CWE Market Coupling Flow-Based Forum

Amsterdam, 1st of June 2011

Welcome words

Bert den Ouden
and
Jean Verseille

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**

- **ATC Market coupling**

    – Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)

- **Flow-Based**

    – Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)

    – Question and answer (15 min)

Lunch break (85 min)

    – Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)

    – Flow-Based market impact analysis (25 min) (Nicolas Omont)

    – Question and answer session (15 min)

    – Flow-Based timing and processes (15 min) (Raphaël Bourgeois)

    – Flow-Based interaction with other projects (10 min) (Marcus Rohleder)

    – Flow-Based implementation planning (10 min) (Michael Pool)

    – Question and answer session (15 min)

- **Conclusions (Bert den Ouden and Jean Verseille)**

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**

- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)

- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
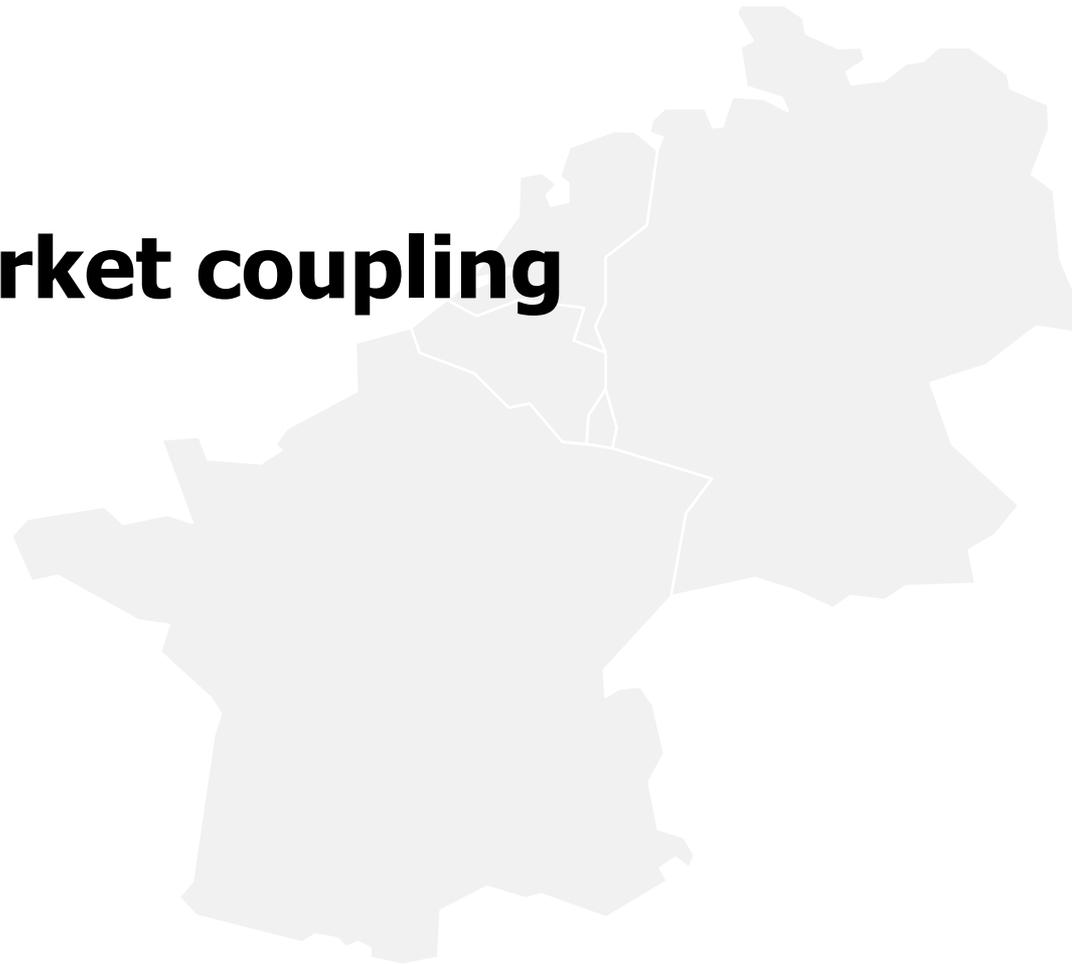 - Question and answer (15 min)

Lunch break (85 min)

  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)

- **Conclusions (Bert den Ouden and Jean Verseille)**

ATC market coupling

ATC market coupling

Operational feedback

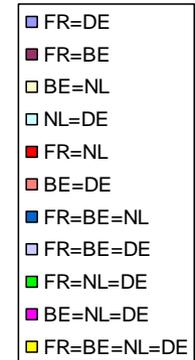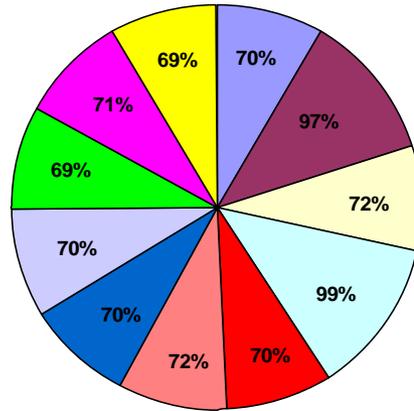# Content

- Price Convergence
- Publication of Market Coupling results
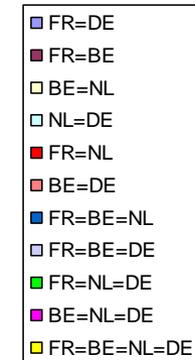- ATC Usage
- CWE Incident on 27 March 2011

amprion

apx endex

BELPEX
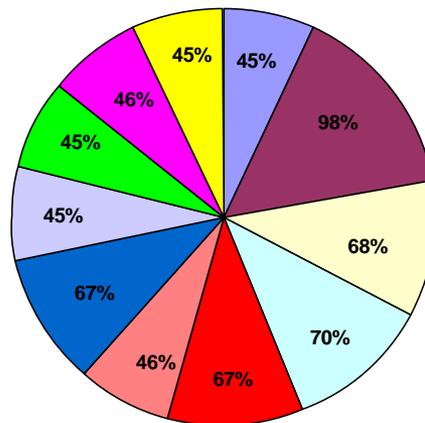Part of APX-ENDEX

creos

elia
Powering a world in progress

EnBW

EPEXSPOT
EUROPEAN POWER EXCHANGE

Rte
Réseau de transport d'électricité

TenneT
Taking power further

Price Convergence

Percentage of hours price convergence - Nov 10

Legend:
- FR=DE
- FR=BE
- BE=NL
- NL=DE
- FR=NL
- BE=DE
- FR=BE=NL
- FR=BE=DE
- FR=NL=DE
- BE=NL=DE
- FR=BE=NL=DE

Values: 70%, 97%, 72%, 99%, 70%, 72%, 70%, 70%, 69%, 71%, 69%

Percentage of hours with price convergence - Dec 10

Legend:
- FR=DE
- FR=BE
- BE=NL
- NL=DE
- FR=NL
- BE=DE
- FR=BE=NL
- FR=BE=DE
- FR=NL=DE
- BE=NL=DE
- FR=BE=NL=DE

Values: 45%, 98%, 68%, 70%, 67%, 46%, 67%, 45%, 45%, 46%, 45%

Price Convergence
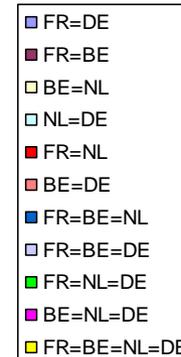
Percentage of hours with price convergence - Jan 11

Legend:
- FR=DE
- FR=BE
- BE=NL
- NL=DE
- FR=NL
- BE=DE
- FR=BE=NL
- FR=BE=DE
- FR=NL=DE
- BE=NL=DE
- FR=BE=NL=DE

Values (Jan 11): 77%, 100%, 89%, 83%, 89%, 77%, 89%, 77%, 76%, 76%, 76%

Percentage of hours with price convergence - Feb 11

Legend:
- FR=DE
- FR=BE
- BE=NL
- NL=DE
- FR=NL
- BE=DE
- FR=BE=NL
- FR=BE=DE
- FR=NL=DE
- BE=NL=DE
- FR=BE=NL=DE

Values (Feb 11): 76%, 97%, 87%, 82%, 86%, 76%, 86%, 76%, 76%, 76%, 76%

Price Convergence

Percentage of hours with convergence of prices - Mar 11

Legend:
- FR=DE
- FR=BE
- BE=NL
- NL=DE
- FR=NL
- BE=DE
- FR=BE=NL
- FR=BE=DE
- FR=NL=DE
- BE=NL=DE
- FR=BE=NL=DE

Mar 11 values: 73%, 96%, 76%, 89%, 76%, 72%, 76%, 72%, 72%, 72%, 72%

Percentage of hours with convergence of prices - Apr 11

Legend:
- FR=DE
- FR=BE
- BE=NL
- NL=DE
- FR=NL
- BE=DE
- FR=BE=NL
- FR=BE=DE
- FR=NL=DE
- BE=NL=DE
- FR=BE=NL=DE

Apr 11 values: 73%, 100%, 70%, 85%, 70%, 73%, 70%, 73%, 67%, 67%, 66%

Price Convergence

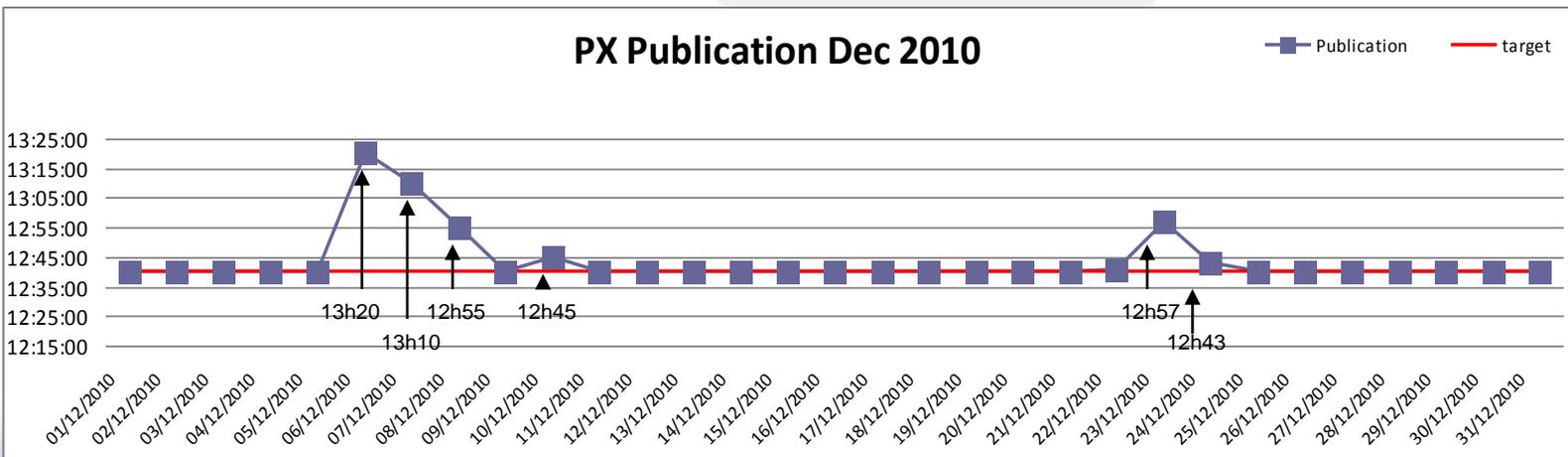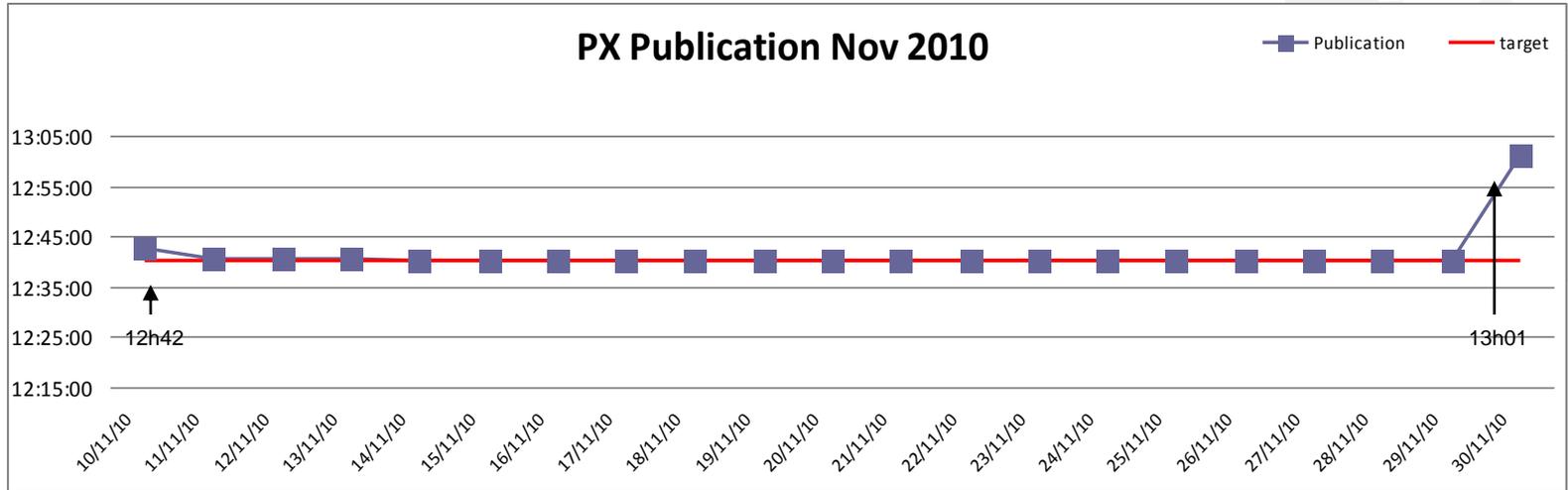|	November 2010	December 2010	January 2011	February 2011	March 2011	April 2011	AVG
FR=DE	70%	45%	77%	76%	73%	73%	68%
FR=BE	97%	98%	100%	97%	96%	100%	98%
BE=NL	72%	68%	89%	87%	76%	70%	78%
NL=DE	99%	70%	83%	82%	89%	85%	85%
FR=NL	70%	67%	89%	86%	76%	70%	78%
BE=DE	72%	46%	77%	76%	72%	73%	69%
FR=BE=NL	70%	67%	89%	86%	76%	70%	78%
FR=BE=DE	70%	45%	77%	76%	72%	73%	68%
FR=NL=DE	69%	45%	76%	76%	72%	67%	68%
BE=NL=DE	71%	46%	76%	76%	72%	67%	68%
FR=BE=NL=DE	69%	45%	76%	76%	72%	66%	68%

Publication of Market Coupling results

Business Process Step	Target Timing
Long Term Nomination Dealine for market parties	9:00
ATC value publication time	10:30
PX's gate closure time	12:00
Publication of Market Coupling Results	12:55 (13:05)

Business Process Step	Target Timing
RTE nomination	14:00
Tennet NL nomination	14:00
Amprion nomination	14:30
Tennet DE nomination	14:30
EnBW nomination	14:30
Elia Hub / Cross-border nomination	14:00 / 14:30

Publication of market Coupling results

PX Publication Nov 2010

PX Publication Dec 2010

Publication of market Coupling results

PX Publication Jan 2011

PX Publication Feb 2011

Publication of market Coupling results
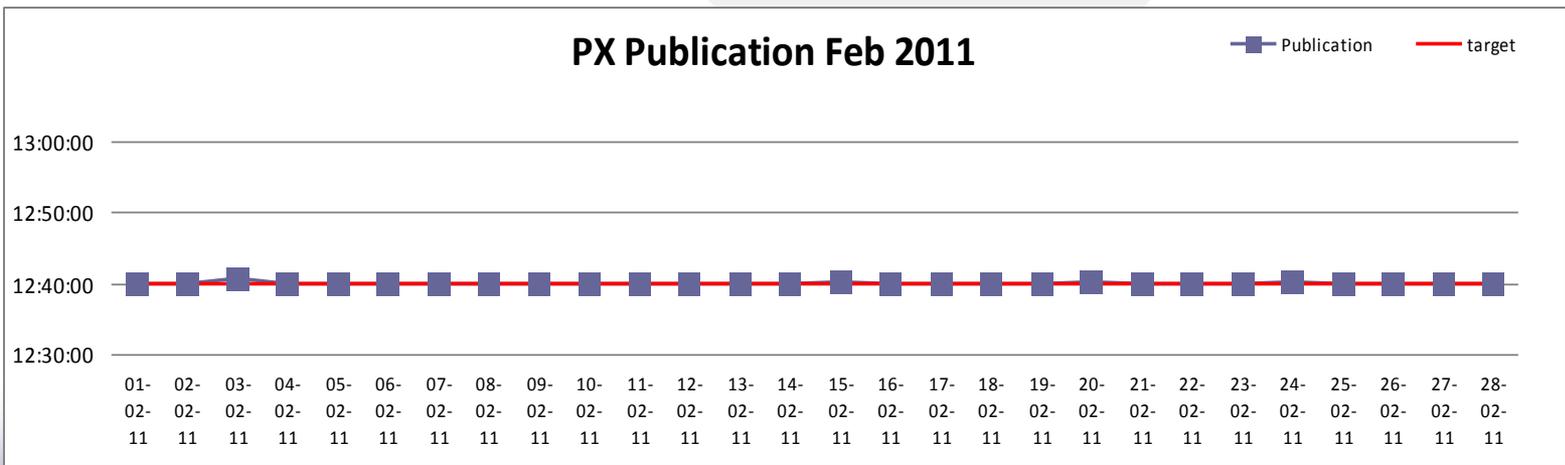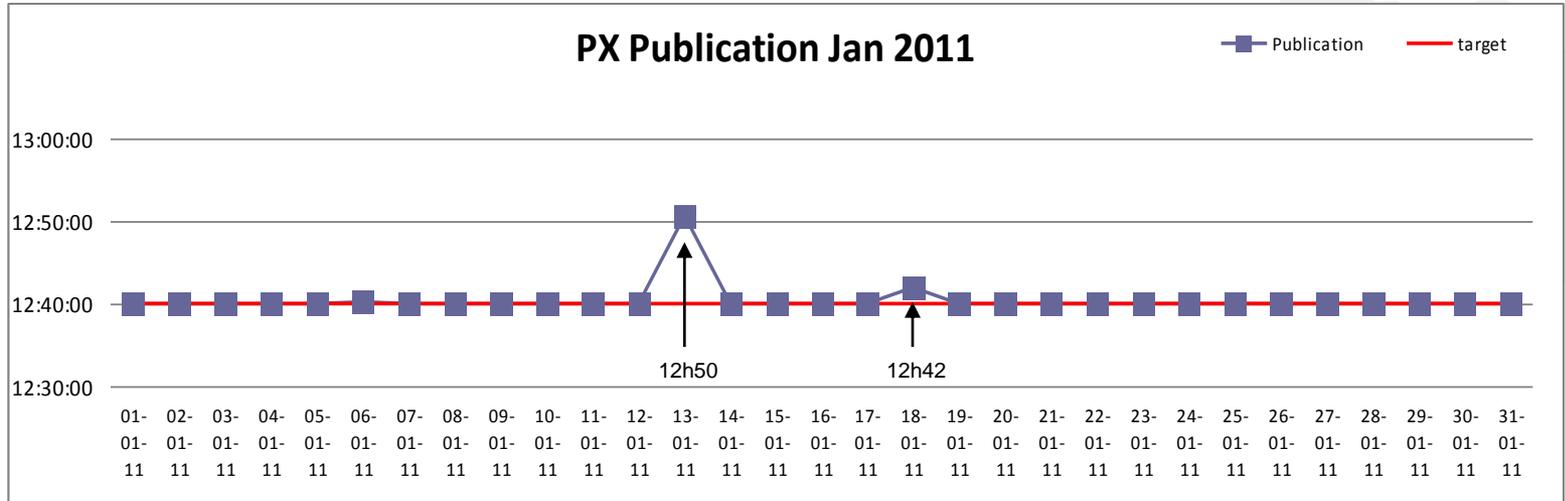
PX Publication Mar 11

PX Publication Apr 11
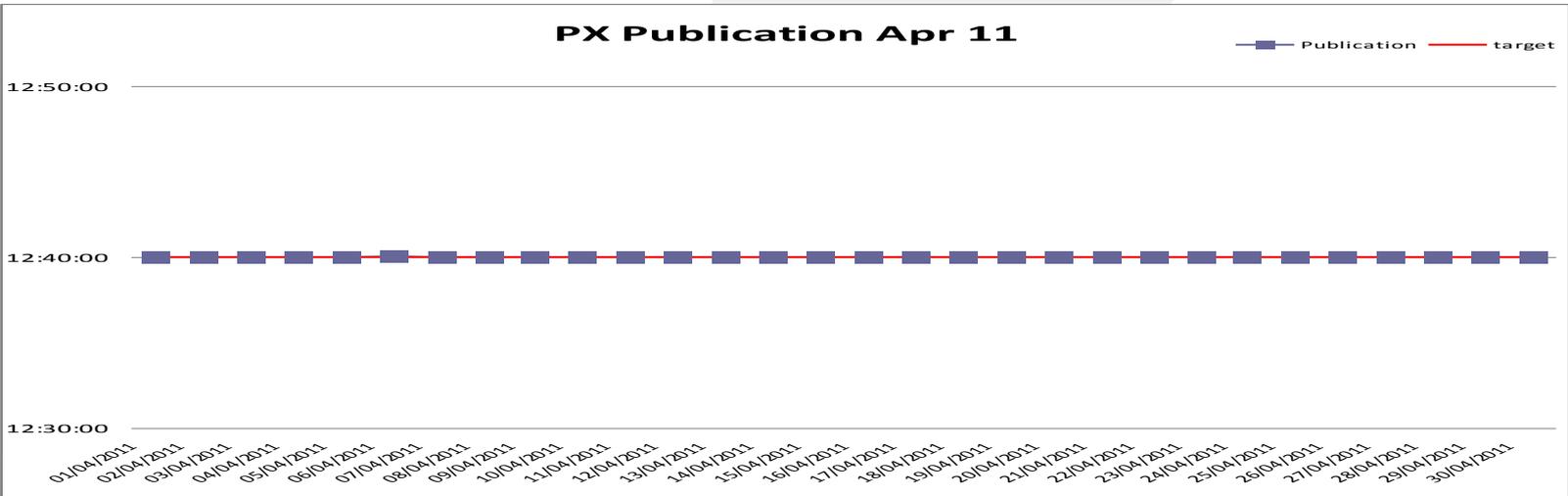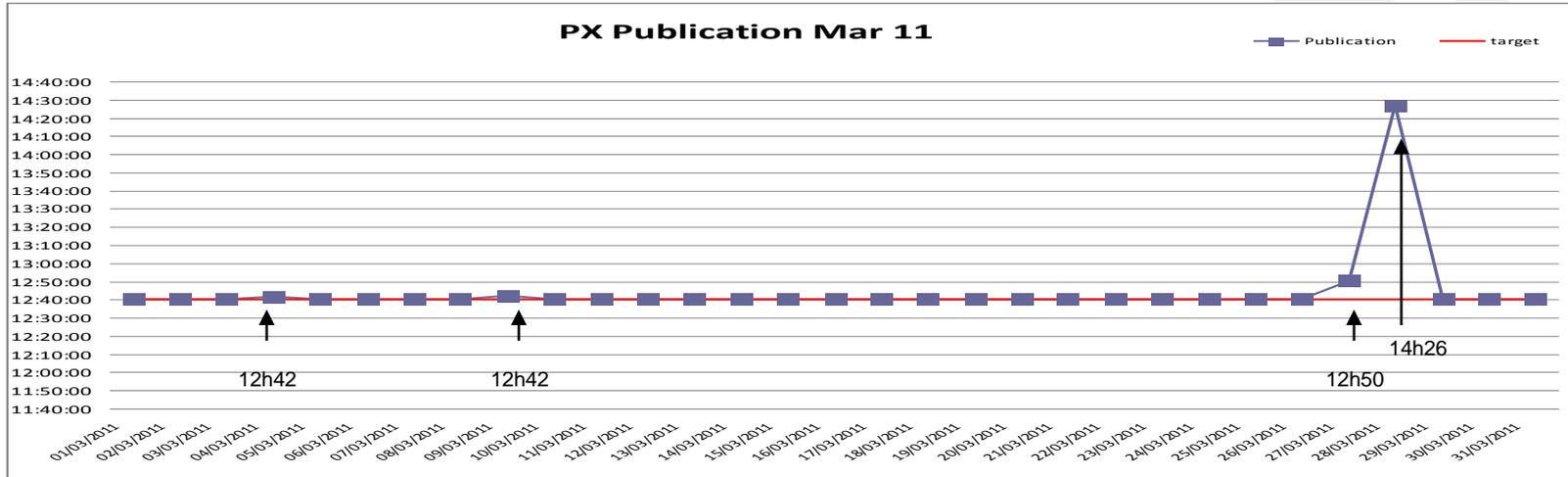
Publication of market Coupling results

	No of Days	Days on time	Percentage
Nov-11	21	19	90.48%
Dec-11	31	26	83.87%
Jan-12	31	29	93.55%
Feb-12	28	28	100.00%
Mar-12	31	28	90.32%
Apr-12	30	30	100.00%
AVG	172	160	93.02%

ATC Usage

ATC Utilisation
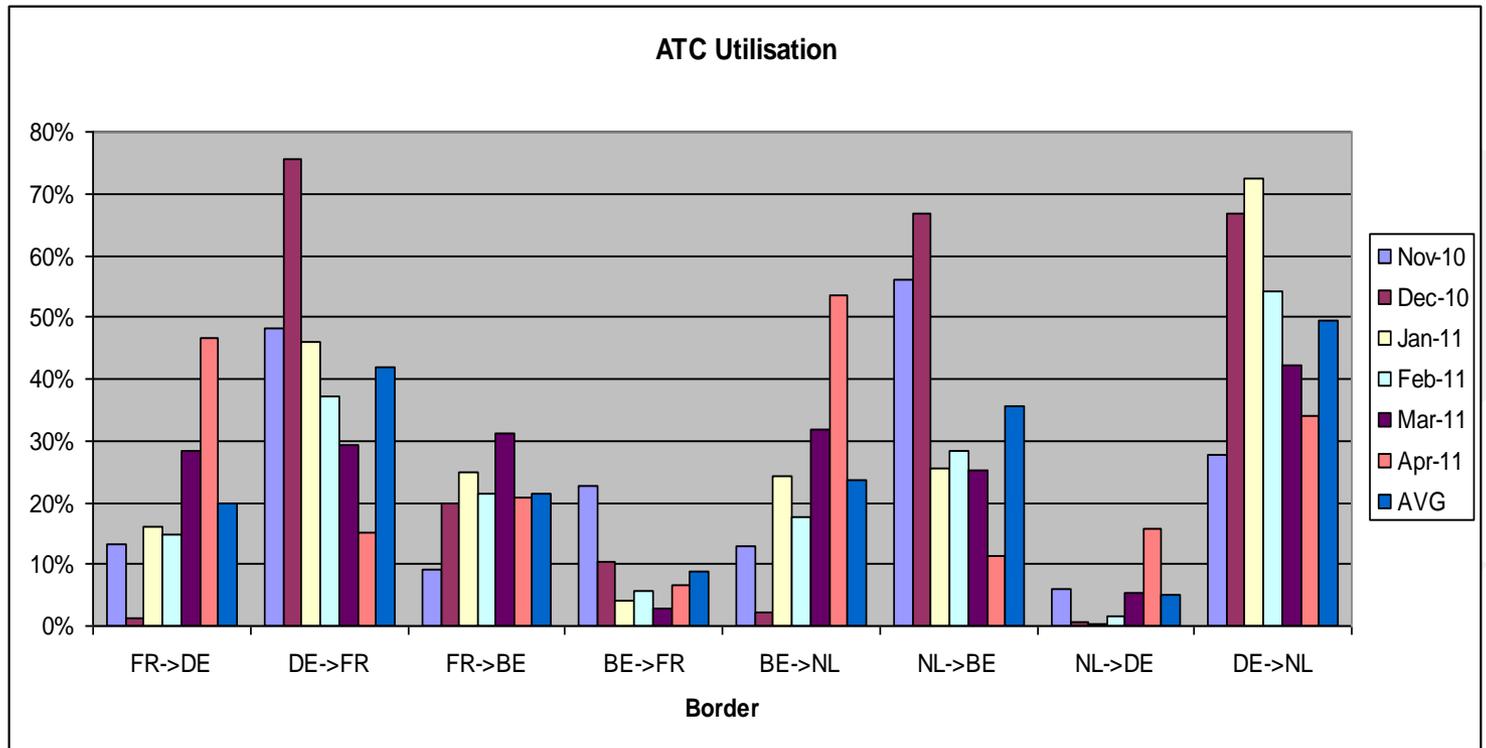
Mon/Brd	FR->DE	DE->FR	FR->BE	BE->FR	BE->NL	NL->BE	NL->DE	DE->NL
Nov-10	13%	48%	9%	23%	13%	56%	6%	28%
Dec-10	1%	76%	20%	10%	2%	67%	1%	67%
Jan-11	16%	46%	25%	4%	24%	26%	0%	72%
Feb-11	15%	37%	21%	6%	18%	28%	2%	54%
Mar-11	28%	29%	31%	3%	32%	25%	5%	42%
Apr-11	47%	15%	21%	7%	54%	11%	16%	34%
AVG	20%	42%	21%	9%	24%	36%	5%	50%

