



## CWE MC and CWE-Nordic ITVC Seminar

*Hamburg, 29<sup>th</sup> September 2010*



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### 1-Welcome words by the Chair *Lene Sonne*





## Agenda

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1. Welcome words by the Chair  
Lene Sonne
2. What is CWE-Nordic ITVC?  
Thorsten Dietz
3. How does CWE-Nordic ITVC work?  
Enno Böttcher

*Lunch*

4. What is the impact of CWE-Nordic ITVC on the CWE and Nordic spot markets?  
Hans Randen, Martine Verelst, Matthijs Nijpels, Klaus Thostrup
5. Tests and simulations  
Ralf Kruse
6. Conclusion  
Jean-François Conil-Lacoste



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*Lunch*

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## 2-What is CWE-Nordic ITVC

Thorsten Dietz



## 2. What is CWE-Nordic ITVC?

### Where do we come from at the Nordic side?



- On the 9<sup>th</sup> November 2009 the market coupling of the Nordic and the German spot market was launched
- The market coupling is governed through EMCC – European Market Coupling Company GmbH
- The results of market coupling are in line with expectations and produced positive results in the past months
  - in 50 % of all hours, prices in Denmark and Germany are nearly identical
  - average price difference between EPEX Spot (GE) and Nord Pool Spot for DK West (DK1) decreased significantly
- On 10<sup>th</sup> May 2010, market coupling was introduced on Baltic Cable
- With the introduction of market coupling on Baltic Cable, EMCC's market coupling is now covering all interconnectors between the Nordic market and Germany

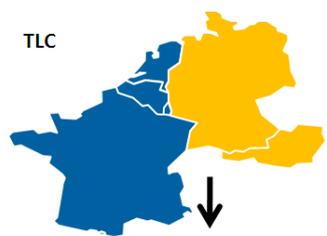




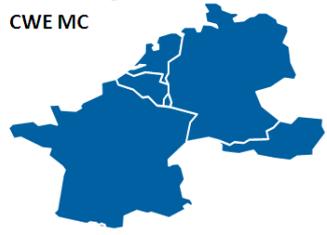
## 2. What is CWE-Nordic ITVC?

### Where do we come from at CWE side?

TLC



CWE MC



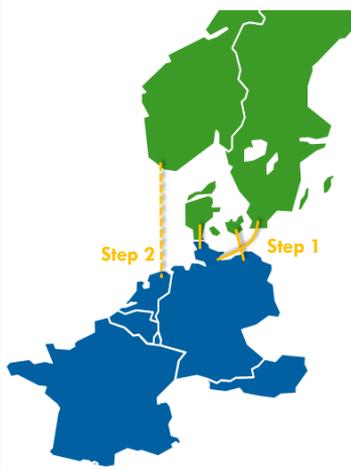
- Original scope of CWE MC based on Memorandum of Understanding in June 2007
- Signatories agreed on the design and implementation of the flow based market coupling in the CWE region
- Project Parties propose to start market coupling with an ATC based solution as a first step in the market coupling
- CWE Market Coupling will replace the currently applied Trilateral Coupling (TLC) and will also be a price coupling
- Dependencies between Nordic and CWE were recognized early on and dealt with accordingly





## 2. What is CWE-Nordic ITVC?

### CWE – Nordic ITVC: A next step towards the Integrated European Market



- Considering the development in the two regions, the project partners launched a study on potential market coupling solutions for the CWE region and the Nordic market
- TSOs and PXs of the combined CWE/Nordic region are committed to implement a price coupling model. However an interim solution is needed to deliver robust market results
- Interim Tight Volume Coupling (ITVC), based on EMCC's Nordic-German coupling, will provide implicit allocation of available capacities between the CWE and the Nordic region
- The project was initiated in January, monitored by joint regulators, and will be launched in two steps:
  - **Step 1** covering both interconnectors between Germany and Denmark and Baltic Cable between Germany and Sweden (expected launch date 9<sup>th</sup> Nov 2010)
  - **Step 2** including NorNed cable (expected launch date 14<sup>th</sup> Dec 2010)





## 2. What is CWE-Nordic ITVC?

### CWE – Nordic regional electricity markets: Global picture

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Current day-ahead market

Interim day-ahead market

**Current solutions**

1. Market splitting Nordic and Estonia (one PX)
2. Price coupling in the Netherlands, Belgium and France (TLC – 3 PXs)
3. Tight volume coupling between the Nordic countries and Germany through EMCC
4. Explicit auctions on other borders

**Interim solution**

1. Market splitting for Nordic and Estonia (NPS)
2. Price coupling in CWE
3. Tight volume coupling on all connections between the CWE and Nordic regions

**ITVC is an interim solution that is more efficient than explicit auctions.**

The ultimate goal of all parties involved is an enduring price coupling over the entire region extendable to other regions or countries.





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### 3-How does CWE-Nordic ITVC work? Enno Böttcher



### 3. How does CWE-Nordic ITVC work?

- Functioning of ITVC
- Developing the ITVC system
- Developing joint ITVC processes





### 3. How does CWE-Nordic ITVC work?

#### Interim Tight Volume Coupling: developed by all parties

1 Definition & initiation	2 Solution development	3 Operation
<ul style="list-style-type: none"> <li>Setting of functional requirements for the interim solution (TSOs and PXs)</li> </ul>	<ul style="list-style-type: none"> <li>EMCC developed solution</li> <li>TSOs prepared for providing available transmission capacity (ATC)</li> <li>PXs prepared for providing order books (OBK)</li> <li>Establishment of governance arrangements (TSOs and PXs)</li> </ul>	<ul style="list-style-type: none"> <li>EMCC operates tight volume market coupling</li> <li>PXs operate second step calculations (price calculation and price coupling)</li> <li>Solution is “as tight as possible”</li> </ul>
<p>EMCC was asked in January 2010 to establish interregional tight volume coupling</p>		

The Interim Tight Volume Coupling (ITVC) solution establishes tight volume coupling on all interconnectors between the CWE and Nordic regions

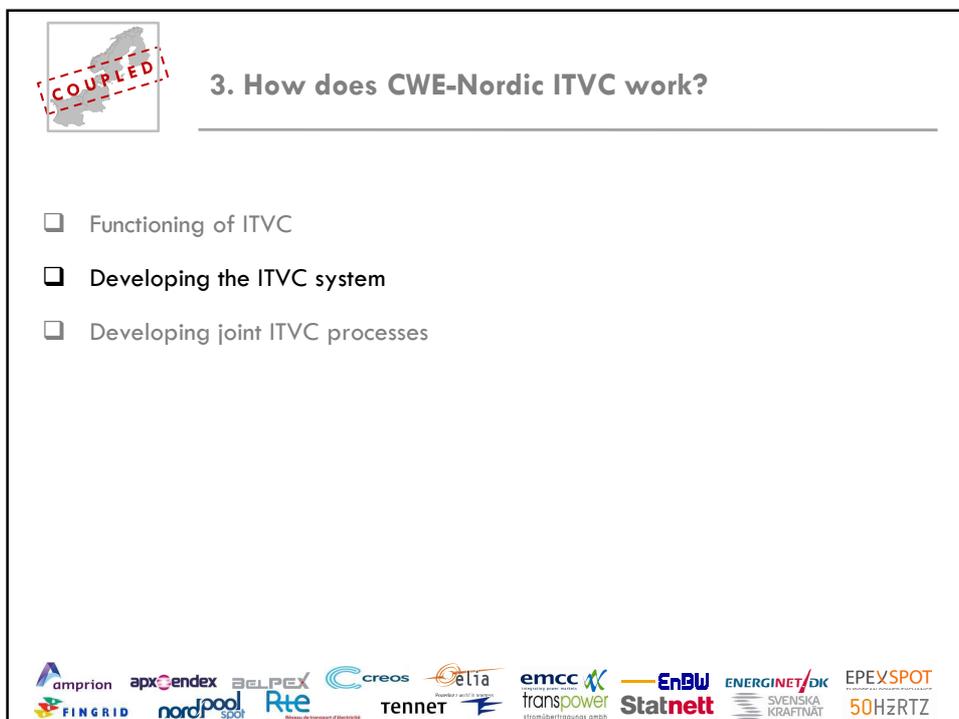
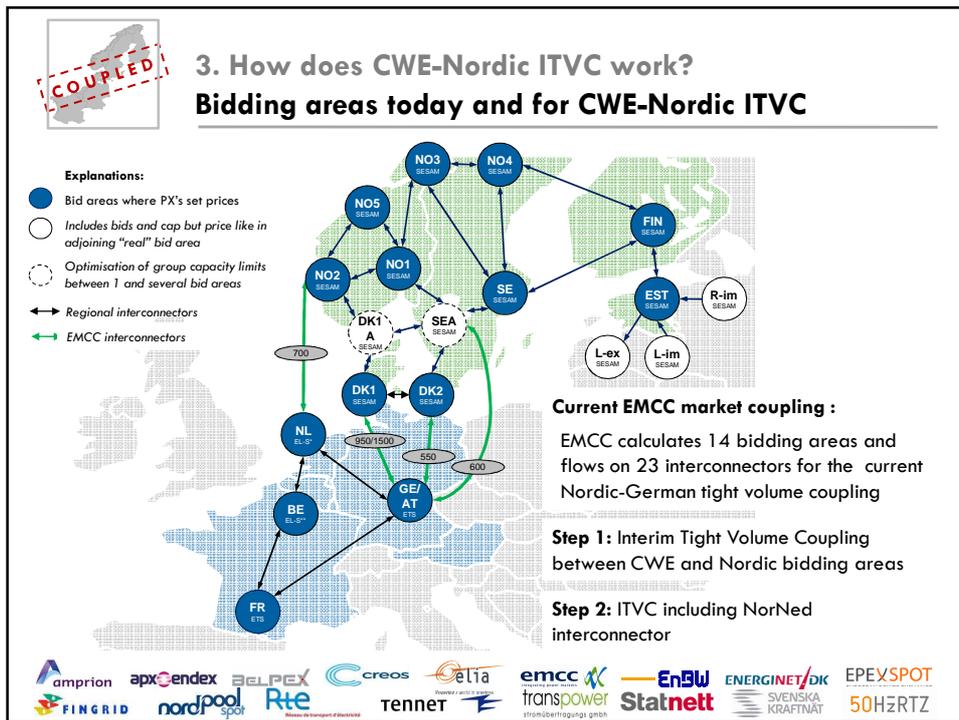



### 3. How does CWE-Nordic ITVC work?

#### Technical and business process deliverables

Objectives	Tasks
<ul style="list-style-type: none"> <li>Develop and implement an Interim Tight Volume Coupling Solution between CWE and Nordic region for the interconnectors Baltic Cable, DK1, DK2 and NorNed in close cooperation with CWE-Nordic TSOs and PXs</li> <li>Management of cross-border flows, shipping and scheduling for the aforementioned interconnectors by EMCC</li> <li>Avoid market irritations which may occur from a “loose” sequential market coupling</li> </ul>	<ul style="list-style-type: none"> <li>Development of technical solution in line with the constraints of CWE-Nordic TSOs and PXs</li> <li>Development of business processes in line with the requirements of CWE-Nordic TSOs and PXs</li> <li>Development of a fallback solution and investigation of robust processes</li> <li>Improvement and harmonisation of extended day ahead processes to cover exceptional situations</li> <li>Coordinated migration of Interim Tight Volume Coupling Solution and CWE market launch</li> </ul>



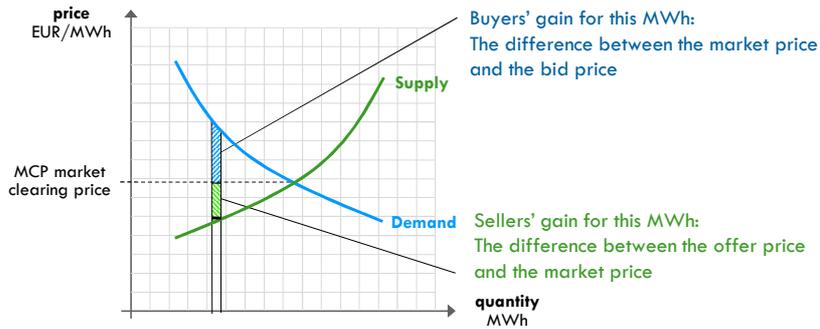




### 3. How does CWE-Nordic ITVC work?

#### Principle of EMCC's system: economic welfare criterion

For one hour for one bidding area: The buyers' and sellers' surplus from the PX day-ahead auction is the area between the exchange's supply curve and demand curve. In addition, there is a congestion revenue in case of congestion between areas.

