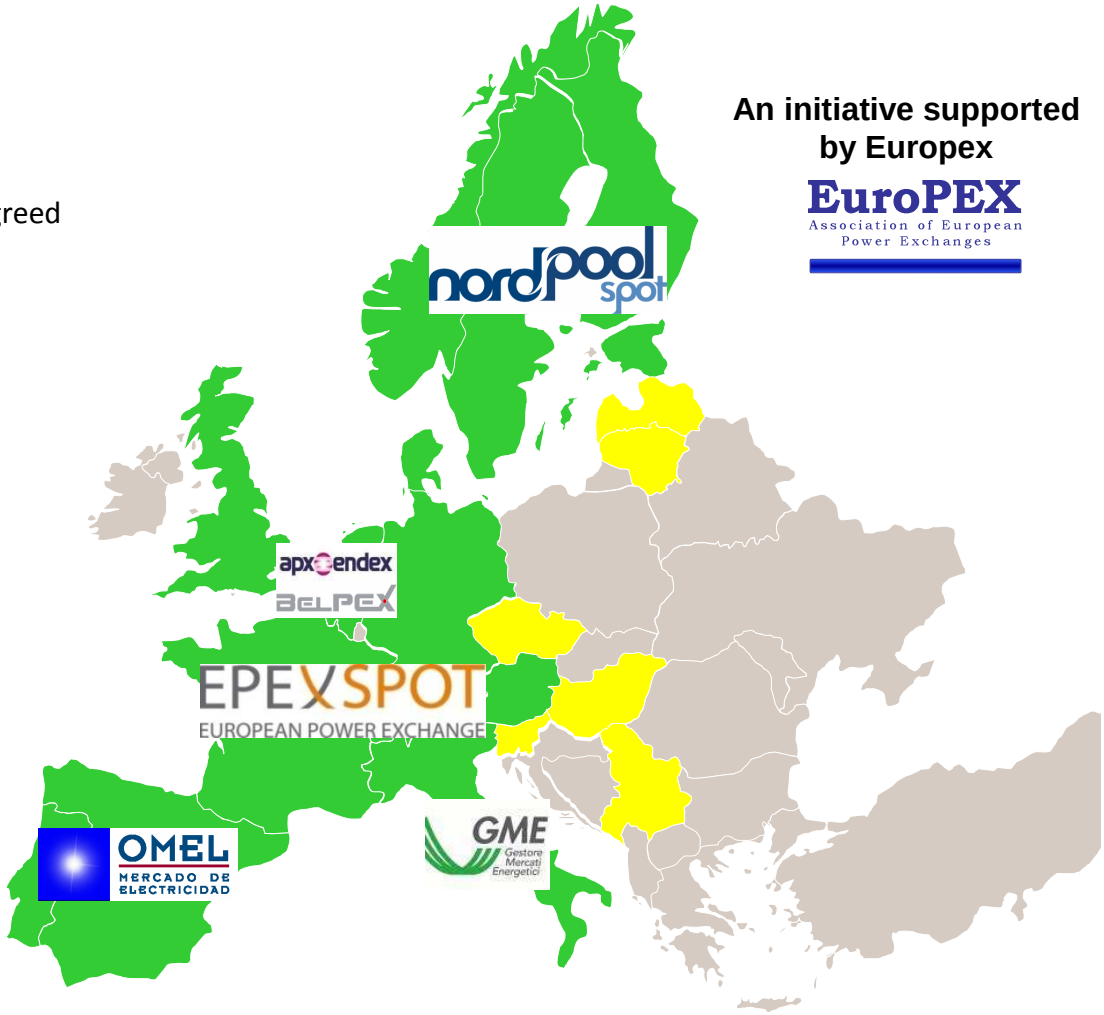
Make it real: PCR project management solutions

Development of the Price Coupling of Regions (PCR) Initiative

Markets initially included in PCR - 2860 TWh

Markets which showed interest to join

Markets that could join next as part of an agreed European roadmap



An initiative supported by Europex

EuroPEX
Association of European Power Exchanges

→ **6 Exchanges only, responsible for price formation in an area covering 80% of the IEM !**