100% ATC Usage

100% ATC Utilisation
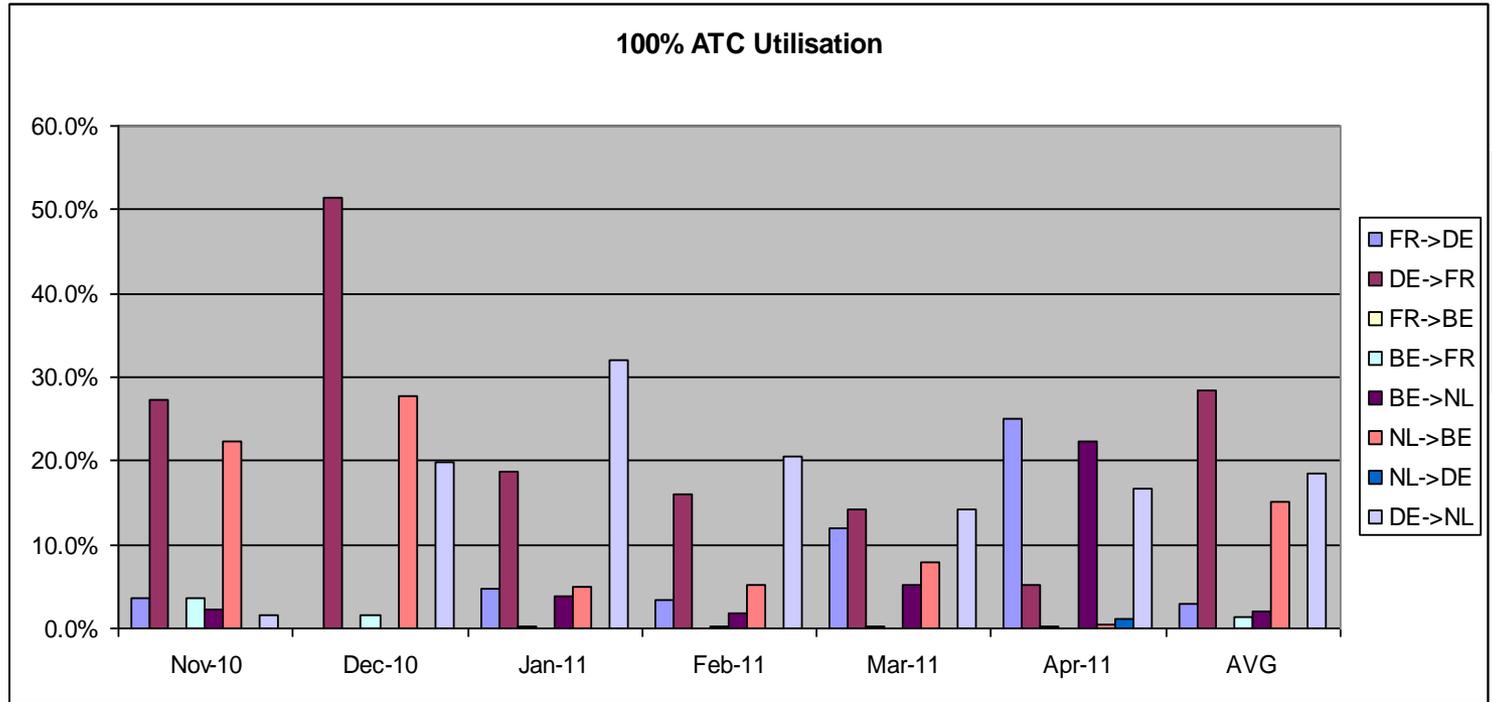
Mon/Brd	FR->DE	DE->FR	FR->BE	BE->FR	BE->NL	NL->BE	NL->DE	DE->NL
Nov-10	3.6%	27.2%	0.0%	3.6%	2.2%	22.4%	0.0%	1.6%
Dec-10	0.0%	51.3%	0.0%	1.6%	0.0%	27.8%	0.0%	19.9%
Jan-11	4.8%	18.8%	0.1%	0.0%	3.8%	5.0%	0.0%	32.1%
Feb-11	3.4%	15.9%	0.0%	0.1%	1.8%	5.2%	0.0%	20.5%
Mar-11	12.0%	14.1%	0.3%	0.0%	5.2%	7.9%	0.0%	14.1%
Apr-11	25.0%	5.1%	0.3%	0.0%	22.4%	0.6%	1.1%	16.7%
AVG	3.0%	28.3%	0.0%	1.3%	1.9%	15.1%	0.0%	18.5%

Content

- CWE Incident on 27 March 2011
  - 27 March 2011 timeline
  - CWE Fallback
  - Impact on prices
  - Technical incident analysis
  - Fallback improvements

27 March 2011 timeline

✓ **Reminder: normal business process + incident management**

Incident Management

ITVC process	CWE process	△1	△2	Shadow Auctions	△3

12:00   12:20   12:40   13:05   13:30   13:40   14:00

△ Message sent to Market Parties

✓ **What happened on the 27ᵗʰ of March?**

Incident Management

ITVC process	CWE Process	△1	△2	Shadow Auctions	△3

12:00   12:35   13:10   13:30   13:40   14:00

- Delay in the ITVC process
- CWE preliminary results files rejected by the PX trading systems
  → Start of the investigation process
- Market Parties regularly updated

amprion
apx endex
BELPEX
Part of APX-ENDEX
creos
elia
Powering a world in progress
EnBW
EPEXSPOT
EUROPEAN POWER EXCHANGE
Rte
Réseau de transport d'électricité
TenneT
Taking power further

20

CWE Fallback (1/2)

✓2 pm: CWE markets could not stay coupled

✓Capacity allocation
- Offered capacity at 13:40 in Shadow Explicit Auctions
- Results of the SA published shortly after 2 pm

Border	No. Registered participants	ATC (MWh) Total 24 H	Requested Capacity (MWh) Total 24 H	Allocated Capacity (MWh) Total 24 H	Price (€/MWh) all hours	No. Companies that won capacity
BE-FR	21	42 936	16 081	16 081	0	6
BE-NL	20	33 936	25 512	25 512	0	5
DE-FR	29	78 120	89 480	78 049	0	13
DE-NL	22	50 644	37 877	37 877	0	9
FR-BE	21	65 764	32 921	32 921	0	6
FR-DE	29	67 080	101 131	67 000	0.01	14
NL-BE	20	33 312	15 841	15 841	0	6
NL-DE	22	66 908	37 259	37 259	0	9

# CWE Fallback (2/2)

✓ Local matching at PXs

- Order books are reopened from 14:00 to 14:20
- ITVC remains coupled and flows on Nordic interconnectors (NorNed, DK1, DK2, Baltic Cable) are included in Dutch and German order books
- Results were published at 14:26 (EPEX FR & DE/AU) and 14:38 (APX-ENDEX & Belpex)
- Nomination deadline postponed to 15:30

Impact on prices

✓ **Belgium market : price peak on hour 8 (settled at 2999 €/MWh)**
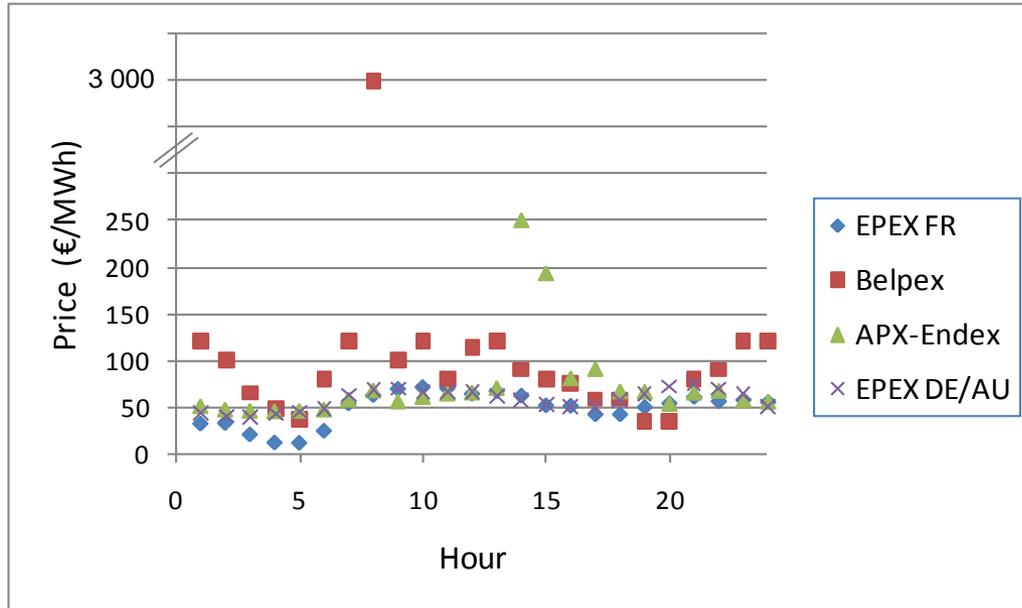
Baseload prices
- BE   206.1 €
- DE/AU   57.52 €
- FR   48.03 €
- NL   73.04 €

✓**Adverse flows on the Nordic interconnectors**

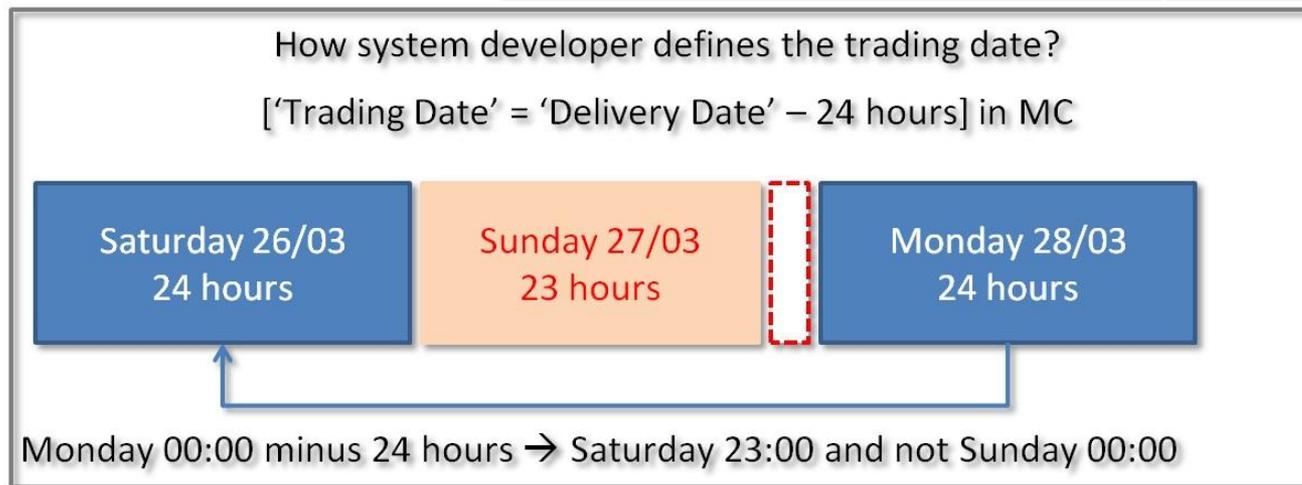| Adverse flows	DK1-DE	DK2-DE	SE-DE	NO2-NL
Number	3	8	3	14
Maximum price difference	1.76 €	6.75 €	6.24 €	185.15 €

Technical incident analysis

On 27 March :
✓ Preliminary results files generated by the MC System were rejected by the PX Trading Systems – Time Stamp error
✓ Investigations were launched but diagnostic not complete until 2 pm
✓ Decision to decouple CWE taken at 2 pm

On 27 March afternoon and 28 March – investigation results
✓ Each file is identified by the combination of the trading & delivery date
✓ On Sunday 27 March, trading & delivery date were not consecutive
✓ Trading date was set to 26 March instead of 27 March
✓ Issue is an indirect consequence of the short clock change

How system developer defines the trading date?

['Trading Date' = 'Delivery Date' – 24 hours] in MC

| Saturday 26/03 24 hours | Sunday 27/03 23 hours | | Monday 28/03 24 hours |

Monday 00:00 minus 24 hours → Saturday 23:00 and not Sunday 00:00

Short term improvements

✓ **Improve clarity of External Communication messages**

Member messages sent at 13:05, 13:30 and 14:00 will be modified in order to :

- Include a reminder about the SA timings : closing at 13:40 and publishing at 14:00
- Remind members they have to check their SA bids
- Underline the increasing risk of decoupling, especially at 13:30
- Clarify the message topic / header (in case of CWE Decoupling)
- Make sure cross-reference is made in CASC messages in order to remind the members it is the same issue (and not a new one)

✓ **Organise more trainings for members/operators**

- Internal operational trainings will be organised by each PXs
- Regular cross-trainings will be organised between PXs and involved parties
- In addition to the ITVC and CWE decoupling member testing which took place on 10th and 11th May 2011, further member testings have to be organised (twice a year, depending on resources and members needs)

⟹ These trainings should be setup during summer and start from September

Long term improvements

✓ **Fallback Improvements Task Force**

• FITF in charge of long term solutions

• Focus :

    • Mitigate risks of adverse flows on Nordics in case CWE markets do not remain coupled

    • Avoid price peaks on local markets

→ Work is in progress between PXs and TSOs

→ Market Participants will be consulted as soon as solution are deemed to be feasible

Thank you for your attention
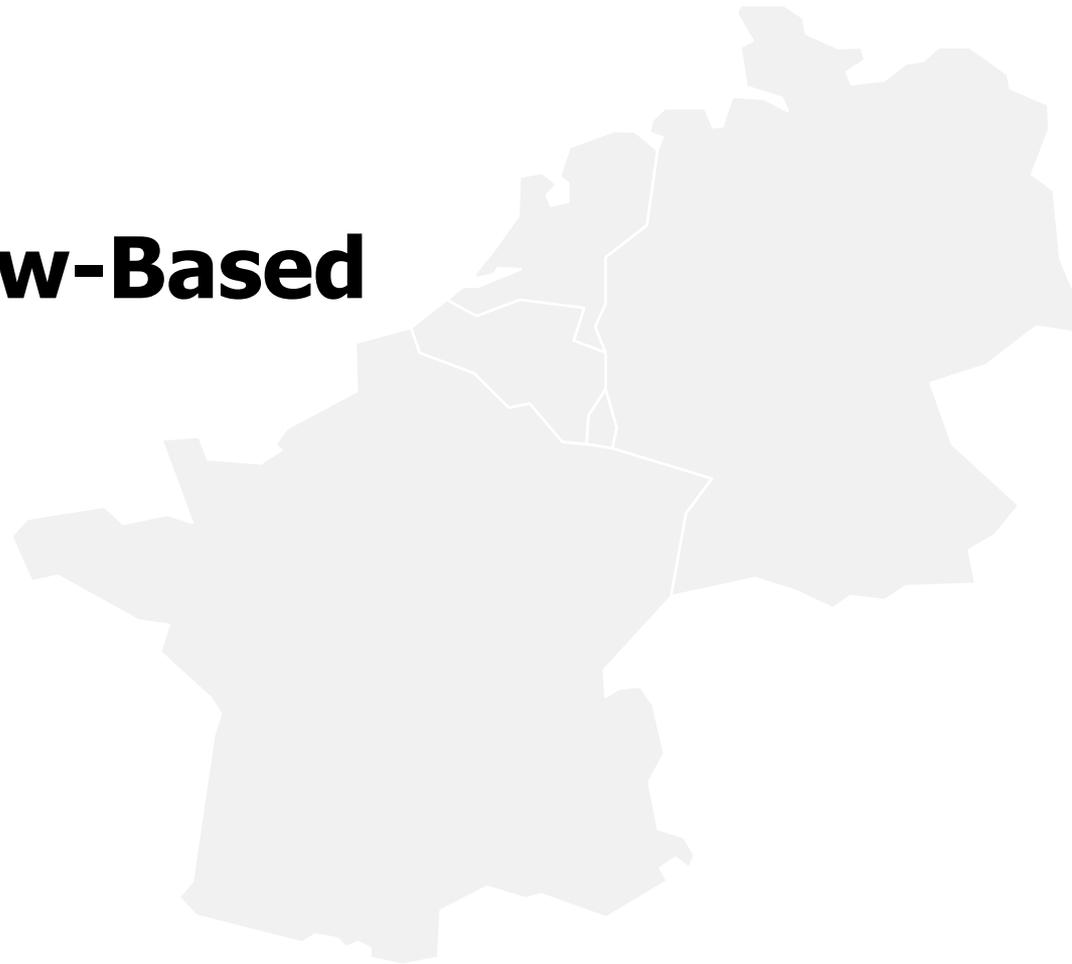
Any questions?

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**
- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)
- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
  - Question and answer (15 min)

Lunch break (85 min)

  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)
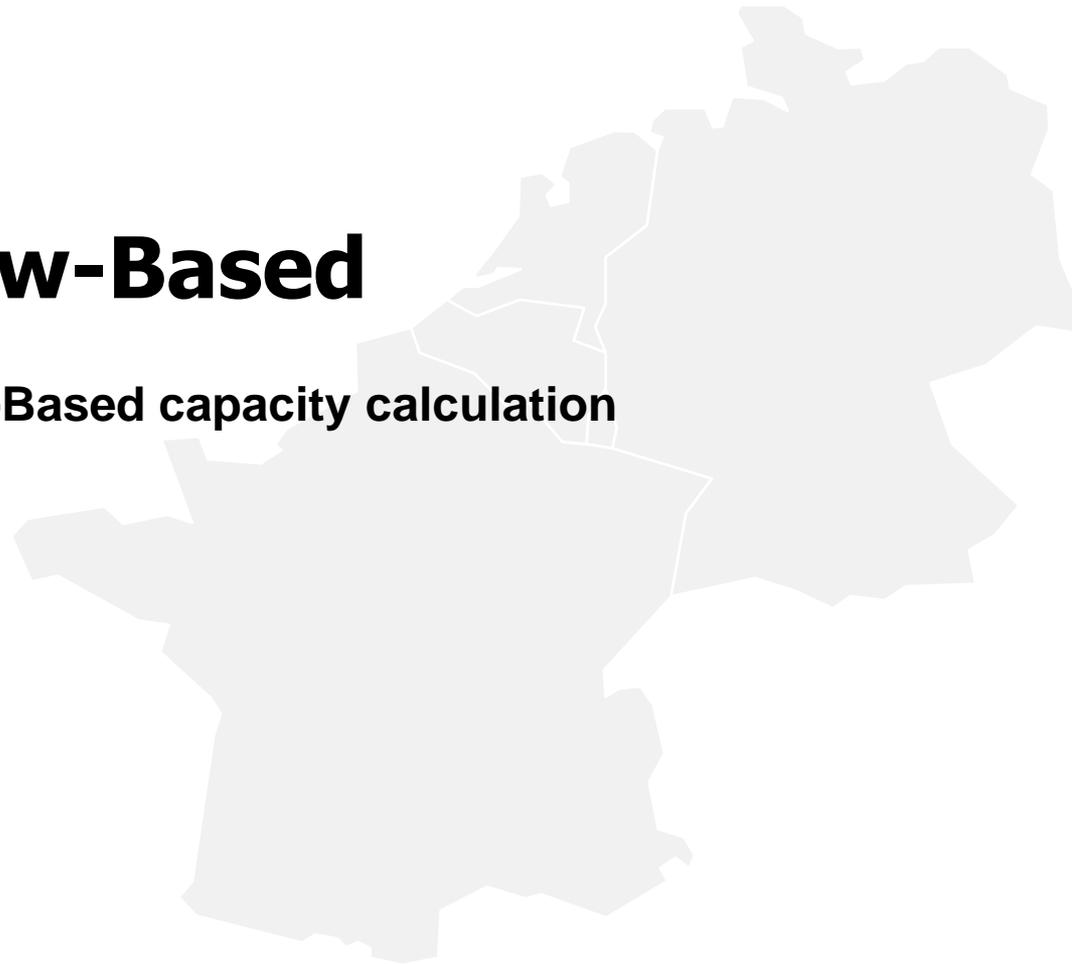- **Conclusions (Bert den Ouden and Jean Verseille)**

Flow-Based

Flow-Based

Theory on Flow-Based capacity calculation

Contents

▶ Theory on Security of Supply (SoS), NTC (Net Transfer Capacity), ATC (Available Transfer Capacity) and FB domain

▶ Advantages for the market of FB compared to NTC/ATC

▶ How to get a grip on the FB domain?

▶ Why CWE can compare coordinated NTC with FB

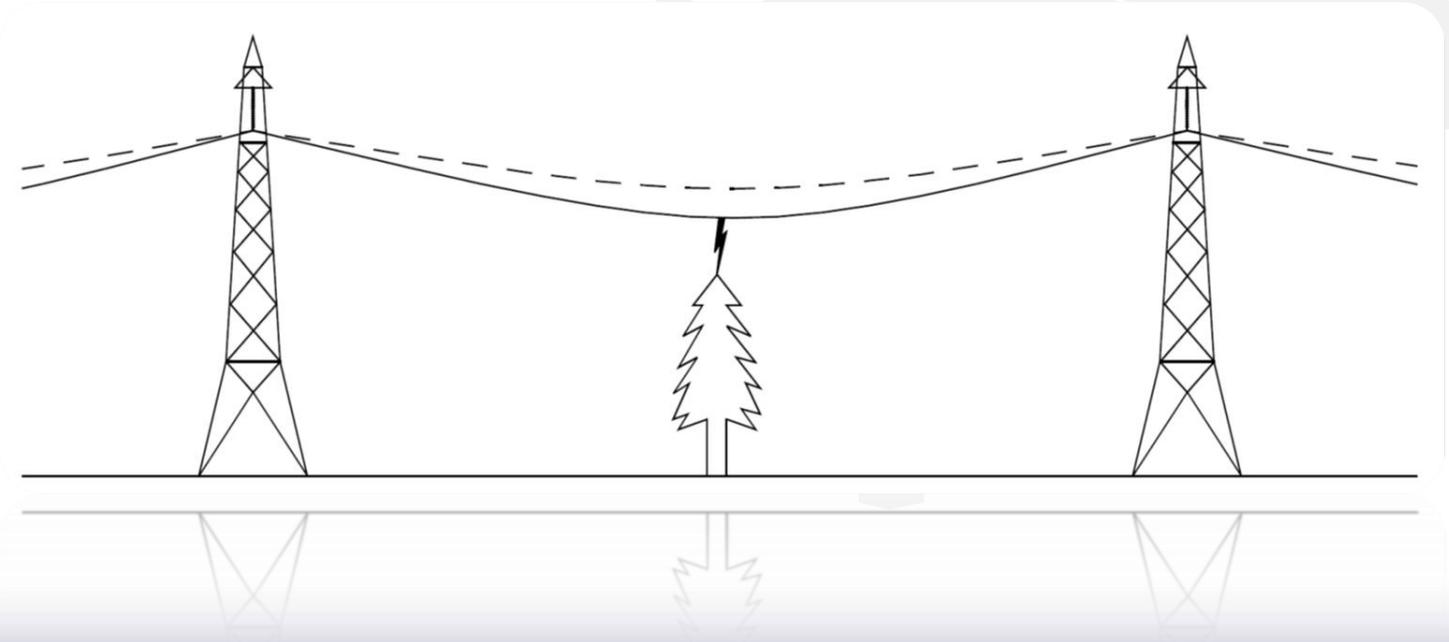▶ Does the theory hold?... Yes!
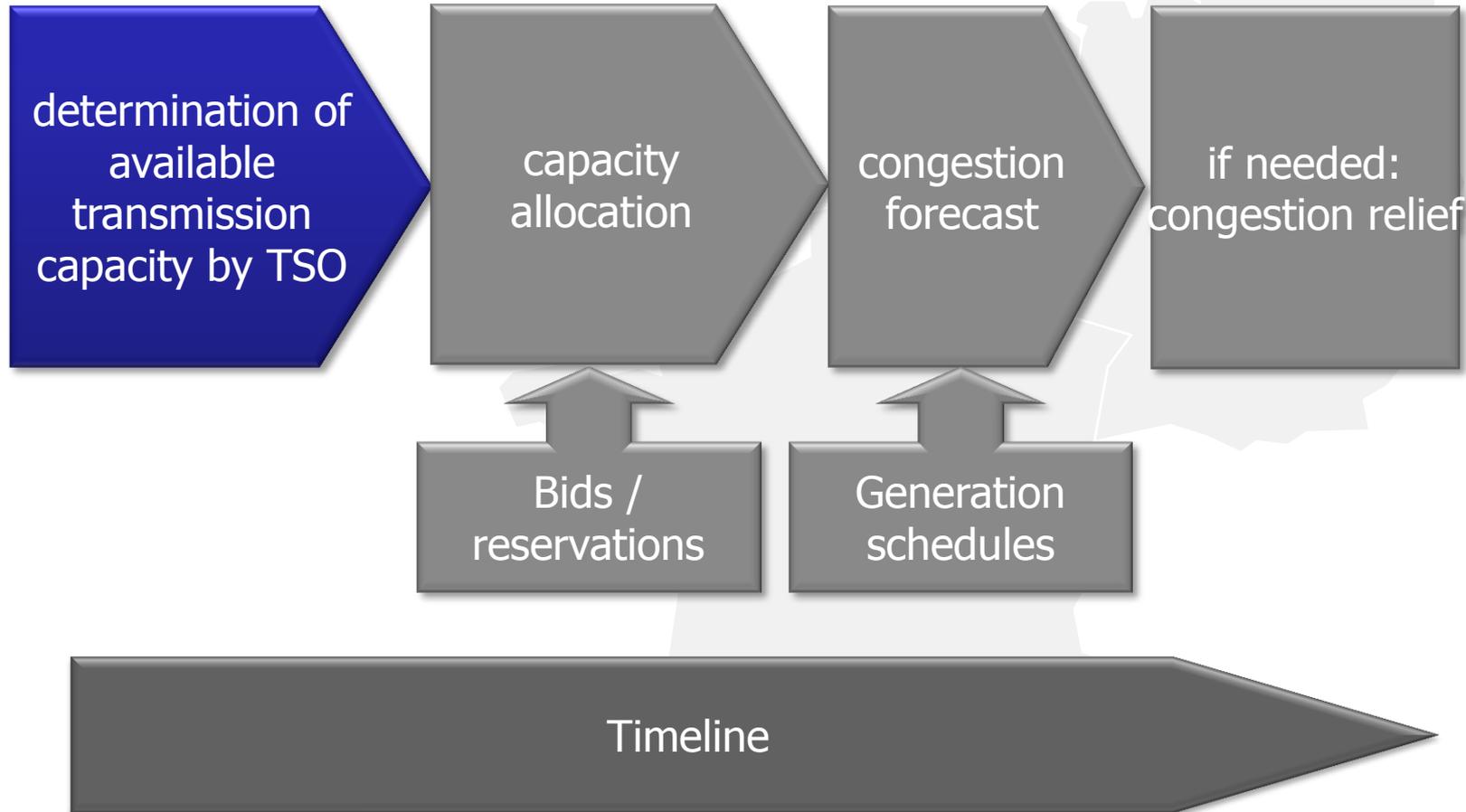
▶ Interaction with long-term.
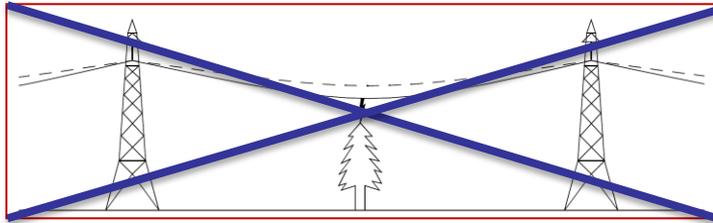
What is congestion?

What is congestion?