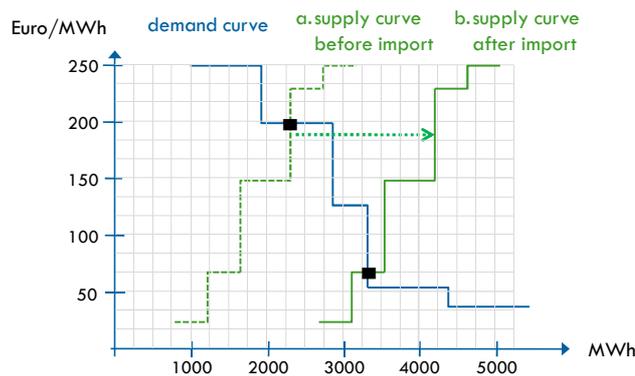


Maximising this area - while respecting the given bid and capacity constraints - will maximise the sum of the participants' economic gains.



### 3. How does CWE-Nordic ITVC work?

#### Principle of market coupling



It is vital that all rules and constraints of PXs and EMCC are aligned. The algorithm calculates all supply and demand bids in each price area and defines the market clearing price.



### 3. How does CWE-Nordic ITVC work?

#### ITVC requirements: products and system adaptations

CWE products	Nordic products
<ul style="list-style-type: none"> <li>Hourly orders</li> <li>Block orders</li> </ul>	<ul style="list-style-type: none"> <li>Single hourly bids, flexible hourly bids</li> <li>Fixed block bids, user defined block bids</li> <li>Linked block bids, convertible block bids</li> </ul>

**Adaptations to volume coupling model**

- Added handling of stepwise curves
- Added handling of additional first/last steps in bid curves
- Added local handling of block exclusion rules
- Included different price ranges: -200 - 2000 for NPS and -3000 - 3000 for CWE

**Solving**

- Introduced faster Branch & Cut algorithm
- Solves relaxed quadratic problem without integer constraints
- Implemented efficient rules for finding appropriate cuts

### 3. How does CWE-Nordic ITVC work?

#### Mathematical methods are questions of optimisation

Here are two examples of how the system is solving and optimising the bids:

**Nonlinear optimisation**

is the process of solving a system of equalities and inequalities, collectively termed constraints, over a set of unknown real variables, along with an objective function to be maximized or minimized, where some of the constraints or the objective function are nonlinear.

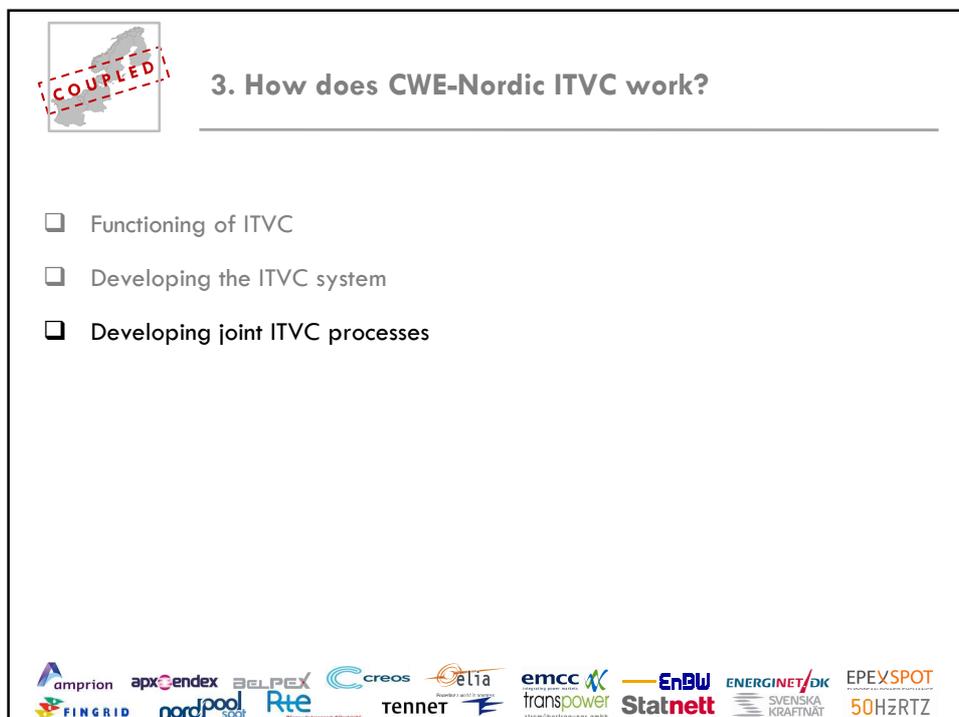
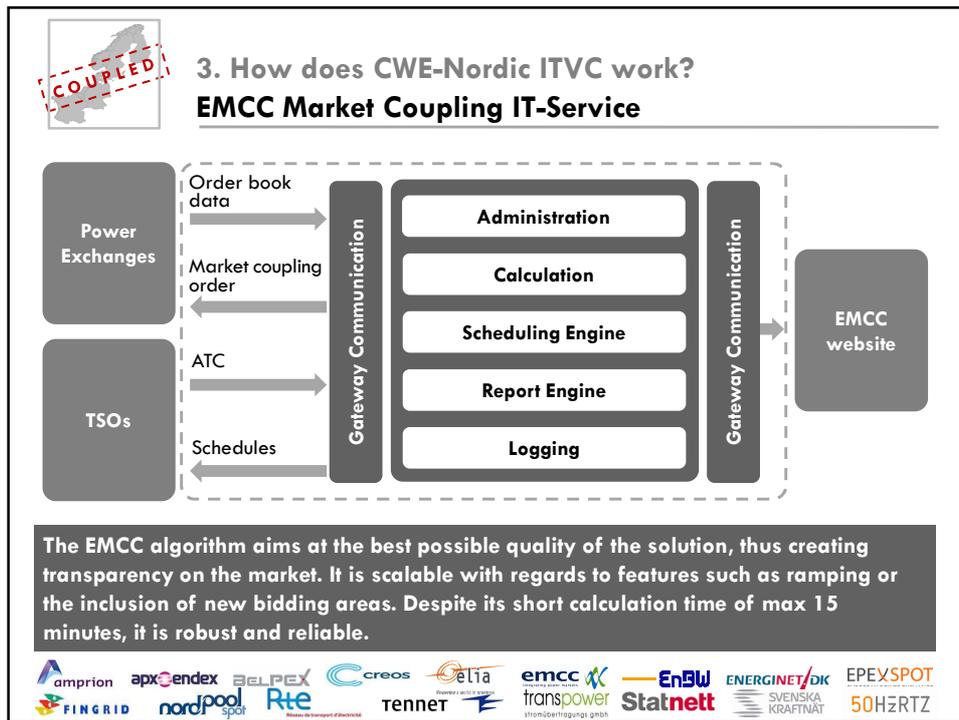
**Branch and cut**

is a general algorithm for finding optimal solutions of various optimisation problems, especially in discrete and combinatorial optimisation.

It consists of a systematic enumeration of all candidate solutions, where large subsets of fruitless candidates are discarded *en masse*, by using upper and lower estimated bounds of the quantity being optimized.

**Example**

for 50 block bids there are  
 $2^{50}$  solutions!





### 3. How does CWE-Nordic ITVC work?

#### Development and scope of Business Processes

##### Development

- Based on existing CWE and EMCC processes, a joint CWE-Nordic working group designed a joint common process within the 2<sup>nd</sup> and 3<sup>rd</sup> quarter 2010

##### Scope

- Process design and business process documentation
- Adaptation of procedures after testing with operators and in production mode (according to agreed change control procedure)

##### Security

- All interfaces and processes are automated
- Back-up routines (called incident routines) were developed for all process steps, ensuring that all transactions can be carried out manually
- The system has redundancies at different locations, the switch between systems takes some milliseconds

##### Communication

- Efficient and timely communication to market participants is ensured by a set of predefined market messages in case of delays and incidents

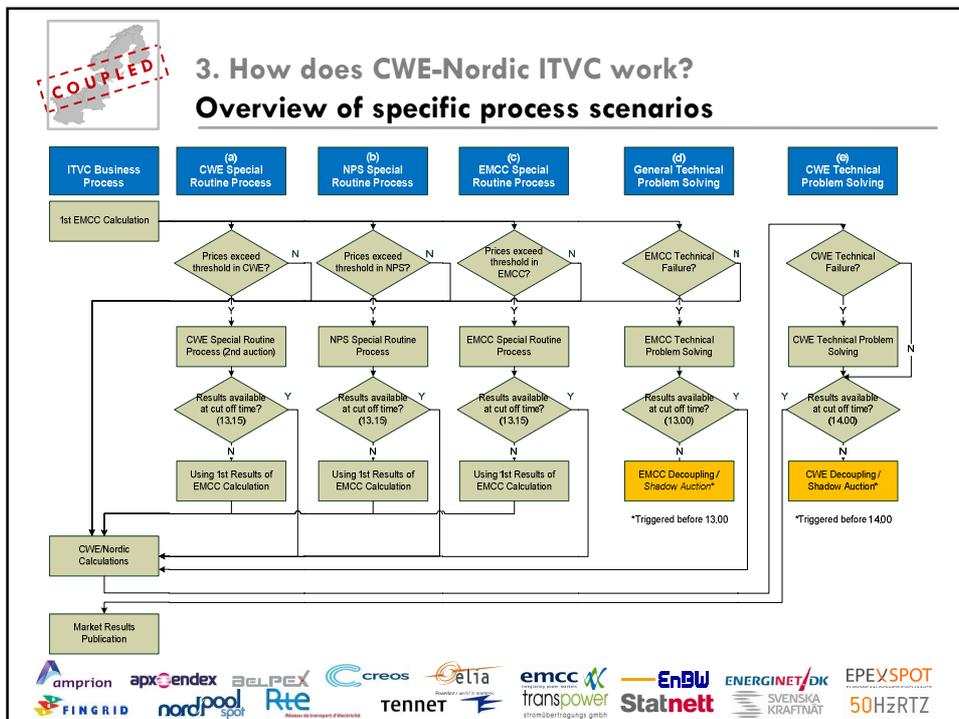
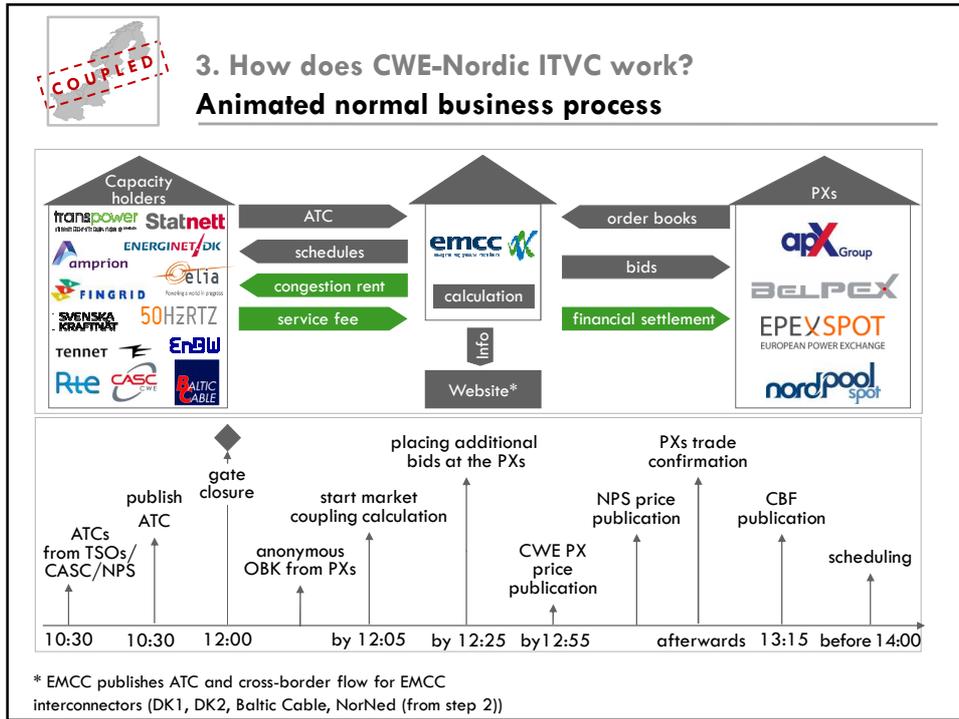


