

Electricity Balancing Pilot Projects 1 & 9 – Experience and Current Status



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General Framework

Technical Implementation

Control Scheme

Real-Time Data
Exchange

Optimization
Functions

Congestion
Management

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Optimisation Functionalities

Activation of Reserves

Imbalance
Netting

aFRR-
Assistance

mFRR-
Assistance

RR-
Assistance

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Imbalance Netting

aFRR-
Assistance \neq aFRR-CMO

mFRR-
Assistance \neq mFRR-CMO

RR-
Assistance \neq RR-CMO

**Assistance is not related to costs!
Only improvement of frequency quality!**

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aFRR-
Assistance

aFRR-CMO

mFRR-
Assistance

mFRR-CMO

RR-
Assistance

RR-CMO

Procurement of Reserves

FCR-CMF

aFRR-CMF

mFRR-CMF

RR-CMF

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Activation of Reserves

Procurement of Reserves

Amount of Reserves

Imbalance Netting

FCR-CMF

aFRR-CMF

Dimensioning

Sharing

aFRR-
Assistance

aFRR-CMO

mFRR-CMF

RR-CMF

mFRR-
Assistance

mFRR-CMO

RR-
Assistance

RR-CMO

Scope of Pilot Project 1



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Amount of Reserves

Imbalance Netting

FCR-CMF

aFRR-CMF

Dimensioning

Sharing

aFRR-
Assistance

aFRR-CMO

mFRR-CMF

RR-CMF

mFRR-
Assistance

mFRR-CMO

RR-
Assistance

RR-CMO



Pilot Project 1 - implemented

Pilot Project 1 - implemented but not submitted

(▶ Pilot Project on FCR)

Scope of Pilot Project 9



Technical Implementation

Control Scheme

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Activation of Reserves

Procurement of Reserves

Amount of Reserves

Imbalance Netting

FCR-CMF

aFRR-CMF

Dimensioning

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aFRR-
Assistance

aFRR-CMO

mFRR-CMF

RR-CMF

mFRR-
Assistance

mFRR-CMO

RR-
Assistance



RR-CMO

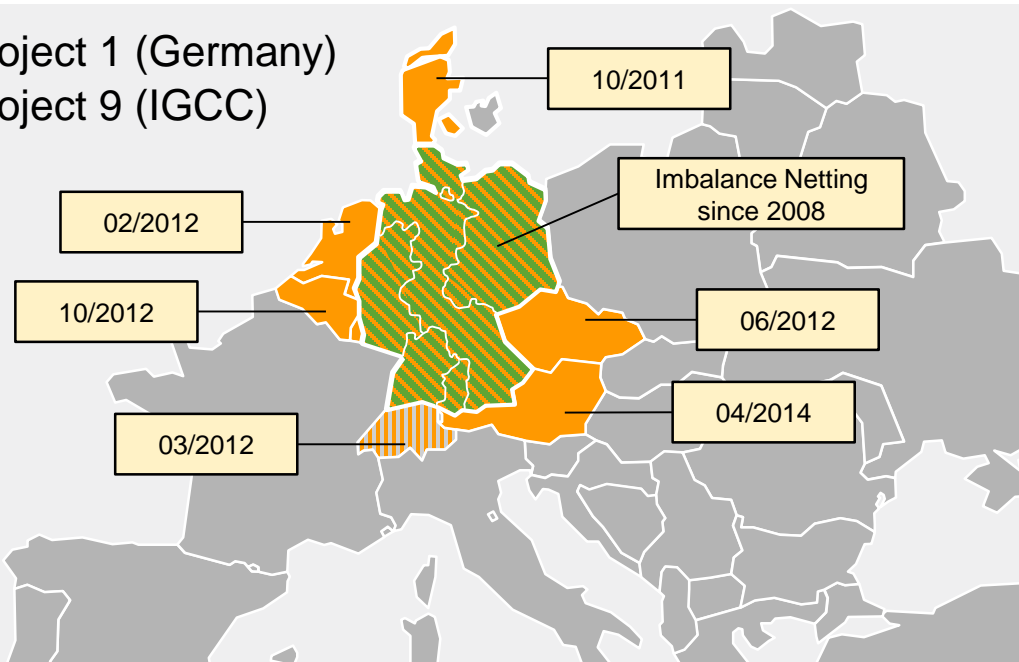
- Pilot Project 9 - implemented
- Pilot Project 9 - first analysis

Two Pilot Projects in Two Bullet Points



Participants

-  Pilot Project 1 (Germany)
-  Pilot Project 9 (IGCC)