- Commercial: more capacity requested by the market than is available
- Physical: overloaded transmission lines leading to outages

Congestion management in the broadest sense

Assessment of the Security of Supply domain

determination of available transmission capacity

capacity allocation

Bids / reservations

NTC/ATC or FB constraints respecting the Security of Supply domain

amprion

apx endex

BELPEX
Part of APX-ENDEX

creos

elia
Powering a world in progress

EnBW

EPEXSPOT
EUROPEAN POWER EXCHANGE

Rte
Réseau de transport d'électricité

Tennet
Taking power further

How to approximate the Security of Supply domain
- example with 3 countries -
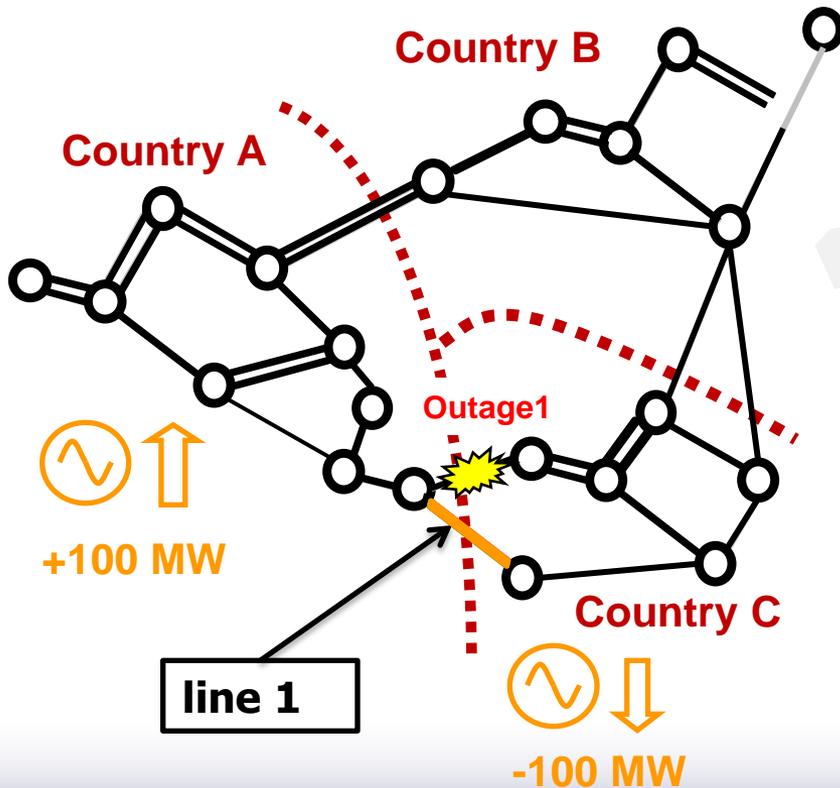
Monitored lines	Outage scenario	Margin left (MW)	Influence of exchange on lines (PTDF)		
			A→B	A→C	B→C
Line 1	No outage	150		10%	
	Outage 1	120		20%	
	…				
Line 2	…				
	…				
Line 3	…				
	…				

Country B

Country A

Outage1

+100 MW

line 1

Country C

-100 MW

The Security of Supply domain

⚠ Numbers are for illustration only

| Monitored Lines	Outage scenario	Margin left (MW)	Influence of exchange on lines (PTDF)		
			A→B	A→C	B→C
Line 1	No outage	150	1%	10%	3%
	Outage 1	120	5%	20%	1%
	Outage 2	100	6%	25%	1%
Line 2	No outage	150	-2%	0	5%
	Outage 3	100	-12%	0	10%
Line 3	No outage				
	Outage 4				

Exchange(A>C)

Exchange(A>B)

----- Constraints

⬛ Security of Supply domain
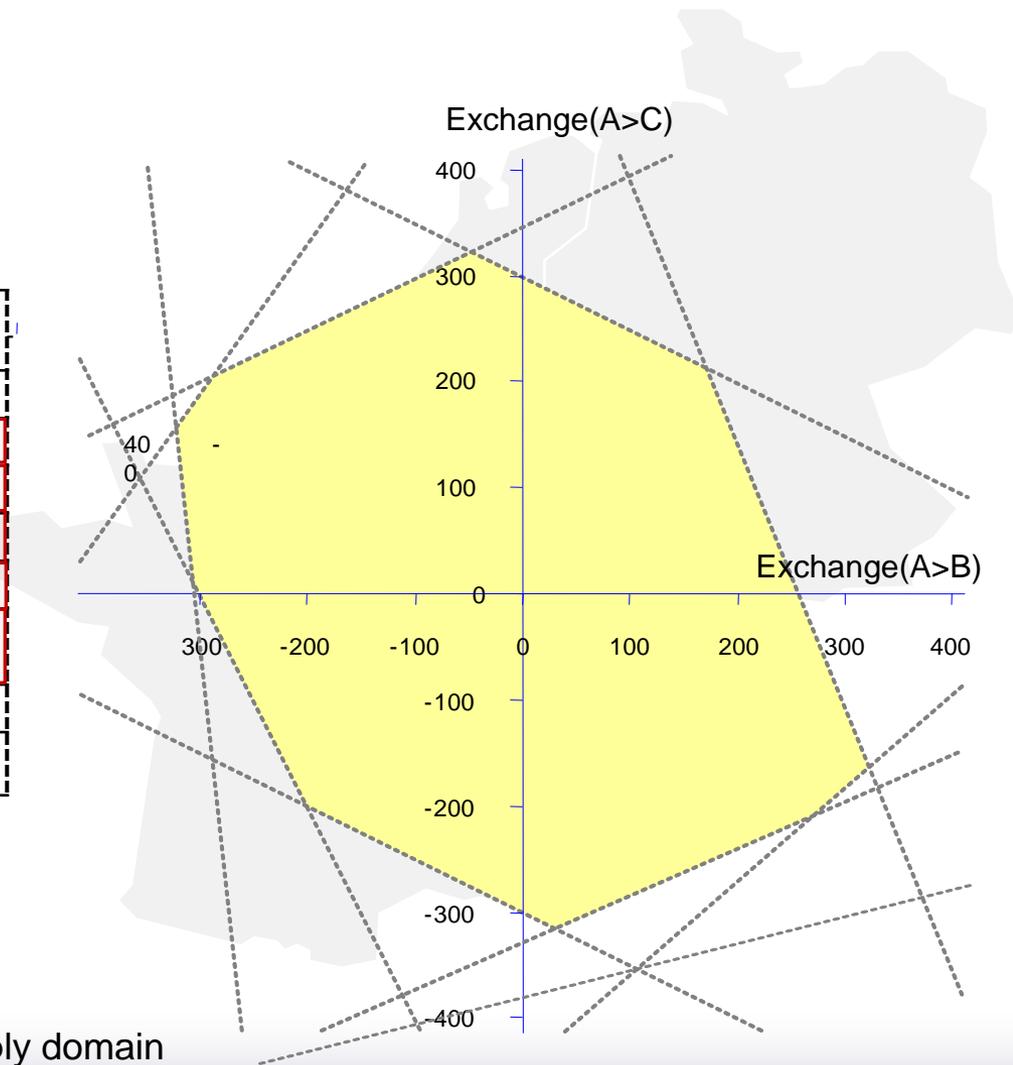
ATC & FB constraints – theory

- Security domain is obtained by taking into account all the relevant physical constraints of the grid

- Given the security domain, NTC/ATC constraints and the corresponding NTC/ATC domain are a choice made by the TSO

- The FB domain is the security domain itself

constraints polyhedron ....   security domain
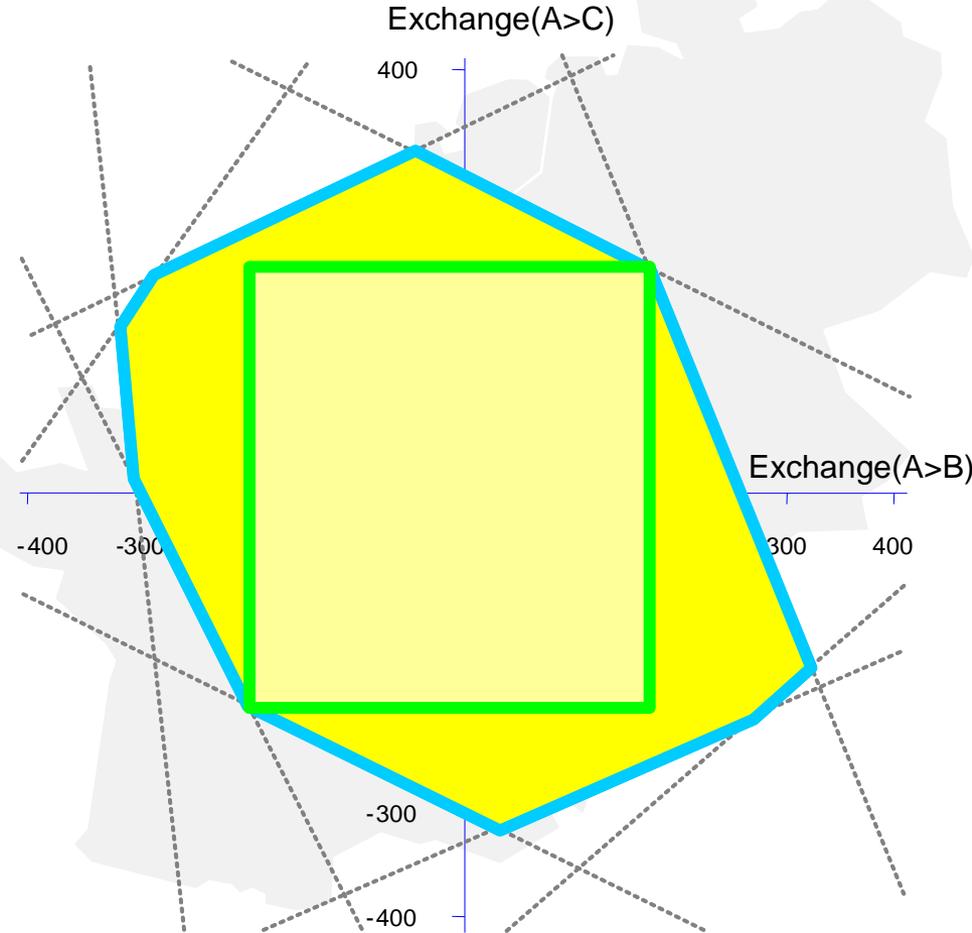
NTC/ATC   Flow-based
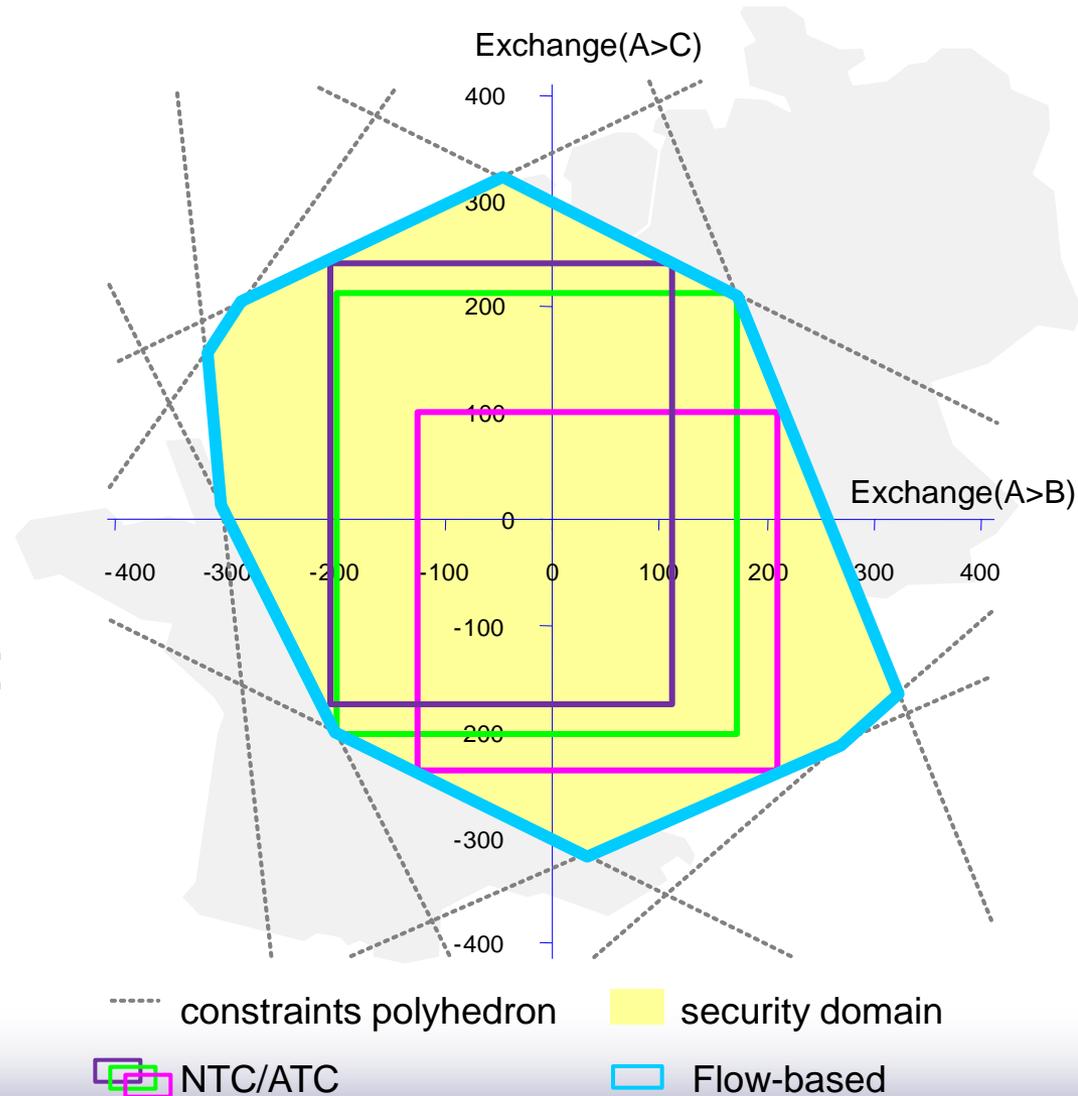
ATC and FB domain
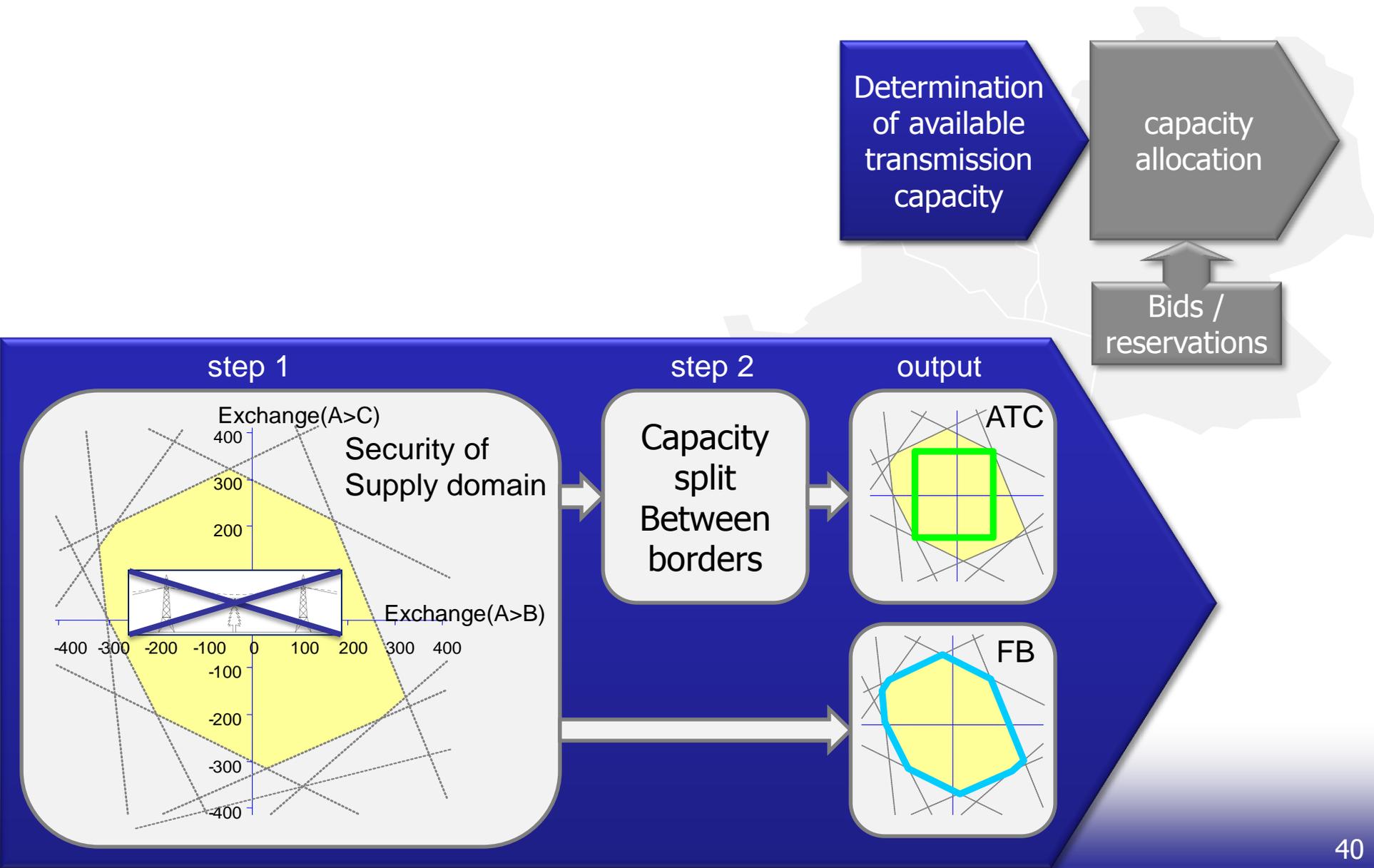
ATC vs FB constraints – theory

- FB offers more trading opportunities with the same level of Security of Supply

- In FB capacity split is not a choice of the TSO, but is market driven (at the time of allocation)


- - - - - constraints polyhedron   █ security domain
☐ NTC/ATC   ☐ Flow-based

FB domain – how to get a grip? (1/2)

- From the constraints itself
- Figures obtained from the search space as defined by the constraints:
  - Maximum bilateral exchanges (●) feasible, given the FB domain
  - The vertices of the FB domain (all the corner points at the boundary of the domain)
  - Maximum net positions feasible, given the FB domain

----- constraints polyhedron   security domain

☐ Flow-based
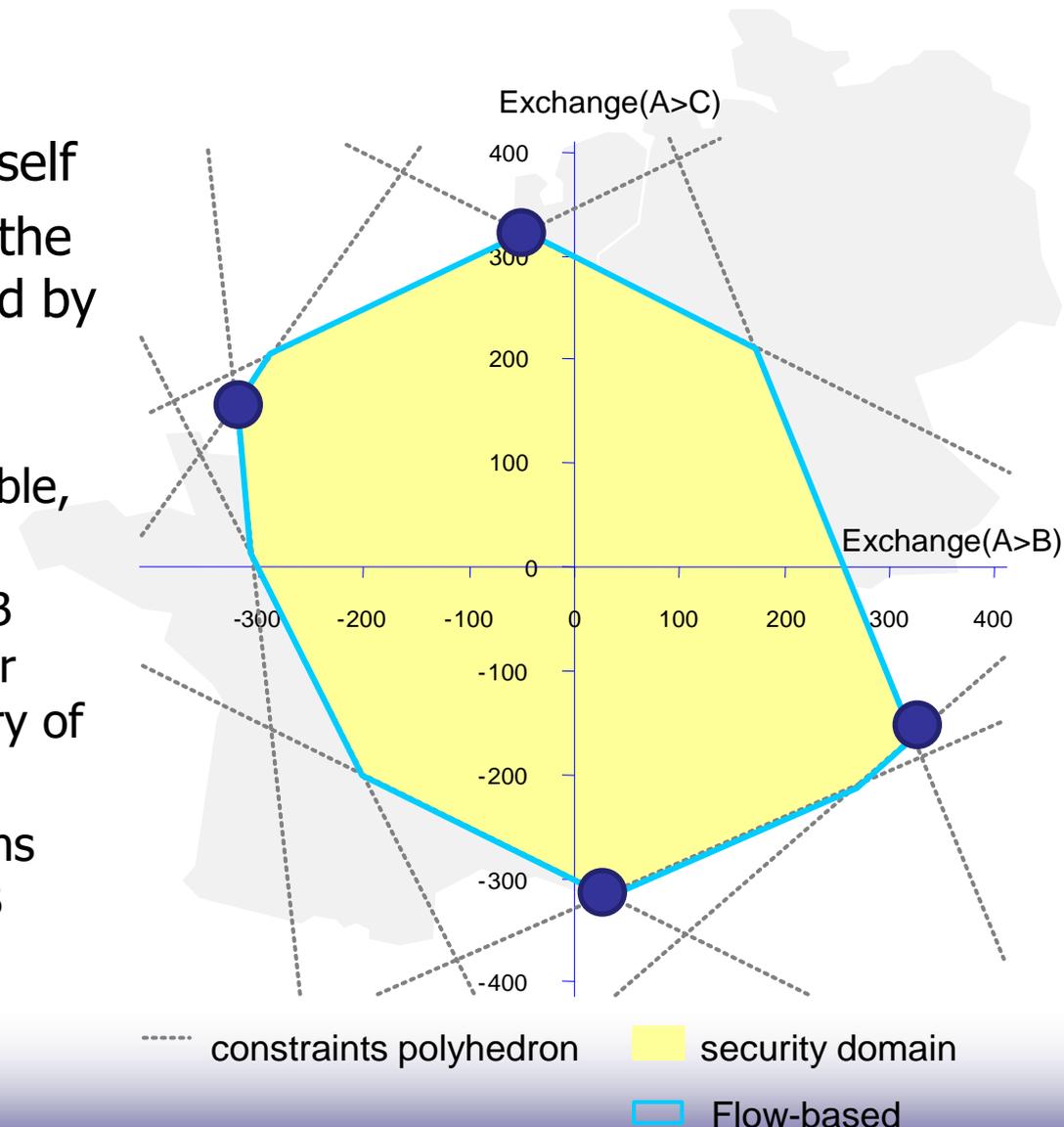
FB domain – how to get a grip? (2/2)
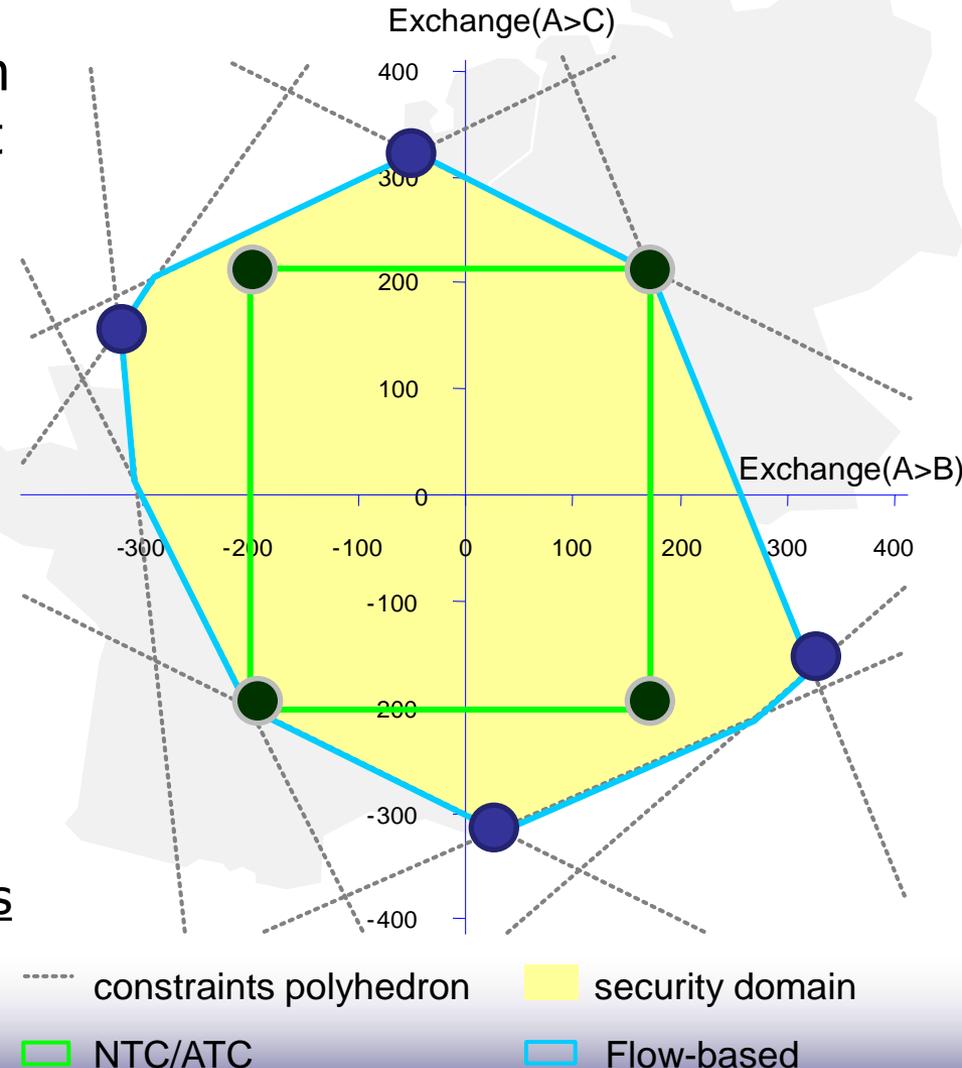
- NTC/ATC and FB can/will show different values for the maximum bilateral exchanges that are feasible
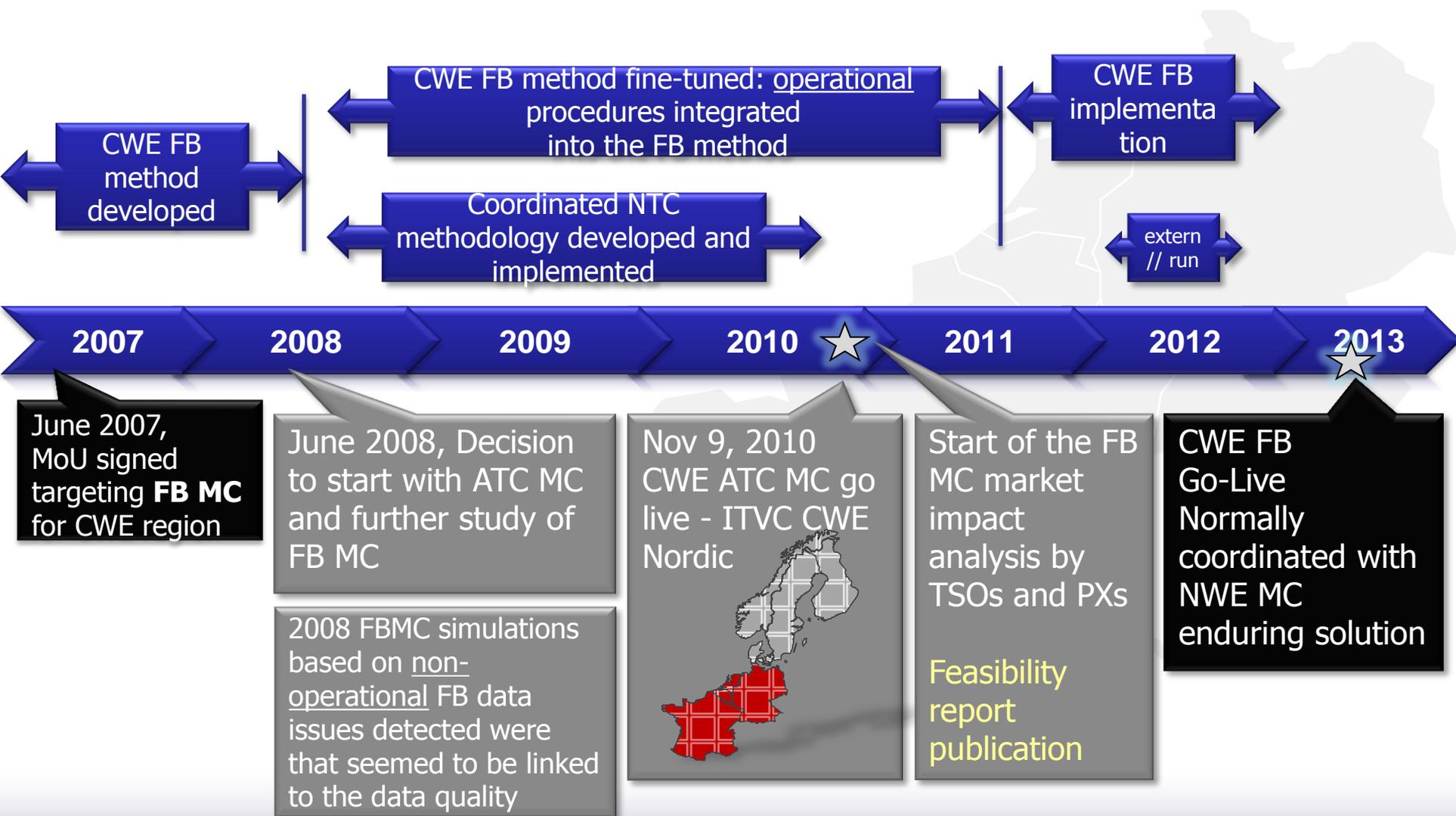
- FB
  - Maximum bilateral exchanges feasible in the FB domain are <u>non-simultaneous</u> values

- NTC/ATC
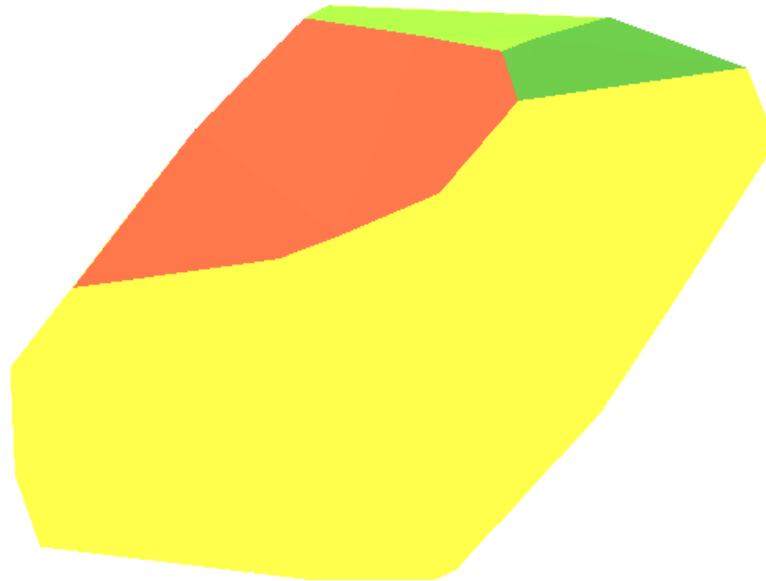 - NTCs/ATCs are by definition <u>simultaneous</u> values that limit the bilateral exchanges

constraints polyhedron   security domain
NTC/ATC   Flow-based

CWE FB- where are we now?

CWE FB method developed

CWE FB method fine-tuned: <u>operational</u> procedures integrated into the FB method

CWE FB implementation

Coordinated NTC methodology developed and implemented

extern // run

2007 | **2008** | **2009** | **2010** ★ | **2011** | **2012** | **2013** ★

June 2007, MoU signed targeting **FB MC** for CWE region

June 2008, Decision to start with ATC MC and further study of FB MC

2008 FBMC simulations based on <u>non-operational</u> FB data issues detected were that seemed to be linked to the data quality

Nov 9, 2010 CWE ATC MC go live - ITVC CWE Nordic

Start of the FB MC market impact analysis by TSOs and PXs

Feasibility report publication

CWE FB Go-Live Normally coordinated with NWE MC enduring solution

ATC vs. FB constraints: preliminary experimental result (a Tuesday 10.30)

In CWE, (4 biding areas) the FB domain is not 2-dimension surface like in previous example but a 3-dimension volume

FB domain

ATC vs. FB domain: aggregated preliminary experimental results

Max. net position is the max. im/export feasible in the FB or ATC domain.

Under ATC this equals at maximum the sum of export ATCs or import ATCs.

Legend:
- FB Cycle 12 (January 2011)
- FB Cycle 11 (November/December 2010)
- FB Cycle 10 (October 2010)
- FB Cycle 8 (June/July 2010)
- FB Cycle 7 (May 2010)
- FB Cycle 6 (April/May 2010)
- FB Cycle 5 (March/April 2010)
- FB Cycle 4 (March 2010)
- FB Cycle 3 (February 2010)
- FB Cycle 2 (January 2010)

Categories: Volume, NL Export Max Net Pos, FR Export Max Net Pos, DE Export Max Net Pos, BE Export Max Net Pos, NL Import Max Net Pos, FR Import Max Net Pos, DE Import Max Net Pos, BE Import Max Net Pos

X-axis: 0% — 100% — 200% — 300% — 400% — 500% — 600%

ATC = 100%

Does the theory hold? … Yes!