→ **The emergence of Regional Power Exchange like EPEX Spot facilitates the organisation of such market integration projects**

*Source: UCTE 2007 power consumption data

Make it real: PCR project management solutions

Project Management

- Manage a project of a pan-European scale
- Optimize the conception and implementation costs of the project
- Ensure a time-to-market project delivery

Make it real: PCR project management solutions

- PCR main concept is **to build on existing solutions**:

Building on existing national/regional technical solutions

- Existing trading systems, IT infrastructure, TSO interfaces as much as possible
- A single algorithm taking into account most of existing market features
- No need of an Ad-Hoc centralised running site

Building on existing national/regional regulations

- Each market responsible of resolving procedures aspects related to PCR that affect their own Nation/Region arrangements
- This includes approval of Market Rules by the Nationally appropriate authorities

Based on the strong experience of the PXs, the cooperation could deliver in 2012

Make it real: PCR governance solutions

Governance

- Provide a sound and flexible cooperation framework for PXs, TSOs and Regulators involved in the project, and ensure dedication from all parties

Make it real: PCR governance solutions

- Involving all the parties

- Price coupling requires active involvement of all stakeholders to meet their complementary requirements:
  - **Regulators** involvement considered essential for the success
  - **ENTSO-E (EU-level) and TSOs** (regional levels) are key partners: target dates and open go-live sequences to be agreed jointly
  - **Market participants** need to be closely consulted

- The project must also be designed to be **open to other PXs on fair and equal terms:**
  - Equal rights for all PX PCR members
  - Voluntary participation of PXs in PCR, but with the condition of accepting the existing Governance Framework, including the Operational procedures

Make it real: PCR governance solutions

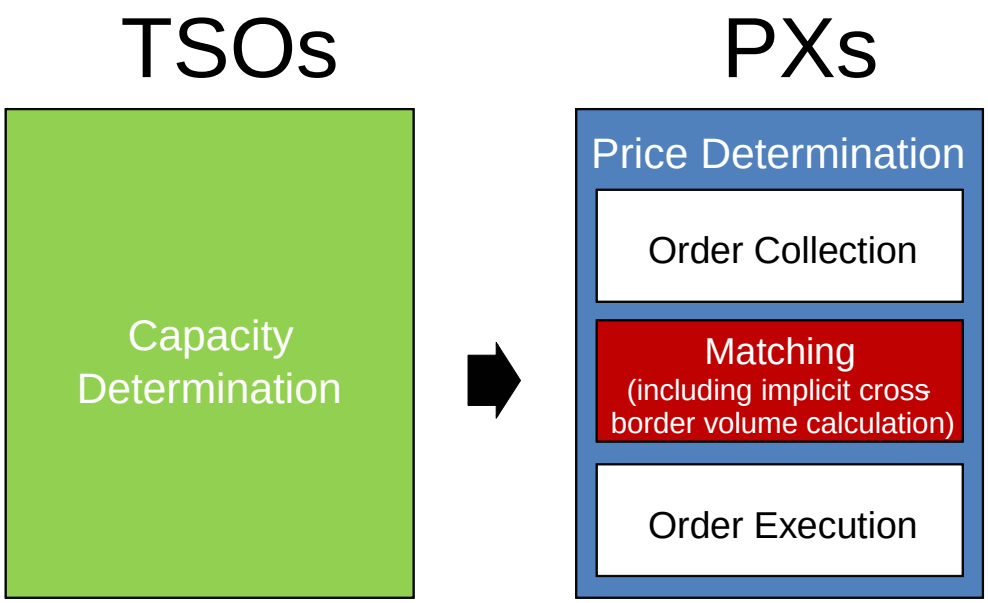
- Sharing the tasks

- To implement the PCR solution, PX believe that governance of the European price coupling should not become a critical issue, provided the current unbundling of functions between TSOs and PXs is duly respected:
  - **TSOs** are responsible for the determination and allocation of the capacity
  - **PXs** are responsible for the price setting & market area import/export position calculation and the clearing

- PCR can support the various ways this unbundling of roles has already been implemented in several market regions (service provision or energy regulation)

Make it real: PCR governance solutions

- Sharing the tasks



Price coupling:

→Clear and efficient allocation of roles ensuring unbundling

→Optimum and robust technical solution

- **In a price coupling scheme**, the cross-border volume optimized through PXs the matching process:
  - Cross-border volume calculation is performed and controlled by the PXs as it is integrated in the matching process

- **TSOs - PXs relationship is established either by a national regulation, or through a direct customer / service provider**
  - PXs take into account TSOs and Regulators requirements regarding the cross-border volume calculation like they take market participants' requirements for order execution

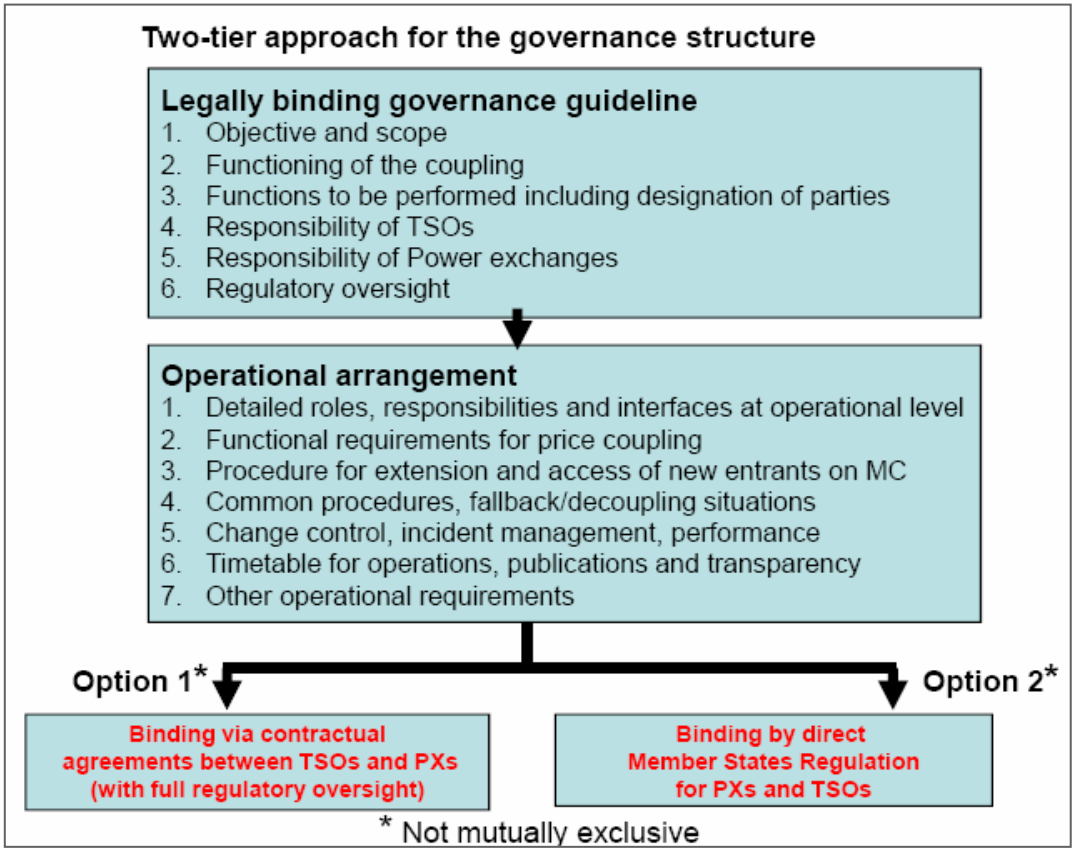
Make it real: PCR governance solutions

- Sharing the tasks

Distribution of responsibilities: CWE case		Distribution of responsibilities: GME, OMEL, Nord Pool Spot cases	
Coordinated Matching	**Cross-Border Clearing & Settlement**	**Coordinated Matching**	**Cross-Border Clearing & Settlement**
PXs jointly responsible for design, build and operation, based on an MoU signed by regulators, governments, TSO, PXs and market parties, subject to: •Capacity allocation functionality agreed with TSOs •Algorithm validation/testing accepted by TSOs •Changes under all-party controls •Operational procedures agreed with TSOs •Incident management by all •Operational performance overseen by all	**Market Coupling:** • PX clearing houses settle X-border internally or between each other; pass congestion revenue to TSOs • Clearing houses nominate X-border flows	PXs responsible for design, build and operation, subject to: •Functionality assigned to PXs and approved by the regulators •Algorithm validation/testing accepted by regulators •Changes under control of regulators •Operational procedures, including incident management, of TSOs and PX approved by regulators •Operational performance of PX and TSOs overseen by regulators	Market Coupling: • PX settles X-border internally and pass congestion revenue to TSOs • PX communicates X-border schedules to TSOs