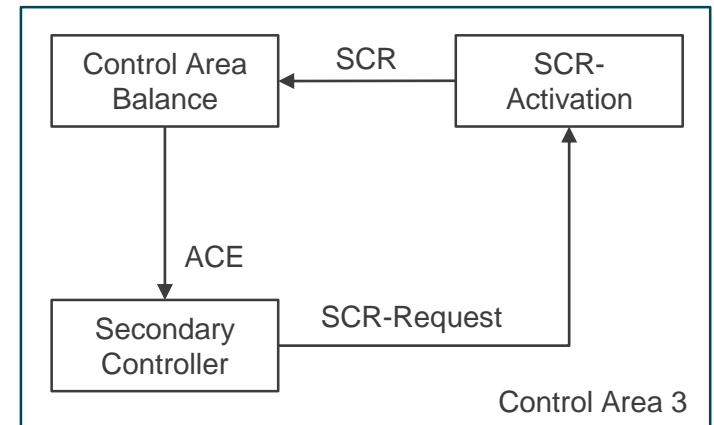
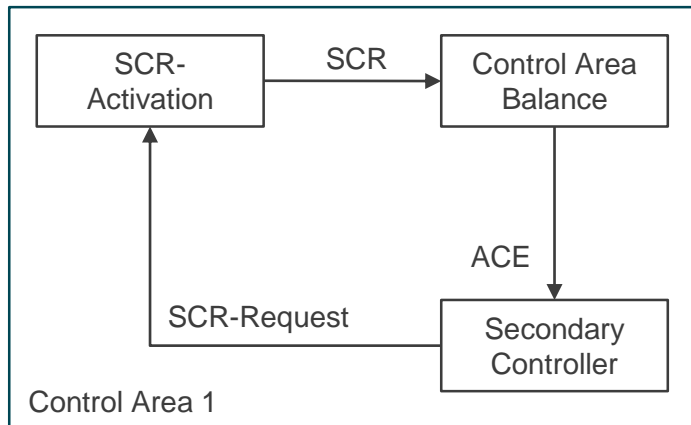


Focus

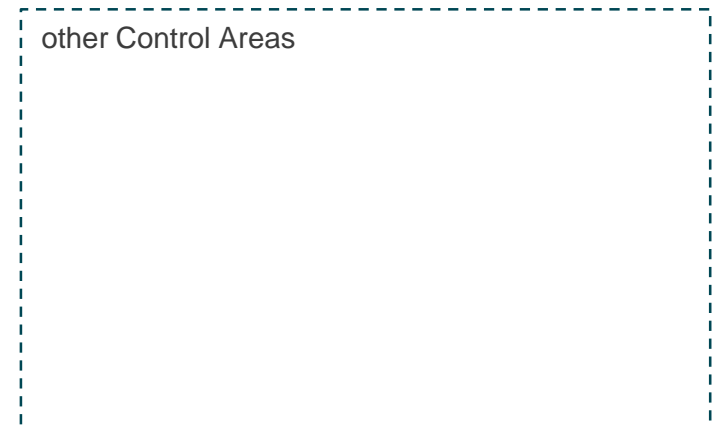
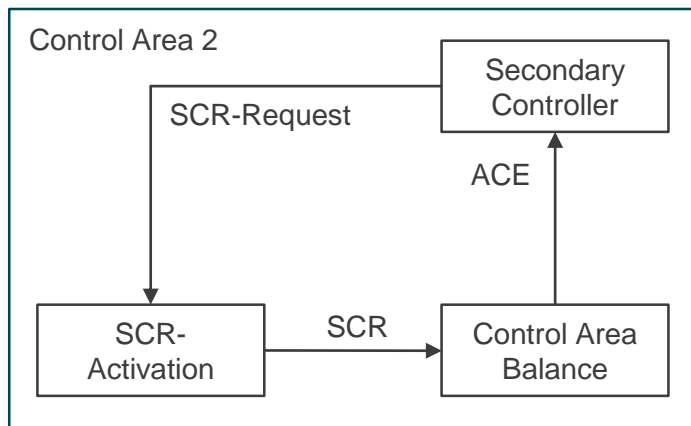
- Pilot Project 1: Grid Control Cooperation, full optimisation potential of TSO-TSO cooperation (harmonised framework)
- Pilot Project 9: International Grid Control Cooperation (IGCC) Imbalance Netting and technical aspects of aFRR

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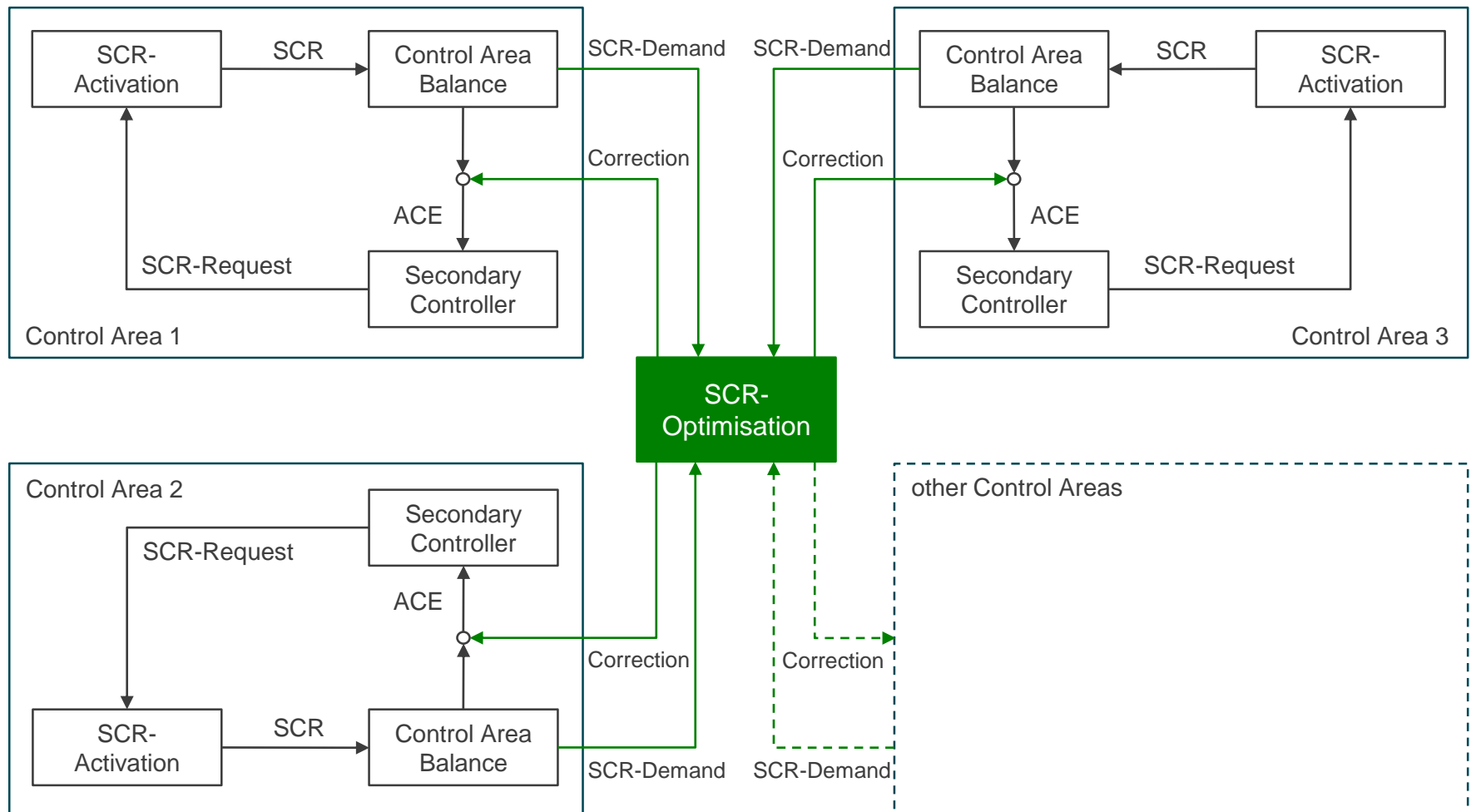
Technical Implementation – Basic Principle