✓ FB offers more trading opportunities with the same level of Security of Supply as the current coordinated ATC

➢ This would mean that FB market coupling results should be better in terms of welfare and price convergence compared to the current ATC MC ones…
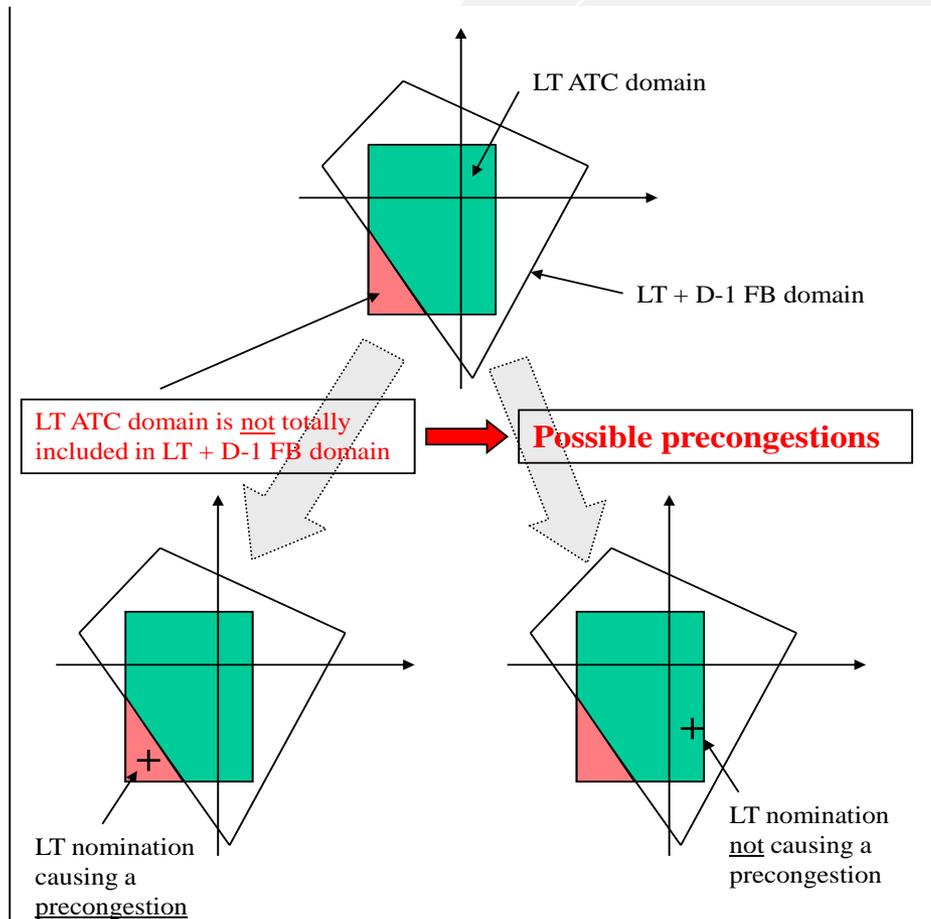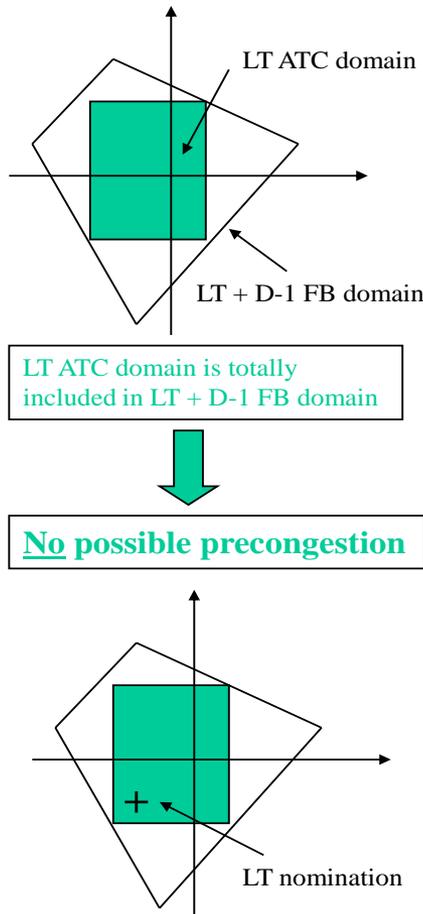
The flow-based parallel run

- Joint effort of TSOs and PXs
- Comparison between the actual ATC MC results and simulated FB MC market outcome =>

Results will be presented today !

CWE D-1 FB compatibility with LT ATC

▸ **The compatibility is granted if the long term capacity domain offered to the market is fully included in the FB domain**.

▸ Practically this means that there will be no negative capacities (no 'precongestions') before the market coupling (which was the case during 2010 experimentation).

LT ATC domain

LT + D-1 FB domain

LT ATC domain is totally included in LT + D-1 FB domain

No possible precongestion

LT nomination

LT ATC domain

LT + D-1 FB domain

LT ATC domain is <u>not</u> totally included in LT + D-1 FB domain ➡ **Possible precongestions**

LT nomination causing a <u>precongestion</u>

LT nomination <u>not</u> causing a precongestion

Conclusion

- The 2010 TSO experimentation has proved that the enhanced FB:
    - is feasible from an operational point of view
    - increases the proposed total capacity offered to the market
    - increases TSO cooperation and SoS in unusual market directions
    - addresses transparency requirements and concerns on market players understanding
    - is compatible with Long Term ATC computation

⟹ From the capacity calculation point of view, the TSOs recommend to continue describing the details of a FB implementation for CWE MC.

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**
- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)
- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
  - Question and answer (15 min)

  Lunch break (85 min)

  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)
- **Conclusions (Bert den Ouden and Jean Verseille)**

Any questions?

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**
- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)
- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
  - Question and answer (15 min)

Lunch break (85 min)

  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)
- **Conclusions (Bert den Ouden and Jean Verseille)**

Lunch break

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**
- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)
- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
  - Question and answer (15 min)

Lunch break (85 min)

  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)
- **Conclusions (Bert den Ouden and Jean Verseille)**

Flow-Based
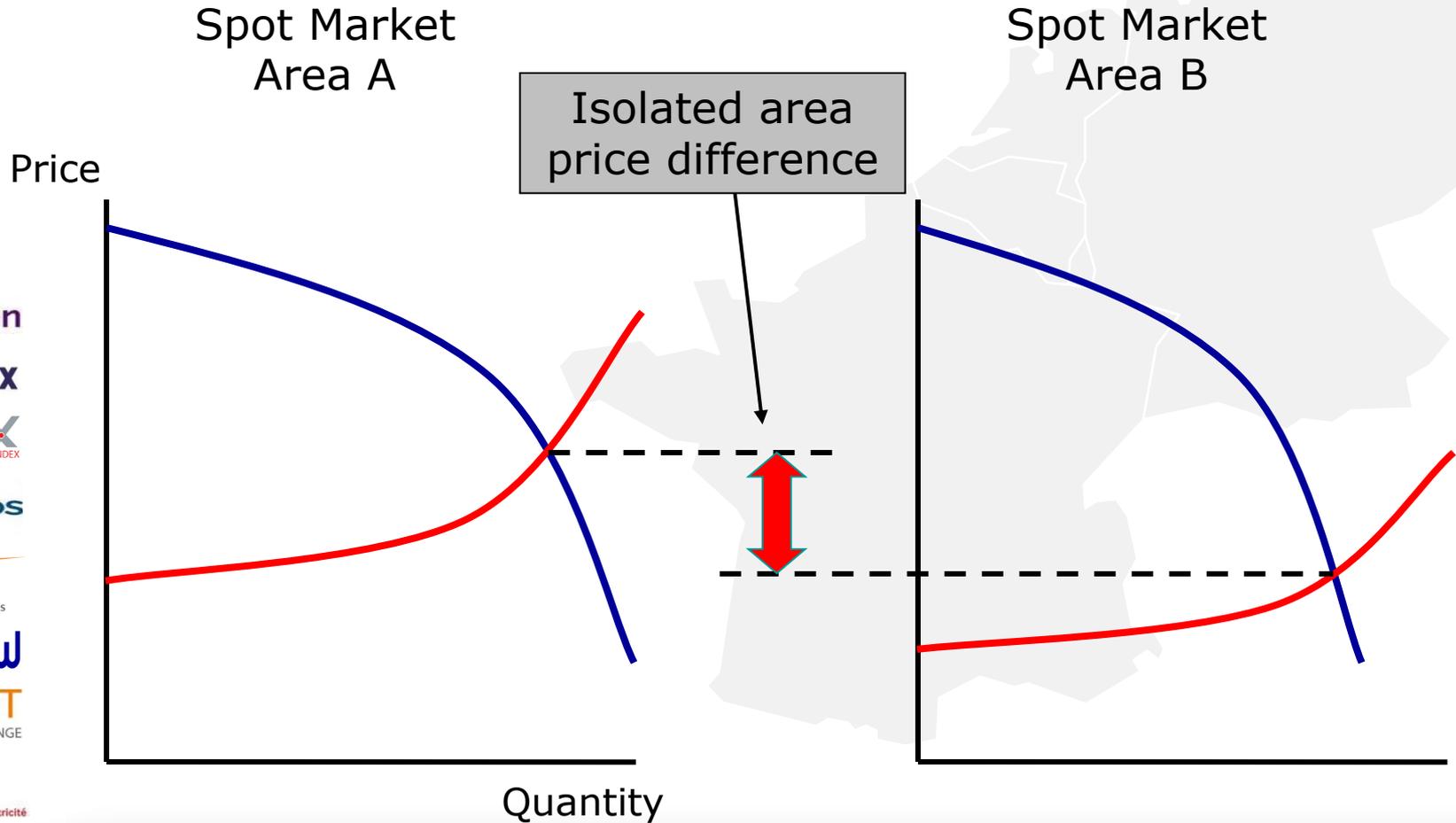
Theory on Flow-Based market coupling
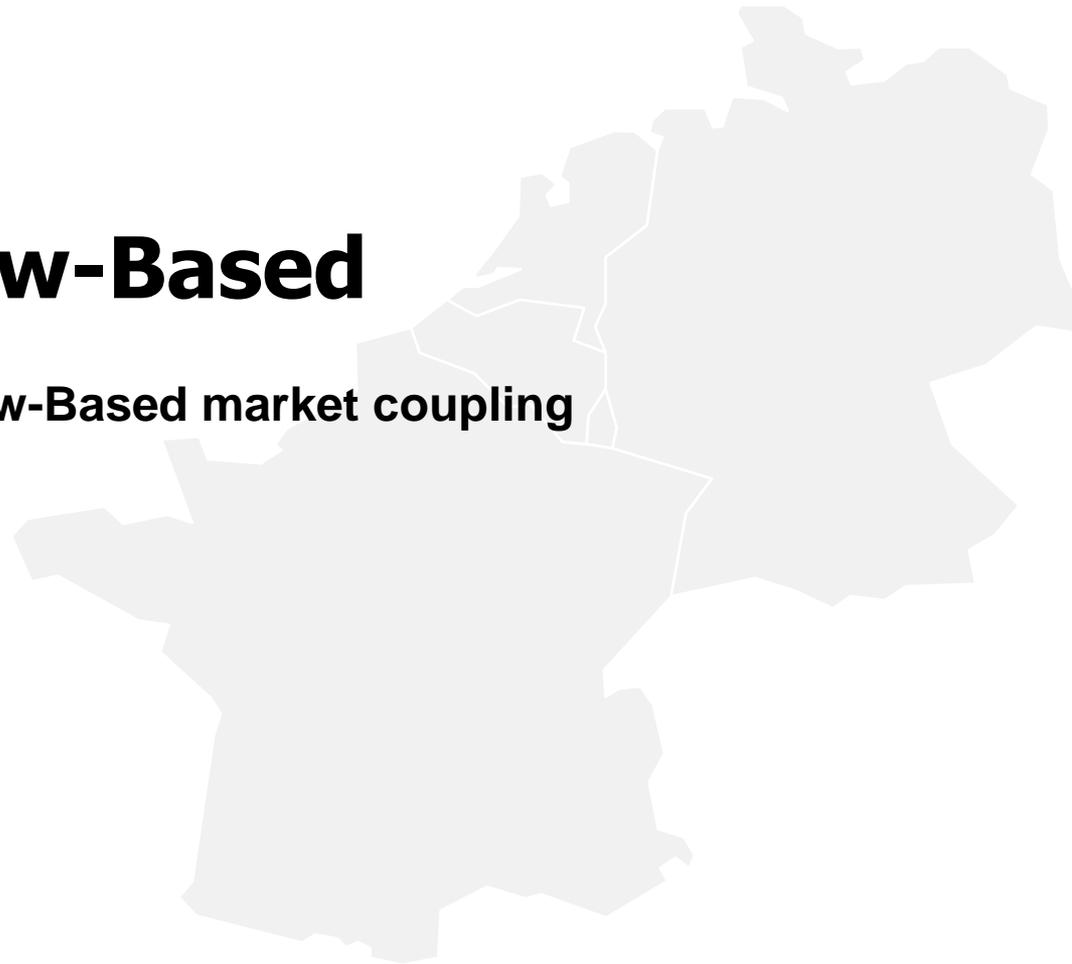
Goal

▶ What was market coupling again?

▶ What is an ATC constraint.

▶ What are constraints under FB?

▶ Illustrative example of:

   ▶ ATC market coupling

   ▶ FB market coupling

Basic price coupling

Spot Market
Area A

Spot Market
Area B

Isolated area
price difference

Price

Quantity

58
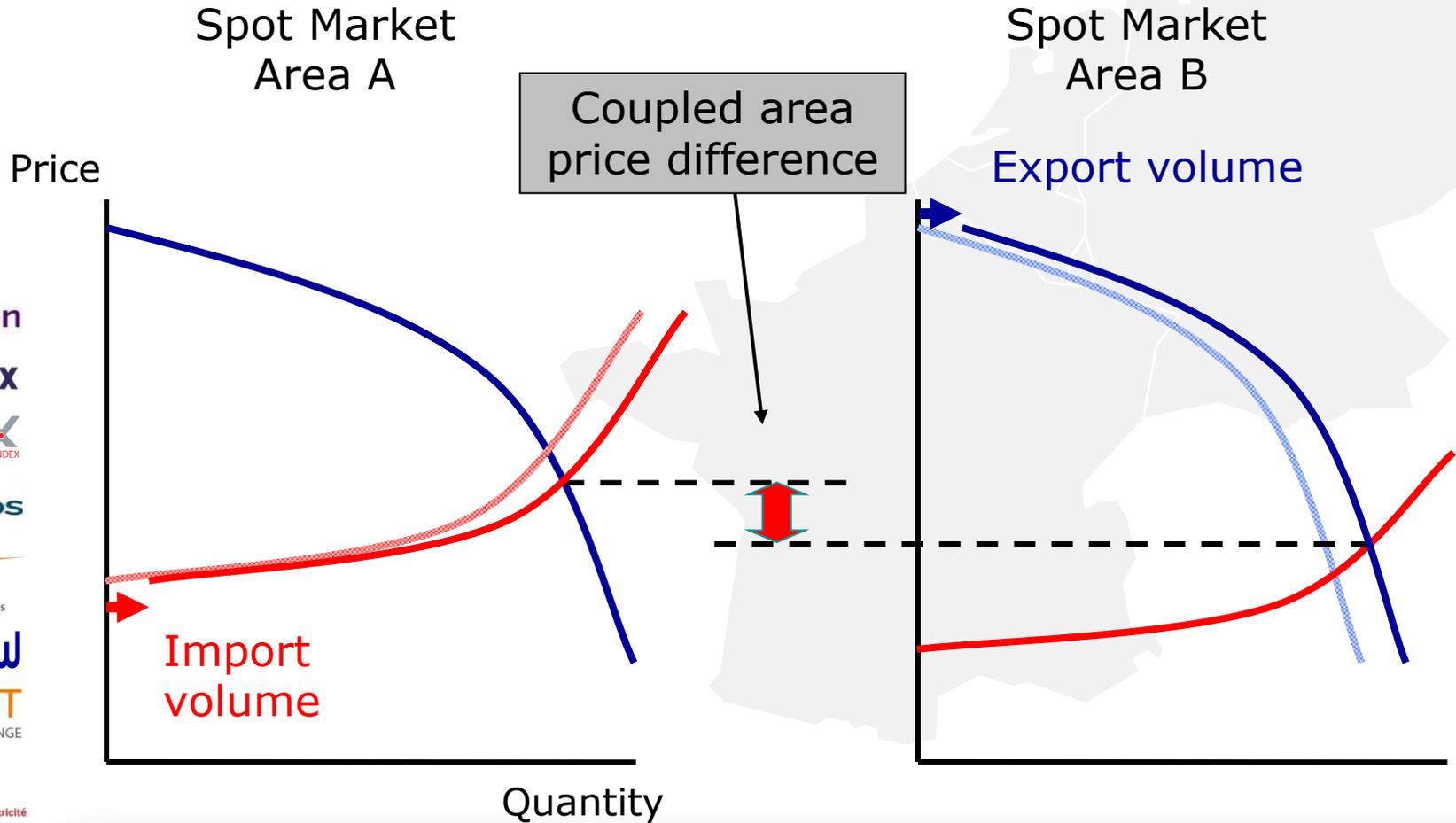
Basic price coupling

Basic price coupling

Spot Market Area A

Price convergence

Spot Market Area B

Price — Quantity

Import volume

Export volume

Basic price coupling

Spot Market Area A

Spot Market Area B
Export volume

Coupled area price difference

Price

Import volume

Quantity

Supplier surplus

Buyer surplus

Congestion rent

61
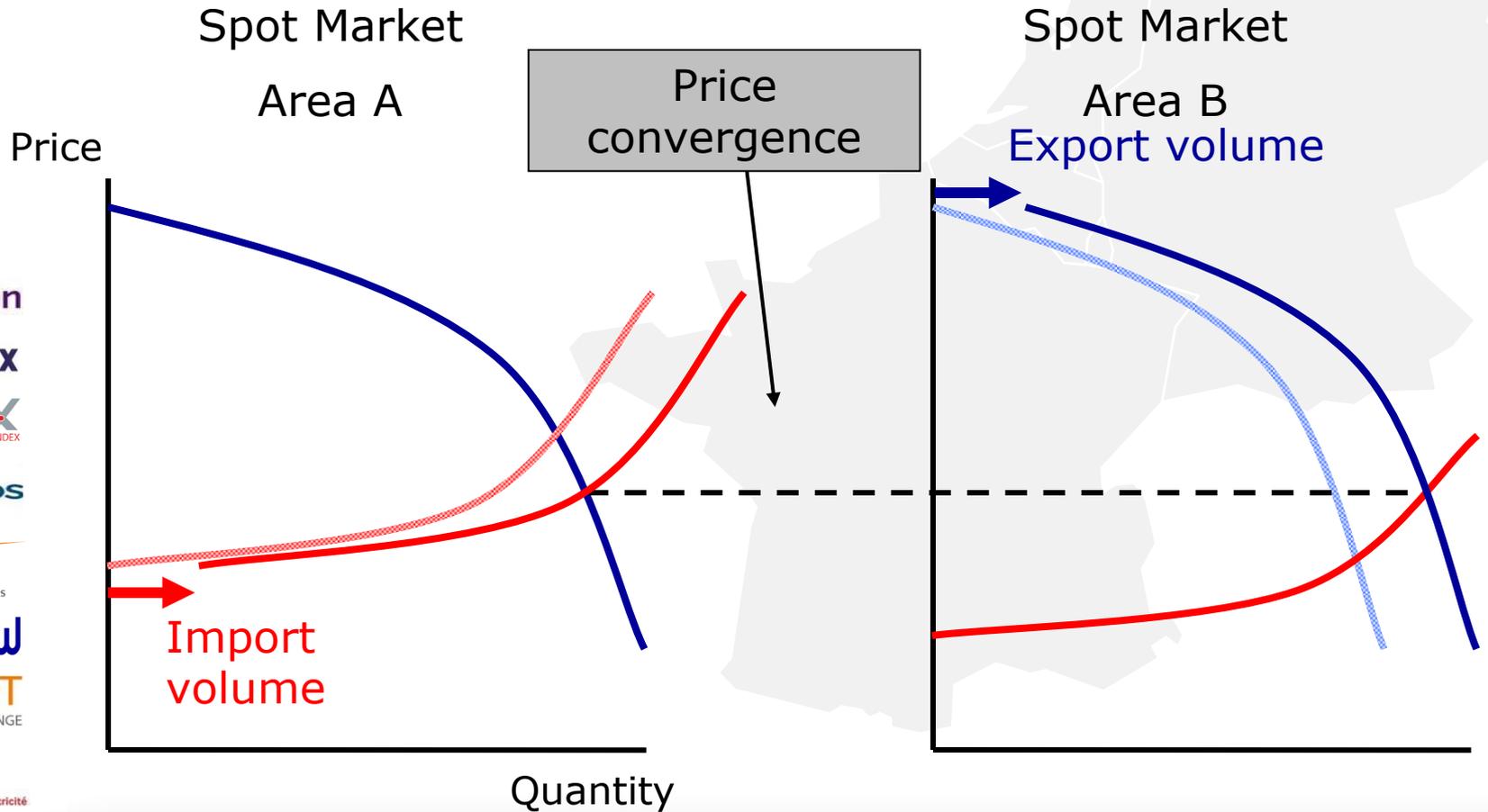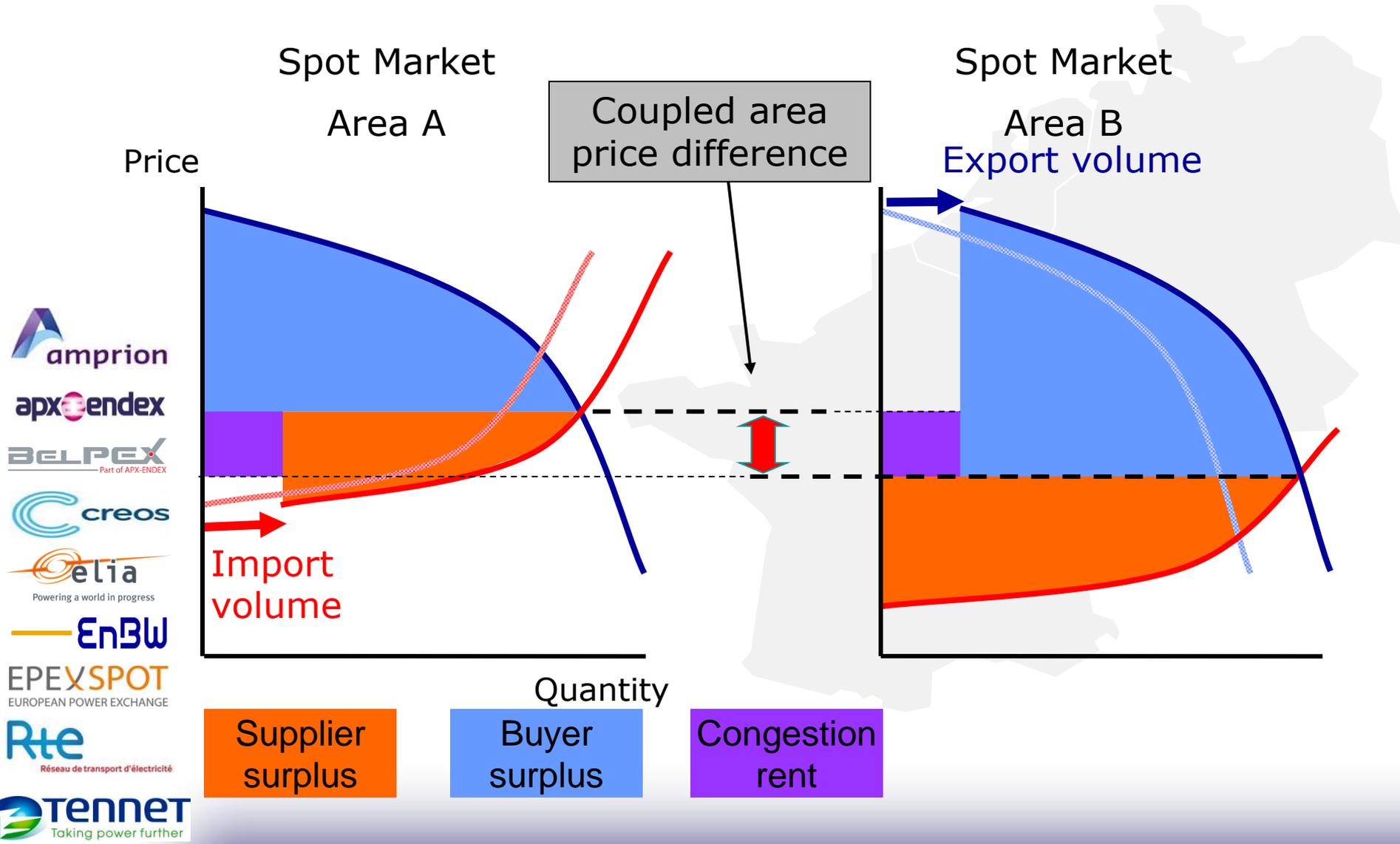
Market Coupling

- Market coupling optimizes the social welfare with respect to the day-ahead order books and the available network capacity.

- However, computed prices impact other transactions (futures, OTCs…).

- Therefore, the objective function is called Day-ahead Market Welfare (DAMW).

Market Coupling

▶ All the bids of the local/national Power eXchanges are brought together in order to be matched by a centralized algorithm.

▶ Objective function: Maximize Day-ahead Market Welfare

▶ Control variables: Net positions

▶ Subject to: $\sum$ net positions = 0

Today   Grid constraints   Foreseen

ATC   FB
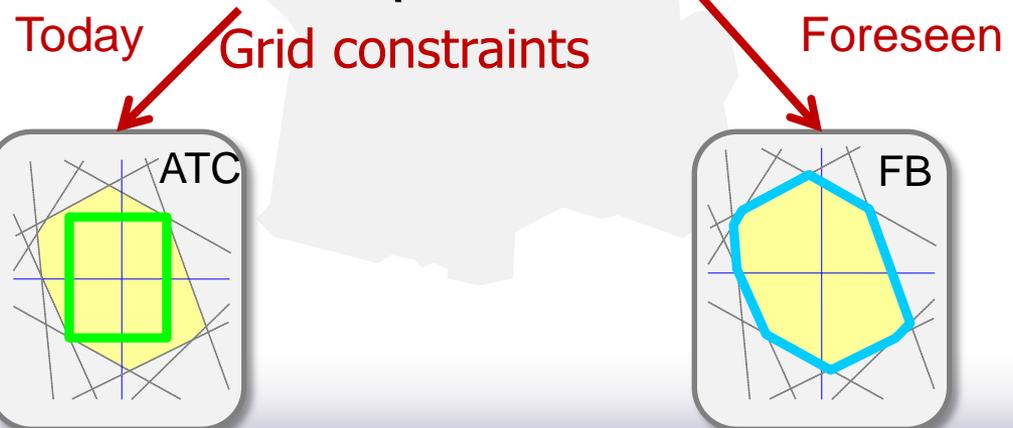
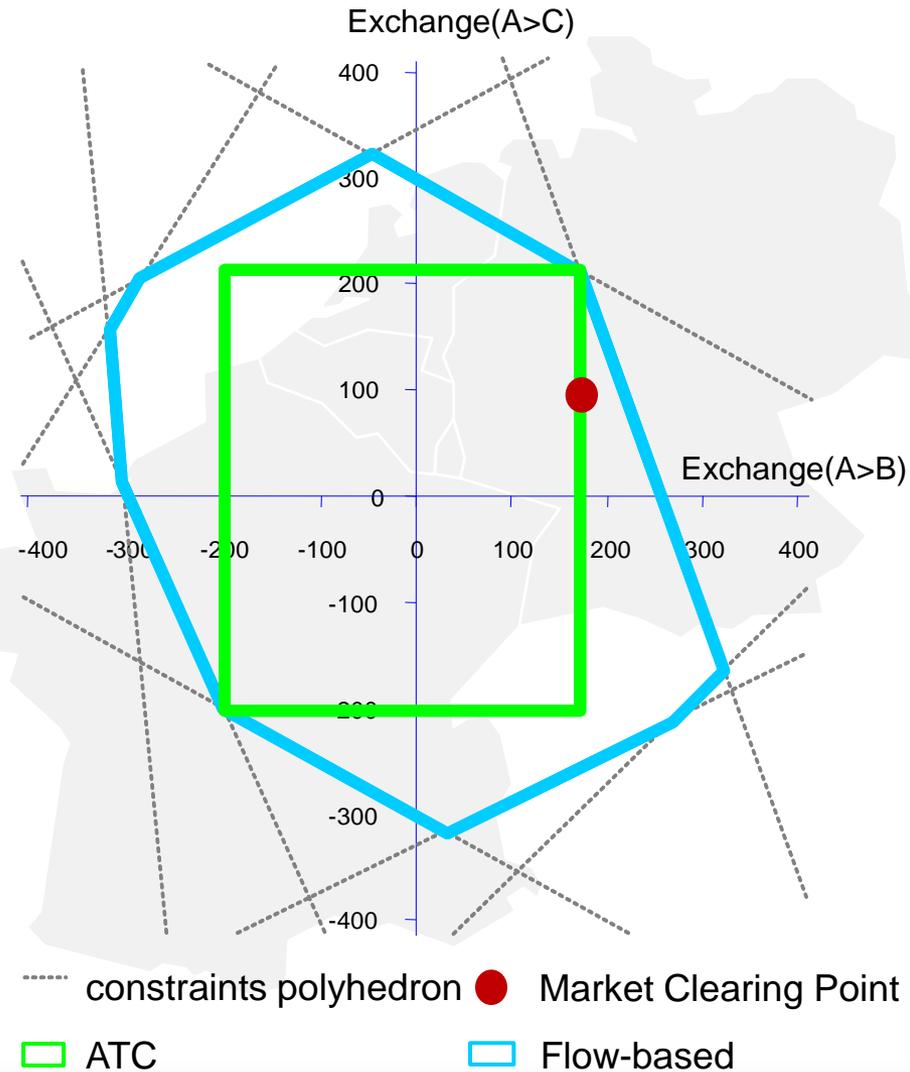# ATC and FB Market Coupling