Make it real: PCR governance solutions

- A PCR governance scheme inspired from the European model



The Day-Ahead "Two-tier" governance model as defined during the XVII Florence Forum (ERGEG)

Subsidiarity & Proportionality principles – "Two-Tier governance"

- Project framework centred exclusively in PCR issues - National/ regional issues to be dealt locally by the concerned parties
- **At the pan-European level:** Governance to be consistent with the European Regulation
- **At the national/regional level:** Using the already existing regulatory frameworks

PCR governance model

Make it real: PCR governance solutions

- **To summarize – The PCR "3 Pillars" of Governance:**

Equal rights for all PX PCR members	Fair task sharing and involvement for all stakeholders	Subsidiarity & Proportionality principles – "Two-Tier governance"

• Voluntary participation of PXs in PCR, but with the condition of accepting the existing Governance Framework, including the Operational procedures	• Unbundling of functions between TSOs and PXs
	• Regulators, TSOs and Market participants involvement is crucial
		• Project framework centred exclusively in PCR issues - National/ regional issues to be dealt locally by the concerned parties
		  • **At the pan-European level:** Governance to be consistent with the European Regulation
		  • **At the national/regional level:** Using the already existing regulatory frameworks

Make it real: PCR technical solutions

Technical

- Implement a single algorithmic solution for the spot pan-European energy and capacity optimization
- Ensure the robustness and the security of a wide and impacting market mechanism

Make it real: PCR technical solutions

- Two key features of the PCR technical model:

1. PXs are using **the same co owned matching algorithm** to deliver an efficient price coupling

2. A pragmatic yet highly **efficient and secure decentralized redundant approach**

Make it real: PCR technical solutions

- PCR Algorithm and Information Sharing

  - **PCR Algorithm requirements:**
    - One algorithm is executed with the information of all involved markets and TSOs
    - The open algorithm able to match all involved energy
    - Input and output information of the algorithm need to be robust
    - No need of a centralised running site

  - **PCR Algorithm governance principles:**
    - Full transparency of the formula (published on internet)
    - Property of all involved PXs
    - Established procedures for introducing modifications with development costs shared between the markets requesting the modifications
    - Modifications may be denied only in case of technical difficulties or changes against the PCR Framework