### 3. How does CWE-Nordic ITVC work?

#### Setup of Business Processes

Type	Application
<b>Normal Business Process</b>	Process steps and timings without incidents
<b>Incident Routines</b>	Backups within the normal process, e.g. manual routines
<b>Technical Problem Solving</b>	Process with prolonged timings applied to avoid decoupling e.g. in case EMCC calculation is not finished after 15 mins
<b>Special Routines</b>	Routines in case PX thresholds (e.g. min or max prices) are reached
<b>Decoupling</b>	Routine to ensure handling of worst case e.g. EMCC or CWE could not calculate
<b>Shadow Auction</b>	Routine with market participants in case of decoupling, participants send shadow bids to CASC
<b>Coordinated Communication</b>	Communication of project parties in an established telephone conference to handle incidents and decoupling
<b>Market Communication</b>	Communication of incidents and delays by means of market messages on EMCC website, NPS UMM and within CWE







### 3. How does CWE-Nordic ITVC work?

#### Changes within the EMCC volume coupling process

Task	Old timing	New timing
Publication of ATC	10:00	10:30
Power exchanges send order books to EMCC	12:15 (flexible)	12:05 (fix <sup>1</sup> )
EMCC calculation finished	12:30 (flexible)	12:25 (fix <sup>1</sup> )
In case of technical failure:		
- triggering of Nordic Shadow Auction <sup>2</sup>	n.a.	12:40
- decoupling	n.a.	13:00
In case of Special Routines:		
- sending of EMCC market coupling orders	n.a.	13:15

<sup>1</sup> fix for normal mode, afterwards process is in extended mode

<sup>2</sup> as shown in presentation by Klaus Thostrup



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## 4-What is the impact of CWE-Nordic ITVC on the CWE and Nordic Spot Markets?

*H. Randen, M. Verelst, M. Nijpels, K. Thostrup*





## 4. Impact of CWE-Nordic ITVC

1. Impact on Nord Pool Spot market (Hans Randen)
2. Impact on CWE market
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    - CWE MC High Level Architecture
    - Coordinated ATC calculation process
  - Short Overview on CWE part of the ITVC solution (Matthijs Nijpels)
    - Normal Process Timeline after go-live
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    - Rules and Entitlement
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  - Decoupling
  - Decoupling known in advance



## 4. Impact of CWE-Nordic ITVC Impact on Nordic (NPS) Elspot Market

CWE-Nordic ITVC is a **positive step** towards ultimate goal of price coupling across wider parts of Europe, because it...

- ... is based on the successful technical and procedural setup and results in place since Nov 2009 for EMCC tight volume coupling between the Nordic areas (NPS) and Germany (EPEX)
- ... further **enhances efficiency of utilization of capacity** between regional/local PX spot markets since it reflects all bid areas in CWE and Nordic spot regions
- ... enhances the **precision** (quality) of tight volume coupling as it is based on economic optimization (welfare criterion), which has been a fact in NPS Elspot since 2007 and is introduced similarly CWE price coupling
- ... shows that a large number of TSOs and PXs, with regulatory support, can agree upon a pragmatic and efficient technical, procedural and governance setup that **delivers on main objectives** for efficiently traded markets and congestion management





#### 4. Impact of CWE-Nordic ITVC Impact on Nordic (NPS) Elspot Market

General impact on the Nordic (NPS) Elspot market:

- **No change** for market player's bidding, TSO capacities or NPS delivery of results in **the NPS Elspot Market** (System/Area Prices, Area-to-Area flows, Area and portfolio volumes, etc.)
- In normal cases no change in timing of 2-step process, i.e. EMCC ITVC and then NPS, after gate closure (12:00), but some changes in details of timing and fallback procedures if ITVC decoupling occurs\*
  - The risk of decoupling is limited due to stable technical and procedural setups, but market parties should be prepared for, especially when market conditions are strained
  - To get a robust and efficient utilization of interconnector capacities as well as pricing it is key that Nordic parties with ability to engage in Shadow Auctions for relevant EMCC interconnectors seeks for entitlement and create routines to engage in SA

\* also explained in presentation by Klaus Thstrup



#### 4. Impact of CWE-Nordic ITVC Impact on Nordic (NPS) Elspot Market

- The fallback for ITVC, i.e. Shadow Auctions, creates a need to allow for reopening of bidding at NPS (like for the other PXs), which will be accomplished via a small change in the NPS Rulebook for the Physical Markets (Note: this will be declared in NPS Exchange Info)
- The ability to activate Nordic routines to handle special situations, e.g. to curtail bids in peak load situations, is incorporated in the routines and timings linked to the ITVC process





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## 4. Impact of CWE-Nordic ITVC Coordinated ATC Calculation

**Today :**

- Bilateral coordination process where Net Transmission Capacities (NTCs) are shared between neighbouring TSOs
- Partly « multi-border coordination » (e.g. Export DE-NL/FR/CH)

**For CWE MC :**

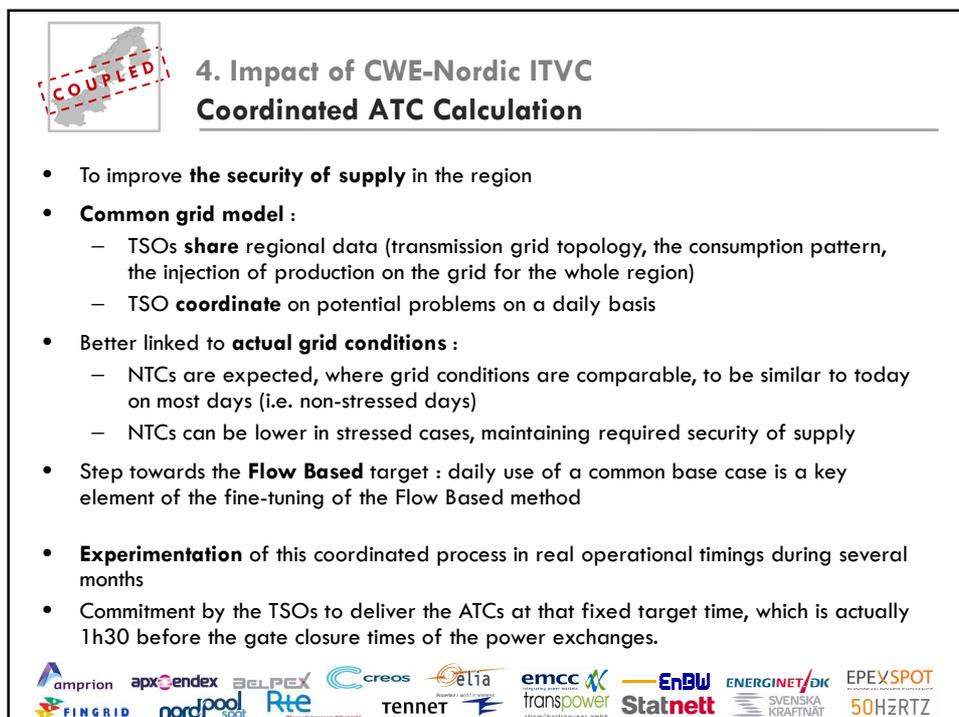
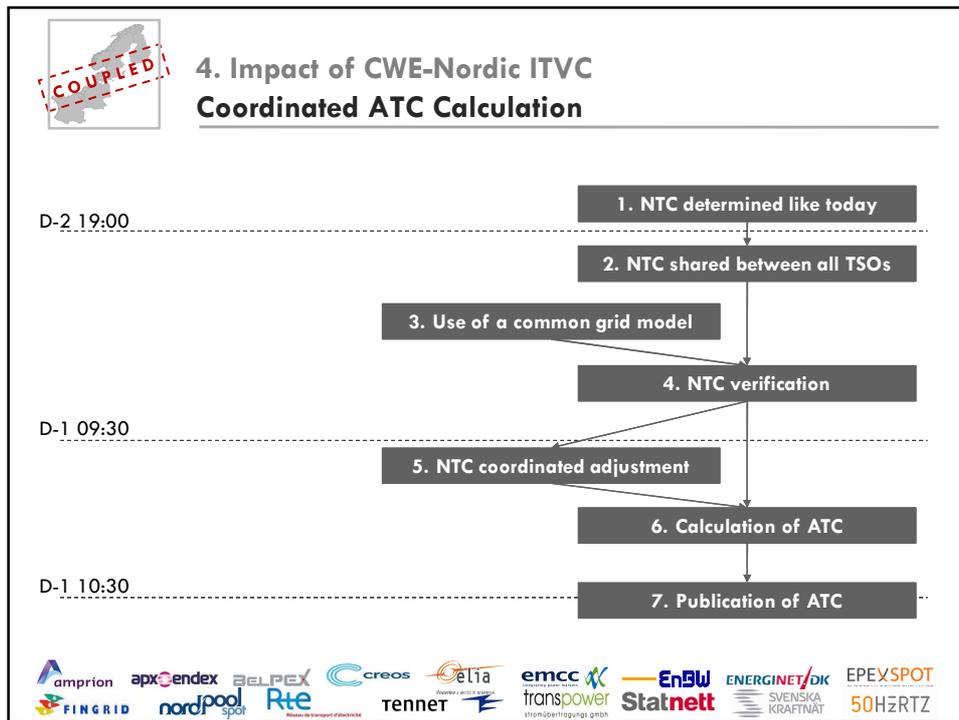
- A new methodology for a regional coordinated process, based on a common grid model.
- NTCs are shared and evaluated by all TSOs of the CWE region.