- ATC not congested
  - 1 single price in CWE
- FB not congested
  - 1 single price in CWE
- Both ATC MC and FB MC provide the same solution (assuming that the order books are the same)
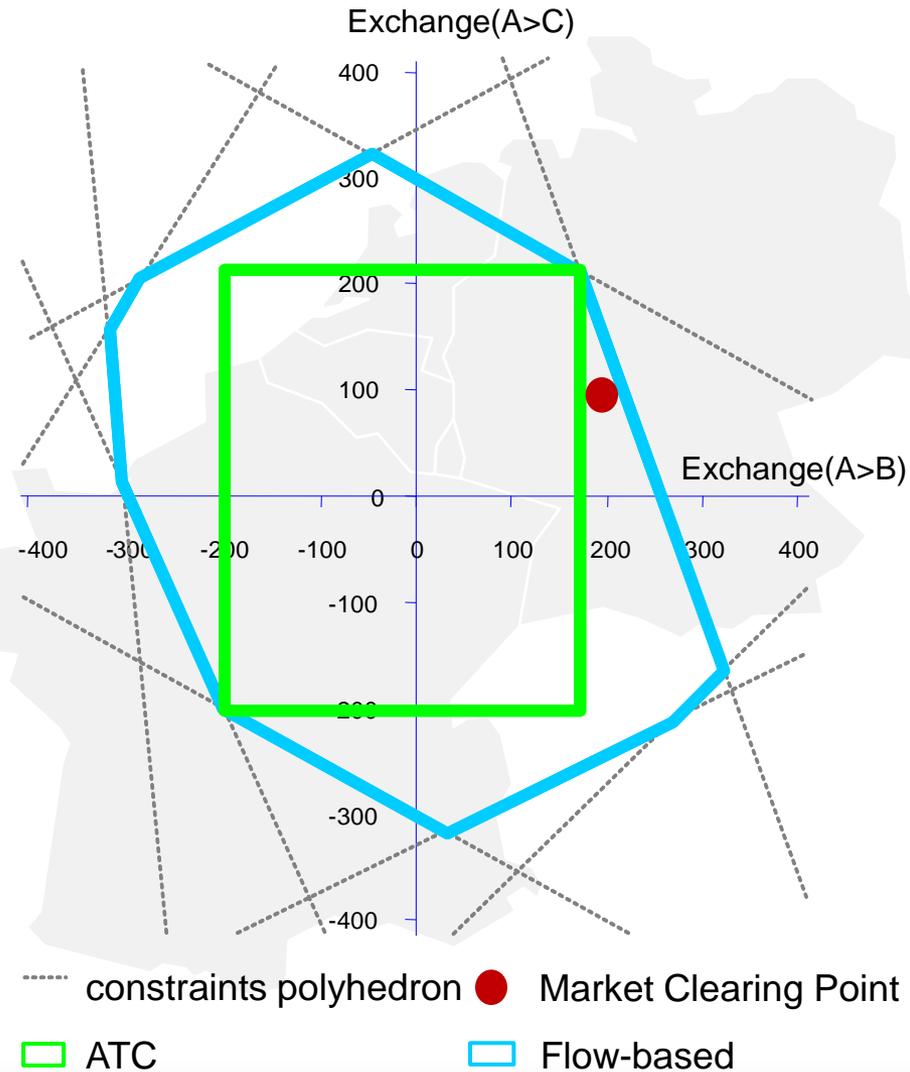 - Same prices
  - Same welfare

constraints polyhedron ● Market Clearing Point
ATC   Flow-based
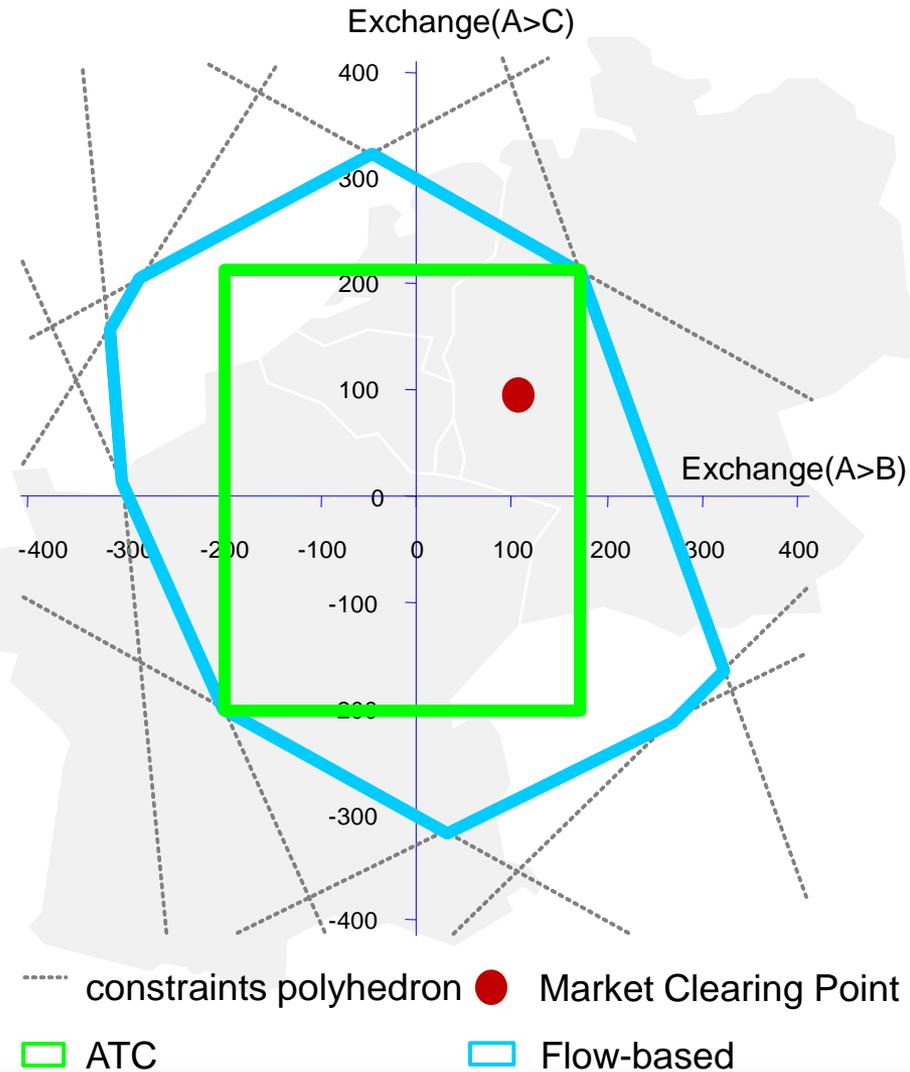
ATC and FB Market Coupling

- ATC congested
  - 4 different prices in CWE (divergence) or
  - partial convergence (e.g. 2 prices DE/NL and BE/FR)
- FB not congested
  - 1 single price in CWE
- ATC MC and FB MC do not provide the same solution
  - Price convergence in FB
  - Higher welfare in FB

Exchange(A>C)

Exchange(A>B)

400, 300, 200, 100, 0, -100, -200, -300, -400

-400, -300, -200, -100, 0, 100, 200, 300, 400

constraints polyhedron ● Market Clearing Point

ATC   Flow-based

ATC and FB Market Coupling

- Market clearing point not feasible under ATC
  - → ATC congested
    - 4 different prices in CWE (divergence) or
    - partial convergence
- FB not congested
  - 1 single price in CWE
- ATC MC and FB MC do not provide the same solution
  - Price convergence in FB
  - Higher welfare in FB

- - - - constraints polyhedron   ● Market Clearing Point

☐ ATC   ☐ Flow-based

ATC and FB Market Coupling

- Market clearing point not feasible under ATC ➔ ATC congested
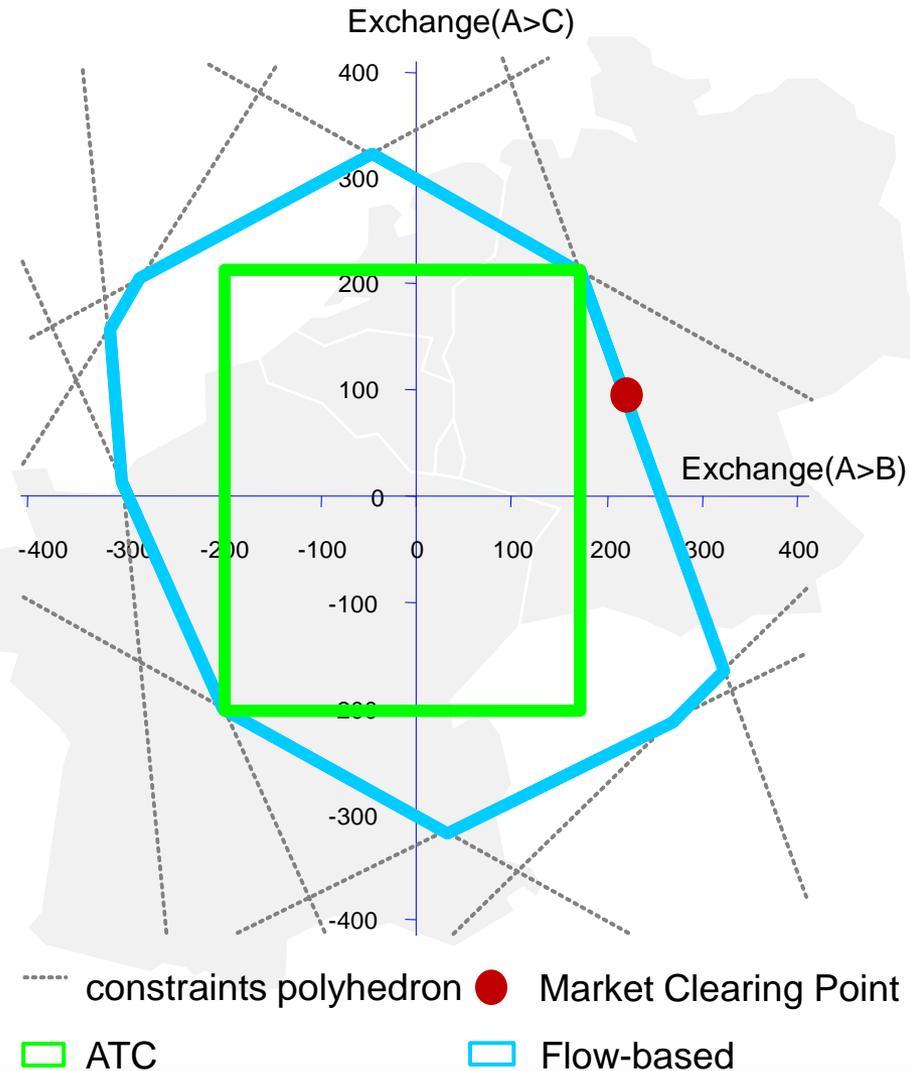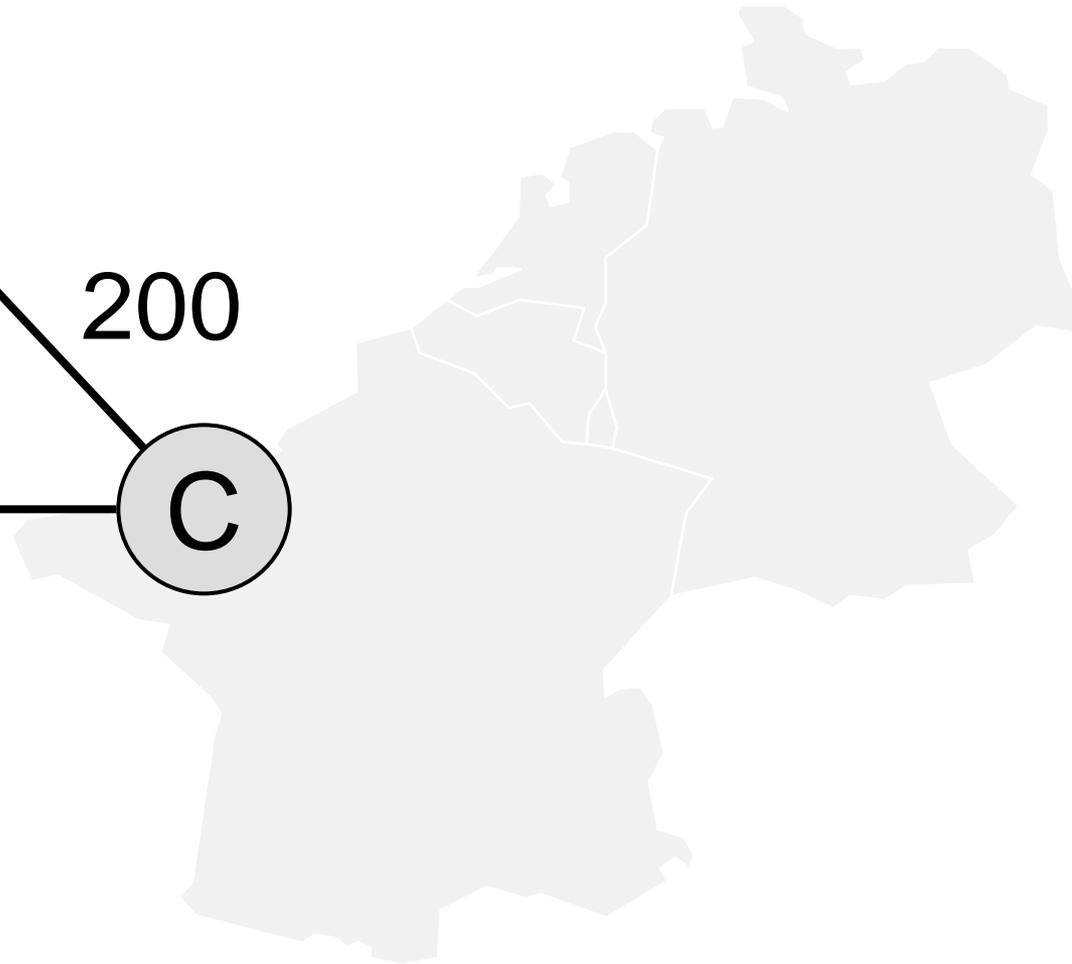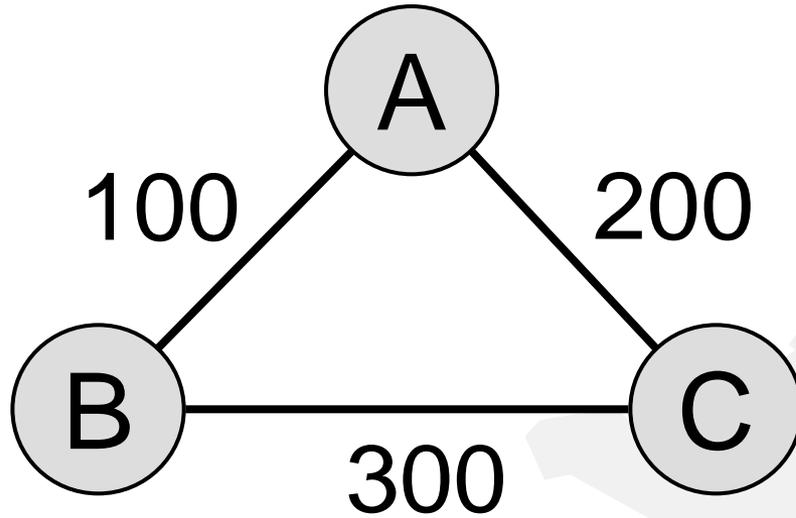 - 4 different prices in CWE (divergence) or
  - partial convergence
- FB congested
  - 4 different prices in CWE
  - Prices determined by the FB constraint
- ATC MC and FB MC do not provide the same solution
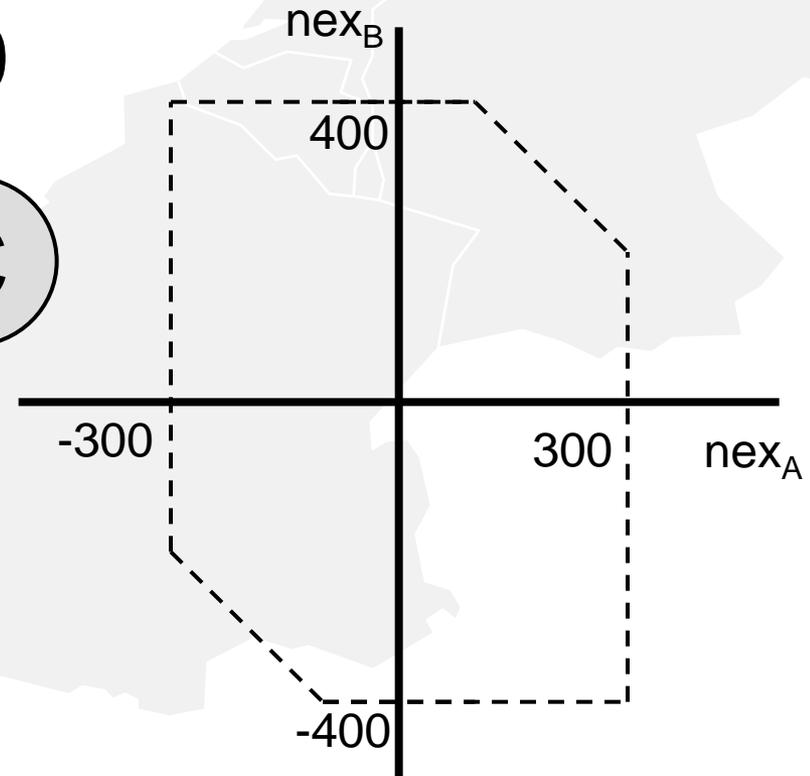 - Higher welfare in FB
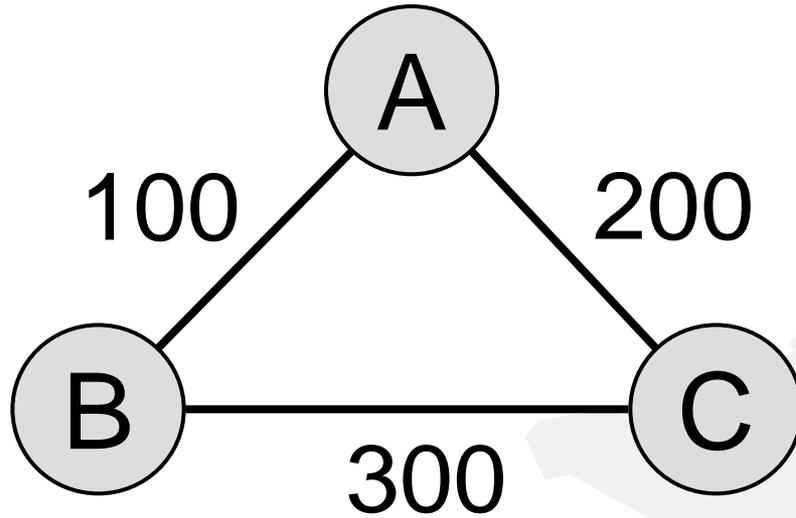

constraints polyhedron ● Market Clearing Point

□ ATC   □ Flow-based

ATC constraints

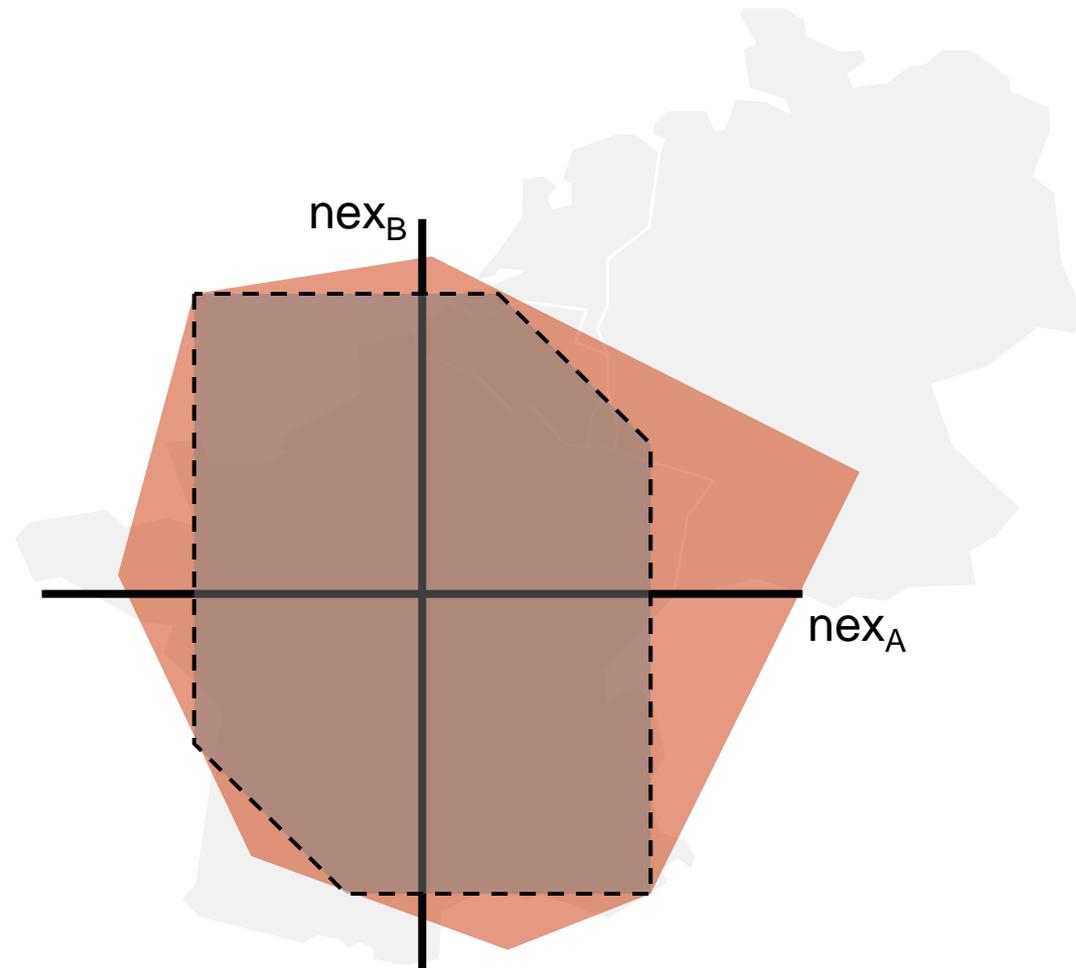# ATC constraints

FB constraints

- ATC contained by FB domain
- ATC domain a-priori choice by TSO

Note: Domain is plotted as a (nexA,nexB) diagram. In this particular case, this is equivalent to the (exchange(A->B),exchange(A->C)) diagram.

Example (ATC)

100

200

B

300

C

A
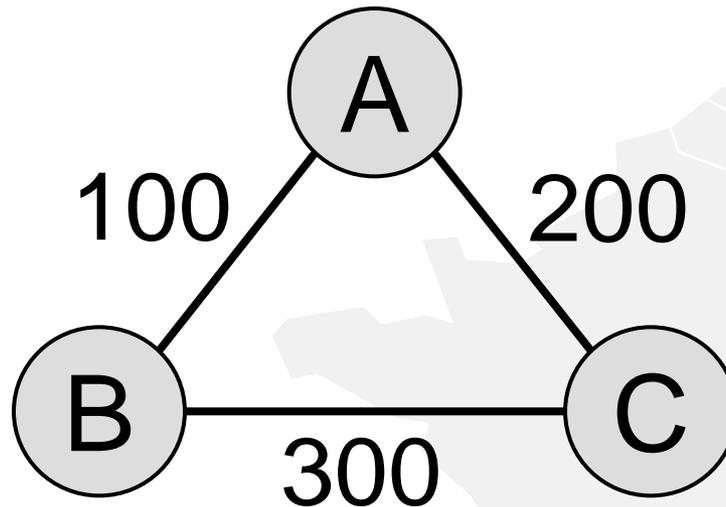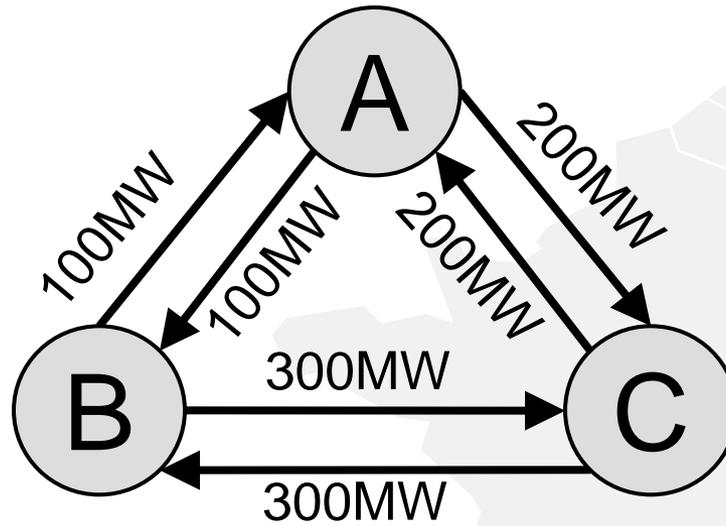
Example (ATC)

Example (ATC)

P (€)

600

400

€ 20
€ 10 ────────┐
            └──────────── S

Q (MWh) 100

200

A

B   C

300

P (€) 100

900

€ 70 ─┐
      │
€ 60 └──────────── D

1000

€ 50 ──────────────── D

P (€)

Q (MWh)   Q (MWh)

73

Example (ATC)

P (€)

600

400
€ 20 ─── S
€ 10

Q (MWh)

P (€) 100
900
€ 70 ─── D
€ 60

Q (MWh)

1000
€ 50 ─── D

P (€)

Q (MWh)

Example (ATC)

P (€)

600

400

€ 20
€ 10 ——————————— S

Q (MWh)

A

100   200
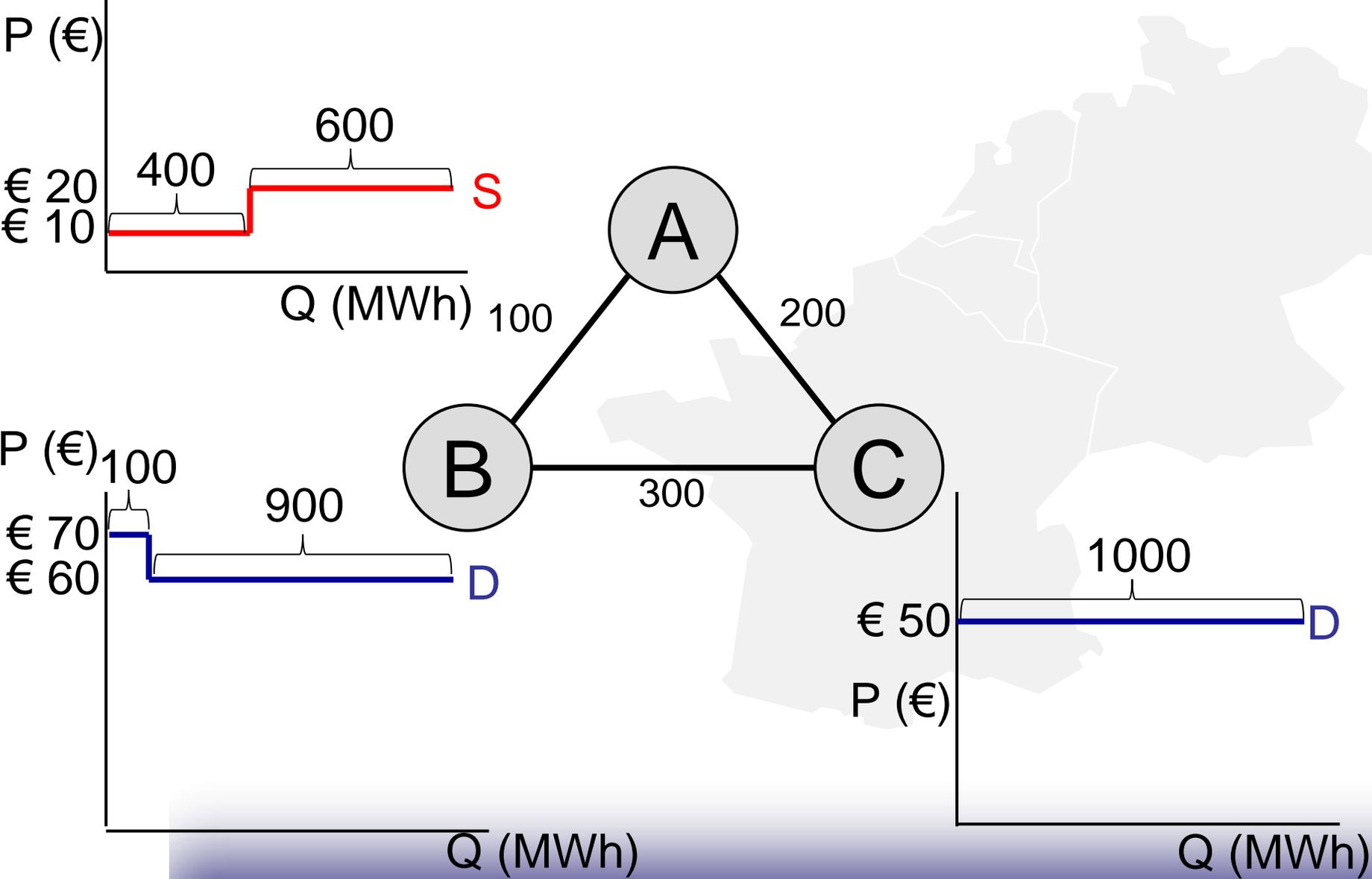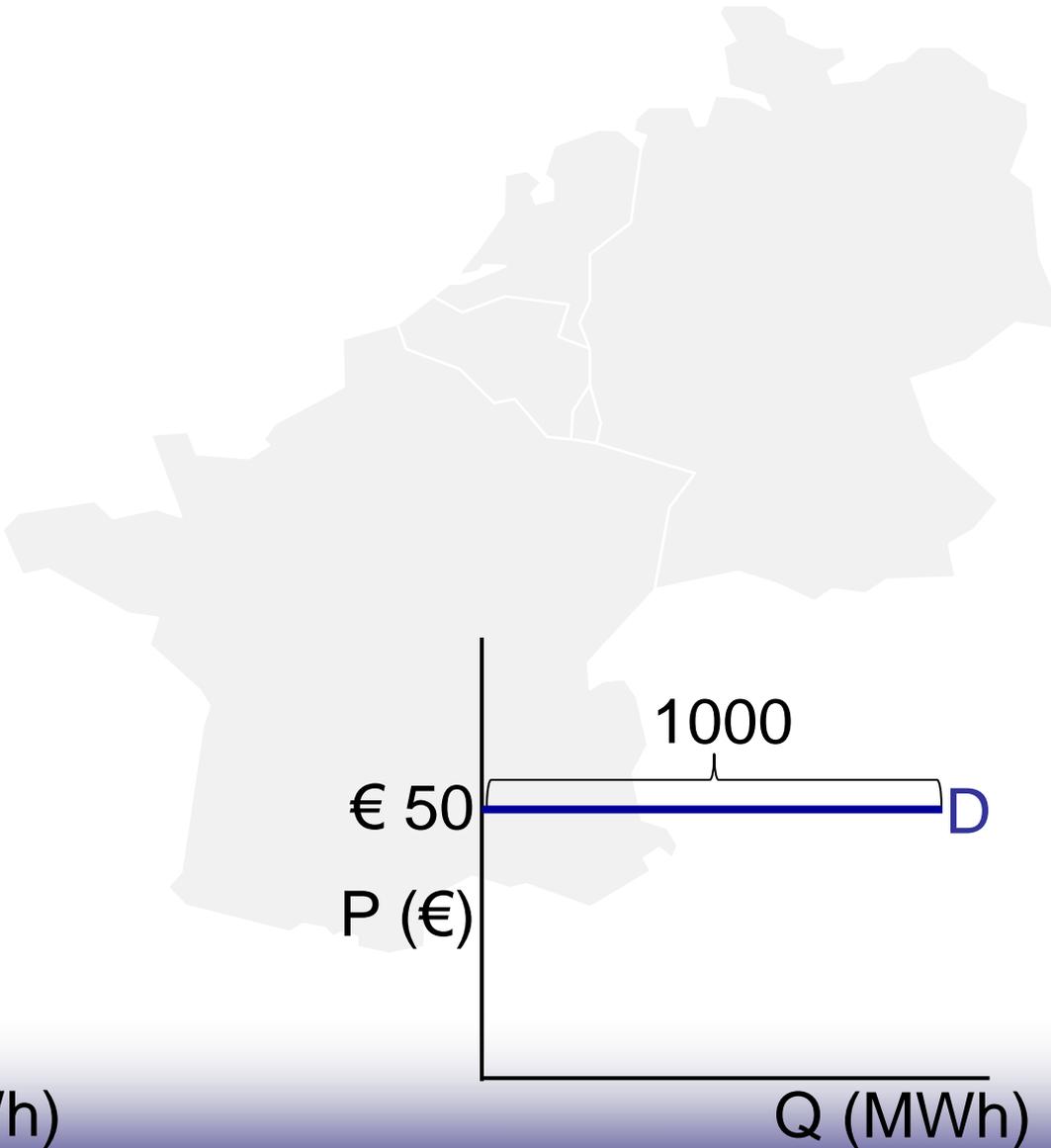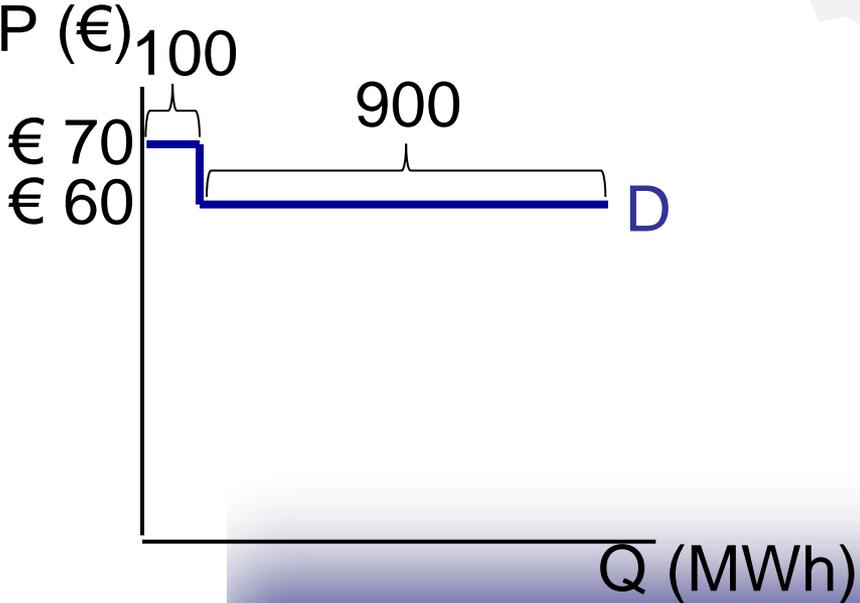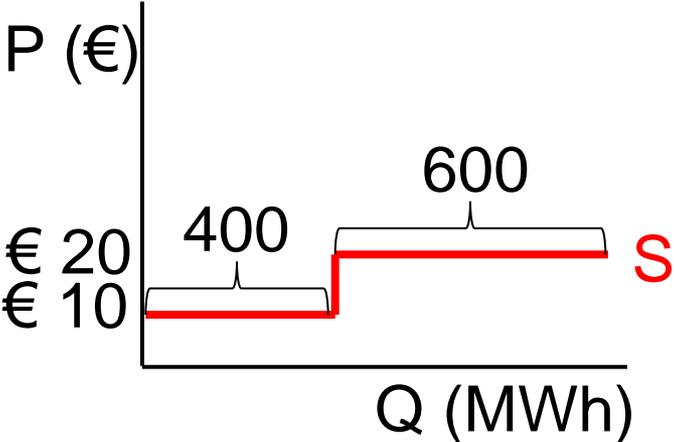
B ———— 300 ———— C
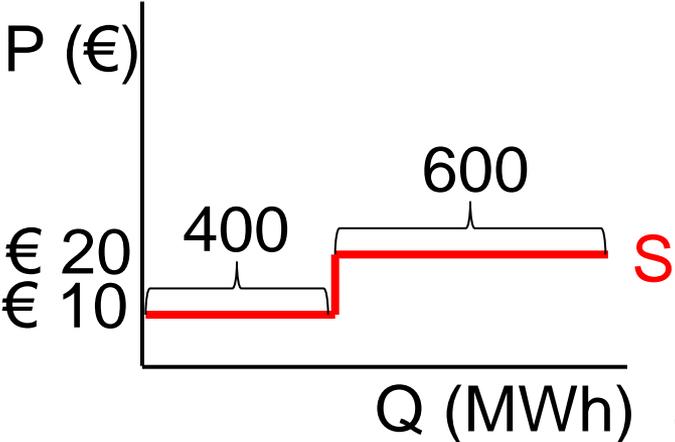
Buyers in market B and C compete for the cheap power from A. Buyers in B win, because they bid higher.