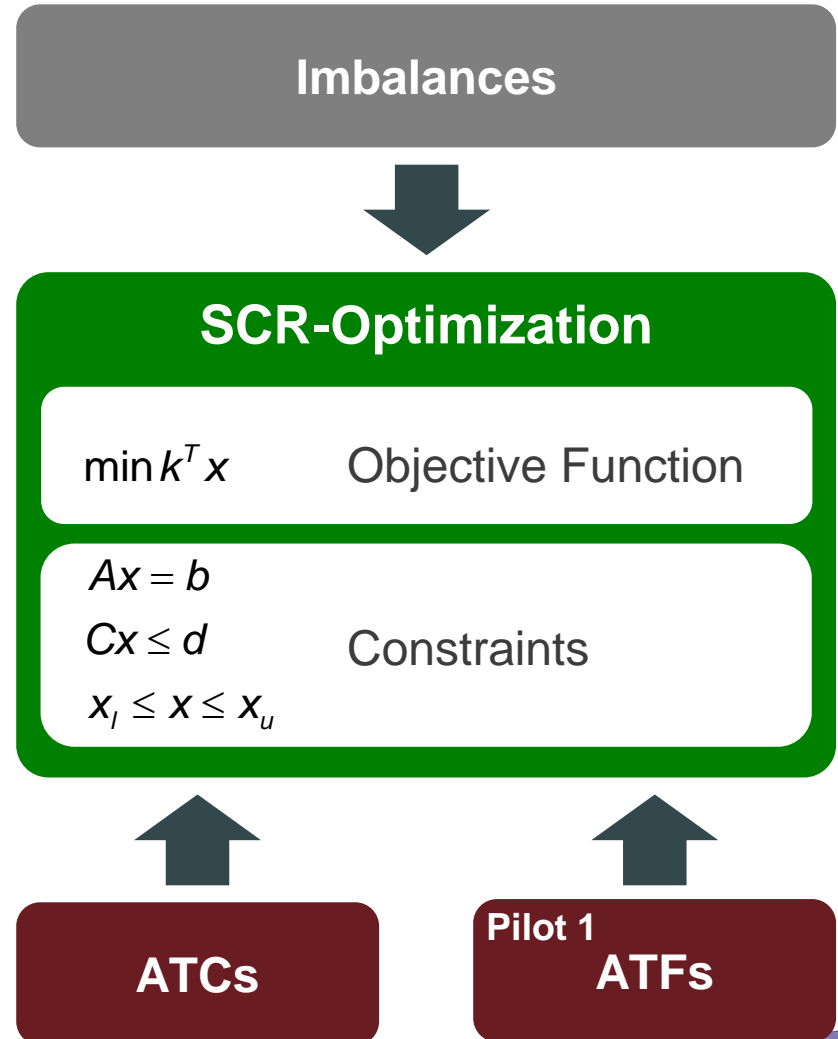
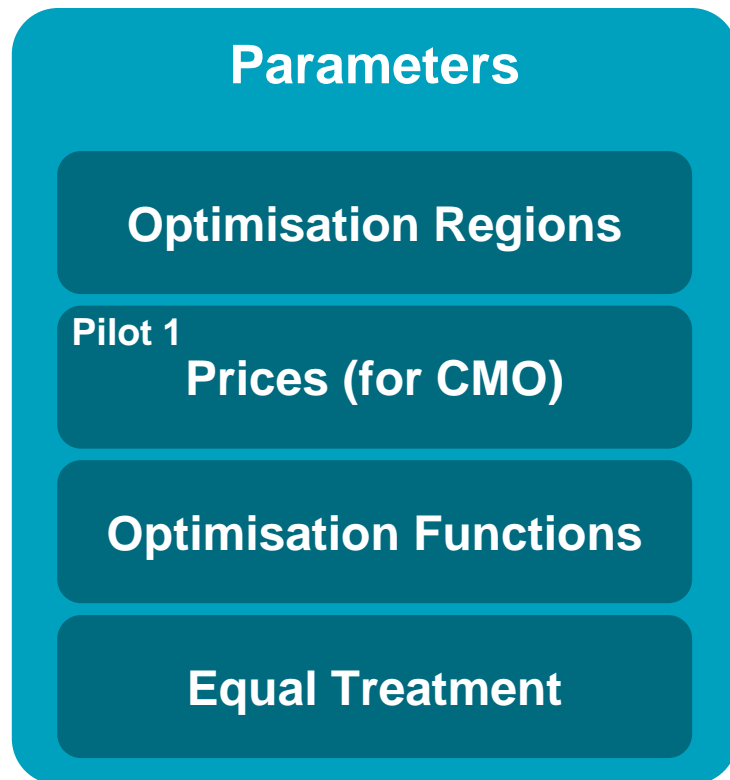
Optimisation Potential!