  → **Candidates for such an Algorithm already exist!**

Make it real: PCR technical solutions

- PCR Algorithm and Information Sharing

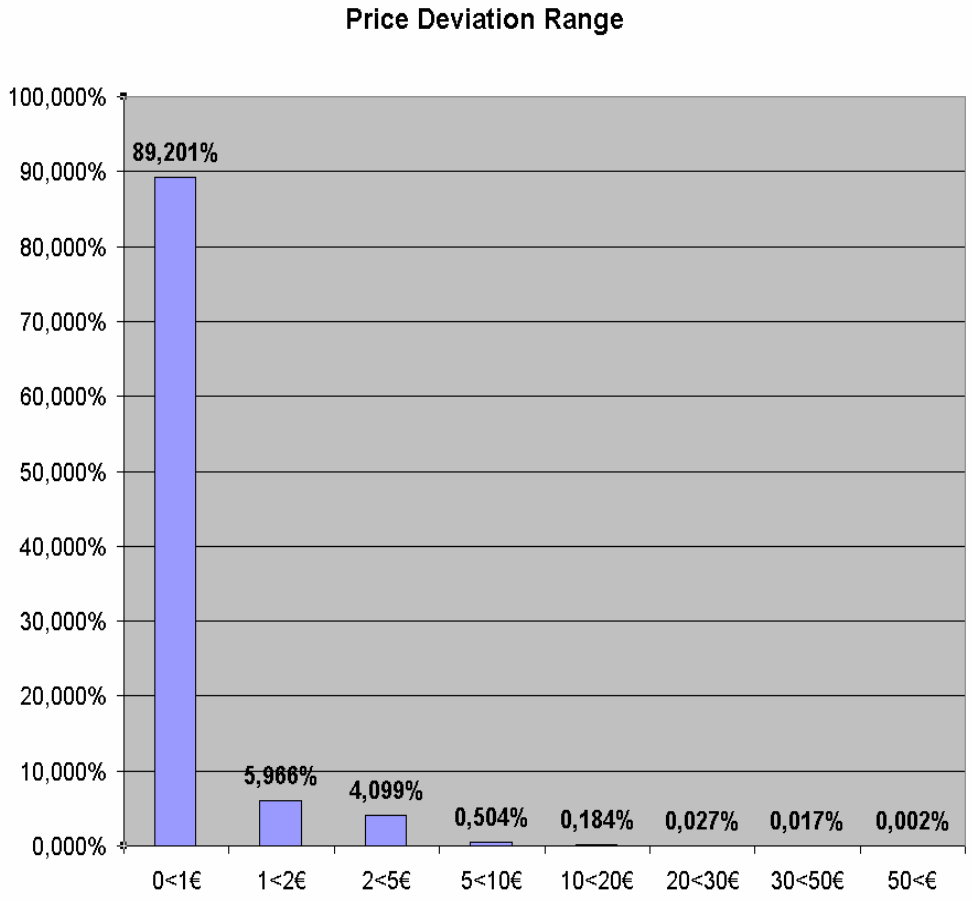
Robustness tests - Prices

•**Price deviation.** Histogram of the number of hourly calculated prices by a single algorithm in one pass, in percentage, vs the value calculated by each of the algorithms for their own prices areas.

•**Ability to handle diversity of products and scale of calculation has been demonstrated on 3 existing algorithms** (154 days, 14 prices areas, 51 744 hourly prices simulated)

•**The calculation of the prices is of a good quality** for a first attempt. Price deviation compared to local algorithm calculation is controlled

→ **Simulation shows that technical feasibility of PCR has been demonstrated in terms of single algorithmic computation**



Make it real: PCR answers to pan-European coupling challenges

Technical

- Implement a single algorithmic solution for the spot pan-European energy and capacity optimization
- Ensure the robustness and the security of a wide and impacting market mechanism