=> 300 MWh will be scheduled from A to B

P (€)
100

900

€ 70
€ 60 ——————————— D

Q (MWh)

1000

€ 50 ——————————— D

P (€)

Q (MWh)

Example (ATC)

Export 300

P (€)

€ 20
€ 10
400
600
S

Q (MWh)

Welfare = € 16,000

A

100
(100)

200
(200)

B

200
(300)

C

P (€) 100
€ 70
€ 60
900
D

Import 300

Q (MWh)

€ 50
1000
D

P (€)

Q (MWh)
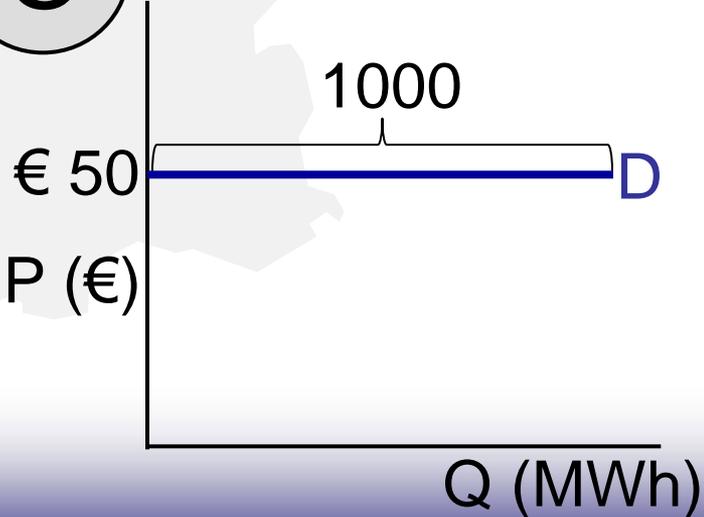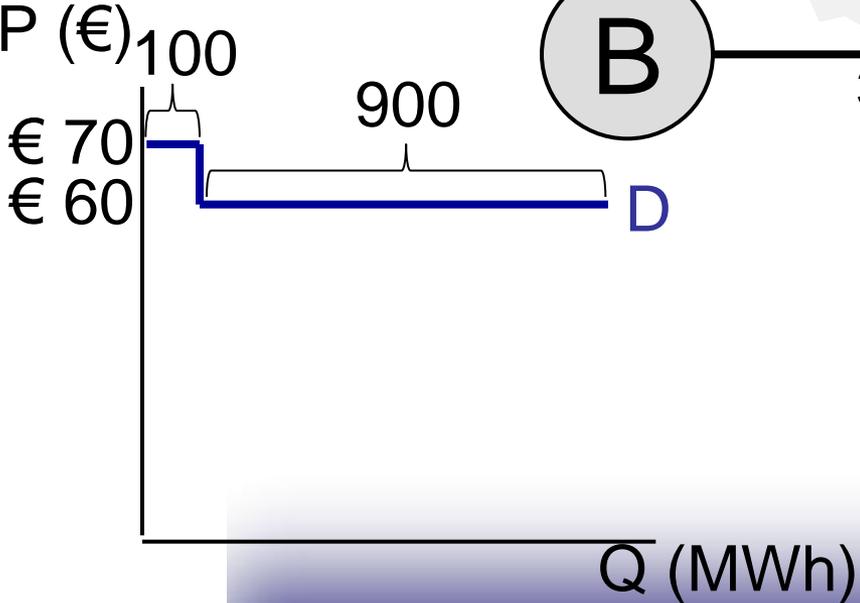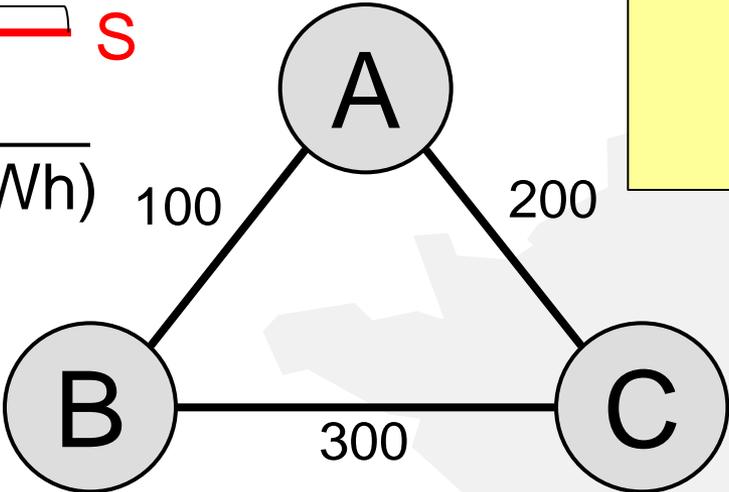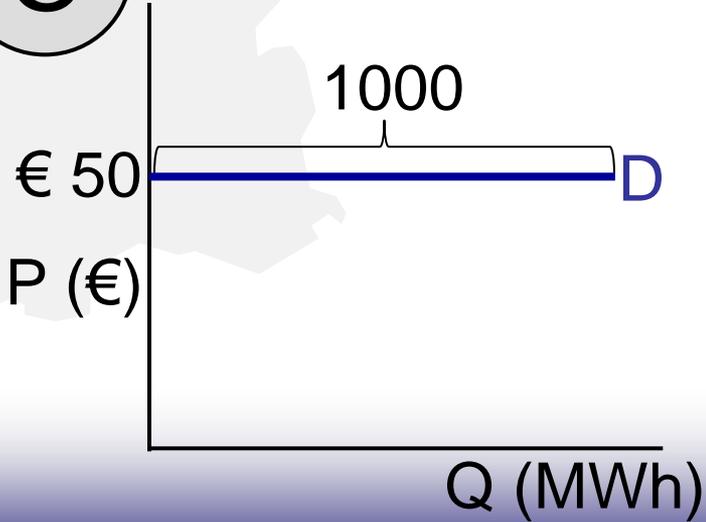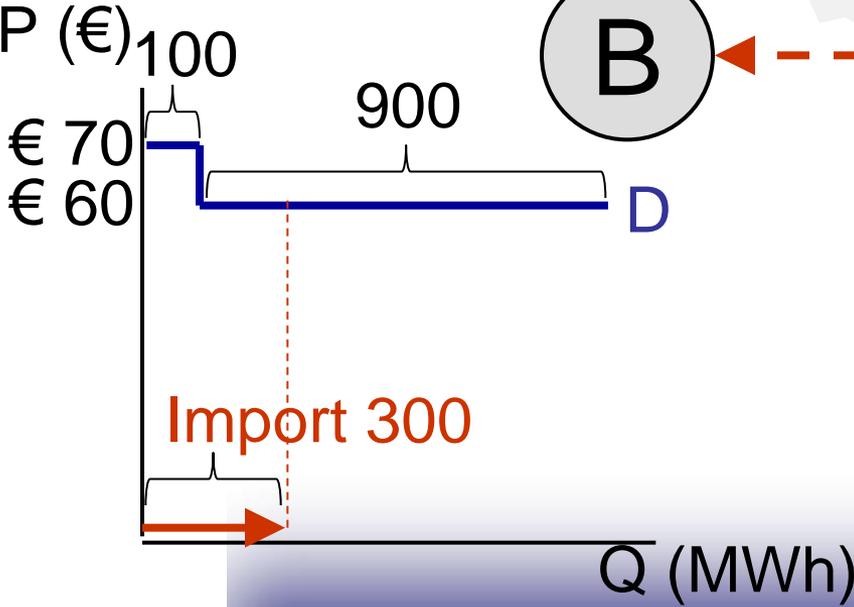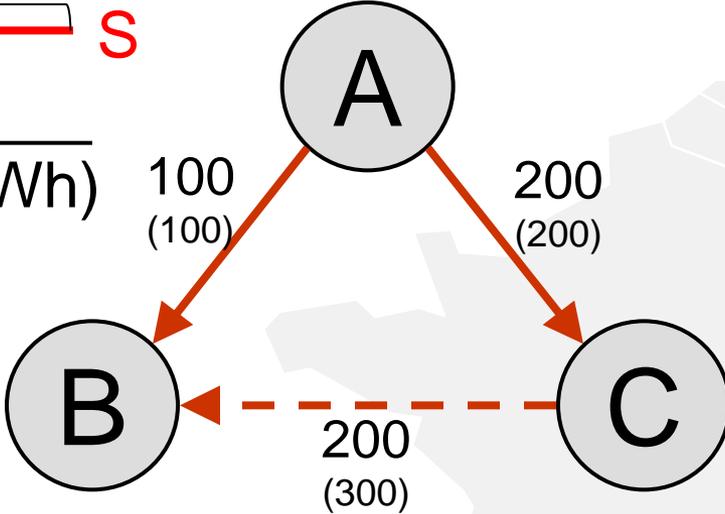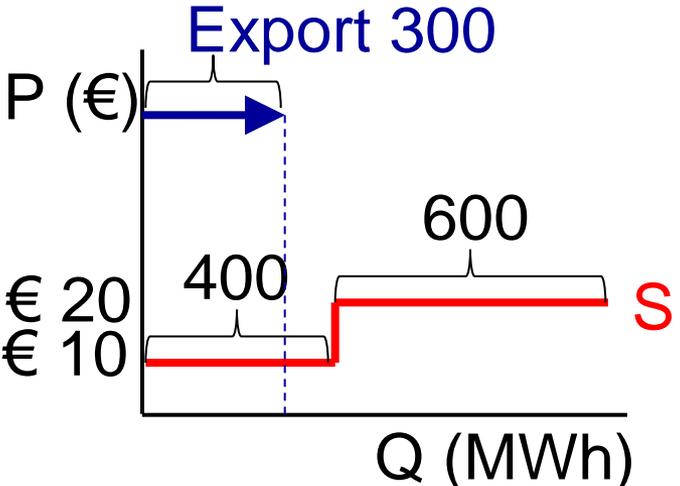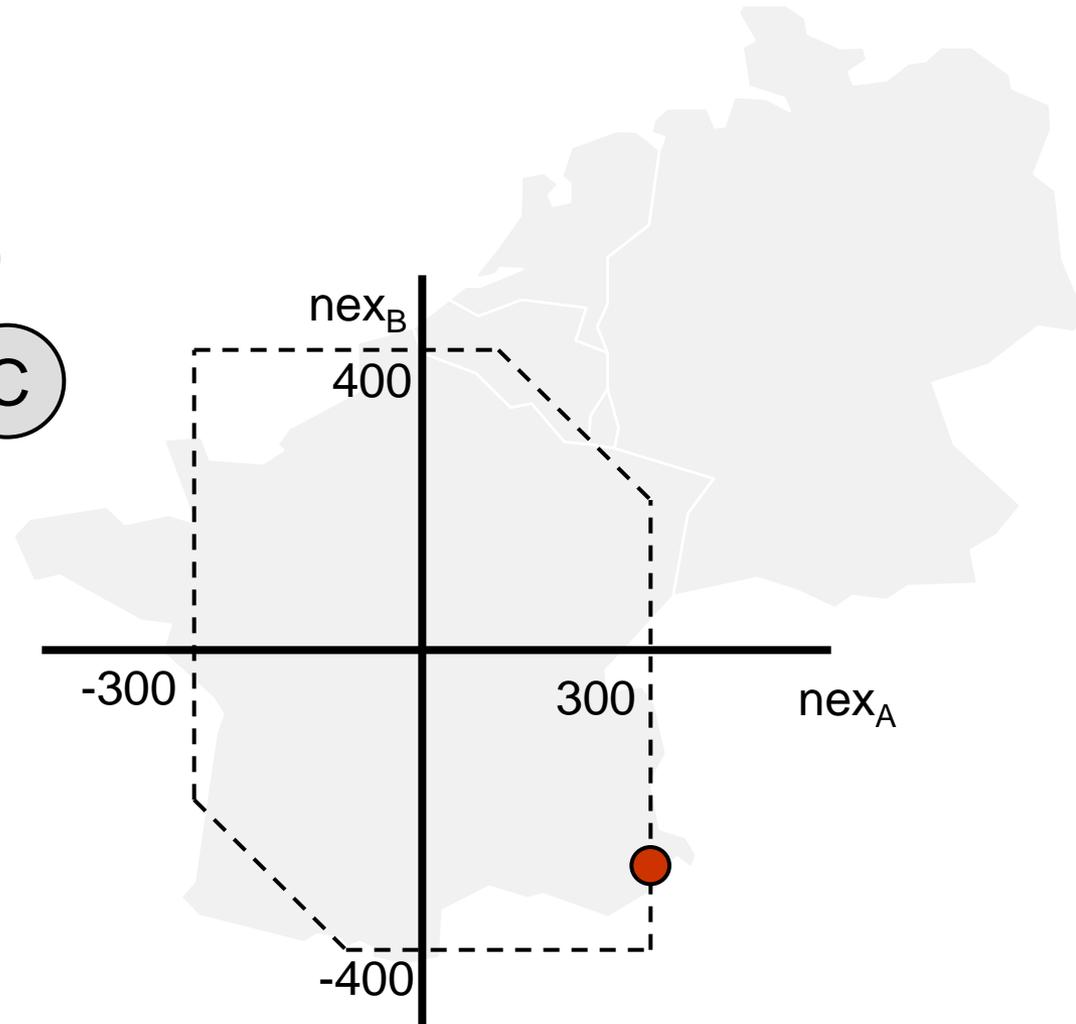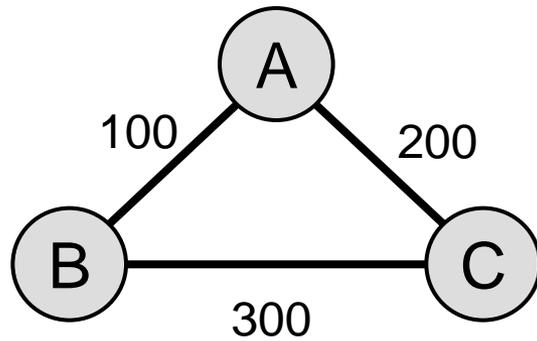
Example (FB)
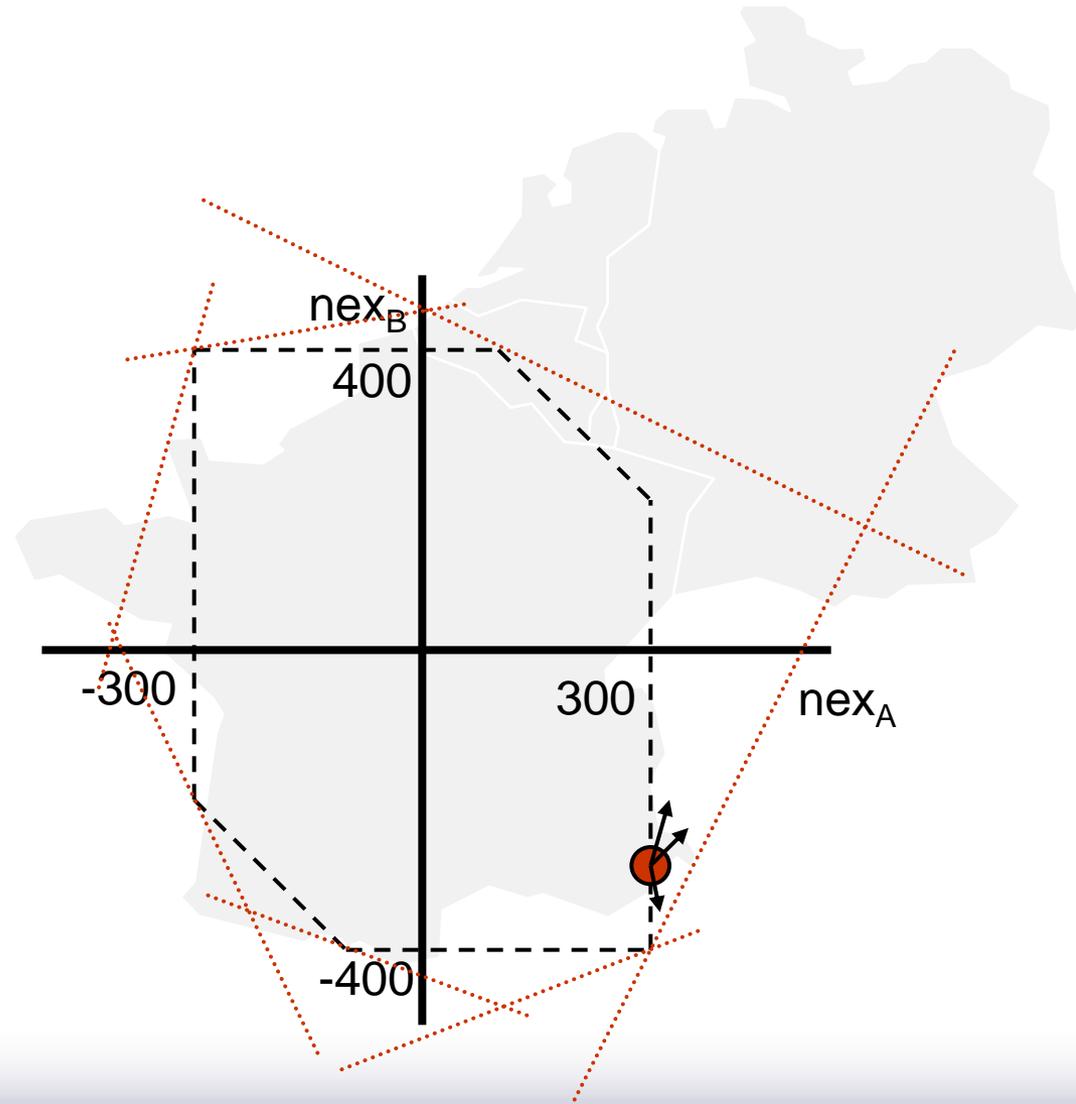
Example (FB)

Example (FB)

$$0.0 \ NEX_A - 0.75 \ NEX_B + -0.5 \ NEX_C \leq 250$$

- ▶ Exchanging 1 MW between A and B uses 0.75 MW
  $\Rightarrow$ Each MW of capacity allows A-B to exchange $^1/_{0.75} = 1.333$ MW
- ▶ Exchanging 1MW between A and C costs 0.5 MW
  $\Rightarrow$ Each MW of capacity allows A-C to exchange $^1/_{0.5} = 2$ MW

Example (FB)

P (€)

(A)

600

400

€ 20
€ 10   S

Q (MWh)
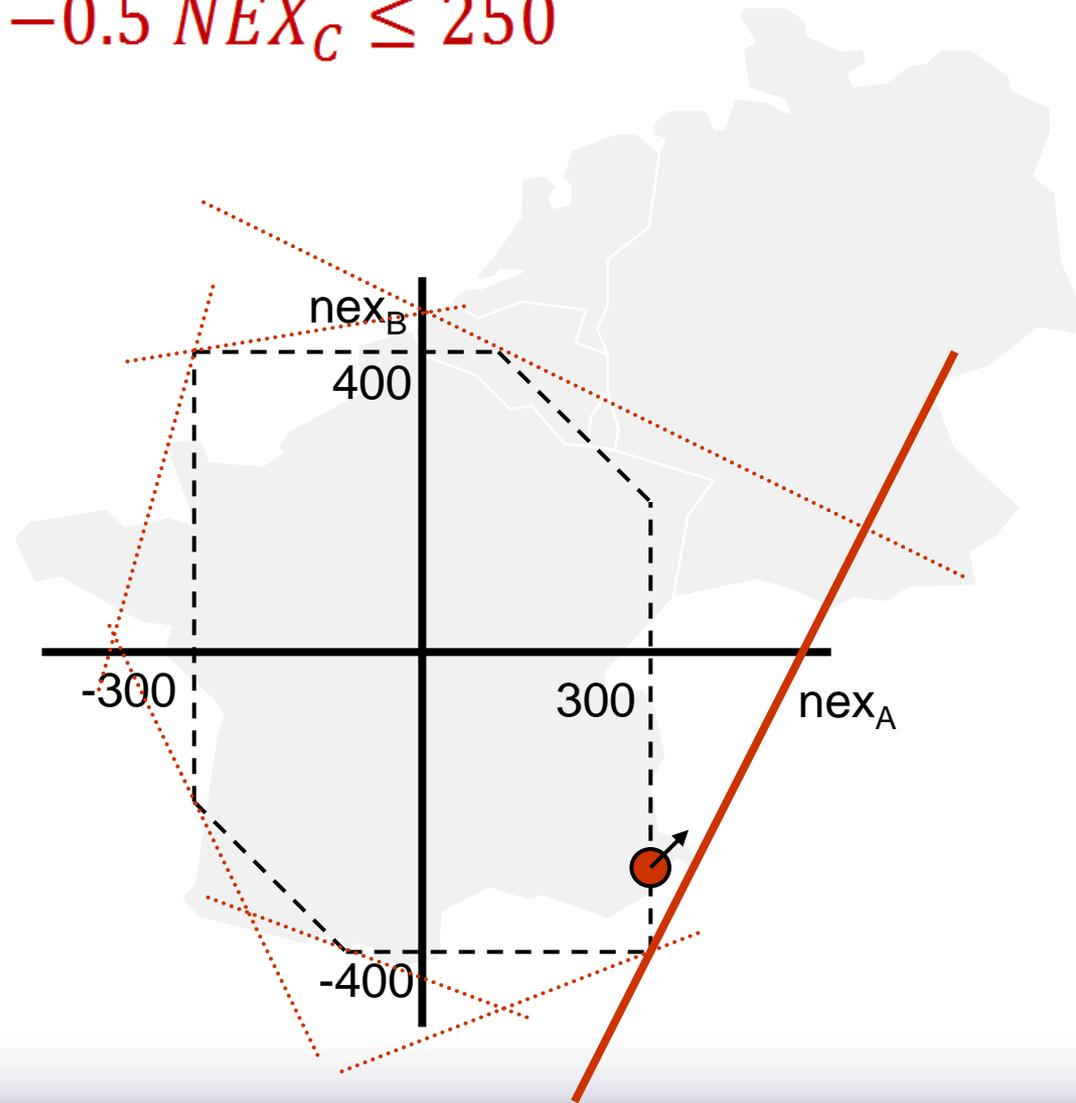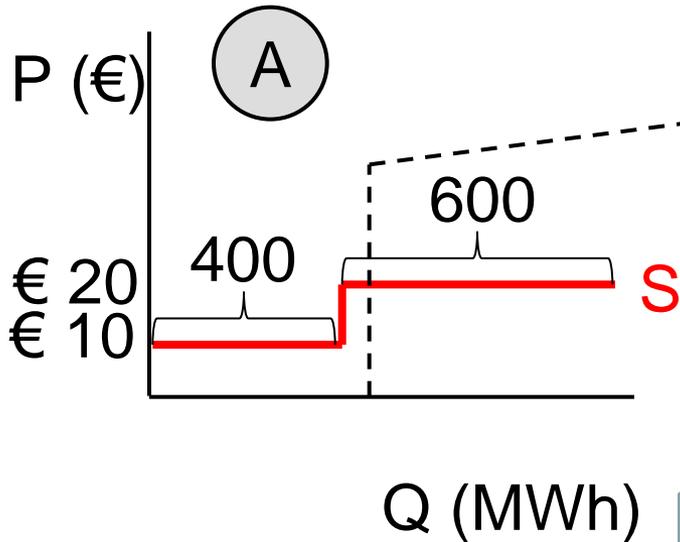
Because of FB, market A can now export > 400MWh ⟹ **mcp$_A$ = € 20**

Because of FB, market C can now import ⟹ **mcp$_C$ = € 50**
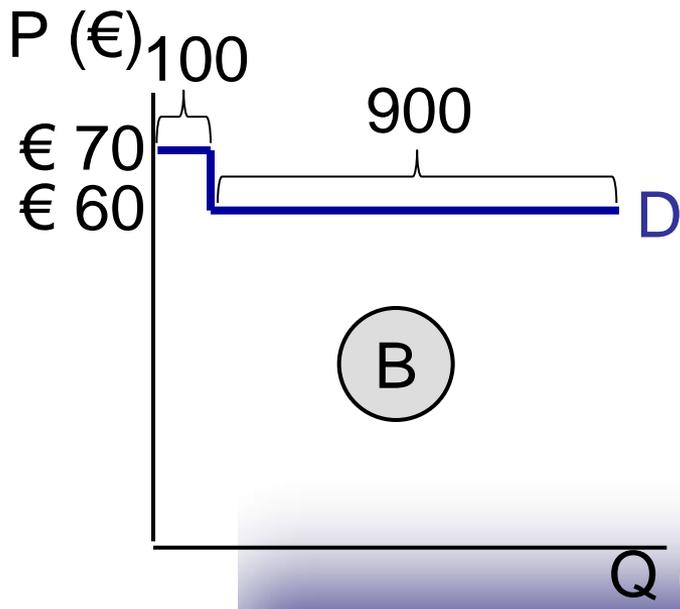
Market B has orders at € 70 and € 60

P (€) 100

900

€ 70
€ 60   D

(B)

€ 50   D

1000

P (€)

(C)

Q (MWh)

Q (MWh)
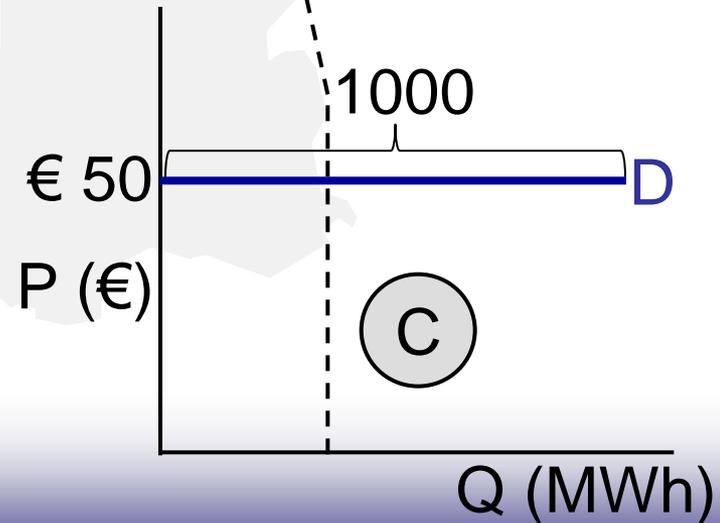
Example (FB)

▸ Each MW of capacity allows A-C to exchange $\frac{1}{0.5} = 2\text{MW}$

   ⟹ Welfare generated (€50-€20)*2 = € 60

▸ Each MW of capacity allows A-B to exchange $\frac{1}{0.75} = 1.333\text{MW}$

▸ Welfare generated:

   ▸ @70⟹ (€70-€20)*1.333=€66.67 >€60

   ▸ @60⟹ (€60-€20)*1.333=€53.33 <€60

The buy order @70 in B is able to outbid the buy order @50 in C, but the order @60 is not. This is because the orders in C have a more favourable flow factor.