Technical Implementation – Basic Principle



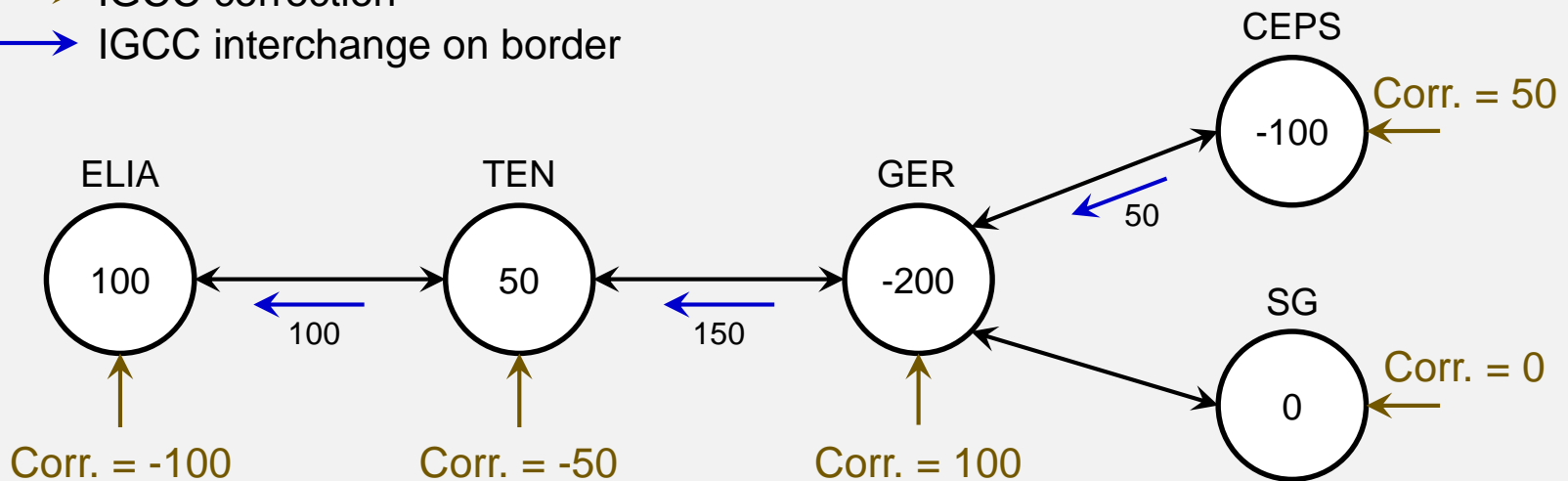
Optimisation Algorithm



IGCC: Pro-Rata Distribution of Netting Potential

Control Block	ELIA	TEN	GER	CEPS	SG
Imbalance (SCR demand) [MW]	100	50	-200	-100	0
Correction without congestions [MW]	-100	-50	100	50	0

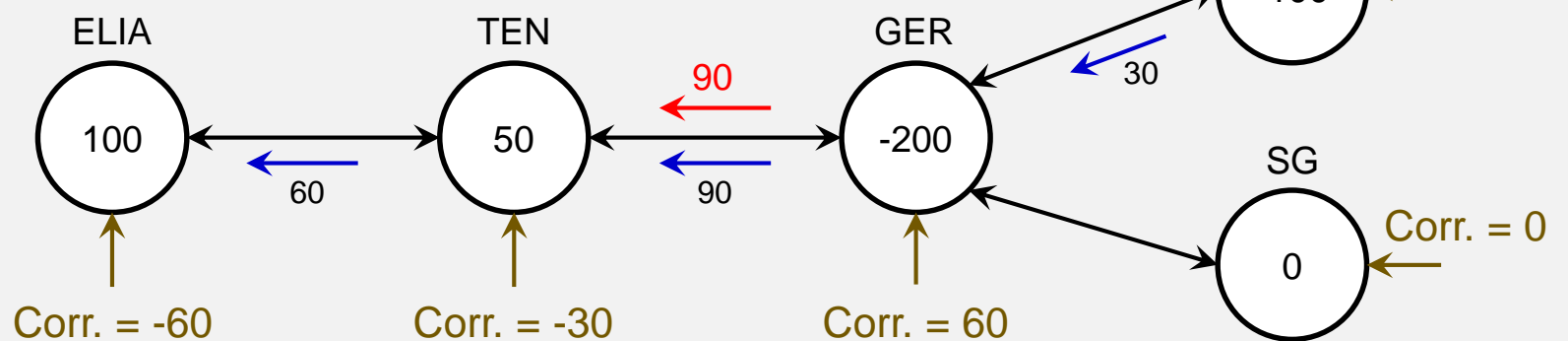
→ IGCC correction
→ IGCC interchange on border