**From NTC to ATC :**

- $\text{Coordinated ATC} = \text{Coordinated NTC} - \text{Netted Long Term nomination}$

Business Process Step	Deadline	
Deadline for submission of Long Term nominations by Market Participants at the TSOs	Belgium :	08:00
	France :	08:15
	Germany :	08:15
	The Netherlands :	09:00







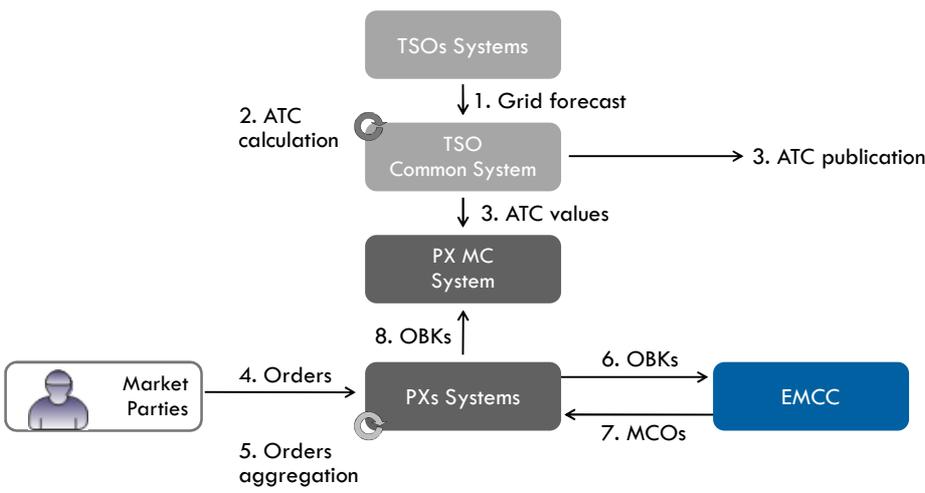
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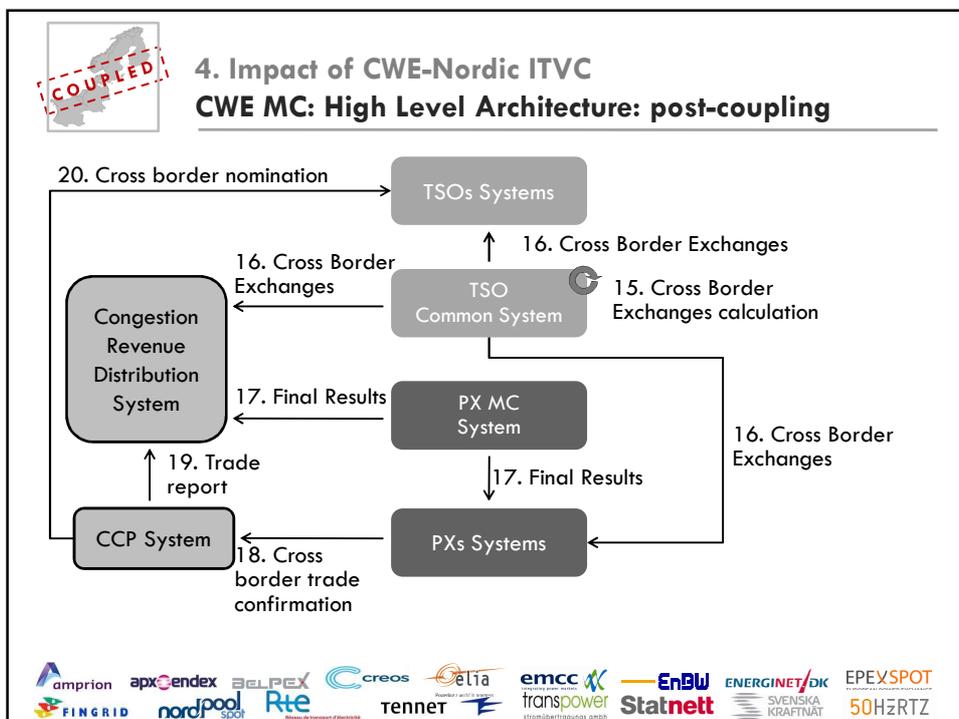
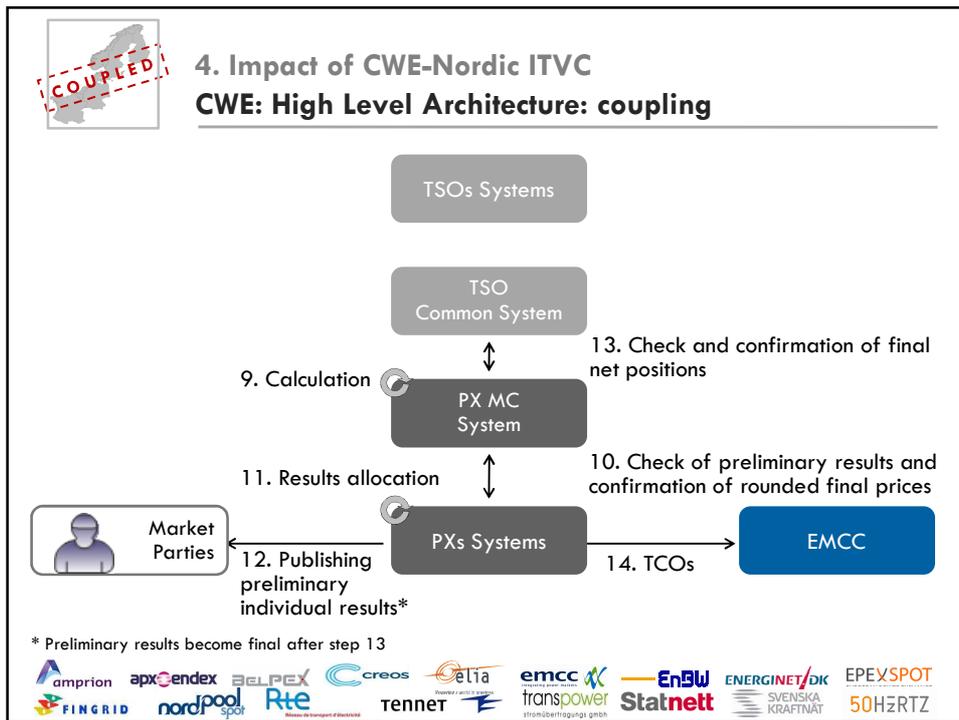
#### CWE: High Level Architecture: pre-coupling and coupling



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    graph TD
      TSO[TSOs Systems] -- "1. Grid forecast" --> TSOCS[TSO Common System]
      TSOCS -- "2. ATC calculation" --> TSOCS
      TSOCS -- "3. ATC publication" --> ATC[3. ATC values]
      ATC --> PXM[PX MC System]
      Market[Market Parties] -- "4. Orders" --> PXS[PXs Systems]
      PXS -- "5. Orders aggregation" --> PXS
      PXS -- "6. OBKs" --> EMCC[EMCC]
      EMCC -- "7. MCOs" --> PXS
      PXS -- "8. OBKs" --> PXM
  
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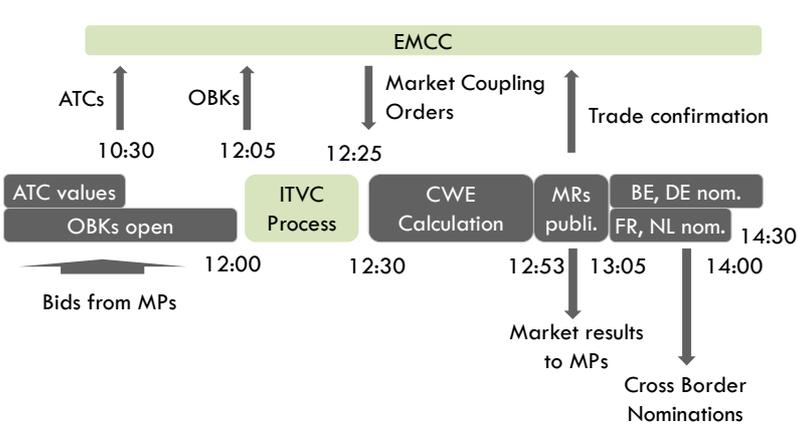
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### 4. Impact of CWE-Nordic ITVC

#### Normal process timeline after go-live



The diagram illustrates the normal process timeline after go-live, showing the interaction between EMCC and Market Participants (MPs) from 10:30 to 14:30.

- 10:30:** ATCs are sent from EMCC to MPs. OBKs are opened by MPs.
- 12:00:** Bids from MPs are submitted to EMCC.
- 12:05:** OBKs are sent from EMCC to MPs.
- 12:25:** Market Coupling Orders are sent from EMCC to MPs.
- 12:30:** The ITVC Process begins, leading to the start of the CWE Calculation.
- 12:53:** MRs (Market Results) are published by EMCC.
- 13:05:** BE, DE nominations are sent from EMCC to MPs. FR, NL nominations are also sent.
- 14:00:** Market results are sent from EMCC to MPs. Cross Border Nominations are also sent.
- 14:30:** Trade confirmation is sent from EMCC to MPs.





## 4. Impact of CWE-Nordic ITVC

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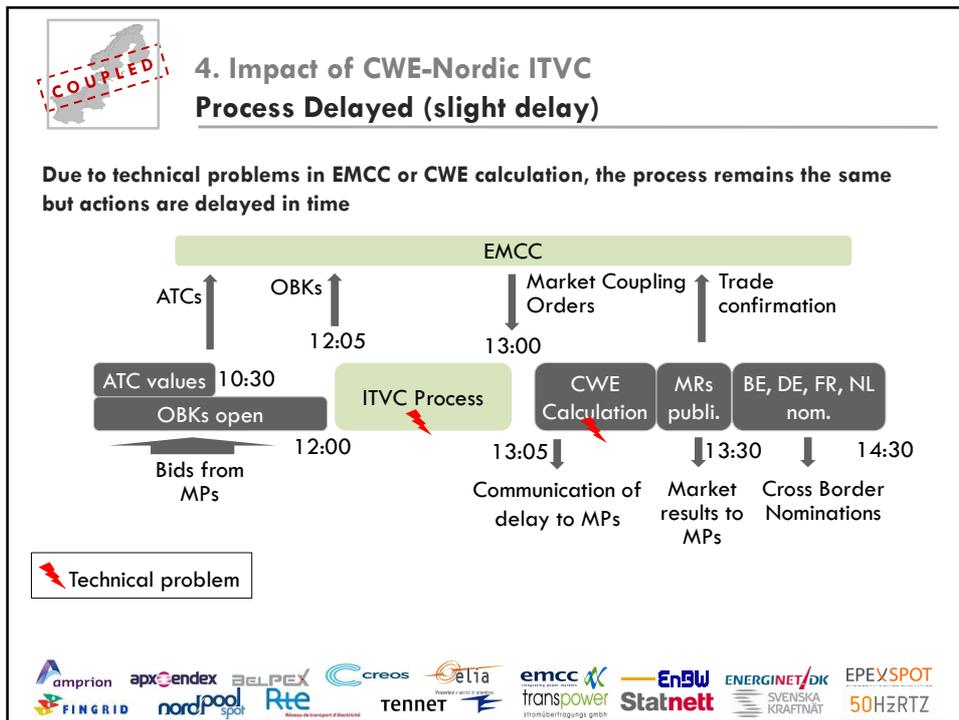


## 4. Impact of CWE-Nordic ITVC Impact of CWE for the Market Parties

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- ATC published at 10:30 on CASC website
- PX gate closure time at 12:00
- Publication of market results between 12:53 and 13:05
- Cross border nomination deadline
  - FR, NL at 14:00
  - GE, BE at 14:30