Example (FB)

Export 450

P (€)

600

400

€ 20
€ 10 .... S

Q (MWh)
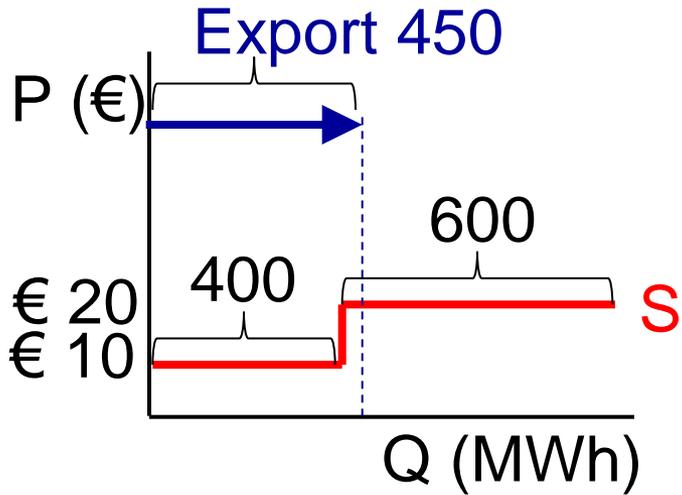
Welfare = € 19,500

vs ATC:

Welfare = € 16,000

(A)

100

350

(B)

(C)

P (€) 100

900

€ 70
€ 60 .... D

€ 50 .... D

1000

P (€)

Import 100

Import 350

Q (MWh)

Q (MWh)
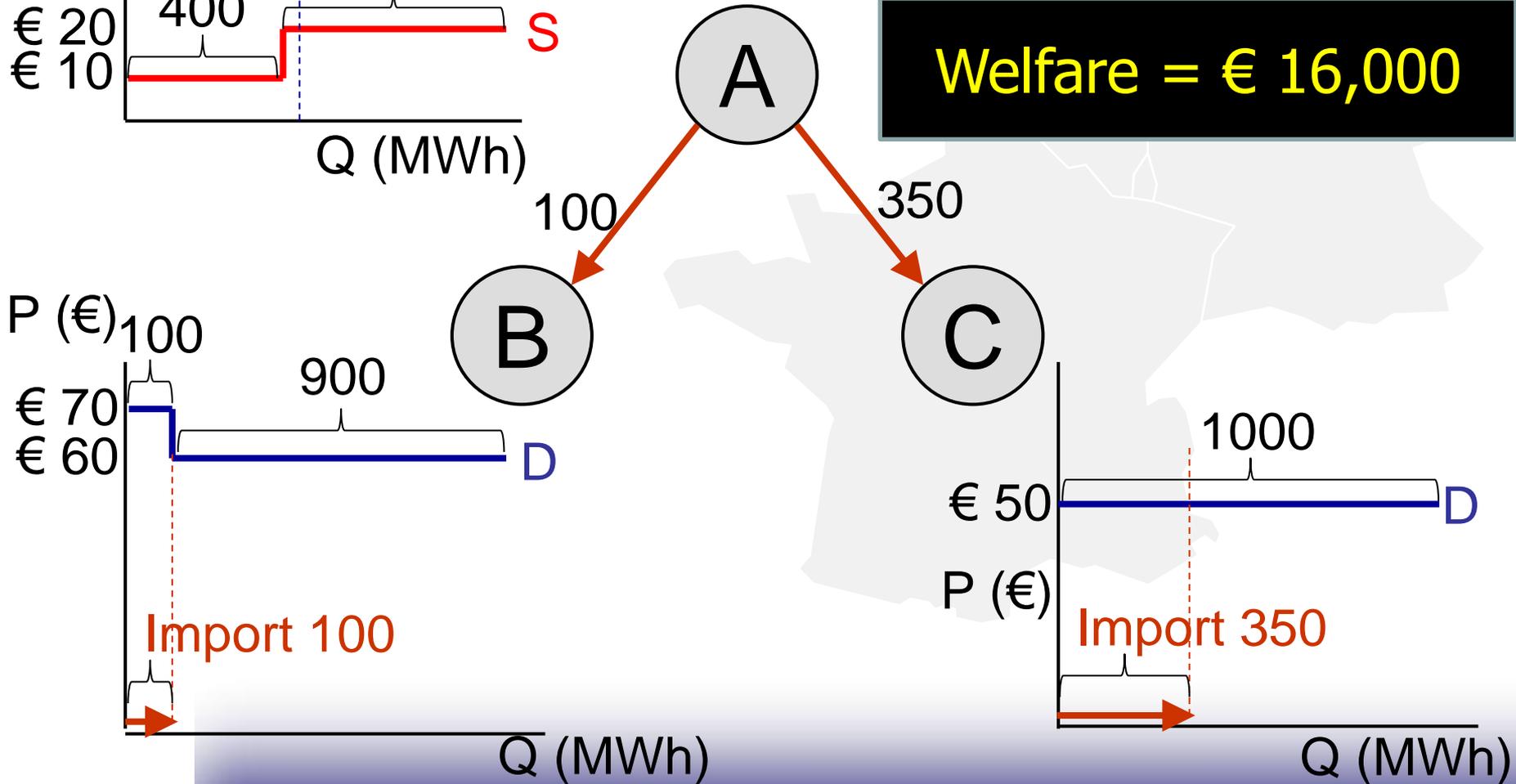
FB vs ATC solution - example

▶ Solution provides better welfare

▶ It is worth to notice that, in FBMC, because of the PTDF, a more competitive buy order in market B was outbid by a less competitive buy order from C.

Intuitivity

- In our examples it was always the case the cheap markets export and expensive markets import;

- Under FB this seemingly trivial property does not necessarily hold: at times results show cheap markets import (and become even cheaper), whereas expensive markets export (and become even more expensive). We consider these case non-intuitive;

- It is possible to suppress this situation: flow based intuitive (FBI) enforces that the cheap market will always export, the expensive market will always import;
  - Since this implies an additional constraint it will be at the expense of DAMW*

*i.e. day-ahead welfare, not taking into account other transactions (futures, OTCs…).

Some thoughts

- FB provides more welfare than ATC.
- Under FB orders in different markets compete via "flow factors" for scarce capacity.
- However, the flows can be in the "wrong direction".
- FBI: force intuitive solutions at the cost of welfare.
- In terms of objective function (DAMW), they rank:
    - Infinite capacity
    - FB
    - FB intuitive
    - ATC
    - Isolated markets
- Both FB and FBI apply ex-post capacity split, which is their main advantage over ATC.

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**

- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)

- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
  - Question and answer (15 min)

Lunch break (85 min)
  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)

- **Conclusions (Bert den Ouden and Jean Verseille)**

Flow-Based

Flow-Based market impact analysis
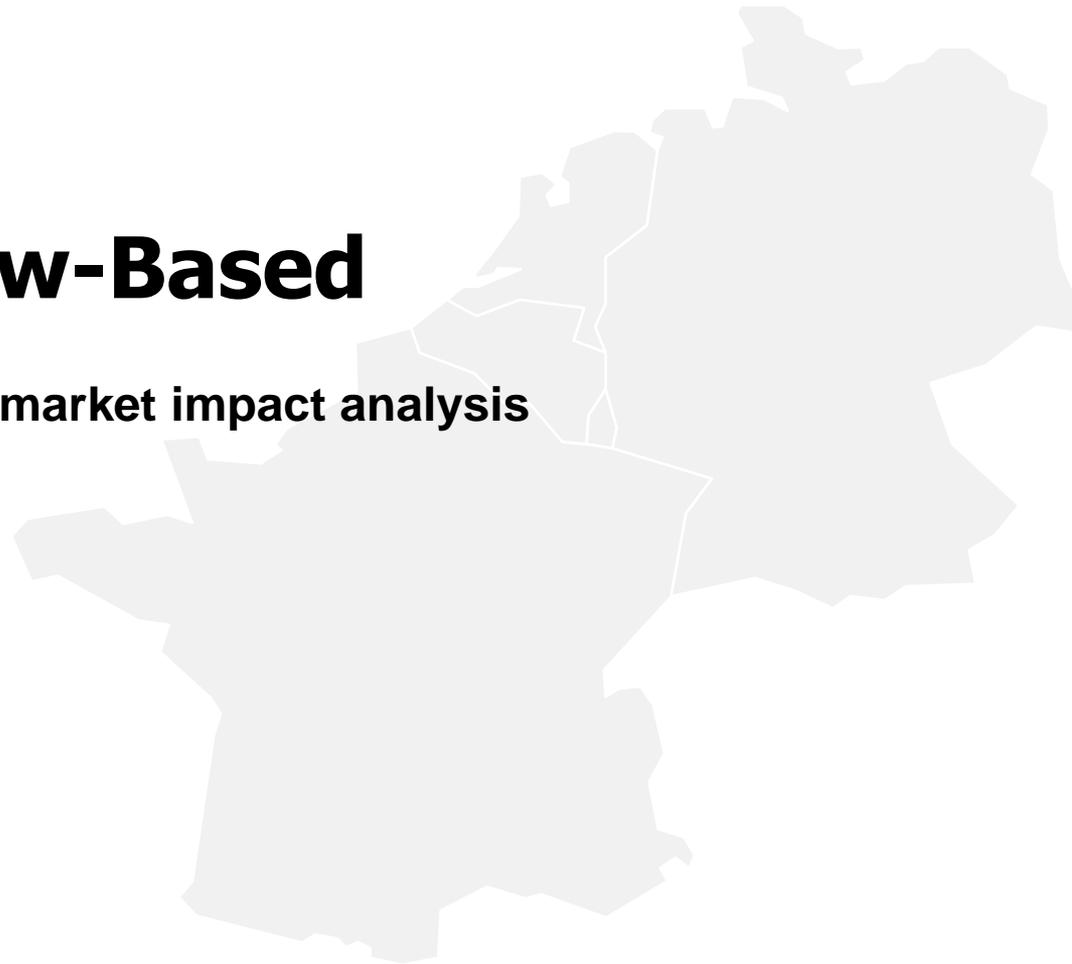
Market impact - **Content**

- Presentation of FB market coupling simulations
- Results:
  - General analysis
  - Clearing volumes
  - Social welfare
  - Price convergence and divergence
  - Focus on intuitiveness
- Conclusions

Market Impact - **Orientation**

- Objective: assess the impact of FB capacity calculation on markets

- Means: simulation of market clearing with FB constraints
  - On 2 times 2 weeks:
    - From 22-11-2010 to 05-12-2010
    - From 04-01-2011 to 17-01-2011
  - $\Rightarrow$ *No possible extrapolation to 1 year.*

- Results: evolution of indicators (welfare…) between historical **ATC Market Coupling (ATCMC)** and:
  - **Flow-Based MC (FBMC)**,
  - **Flow-Based Intuitive MC (FBIMC)**, enforcing intuitiveness
  - **Infinite MC,** i.e. 'copper plate': no capacity constraints thus identical price in every area.

Market Impact – General analysis

▶ Different market conditions over the weeks:

Heavily congested — Mildly congested — Lightly congested

Belgium daily baseload price during parallel run
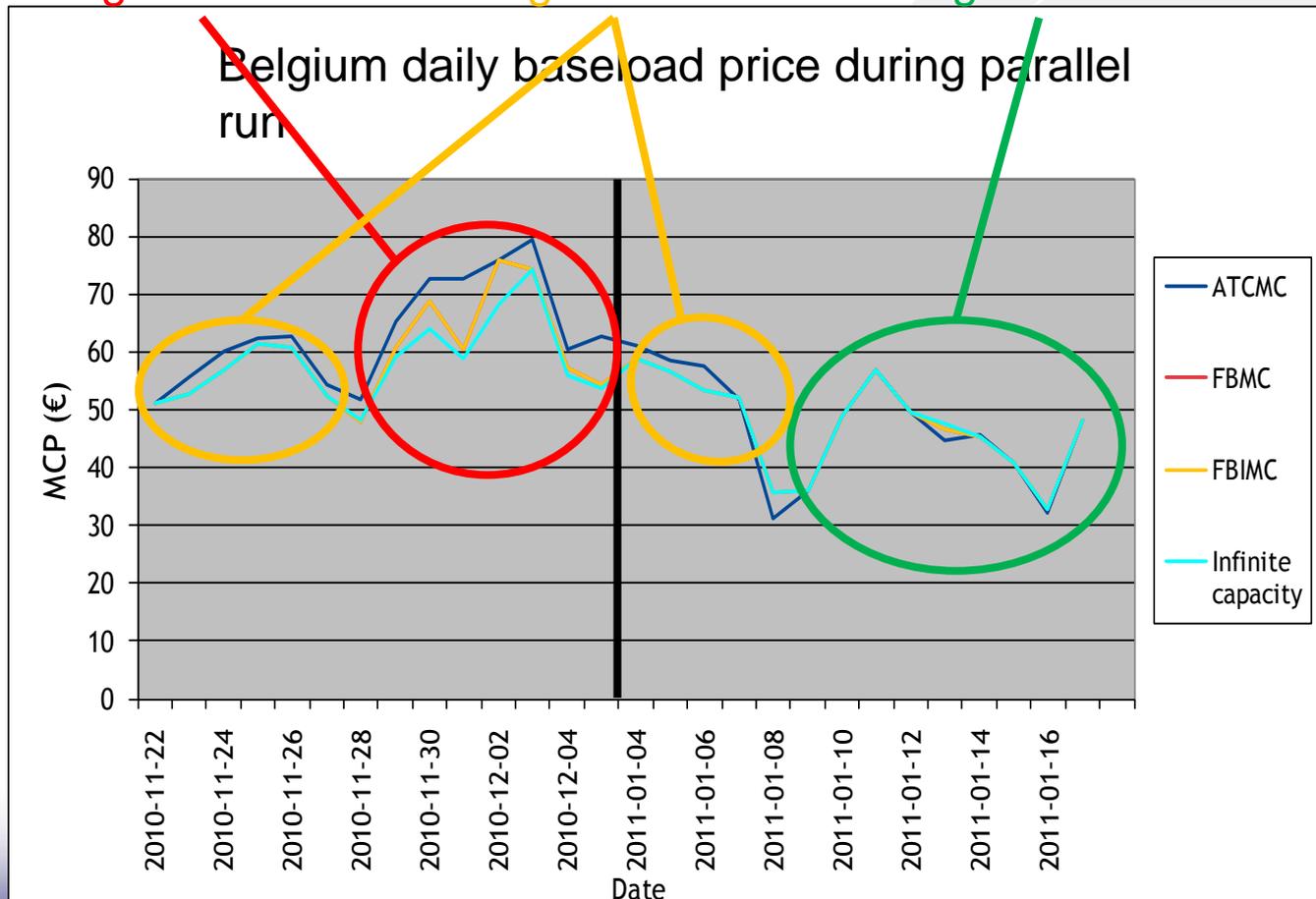
*Other baseload price curves show similar behaviour and are given in the FB feasibility report

90

Market Impact – **Clearing volumes**

- Clearing volume (`dem+sup`) is the sum of the volume of accepted bids in MWh over the simulation period.
    - Demand (`dem'`) clearing volume is the partial sum over accepted demand orders.
    - Supply (`sup) clearing volume is the partial sum over accepted supply orders.

- Clearing volume indicator: difference of clearing volumes in FBMC, FBIMC, Infinite MC with volumes in ATCMC.

- *Note: Market Clearing Volume (MCV) is usually defined differently as the sum over hours of the maximum of the demand and supply volumes.*

Market Impact – Clearing volumes

ΔMCV (FBMC - ATCMC)

Increase of exports from Germany to France (~650 MW on average).
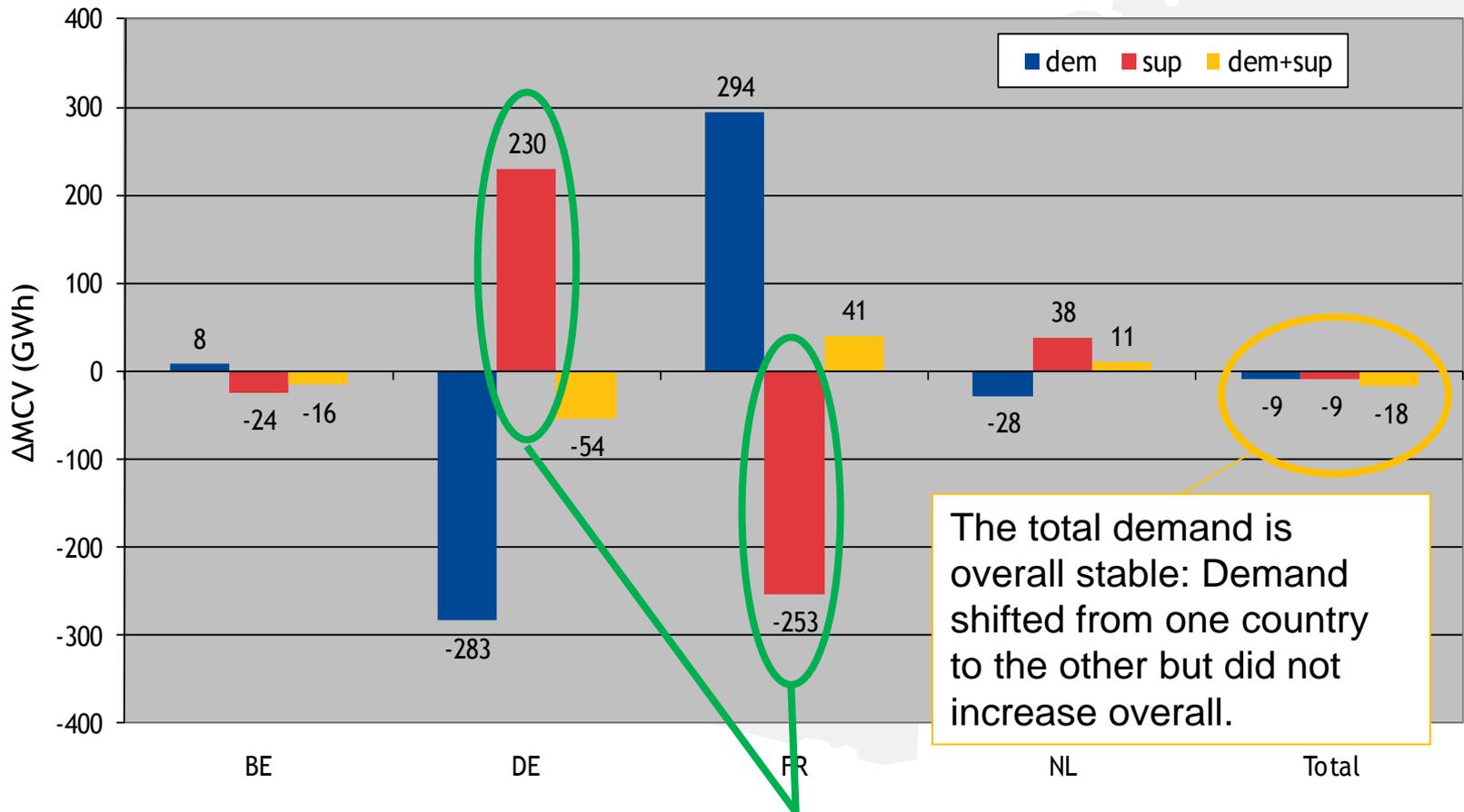
The total demand is overall stable: Demand shifted from one country to the other but did not increase overall.

Market Impact – Social Welfare

▶ **Social welfare is:**
   ▶ + what accepted buyers were ready to pay
      - what accepted sellers were ready to be paid.
   ▶ (Equivalently) the buyer surplus + the seller surplus + the congestion rent.
      ▶ **Buyer surplus**: what accepted buyers were ready to pay minus what they paid.
      ▶ **Consumer surplus**: what accepted sellers received minus what they were ready to be paid.
      ▶ **Congestion rent**: what accepted buyers paid minus what accepted sellers received.

▶ High social welfare ⇔ high efficiency.

Market Impact – Social Welfare

Spot Market Area A

Price

Coupled area price difference

Export volume

Import volume

Quantity

Spot Market Area B
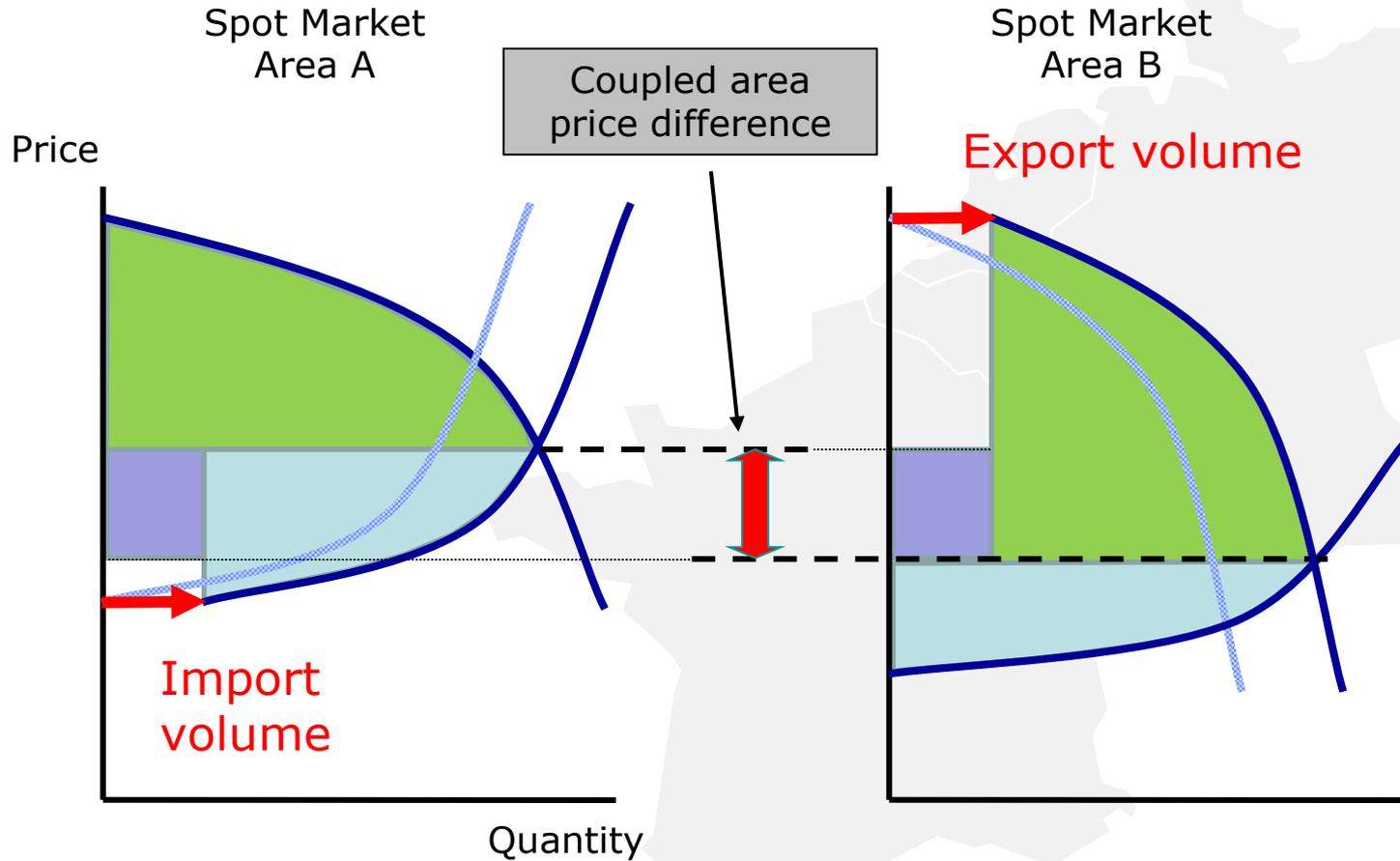
| Supplier surplus | Buyer surplus | Congestion rent (x2*) |

* Each purple square represent the full congestion rent

Market Impact – Social Welfare

- Social welfare indicator: difference between welfare in a scenario (FBMC, FBIMC, Infinite MC) compared to ATC MC.

  - Why? As absolute social welfare figures are difficult to analyse because of price taking orders.
  - Theoretically, as the capacity domain is successively reduced:

    W(Infinite MC) $\geq$ W(FBMC) $\geq$ W(FBIMC) $\geq$ W(ATCMC)

    $\Rightarrow$ The difference with ATCMC will be positive.

- *Note: Day-Ahead price impacts other markets (futures). Social welfare figures are computed on the Day-Ahead Market only and thus sometimes called DAMW (Day-Ahead Market Welfare).*

Market Impact – Social Welfare per actor class

Daily average welfare difference (relative to ATC)

Buyer/supplier variations linked to DE to FR exchange increase

Legend:
- FBMC-ATCMC (red)
- FBIMC - ATCMC (yellow)
- Infinite-ATCMC (light blue)

Y-axis: Difference (x € 1000)

Values:
- **buyer surplus**: -374, -350, -372
- **supplier surplus**: 943, 907, 1039
- **congestion rent**: -395, -387, -477
- **Total** (= buyer surplus + supplier surplus + congestion rent): 174, 170, 190
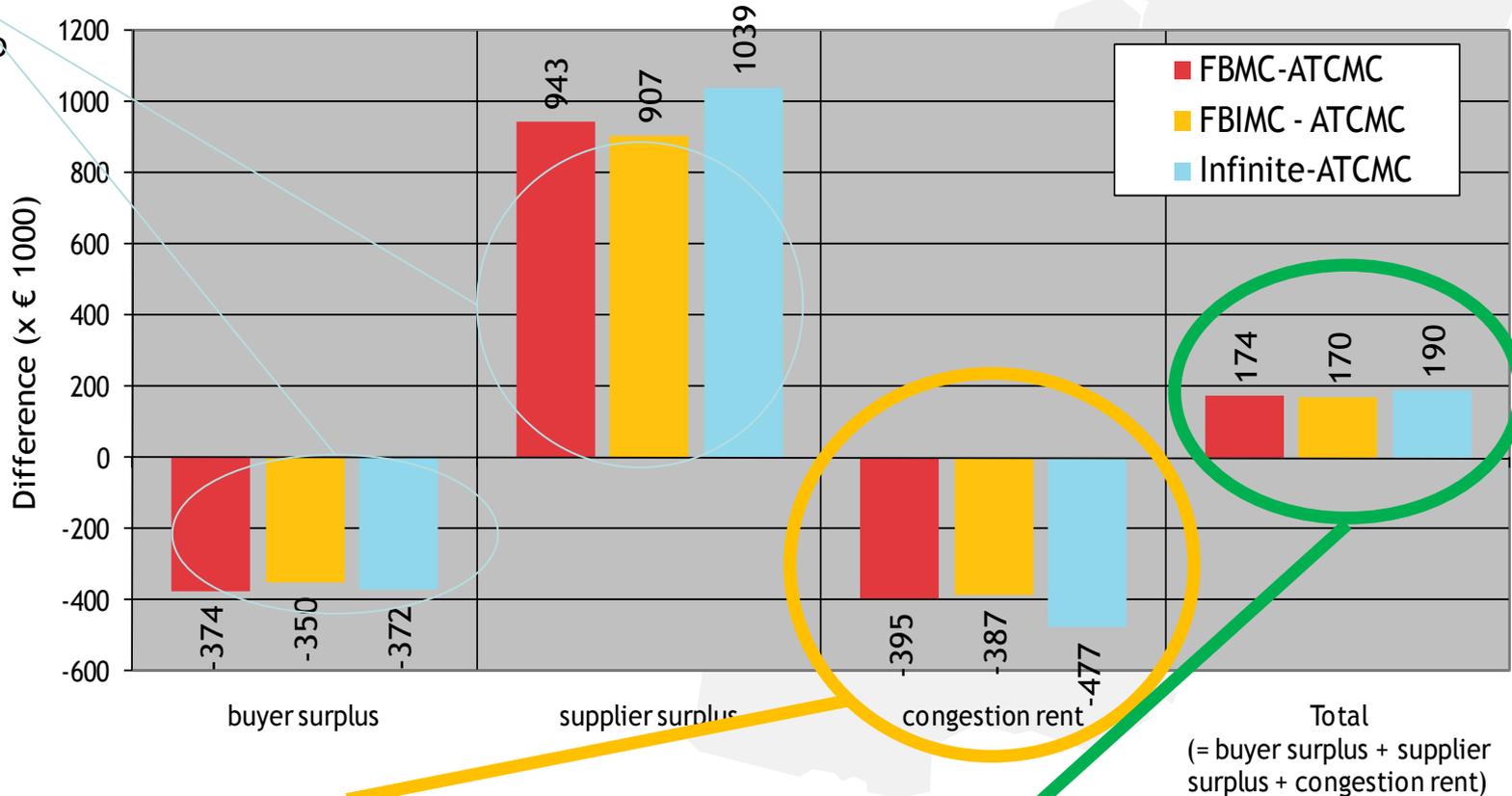
FB ⇔ More than 81% decrease of congestion rent

FB ⇔ More than 89% of possible welfare increase
Loss linked to enforcing intuitiveness in FBIMC is small (less than 2% of the increase).