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- IGCC correction
- IGCC interchange on border
- IGCC congestion (\leq ATC after market)



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IGCC Settlement and Value of Netted Imbalances

Opportunity Price
as Input for
Settlement in
IGCC

Calculation of
IGCC Settlement
Price

Value of Netted
Imbalances

without IGCC

$$\begin{array}{l} \text{SCE}_{\text{before IGCC}} \text{ [MWh]} \\ \times \\ \text{SCE price}_{\text{before IGCC}} \\ \text{[€/MWh]} \end{array}$$

with IGCC

$$\begin{array}{l} \text{IGCC exchange} \\ \text{SCE}_{\text{after IGCC}} \text{ [MWh]} \\ \times \\ \text{SCE price}_{\text{after IGCC}} \text{ [€/MWh]} \end{array}$$

Opportunity Price =
Opportunity Value/IGCC Volume

$$\frac{[(\text{SCE}_{\text{before IGCC}} * \text{SCE price}_{\text{before IGCC}}) - (\text{SCE}_{\text{after IGCC}} * \text{SCE price}_{\text{after IGCC}})]}{\text{IGCC exchange}}$$

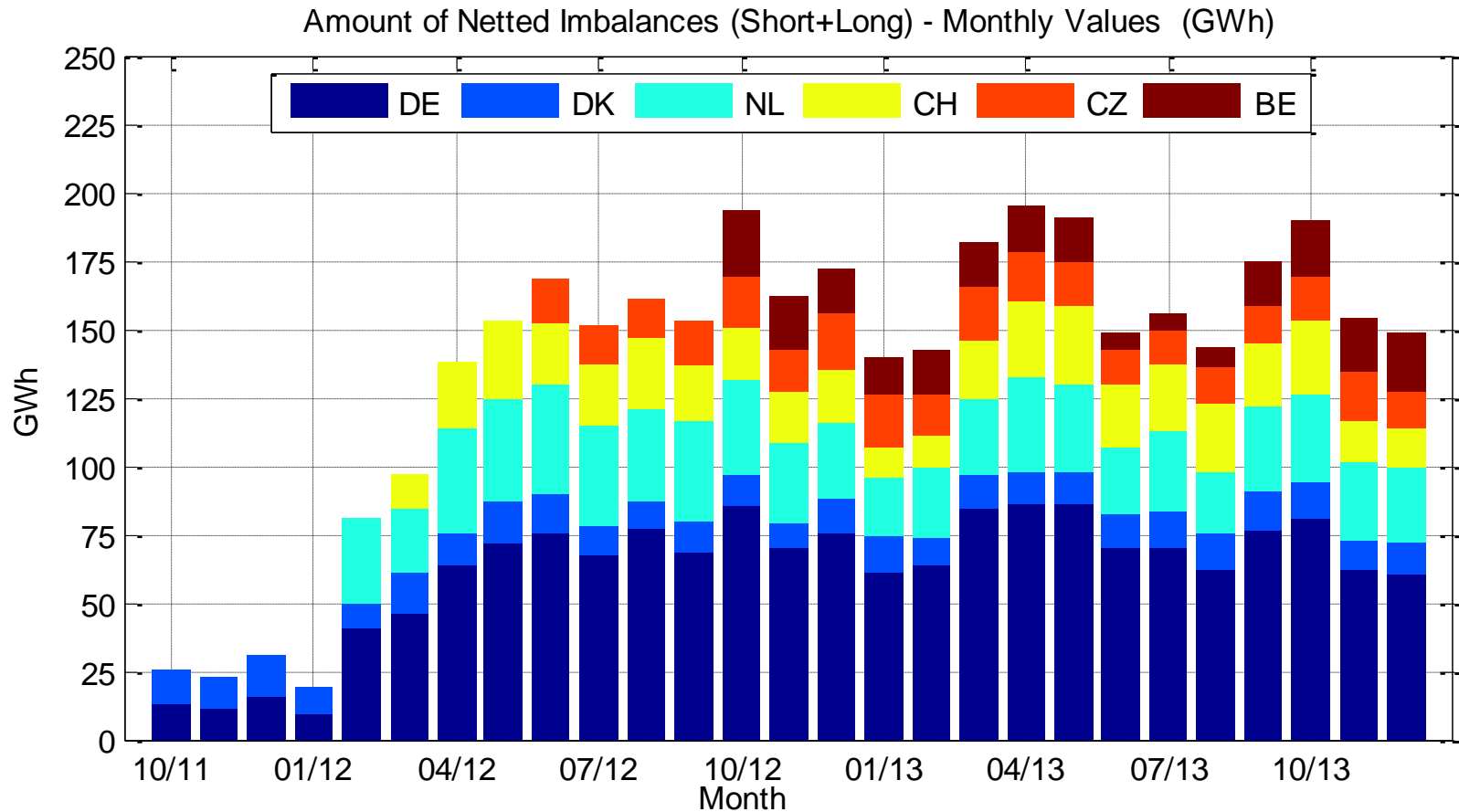
- IGCC Settlement Price (C_{IGCC}): **Energy weighted average** of the **opportunity prices** ($C_{\text{Imp},i}$ and $C_{\text{Exp},i}$)
- Single price for all IGCC exchanges

$$C_{\text{IGCC}} = \frac{\sum_{i=1}^n (C_{\text{Imp},i} E_{\text{Imp},i} + C_{\text{Exp},i} E_{\text{Exp},i})}{\sum_{i=0}^n (E_{\text{Imp},i} + E_{\text{Exp},i})}$$