Make it real: PCR technical solutions

- PCR High Level System Design

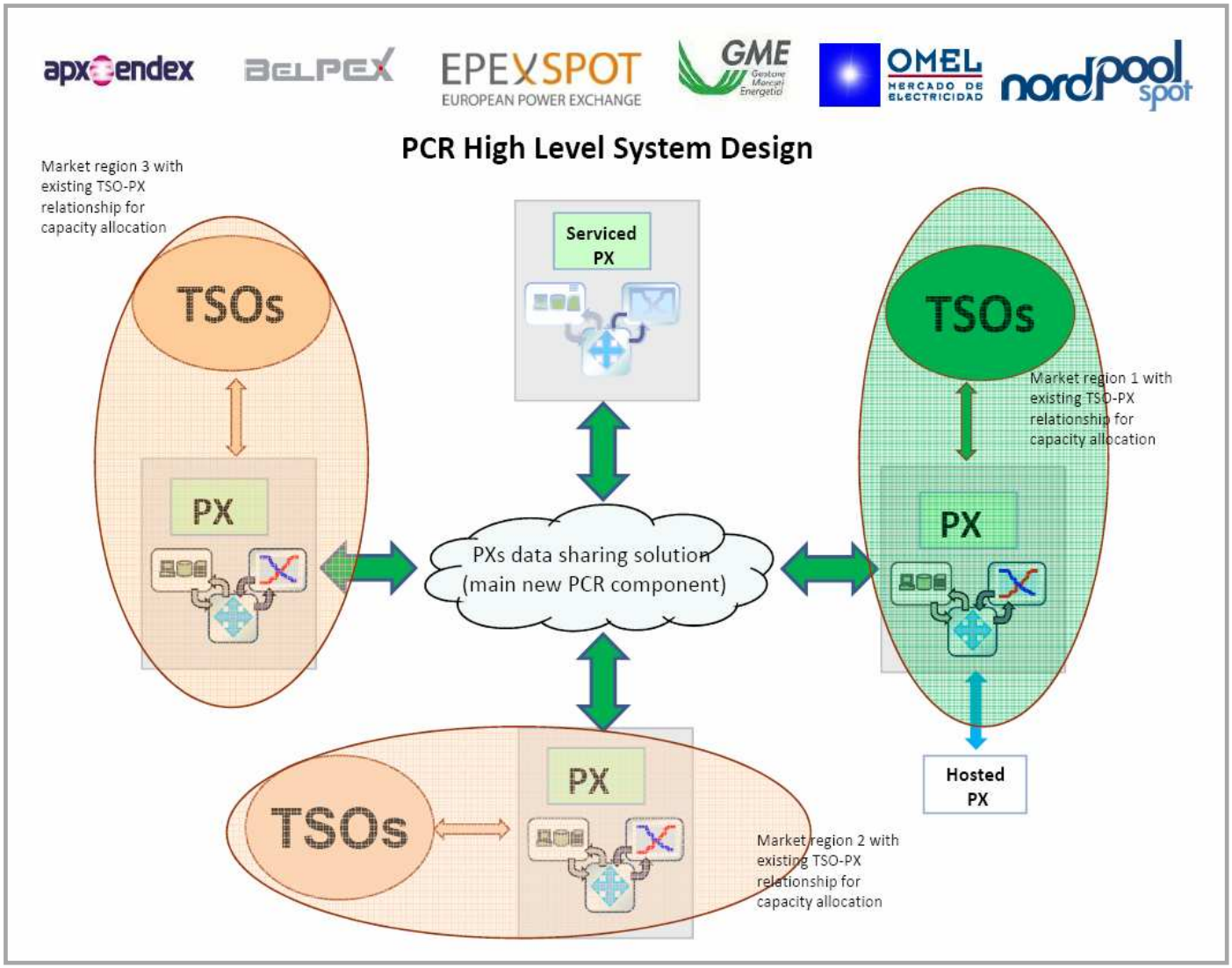
  - The concept is based on **applying 4 general enhancements to the existing technical infrastructures:**

    1. Use the same algorithm in each of the PX matching systems
    2. Configure the network topology and Bid Areas in the matching systems identically, so that prices and net positions (or as applicable Area to Area flows) in all PCR Bid areas are computed in parallel in every matching system (***Very Hot Backup*** concept)
    3. Connect the PXs systems in a way that all input and output data is shared in aggregated and anonymous form per Bid Area
    4. Ensure that results computed in another matching system are identical to the results then published by each PX for their respective Spot Markets (***Master/Slave*** concept)

Make it real: PCR technical solutions

- PCR High Level System Design
  - High Level System Design principles
    - **Fulfilling legal and regulatory requirements is an individual PX responsibility:** The roles of PXs today are already included in national and/or regional applicable contracts, laws and regulations
    - **Data interchange with TSOs is the responsibility of each national and/or regional PX** maintaining existing interchange arrangements
      - Does not impede more centralization on TSO level but it is not a requirement from the PXs
    - **Readily extendible:** The software developed should allow for the extension to more Market Regions with several options
    - **Robustness:** The system has to be robust - For example allow for **partial decoupling** whenever there is a problem in one region so that not all European prices are unavailable

The PCR High Level System Design



- **Efficient price-coupling solution:**
  - Single algorithm
  - PXs data sharing solution
  - Single price solution (*Master/Slave* concept)
- **Flexible:**
  - Using existing trading systems
  - Readily extendible to other markets (several options)
- **Robust:**
  - Partial decoupling possible, to always ensure regional price-setting (*Very Hot Backup* concept)