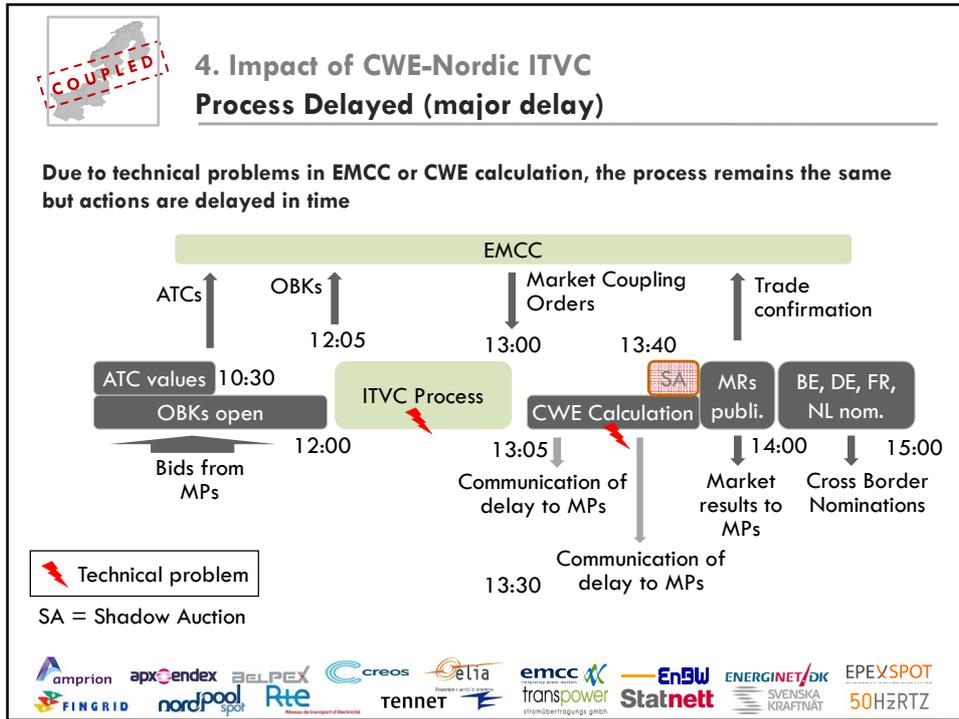




**4. Impact of CWE-Nordic ITVC Process (slightly) delayed: Impact on Market Parties**

Timing	Message	Additional actions for MPs	Market results Publication deadline	Cross broder nominations deadline
13:05	Market results publication delay 1		13:30	14:30

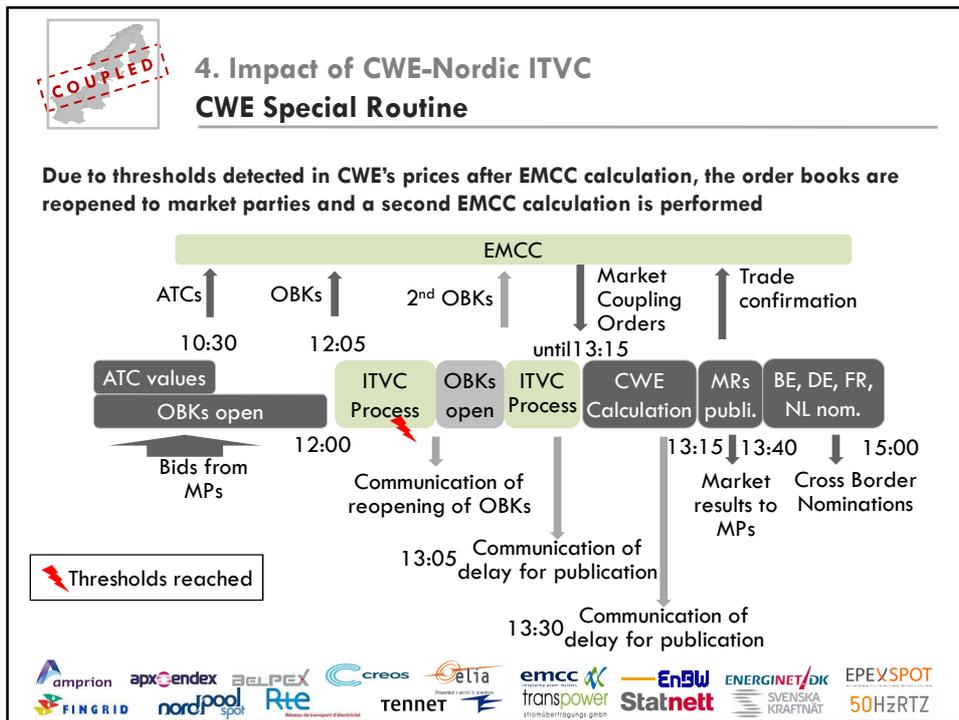
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 FINGRID nordpool Rte tennet transpower SVENSKA KRAFTNÄT 50HERTZ



**4. Impact of CWE-Nordic ITVC Process Delayed (major delay): Impact on Market Parties**

Timing	Message	Additional actions for MPs	Market results Publication deadline	Cross border nominations deadline
13:05	Market results publication delay 1		13:30	14:30
13:30	Market results publication delay 2	Bids update in the Shadow Auction system	14:00	15:00

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 FINGRID nordpool Rte tennet SVENSKA KRAFTNÄT 50HERTZ

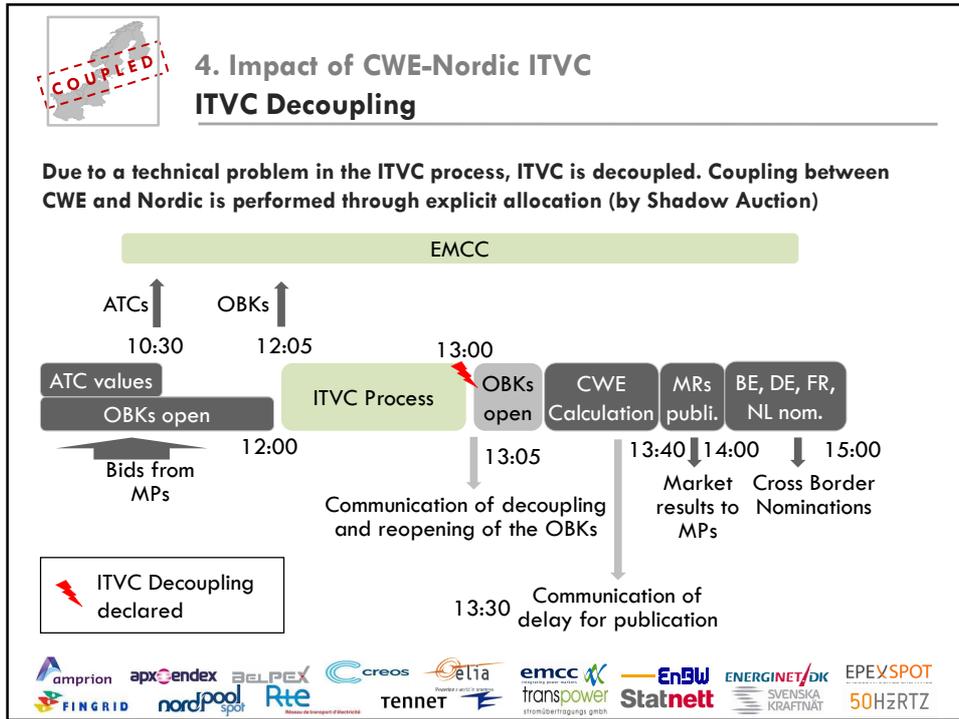


**4. Impact of CWE-Nordic ITVC  
Special Routine: Impact on Market Parties**

Timing	Message	Additional actions for MPs	Market results Publication deadline	Cross border nominations deadline
Around 12:30	Price thresholds reached: reopening of the OBKs	OBK open for 10 minutes after message		
13:05	Market results publication delay 1		13:30	14:30
13:30	Market results publication delay 2	Bids update in the Shadow Auction system	14:00	15:00

Not always

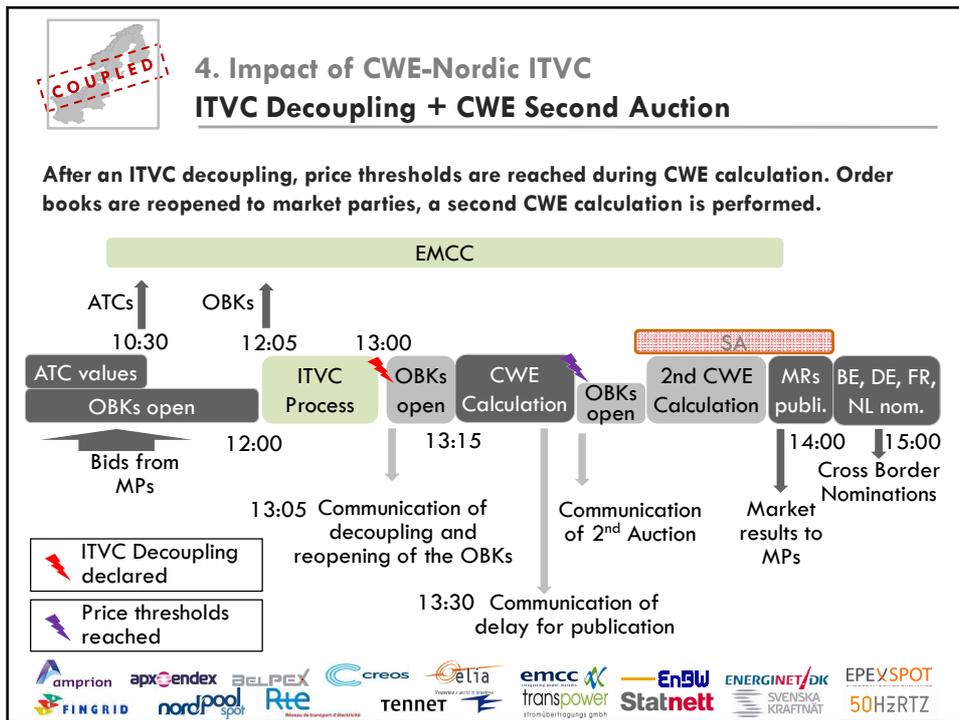
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**4. Impact of CWE-Nordic ITVC ITVC Decoupling: Impact on Market Parties**

Timing	Message	Additional actions for MPs	Market results Publication deadline	Cross border nominations deadline
13:05	ITVC decoupling, reopening of the OBKs	OBK open until 13:15		14:30
13:30	Market results publication delay	Bids update in the Shadow Auction system	14:00	15:00

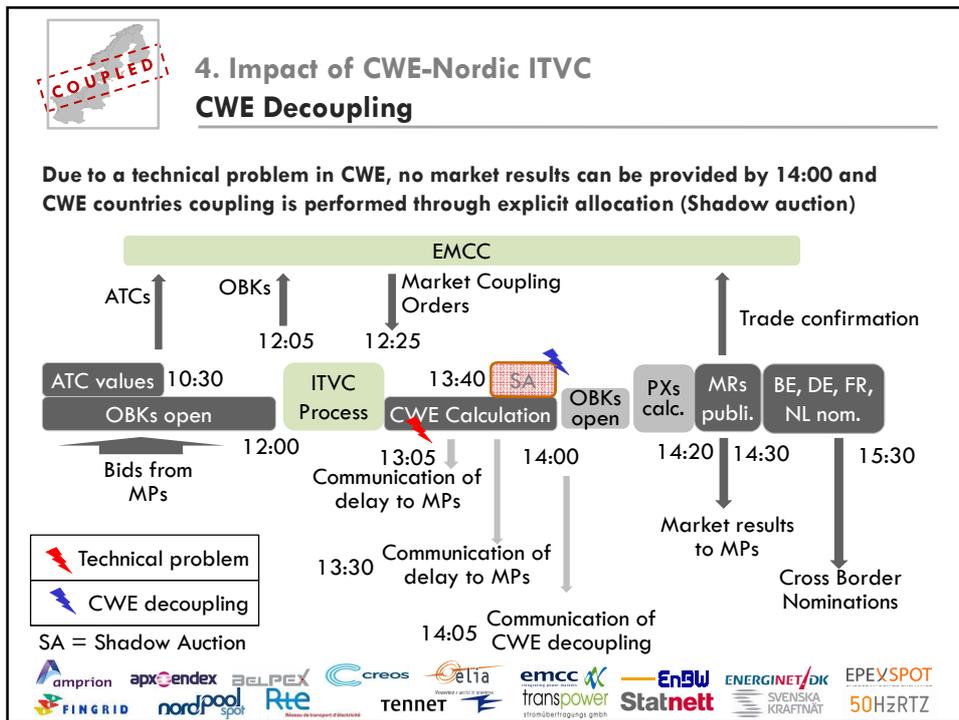
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**4. Impact of CWE-Nordic ITVC  
ITVC Decoupling + CWE Second Auction:  
Impact on Market Parties**