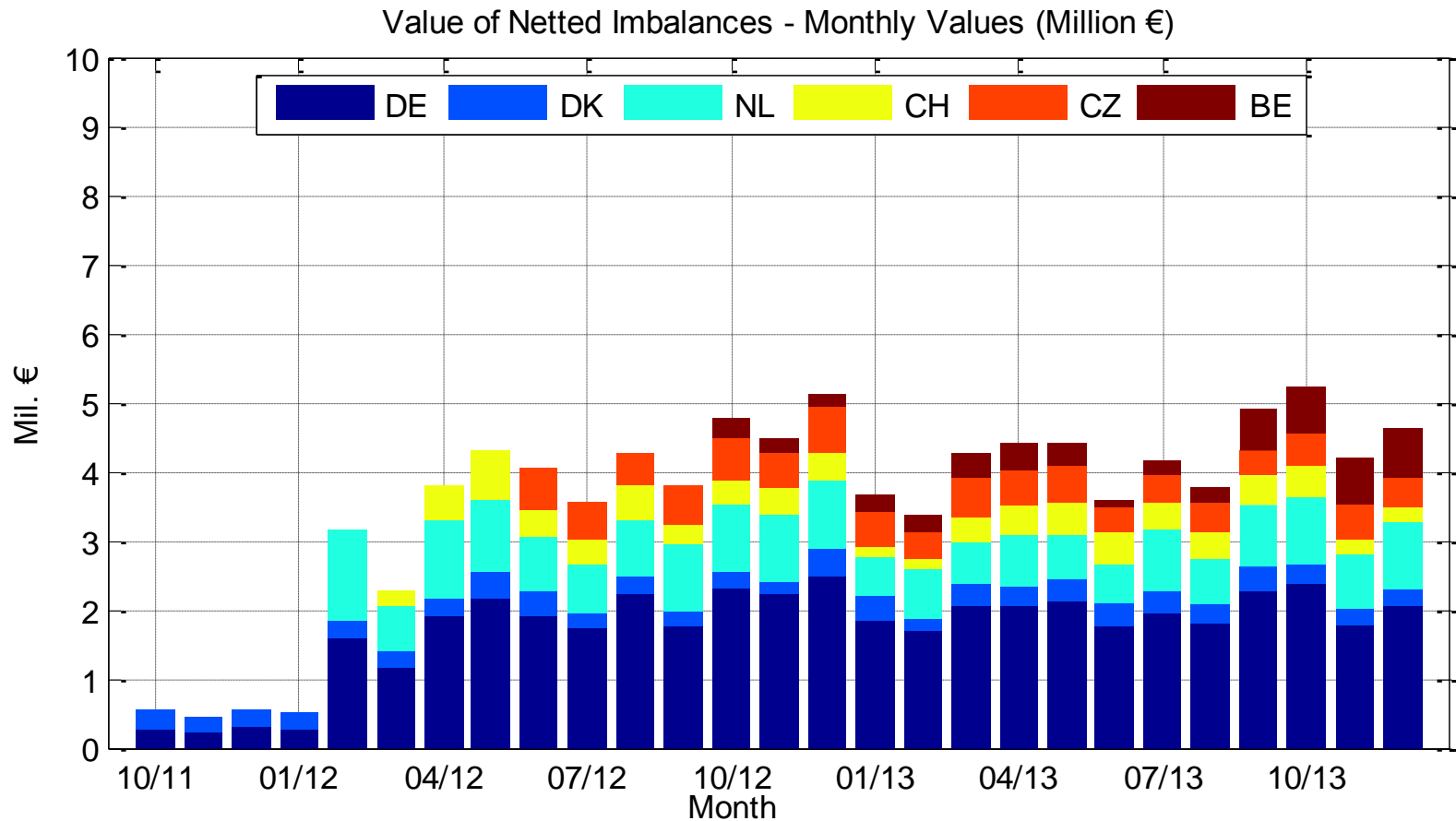
- Value of avoided activations for a participant is driven by the spread between the opportunity price and the IGCC settlement price

$$R_{\text{IGCC}} = \sum_{i=1}^n (C_{\text{Imp},i} - C_{\text{IGCC}}) \cdot E_{\text{Imp},i} + \sum_{i=1}^n (C_{\text{IGCC}} - C_{\text{Exp},i}) \cdot E_{\text{Exp},i}$$