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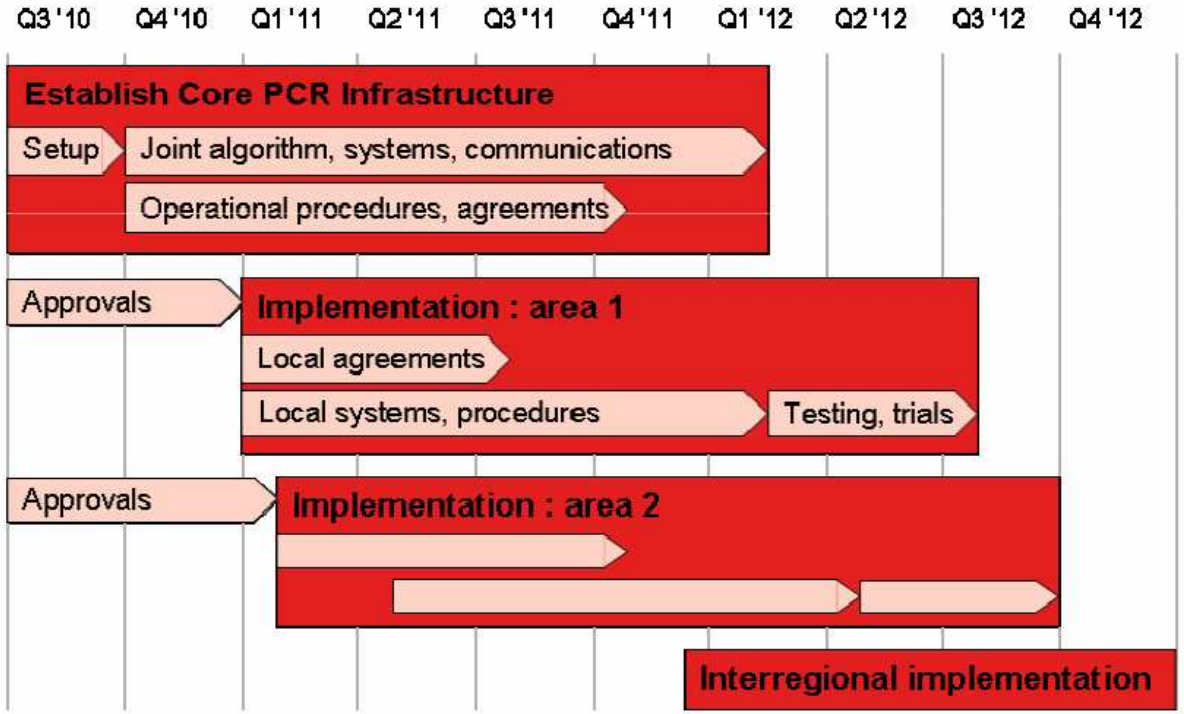
Delivering the PCR: Next steps

Development of the Price Coupling of Regions (PCR) Initiative

- Implementation plan



Final Remarks

- The PCR project is becoming a reference project for European spot power market integration:

10. The Forum took note of the Europex presentation of a decentralised multi-regional price coupling concept. The objective is to quickly deliver a price coupling solution covering the Nordic, Central West and Southern regions, i.e. more than 75% of total European electricity consumption.

Conclusions, XVII European Electricity Regulatory Forum, 10-11 Dec. 2009

9. The Forum welcomed the Power Exchanges' initiative PCR and asked to ensure that it is in accordance with the emerging governance framework.. The Forum stressed the need for co-operation between regulators, TSOs and Power Exchanges. The Forum also stressed the importance of ensuring that the input and requirements of TSOs and regulators are taken into account.

Conclusions, XVIII European Electricity Regulatory Forum, 10-11 June 2010

ERGEG and SWE Regulators Press Release, 7 Dec. 2009

Final Remarks

- The 6 PXs PCR cooperation is a concrete example of how the concept of price-coupling can be implemented at a truly pan-European scale

- This pragmatic initiative can coordinate price formation in an area of organized spot markets trading over 1000 TWh/year
  - Based on price coupling, supported by European stakeholders
  - Fast to implement since building on existing infrastructures and regulatory frameworks
  - Based on their extensive experience in developing and operating price coupling solutions, PXs are are confident that the PCR cooperation could deliver in 2012

- The PCR project should offer an enduring solution for spot power market integration, both in terms of governance and technical model

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Thank you for your attention

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