Timing	Message	Additional actions for MPs	Market results Publication deadline	Cross border nominations deadline
13:05	ITVC decoupling, reopening of the OBKs	OBK open until 13:15		14:30
13:30	Market results publication delay	Bids update in the Shadow Auction system	14:00	15:00
ASAP when thresholds observed	Thresholds reached in CWE, reopening of the OBKs	OBK open for 10 minutes	14:00	15:00

Logos: amprion, apx, endex, BELPEX, creos, elia, emcc, transpower, ENBW, ENERGINET/DK, EPEXSPOT, FINGRID, nordpool, Rte, tennet, statnett, SVENSKA KRAFTNÄT, 50HERTZ



**4. Impact of CWE-Nordic ITVC  
CWE Decoupling: Impact on Market Parties**

Timing	Message	Additional actions for MPs	Market results Publication deadline	Cross border nominations deadline
13:05	Market results publication delay 1		13:30	14:30
13:30	Market results publication delay 2	Bids update in the Shadow Auction system	14:00	15:00
14:05	CWE decoupling, reopening of the OBKs	OBK open at local PX for 10 minutes	14:30	15:30

Logos: amprion, apx, endex, BELPEX, creos, elia, emcc, transpower, ENBW, ENERGINET/DK, EPEXSPOT, FINGRID, nordpool, RTE, tennet, SVENSKA KRAFTNÄT, 50HERTZ



## 4. Impact of CWE-Nordic ITVC

1. Impact on Nord Pool Spot market (Hans Randen)
2. Impact on CWE market
  - Short Overview on CWE part of the ITVC solution (Martine Verelst)
    - Coordinated ATC calculation process
    - CWE MC High Level Architecture
  - Short Overview on CWE part of the ITVC solution (Matthijs Nijpels)
    - Normal Process Timeline after go-live
    - Timelines for Market Participants in Exceptional Processes
    - Rollback
    - Rules and Entitlement
3. Shadow Auctions (Klaus Thostrup)
  - Decoupling
  - Decoupling known in advance



## 4. Impact of CWE-Nordic ITVC

### Rollback

**If after CWE decoupling if it is not possible to return to a normal situation within a reasonable timeframe, we can revert to TLC and explicit allocation on the German borders.**

#### 1. Who decides?

Joint decision by the Project Partners

#### 2. Activation period?

2 months after launch

#### 3. Time needed to Rollback?

5 to 7 days to setup, during this period the daily explicit auctions will be held with the Shadow Auction System

#### 4. Two main differences compared to current processes :

- GCT remains at 12:00
- Shadow Auctions for GE borders





## 4. Impact of CWE-Nordic ITVC

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  - Decoupling known in advance



## 4. Impact of CWE-Nordic ITVC Registration and Entitlement on CWE side

### **A new version of CWE Auction Rules will enter into force by CWE MC go-live**

(taking into account CWE Market Coupling, Shadow Auctions, Rollback)

- **Participants already registered at CASC, with a business account, willing to participate to CWE LT Auctions, CWE MC, Shadow Auction, Rollback:**
  - Complete and send Appendix 5 of CWE Auction Rules to indicate on which borders you want to participate in Shadow Auctions and for Rollback mode.
  - The «Declaration Of Acceptance» remains valid (Appendix 1 of CWE Auction Rules)
- **Participants already registered at CASC, only willing to participate in fallback situations of Market Coupling :**
  - **Option 1:**
    - Keep your business account.
    - Complete Appendix 5 to indicate on which borders you want to participate in the Shadow Auctions and for the Rollback mode. The « Declaration Of Acceptance » remains valid.
  - **Option 2:**
    - Close the business account and terminate the « Participant's Financial Agreement ».
    - Sign a new « Declaration of Acceptance » to register as Participant to the Shadow Auctions Only.





## 4. Impact of CWE-Nordic ITVC Registration and Entitlement on CWE side

### **CWE Auction Rules, CWE Market Coupling, Shadow Auctions, Rollback:**

- Participants which are not registered at CASC, depending on the status chosen :
  - Participant: sign the « Declaration of Acceptance », the « Participant's Financial Agreement » and open a business account.
  - Participant to Shadow Auctions Only: Sign the « Declaration of Acceptance ».

### **Nominations to TSOs**

- For nominations, make sure that your nominations contracts are still compliant, nearby the related CWE TSOs.

### **CWE Power Exchange Rules**

- A new set of Market Rules will be published by each PX on their website, a few weeks before launch.
- Market Parties do not need to sign any declaration of acceptance. The procedure is implicit.



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## 4. Impact of CWE-Nordic ITVC

### Introduction

- In special cases we can have decoupling of ITVC
- Reasons for decoupling :
  - EMCC is not able to calculate the Market Coupling Order before 13:00 due to technical failure
- This means that there will be no market coupling
- The shadow auction system is a parallel daily process\*, ready to be run everyday in case ITVC, due to technical reasons, cannot deliver results by 13:00.
  - CASC-CWE will perform the shadow auction
  - It runs a parallel explicit auction system (shadow auction), based on bids sent by Market parties.\*\*
  - Market Parties may send default bids

\* Subject to full IT compatibility

\*\*For NorNed, shadow auctions are still subject to testing and regulatory approval



## 4. Impact of CWE-Nordic ITVC

### Daily process highlights

- **12:40:** Market parties receive a message from CASC and PXs on the risk of decoupling if EMCC was unable to deliver results by 12:40.
- **12:40-12:50:** Market parties will have 10 minutes to update their bids if necessary.
- **13:05 (latest):** CASC publishes the result of the Shadow auction, if and only if, EMCC announces decoupling
- Re-opening of order books
  - 13:05-13:15:** CWE PXs re-opening of PXs order books
  - 13:05-13:20:** NPS (reflect minimum time) re-opening of order books
- Publication of prices:
  - 14:00 (latest):** CWE PXs
  - by 13:55 (normally):** NPS
- Compliant with each TSOs rule, market parties will send their cross-border nominations





## 4. Impact of CWE-Nordic ITVC Prerequisites for Shadow Auctioning

- Registration:
  - 1 valid Declaration of Acceptance (signed by market participant and CASC)
  - No financial guarantee needed to take part in the Shadow auctions
- Entitlement:
  - The participant must be a Balance Responsible Party (BRP) with the TSOs on both sides of the border on which a participant wants to participate
- Nomination:
  - NorNed: shadow auction participant has to be BRP on at least one end of the country border, and must have a “partner” agreement with a BRP on the other end\*
  - DE-DK1\*\* / DE-DK2: Shadow Auction participant has to be BRP on both sides of the border.

\* For NorNed, shadow auctions are still subject to testing and regulatory approval

\*\*Subject to full IT compatibility



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  - Decoupling
  - Decoupling known in advance





#### 4. Impact of CWE-Nordic ITVC Decoupling known in advance

- Shadow auction system will be used
- Shadow auctions will be performed in the morning
  - Exact timing will be published on the CASC website
  - Normal deadlines for the order books at the PXs will apply



#### 4. Impact of CWE-Nordic ITVC Further information

- Information regarding new nomination procedures and other issues special to shadow auctions\* will be presented:
  - Energinet.dk: 8th of October 2010
  - Statnett : information will be given soon
  - 50 Hertz Transmission: will be organised if necessary
  - transpower: will be organised if necessary
  - TenneT : via BRP-reference group, date to be announced
- CASC system information: Online electronic trial for Market Participants to try the shadow auction system in a test environment.

\* Subject to full IT compatibility





## Agenda

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1. Welcome words by the Chairmen
2. What is CWE-Nordic ITVC?
3. How does CWE-Nordic ITVC work?

*Lunch*

4. What is the impact of CWE-Nordic ITVC on the CWE and Nordic Spot Markets?
5. Tests and simulations
6. Conclusion



## 5-Tests and Simulations

### Ralf Kruse





## 5. Tests and simulations

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- Test setup and aims
- Simulation results
- Comparison of ITVC results and EMCC production results
- Announcement of member testing




## 5. Tests and simulations

### Overview of goal and test phases

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Overall goal	Definition of test phases
<p>ITVC between the CWE and Nordic regions shall...</p> <ul style="list-style-type: none"> <li>• ...be a <b>reliable solution</b></li> <li>• ...allow for <b>fair and transparent allocation of the capacity</b> on the interconnectors</li> <li>• ...<b>minimize suboptimal utilisation</b> on the interconnectors after regional matching by CWE-Nordic PXs</li> <li>• ...be <b>developed within an agreed timeframe</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Technical Tests</b> <ul style="list-style-type: none"> <li>- connectivity</li> <li>- transfer / - data</li> </ul> </li> <li>• <b>Algorithm tests</b> <ul style="list-style-type: none"> <li>- synthetic</li> <li>- real</li> <li>- CAVA / CWE-Nordic</li> </ul> </li> <li>• <b>Procedural tests</b> <ul style="list-style-type: none"> <li>- functional test</li> <li>- operator acceptance test</li> </ul> </li> <li>• <b>Integration tests</b> <ul style="list-style-type: none"> <li>- parallel test</li> <li>- member tests</li> </ul> </li> </ul>





## 5. Tests and simulations

### Test set-up

**Technical Tests**

- Connectivity and data transfer between EMCC and EPEX, TSOs, APX/Belpex
- Daylight savings time (DST), clock shift test

**Algorithm Tests**

- Synthetic
  - EMCC-NPS  
(30 calculations with historical data, 5 special cases with synthetic data to trigger special situations e.g. block bid conversion)
  - EMCC-EPEX  
(15 special cases with synthetic data to trigger special situations e.g. "hourly bids only")
  - EMCC-APX/Belpex  
(14 special cases with synthetic data to trigger special situations e.g. "two times same quantity due to rounding")
  - CWE-Nordic  
(all systems involved, 1.744 hours tested with final versions of algorithms, interconnector and area configuration represents expected configuration at launch date)
- CAVA (combined algorithm validation of EMCC and Cosmos, 3.744 hours tested)




## 5. Tests and simulations

### Test set-up

**Integration & Procedural Tests**

- parallel test  
(9 calculations of normal days, will probably be extended until launch date, subject to availability of the systems involved)
- operator acceptance test  
(14 days procedural tests)
- member tests  
(5 scenarios to be tested end of October\*)

In total, the test period took more than six months with all parties involved.

\*information will be given within this presentation

Since the CWE-Nordic synthetic test included all systems and represented the final configuration, its results are regarded as most significant and meaningful.





## 5. Tests and simulations

### Acceptance criteria

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Testing was organized between CWE parties, EMCC and NPS to validate the following principles:

The ITVC solution should be at least as good as the current EMCC system.

The utilisation of interconnectors shall be at least 85 % in the right direction.