Logos: amprion, apx endex, BELPEX (Part of APX-ENDEX), creos, elia (Powering a world in progress), EnBW, EPEXSPOT (EUROPEAN POWER EXCHANGE), Rte (Réseau de transport d'électricité), TenneT (Taking power further)

Market Impact – Social Welfare per country

Daily average welfare difference (relative to ATC)

Legend:
- FBMC-ATCMC
- FBIMC - ATCMC
- Infinite - ATCMC

Y-axis: Difference (x € 1000)

	surplus BE	surplus DE	surplus FR	surplus NL	CR
FBMC-ATCMC	46	195	278	50	-395
FBIMC - ATCMC	47	188	273	49	-387
Infinite - ATCMC	63	216	328	60	-477

All surplus difference are positive: overall, all countries benefit from the social welfare increase.

amprion
apx endex
BELPEX
Part of APX-ENDEX
creos
elia
Powering a world in progress
EnBW
EPEXSPOT
EUROPEAN POWER EXCHANGE
Rte
Réseau de transport d'électricité
TenneT
Taking power further

Market Impact – Convergence and divergence

- Convergence is the frequency of situations with:
  - the same price in all bidding areas (**full convergence** or `copper plate'`).
  - at least 2 bidding areas with the same price (**partial convergence**).
  - all bidding areas having different prices (**full divergence**).

- Divergence indicator:
  - Distribution of the difference between the highest price and the lowest price hour per hour (or, equivalently, the maximum price difference between 2 areas).
  - Noted `Pmax-Pmin'`.

Market Impact – Price convergence

Copper plate occurrence increase:
⇒ *Congestion rent decrease.*

+40 %

In FBMC, partial convergence in congested situations disappears.
Example: no congested situation with the same price in BE and FR and in DE and NL.
See next slide for analysis.

(convergence ⇔ price difference below 0.002 €/MWh)
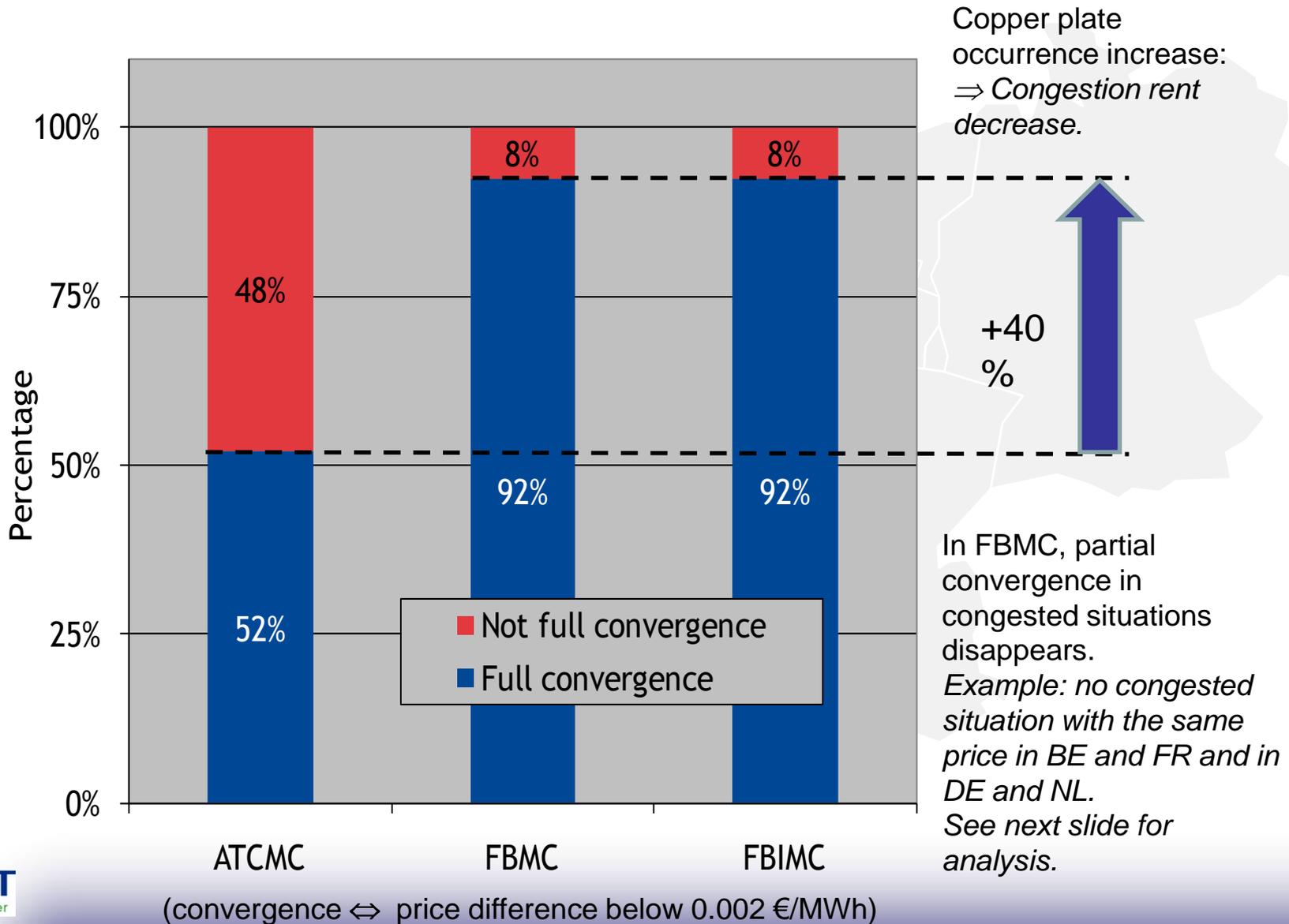
Market Impact – **Price divergence**

Even in congested situations, divergence is on average lower in FB than in ATC despite partial convergence loss.

Divergence is reduced for most situations, thus the congestion rent decreases.

Legend: ATCMC, FBIMC, FBMC

Y-axis: Pmax - Pmin

X-axis: Number of hours
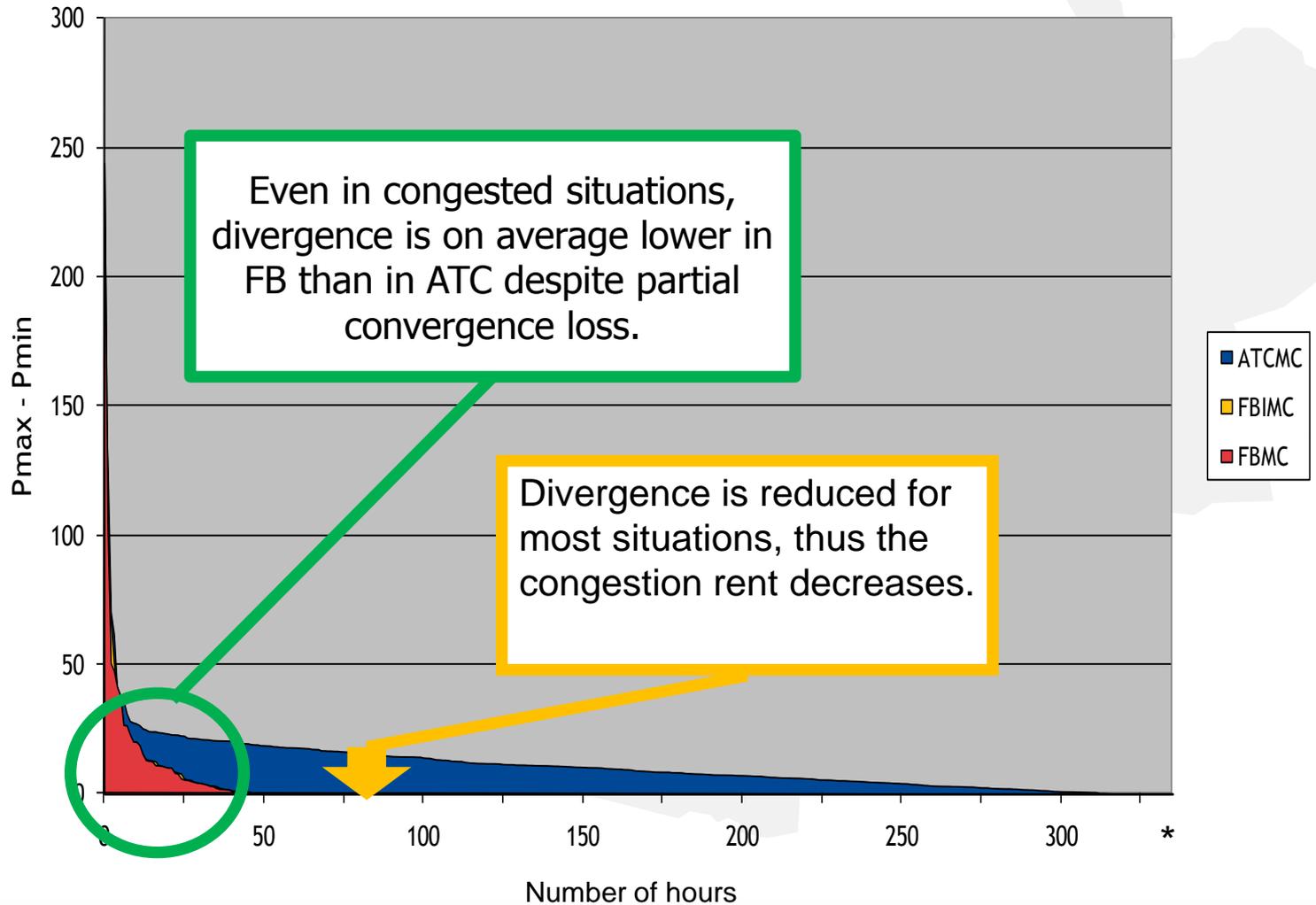
*Price divergence is 0 for the remaining hours.

Market Impact – **Intuitiveness**

- 2.3% of all situations (16h) were non-intuitive with FBMC, representing 31% of congested situations.

- As expected, none were non-intuitive with FBIMC.

- `Cost' of enforcing FBIMC is reasonably low:
  - No degradation of full convergence between FBMC and FBIMC has been observed (Theoretically expected).
  - The welfare decrease is small.
  - The divergence increase is limited.

$\Rightarrow$ Assessment of advantages of each coupling variant is ongoing. A proposition to regulators will be made before the end of 2011. In any case, both have been implemented.

Market Impact – **Conclusion**

- On a limited simulation period, FBMC and FBIMC have a positive impact on the market compared to ATCMC.

- Non intuitive situations were found in FBMC. Using FBIMC removes these situations without unacceptable deterioration of the other indicators.

- Next steps:
    - More simulations are required to confirm current conclusions on a longer period of comparison **(Up to go live).**
    - To propose a configuration of the coupling method (intuitiveness…) **(Before end 2011).**

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**
- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)
- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
  - Question and answer (15 min)

Lunch break (85 min)

  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)
- **Conclusions (Bert den Ouden and Jean Verseille)**

Any questions?

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**

- **ATC Market coupling**

  – Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)

- **Flow-Based**

  – Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)

  – Question and answer (15 min)

Lunch break (85 min)

  – Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)

  – Flow-Based market impact analysis (25 min) (Nicolas Omont)

  – Question and answer session (15 min)

  – Flow-Based timing and processes (15 min) (Raphaël Bourgeois)

  – Flow-Based interaction with other projects (10 min) (Marcus Rohleder)

  – Flow-Based implementation planning (10 min) (Michael Pool)

  – Question and answer session (15 min)

- **Conclusions (Bert den Ouden and Jean Verseille)**

Flow-Based

Flow-Based timing and processes

Timing

▶ The objective is to keep the current timings unchanged.

⟹ CWE interconnectors FB constraints publication at 10:30

▶ Current timing (normal day):

Description	Time
ATC publication (CWE interconnectors)	10:30
ATC publication (DK1, DK2, Baltic cable)	10:30
Gate Closure Time	12:00
CWE Market Results publication	around 12:55
Publication of cross-border exchanges, capacity value	around 13:00
Publication of CBF (DK1, DK2, Baltic cable) and price deviation (DE-DK)	around 13:05

Handling FB data: indicators

- NTC/ATC and FB can/will show different values for the maximum bilateral exchanges that are feasible
- FB
    - Maximum bilateral exchanges feasible in the FB domain are <u>non-simultaneous</u> values
- NTC/ATC
    - NTCs/ATCs are by definition <u>simultaneous</u> values that limit the bilateral exchanges
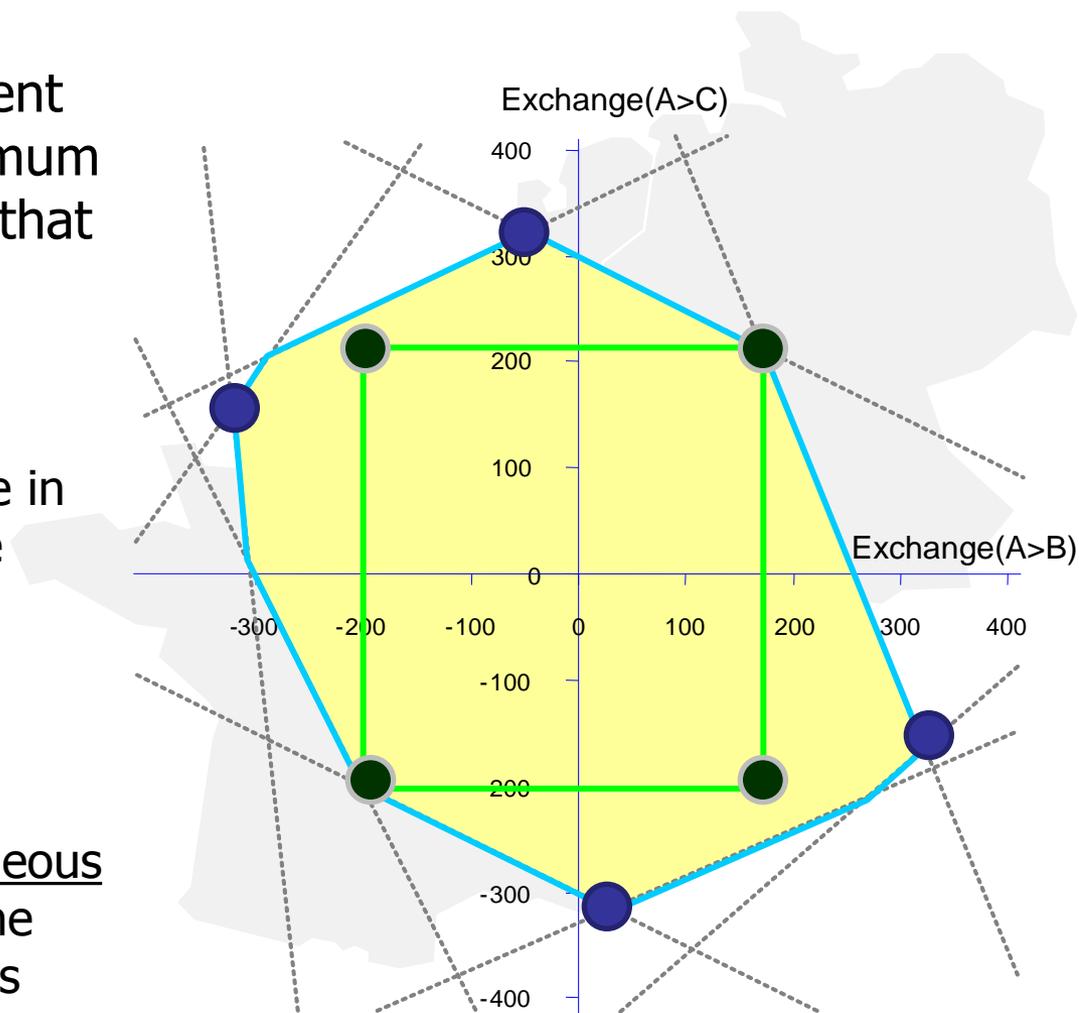
constraints polyhedron   security domain
NTC/ATC   Flow-based

Handling FB data: the utility tool

- Public access to the anonymized historical FB constraints dataset, fed on a daily basis by TSOs (about 20 constraints per hour).

- To check if one given set of NEX is feasible over a period of time (typically 24h). Results would be a table with yes/no for each hour.
  - If "no", the highest overload would be given.
  - If "yes", the smallest remaining margin would be given.

- To display tables and plots of the min/max bilateral exchanges or net position over a given period of time with the possibility to superimpose 2 different weeks / months / years for comparison purpose.

- Utility tool will be available during external parallel run.

Handling FB data: prototype

Note: the prototype covers only one hour and does not allow historical Comparisons.

Handling FB data: prototype

2) Max volume *(information module)*

Here you can find the maximal trade volumes (MWh/h) which can be physically transported between two Hubs under the condition that no other trade is executed between other Hubs.

	direction -->	direction <--
DE=>BE	3444	2971
DE=>NL	4069	3769
DE=>FR	5027	6542
NL=>BE	3743	3149
NL=>FR	3566	5737
BE=>FR	2292	5383

	export	import
DE	7000	8179
BE	3630	6325
FR	9558	5447
NL	4368	6096

Maximum exchange from DE to BE assuming no other exchanges.
(Non simultaneous values!)

Maximum DE export *(other areas are importing to ensure the balance)*

amprion

apx endex

BELPEX
Part of APX-ENDEX

creos

elia
Powering a world in progress

EnBW

EPEXSPOT
EUROPEAN POWER EXCHANGE

Rte
Réseau de transport d'électricité

TenneT
Taking power further

Handling FB data: prototype

1) Check volume (interactive module)

Here you can check the simultaneous execution of trading volumes of the markets involved in the CWE Market Coupling

	Hub-to-Hub trade in MWh/h (please insert values)	Test 1: hub to hub inside FB space
DE=>BE	0	
DE=>NL	2464	
DE=>FR	4535	**Trades feasible**
NL=>BE	0	
NL=>FR	0	
BE=>FR	124	

	Hub Positions trade in MWh/h (please insert values)	Test 1: sum hub positions = 0	Test 2: hub positions inside FB space
DE	6999		
BE	125	**OK**	**Constrained Transmission System**
FR	-4660		
NL	-2464		

These exchanges are equivalent to these positions:
   DE: 6999
   BE: 124
   FR: -4659
   NL: -2464
They are feasible.

Add 1 MWh from BE to FR. This is not feasible anymore. Indeed, the flow on the CB is forecasted to be 399.1 MW*, higher than the max. allowed (399.07MW)

* - 0.0211 x 6999 - 0.0614 x 125 - 0.1005 x - 4660 - 0.0350 x -2464 = 399.1 MW

External parallel run

▶ After May 2012, simulation of FB market coupling will be published ex-post on a weekly basis.

  ▶ Goal: to provide the opportunity to market parties to gain a very good knowledge of FB before go-live thanks to a one year long parallel run.

  ▶ Based on:

    ▶ FB constraints produced in parallel to ATC.

    ▶ Real order books of the operational ATC market coupling.

  ▶ Published data:

    ▶ FB constraints.

    ▶ FB MC Net positions and clearing prices.

▶ The process will not be operational as prototypes will be used.

Conclusions

- No timing change expected.
- The utility tool will provide:
    - The detailed FB dataset for advanced simulations
    - Global indicators for quick analysis
    - Comparison with historical data for transparency

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**
- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)
- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
  - Question and answer (15 min)

Lunch break (85 min)

  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)
- **Conclusions (Bert den Ouden and Jean Verseille)**

Flow-Based

Flow-Based interaction with other projects

Compatibility

- CWE MC coupling is feasible with:
    - AC or DC cable connected areas
    - FB or ATC constraints
    - implicit or explicit allocation

- Coupling of CWE MC in FB with these regional initiatives is feasible:
    - North – West Europe (NWE)
    - Central East Europe (CEE)
    - France – UK – Ireland (FUI)
    - Central – South Europe (CSE)
    - South – West Europe (SWE)

- As a pan-European coupling solution adapted to all regional initiatives, PCR is in line with the requirements of FB MC

Principles of interaction

▶ In CWE FB MC two fundamental principles will be realized:

   ▶ Flow Based model will be used to calculate available capacities

   ▶ Market model: Implicit auctions to couple local markets

▶ Feasibility of interaction was subject to a study performed in the CWE FB project

▶ Compatibility with different allocation methods in adjacent regions is ensured:

   ▶ Studies outline that CWE FB MC is compatible with adjacent explicit auctions or with another region under implicit auctions

   ▶ In target solution of single European price coupling, the market algorithm is able to couple (so called) FB or ATC regions.

Market model and Capacity Calculation: Compatibility with ITVC

- Interim Tight Volume Coupling (ITVC) provides implicit allocation of available cross-border capacities between the CWE and the Nordic region

- The ITVC coupling process is based on the ATC capacity calculation method as currently applied in CWE and Nordic regions

- In order to handle FB constraints the ITVC system needs to be modified according to the agreed change control procedures

- Discussions with ITVC parties started already and different options will be evaluated further:
  - Implementation of FB method within ITVC
  - Submission of CWE ATC values consistent with (i.e. within) the CWE FB domain

- Price coupling solutions (PCR and NWE) between both regions will not have compatibility issues.

Capacity Calculation: FB in CWE and CEE

- Two FB models in testing phase:

  - CWE FB MC - Flow based method combined with implicit auction
  - CEE FB - Flow based method combined with explicit auction

- While the market model is different the underlying principle of capacity calculation is similar
- Standards for parameter are discussed and experience is exchanged in TSO inter regional ad-hoc group of flow based expert

- Independent of the market model the interaction and harmonization of capacity calculation models is under investigation

- Close cooperation and information exchange between the regions is interesting for future CWE FB and CEE FB harmonization

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**

- **ATC Market coupling**
  - Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)

- **Flow-Based**
  - Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)
  - Question and answer (15 min)

Lunch break (85 min)

  - Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)
  - Flow-Based market impact analysis (25 min) (Nicolas Omont)
  - Question and answer session (15 min)
  - Flow-Based timing and processes (15 min) (Raphaël Bourgeois)
  - Flow-Based interaction with other projects (10 min) (Marcus Rohleder)
  - Flow-Based implementation planning (10 min) (Michael Pool)
  - Question and answer session (15 min)

- **Conclusions (Bert den Ouden and Jean Verseille)**

Flow-Based

Flow-Based implementation planning

FB Planning in detail

FB Preparation | **FB implementation**

2011									2012												2013					
Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 12	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 13	Feb	Mar	Apr	May	Jun

FB "TSO only"

Experimentation performed by key users — Transfer from experts to operators — Experimentation performed by operators (all the days)

Common System Operators Training

Functional Common System requirements

IT Common Systems requirements — Quotation — IT Development of Common System

FRM assessment / model quality study

TSO sub integration/ sub simulation tests Common System

Provider selection

TSOs + PXs tests

Interface validation — Development of Utility or Market

Pre tests — Full integration/Full Simulation

Member testing

lel run TSOs + PXs

// experimentation extension period — Internal // Run

External // Run

(publish FB data & results of FB MC simulation using orderbooks from ATC MC => no MP extra bidding needed)

Stakeholders acceptance

▲ FB Feasibility report publication
CWE Steering Committee

▲ FRM assessment report / model quality study

▲ SC approval on final report

Go for Quotation (from three pre-selected providers)

Key decisional Milestones:
- TSOs feasibility report, Price/Market Analysis with more data, regulatory recommendation on FBMC or FBIMC
- Implementation details
- Answers to questions external stakeholders incl. REGs
- Solution on dependency with ITVC, NWE

CWE FB MC ready

CWE FB MC Go-live (dependant also of NWE Single price coupling Go-live date if ITVC not compatible with FB)
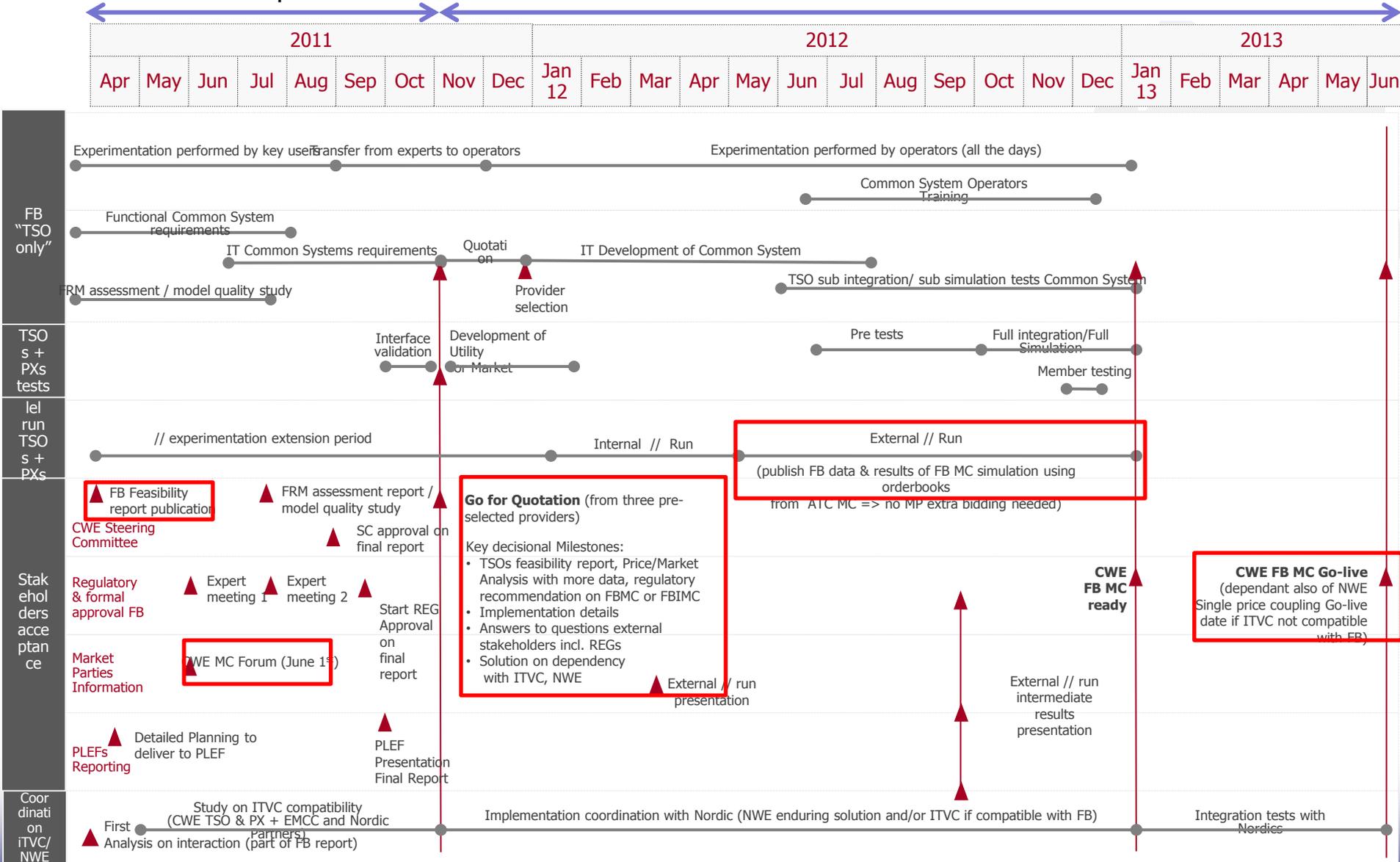
Regulatory & formal approval FB

▲ Expert meeting 1 ▲ Expert meeting 2

▲ Start REG Approval on final report

Market Parties Information

CWE MC Forum (June 1st)

PLEF Presentation Final Report

▲ External // run presentation

External // run intermediate results presentation

PLEFs Reporting

▲ Detailed Planning to deliver to PLEF

Coordination iTVC/NWE

▲ First Analysis on interaction (part of FB report)

Study on ITVC compatibility (CWE TSO & PX + EMCC and Nordic Partners)

Implementation coordination with Nordic (NWE enduring solution and/or ITVC if compatible with FB)

Integration tests with Nordics

123

Short explanation on milestones

▶ Two phases: a "FB preparation phase" (until November 2011) and a "FB implementation phase"

▶ Main milestones in the preparation phase :

- ▶ 1st of June : CWE MC Forum in Amsterdam
- ▶ Early June : First Expert meeting with regulators. Topic : "Questions and answers concerning the FB MC feasibility report"
- ▶ Mid July : FRM assessment report as explained in the FB report
- ▶ End July : Second Expert meeting with regulators
- ▶ End August : Approval of the Final Report as basis for the formal approval procedure by the Steering Committee
- ▶ End of September : Presentation of the report at PLEF meeting end of September
- ▶ Beginning of November: CWE Steering Committee decision next phase (FB implementation) – Go / No Go for quotation

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**

- **ATC Market coupling**

  – Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)

- **Flow-Based**

  – Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)

  – Question and answer (15 min)

Lunch break (85 min)

  – Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)

  – Flow-Based market impact analysis (25 min) (Nicolas Omont)

  – Question and answer session (15 min)

  – Flow-Based timing and processes (15 min) (Raphaël Bourgeois)

  – Flow-Based interaction with other projects (10 min) (Marcus Rohleder)

  – Flow-Based implementation planning (10 min) (Michael Pool)

  – Question and answer session (15 min)

- **Conclusions (Bert den Ouden and Jean Verseille)**

Thank you for your attention

Any questions?

Agenda Technical forum

- **Welcome words (Bert den Ouden and Jean Verseille)**

- **ATC Market coupling**

  – Operational feedback (45 min) (Matthys Nijpels and Céline Maurer)

- **Flow-Based**

  – Theory on Flow-Based capacity calculation (30 min) (Manuel Aguado)

  – Question and answer (15 min)

Lunch break (85 min)

  – Theory on Flow-Based market coupling (45 min) (Joël Hoeksema)

  – Flow-Based market impact analysis (25 min) (Nicolas Omont)

  – Question and answer session (15 min)

  – Flow-Based timing and processes (15 min) (Raphaël Bourgeois)

  – Flow-Based interaction with other projects (10 min) (Marcus Rohleder)

  – Flow-Based implementation planning (10 min) (Michael Pool)

  – Question and answer session (15 min)

- **Conclusions (Bert den Ouden and Jean Verseille)**

Conclusion

Bert den Ouden
and
Jean Verseille