## 5. Tests and simulations

### Test measures

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Measure	Meaning
<b>Cross-border flow (CBF)</b>	➢ Flow calculated by EMCC, not physical flow on interconnector
<b>Utilisation</b>	➢ Utilisation is the CBF per hour and direction traded according to the available capacity (i.e. total used capacity excluding adverse flows)
<b>Suboptimal utilisation</b>	➢ The flow is in the right direction but the full capacity of an interconnector is not used despite price spread
<b>Price spread</b>	➢ Differences between two price areas of different PXs
<b>Price deviation</b>	➢ Difference between EMCC calculated price and PX price for one area
<b>Adverse flow (AF)</b>	➢ Flow of electricity not in line with the PX price signal, i.e. going from the high-price area into a low-price area
<b>AF &lt; 0,20 €/MWh</b>	➢ AF with a price spread < 0,20 €/MWh are regarded as inherent to volume coupling and are not considered as adverse flows
<b>Turnover</b>	➢ Financial turnover per interconnector (i.e. capacity traded x price spread per MWh)





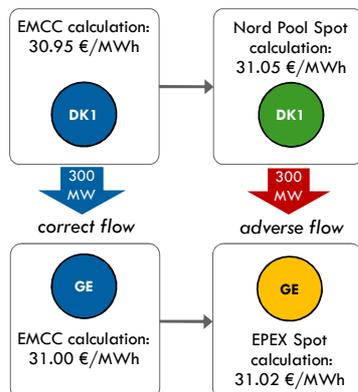
## 5. Tests and simulations Inherent features of tight volume coupling

1. EMCC determines the flow on the ITVC interconnectors (Volume Coupling (VC))
2. The indicative prices for DK1, DK2, SE and GE given in the EMCC ITVC calculation determine the electricity flow direction. Like in the PX systems this is always from low price area to the high price area (exception: grid related constraints, e.g. ramping)
3. Afterwards, the Power Exchanges (PXs) calculate their prices. Those prices are relevant as the PXs have the pricing authority
4. If there are small differences in the calculated prices, the electricity may seemingly flow from high price to low price area
5. Reasons for price differences are treatment of overlapping curves, details in block bid selection and minor factors such as currency conversion and rounding rules

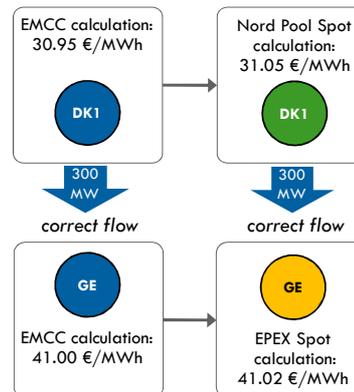


## 5. Tests and simulations Inherent features of tight volume coupling

Adverse flow due to small price spread:



No adverse flow due to high price spread:





## 5. Tests and simulations

- Test setup and aims
- Simulation results
- Comparison of ITVC results and EMCC production results
- Announcement of member testing

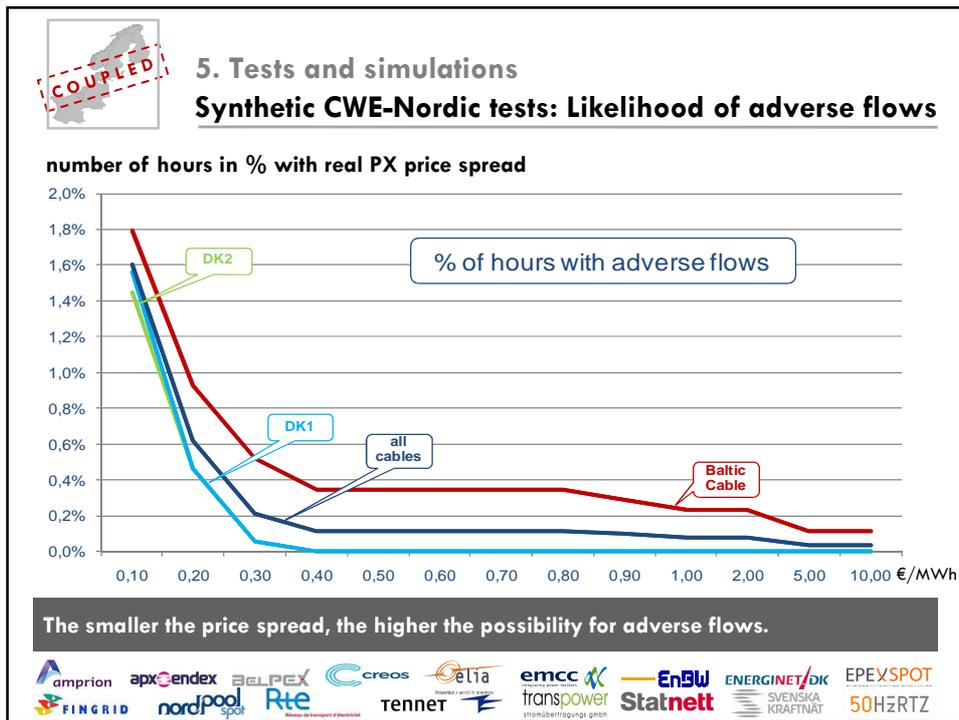


## 5. Tests and simulations Synthetic CWE-Nordic tests: Summary of results

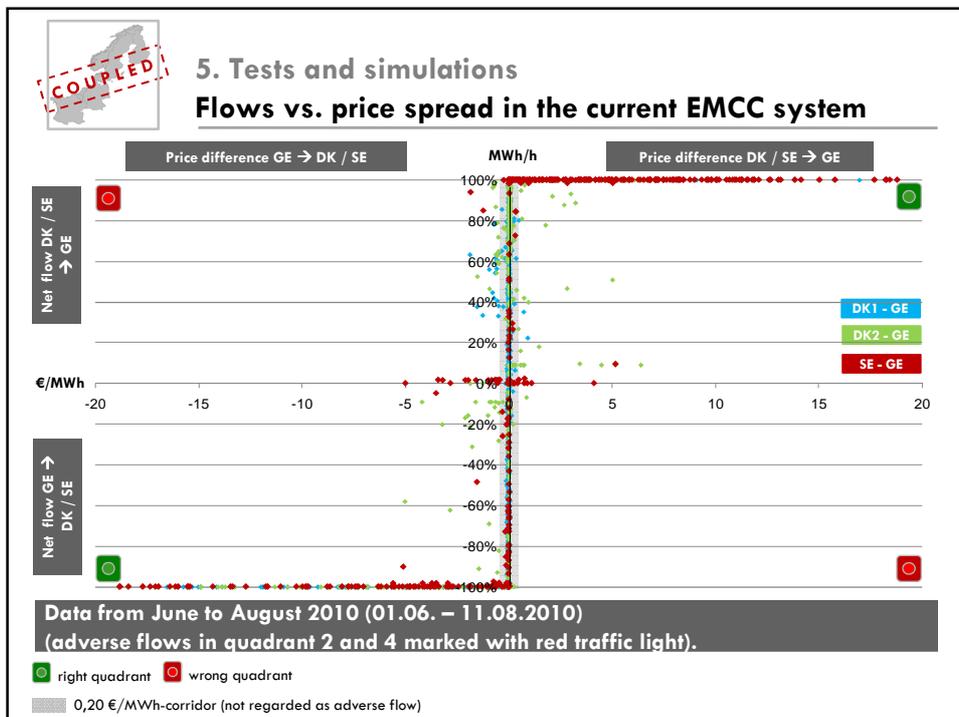
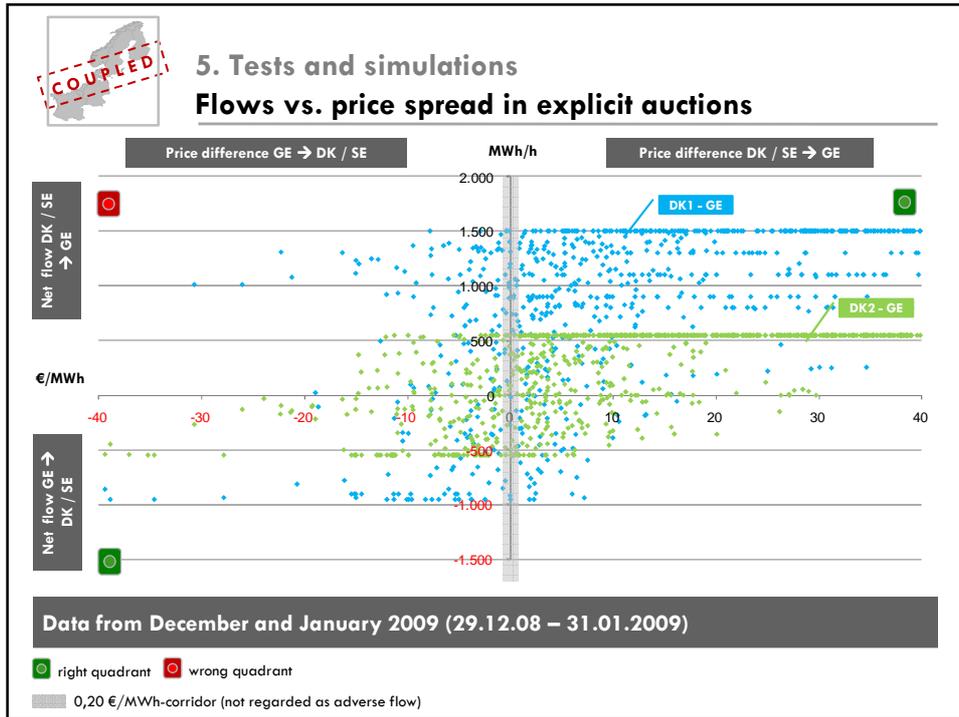
Synthetic CWE-Nordic results							
Interconnector	classification	hours	hours ratio	CBF	CBF ratio	turnover	turnover ratio
[ Name ]	[ -- ]	[ h ]	[ % ]	[ MWh ]	[ % ]	[ EURO ]	[ % ]
DK 1 - GE	AF >= 0,20 Euro/MWh	8	0,5%	4.055	0,5%	-1.022 €	-0,05%
	AF < 0,20 Euro/MWh	276	16,0%	107.233	13,4%	-3.377 €	-0,15%
	correct flow	1.444	83,6%	691.256	86,1%	2.265.350 €	99,80%
	subsum	1.728	---	802.543	---	2.260.951 €	---
DK 2 - GE	AF >= 0,20 Euro/MWh	8	0,5%	2.597	0,4%	-726 €	-0,03%
	AF < 0,20 Euro/MWh	165	9,5%	51.426	8,6%	-1.407 €	-0,05%
	correct flow	1.555	90,0%	546.790	91,0%	2.830.676 €	99,92%
	subsum	1.728	---	600.812	---	2.828.544 €	---
SE - GE	AF >= 0,20 Euro/MWh	16	0,9%	3.955	0,5%	-1.325 €	-0,03%
	AF < 0,20 Euro/MWh	177	10,2%	64.836	8,0%	-1.866 €	-0,04%
	correct flow	1.535	88,8%	746.210	91,6%	4.935.571 €	99,93%
	subsum	1.728	---	815.000	---	4.932.381 €	---
Sum	AF >= 0,20 Euro/MWh	32	0,6%	10.606	0,5%	-3.072 €	-0,03%
	AF < 0,20 Euro/MWh	618	11,9%	223.494	10,1%	-6.649 €	-0,07%
	correct flow	4.534	87,5%	1.984.256	89,4%	10.031.598 €	99,90%
	total sum	5.184	---	2.218.356	---	10.021.876 €	---

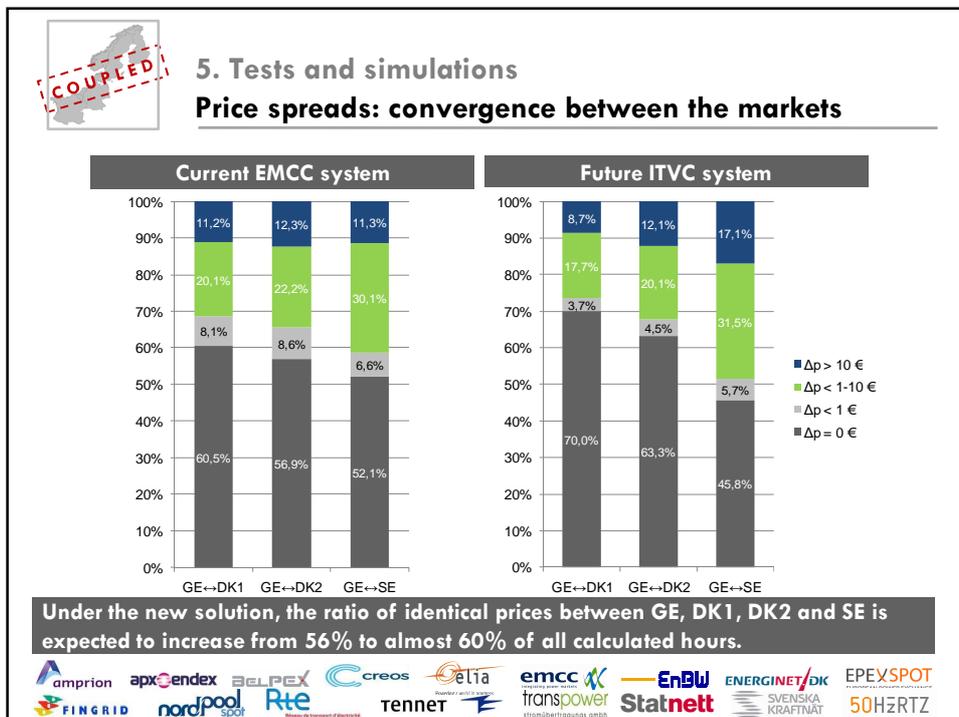
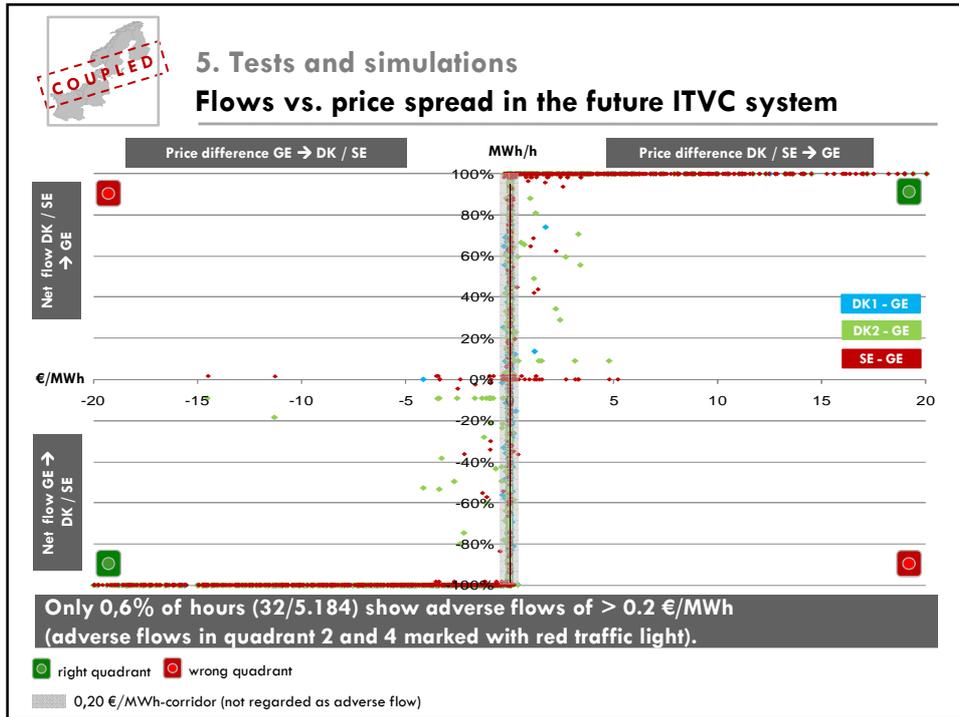
The utilisation (cross-border flow , CBF) on each interconnector is > 85%

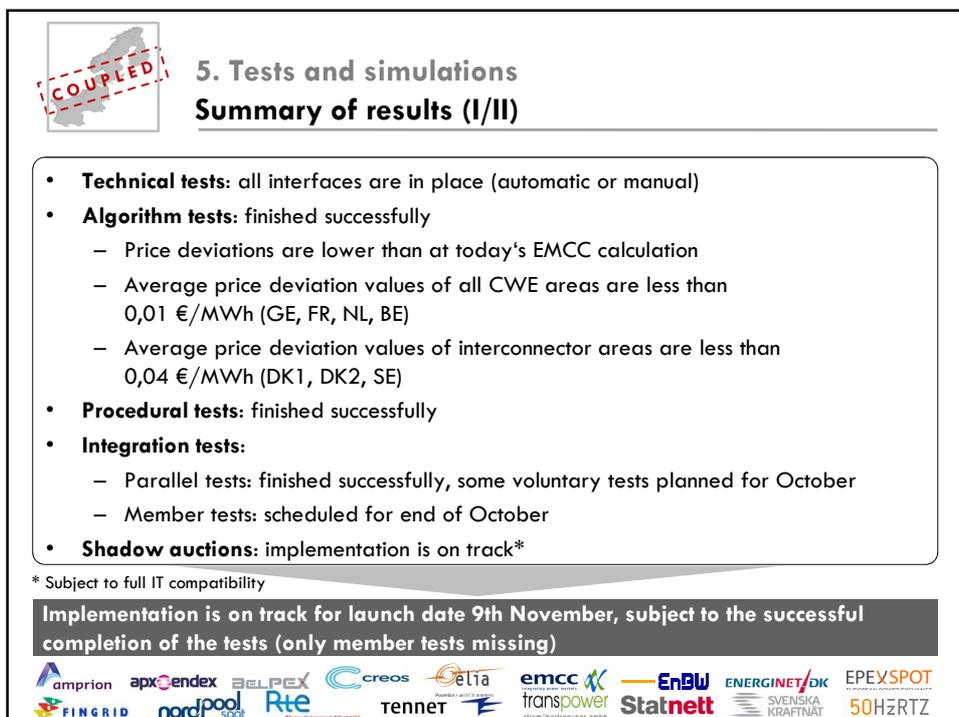
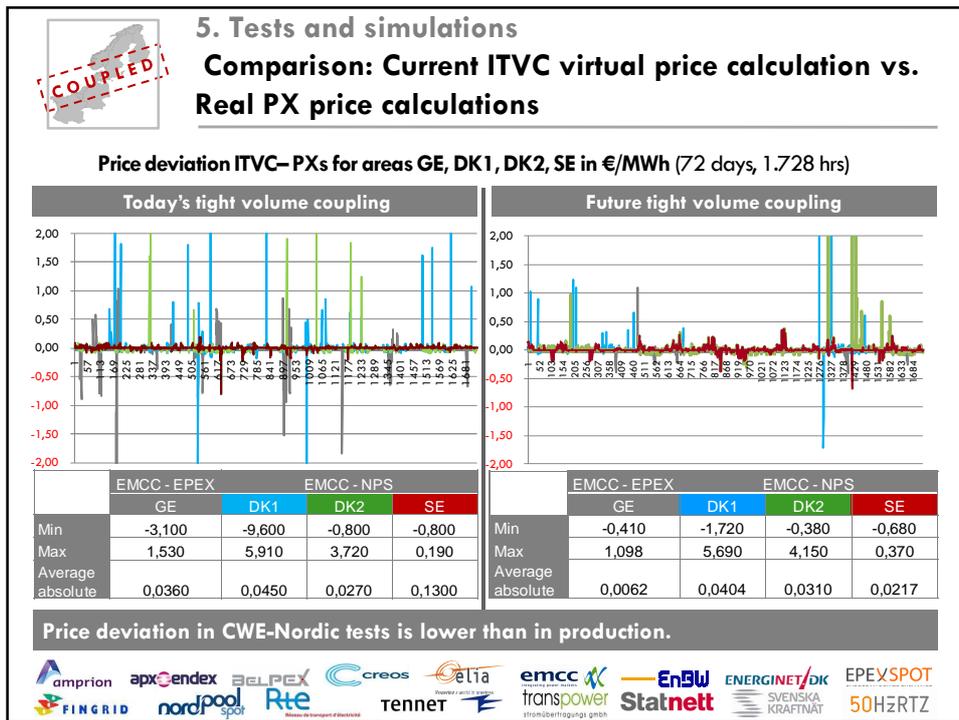




- 
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## 5. Tests and simulations

### Summary of results (II/II)

- Following the implementation of our new solution, the **algorithms** of EMCC and the PXs are very well **aligned** and produce results that are of a high quality, e.g. equal prices.
- **Adverse flows** are inevitable under a volume coupling scheme. The ITVC solution produces very few adverse flows which account for minimal monetary losses, compared with the calculated overall welfare.
- If adverse flows occur, they are mostly due to **minimal price spreads** ( $< 0,20 \text{ €/MWh}$ ), therefore, the negative turnover is also minimal compared with the economic welfare.
- **Prices** in the neighbouring areas are **converging**, contributing to the aim of the EU to develop an integrated European market.
- The **desired effect of market coupling** has set in since the start of Nordic-German market coupling and will be continued with the ITVC solution.

The solution found is the closest tight volume coupling that can be performed under current circumstances.



## 5. Tests and simulations

- Test setup and aims
- Simulation results
- Comparison of ITVC results and EMCC production results
- Announcement of member testing





## 5. Tests and simulations

### Member testing

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- New session of member testing: Week 43
- End to end tests including CWE MC, ITVC processes and shadow auctions ( Nord Pool Spot order books will be simulated)
- 5 days of testing:
  - o 25 Oct : 1 normal day
  - o 26 Oct : 1 special routine
  - o 27 Oct : 1 ITVC decoupling
  - o 28 Oct : 1 normal day
  - o 29 Oct : 1 CWE decoupling
- All tests will be performed in the afternoon, avoiding overlapping with operations
- A communication with the registration details and scenarios will be sent in the coming days to the Market Participants by the CWE PXs and CASC.



## Agenda

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*Lunch*

4. What is the impact of CWE-Nordic ITVC on the CWE and Nordic Spot Markets?
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6. Conclusion





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## 6-Conclusion

Jean-François Conil-Lacoste



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## Annex





## List of Abbreviations

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ACK	Acknowledgement file
AF	Adverse flow
APX	APX-ENDEX, The Power and Derivative Exchange
ATC	Available Transmission Capacity
BRP	Balance Responsible Party
CBF	Cross Border Flow
CAS	Control Area Schedules
CASC	Capacity Allocation Service Company, provider of CWE ATC and Shadow Auction
CM	Congestion Management
CWE	Central Western European
DK1	Denmark West (Optimisation Area), used as synonym for interconnector
EMCC	European Market Coupling Company GmbH
ENDK	Energinet.dk (TSO)
EPEX	European Power Exchange EPEX Spot SE (PX)
ETS	EPEX trading system
ETSO	European Transmission System Operators
MCO	Flexible Market Coupling Order (for APX only)




## List of Abbreviations

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ITVC	Interim Tight Volume Coupling
LEX	Latvia Export (Virtual Area of NPS)
LIM	Latvia Import (Virtual Area of NPS)
MC	Market Coupling
MCO	Market Coupling Order
MCP	Market Clearing Price per area and hour
MP	Market Party, Market Participant
MR	Market Results
NPS	Nord Pool Spot AS (PX)
OBK	Order book
PX	Power Exchange
RIM	Russia Import (Virtual Area of NPS)
SA	Shadow Auction
SCH	Schedule
TCO	Trade Confirmation
TSO	Transmission System Operator
UMM	Urgent Market Message (messaging system on NPS website)