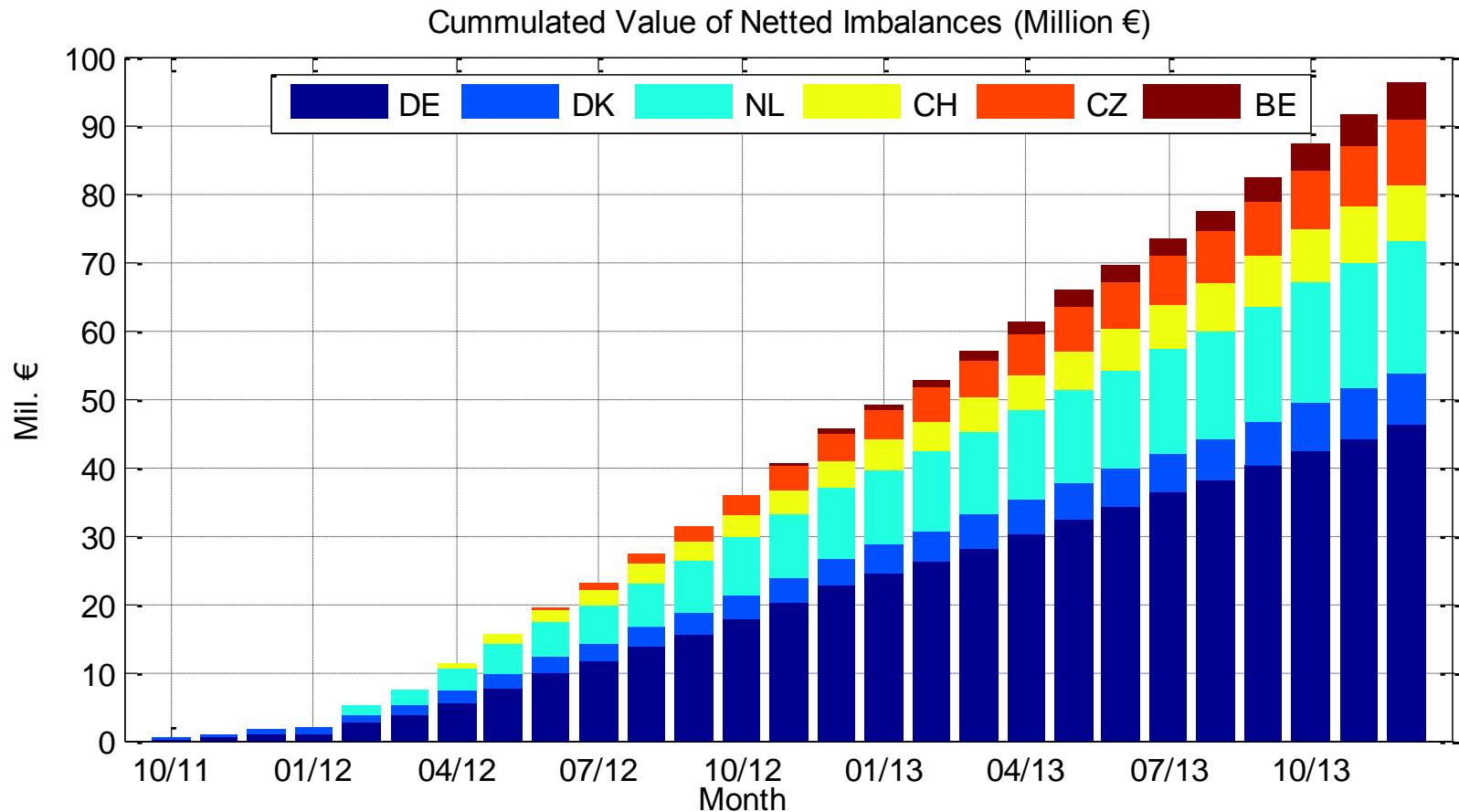
Amount of Netted Imbalances per Country



Monetary Value of Netted Imbalances per Country



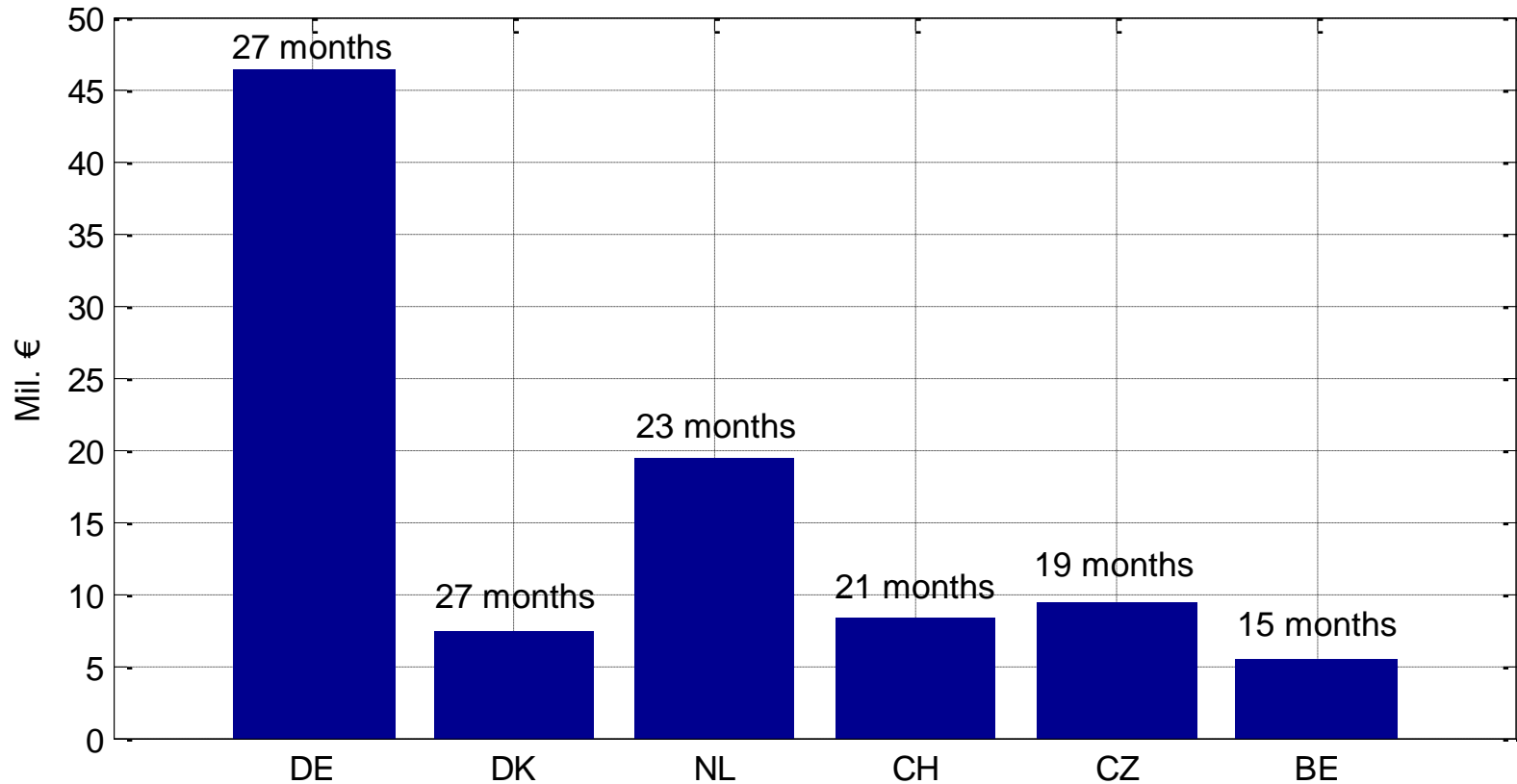
Total Value of Netted Imbalances



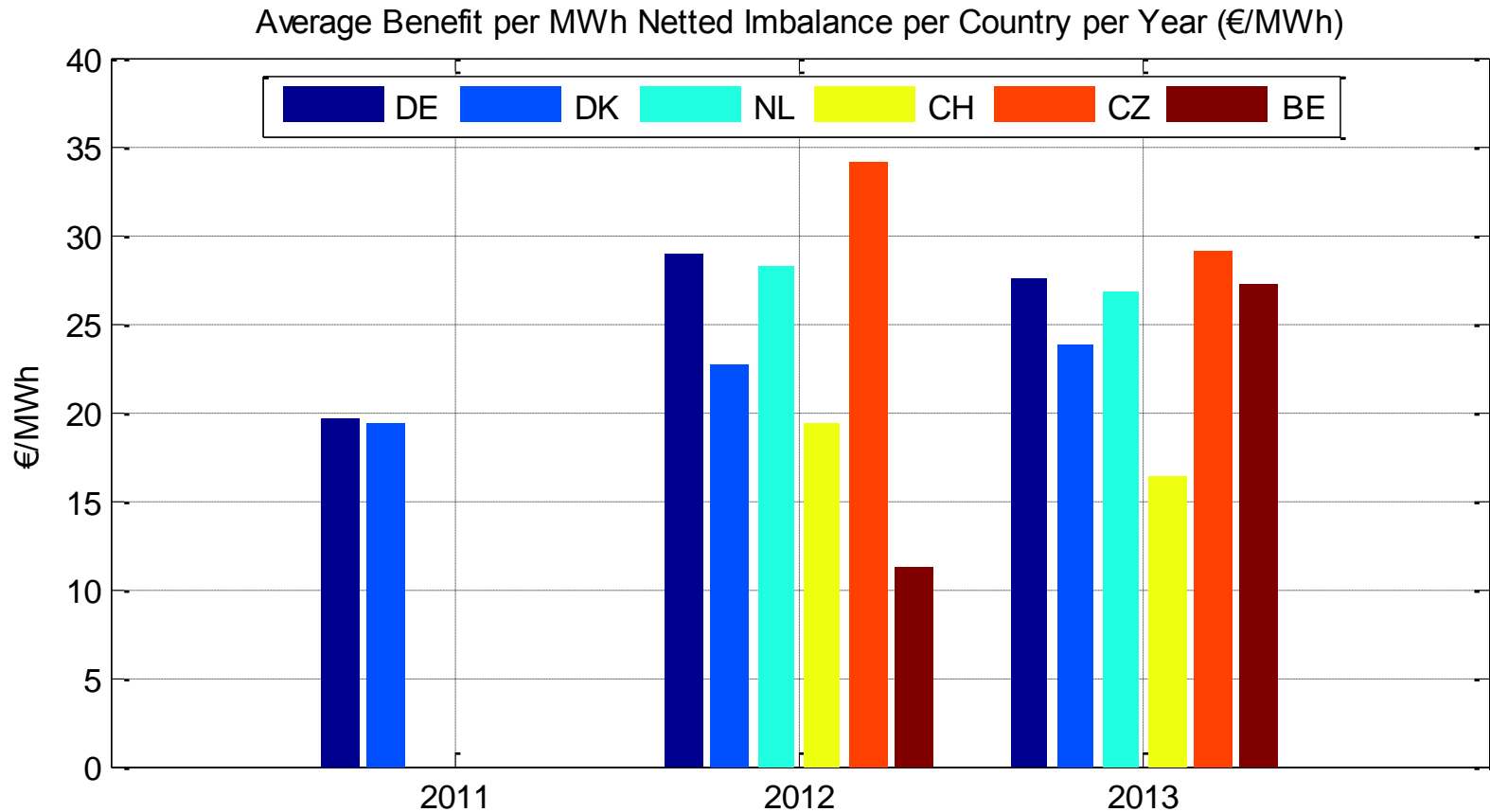
Remark: Value of Netted Imbalances **surpassed €100 Million in Jan 2014**

Total Value of Netted Imbalances per Country

Cummulated Value of Netted Imbalances per Member Country (Million €)



Average Value of Netted Imbalances per Country



Remark: Different prices for aFRR-energy lead to different benefits

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Summary

Challenges

- 10 TSOs from 7 countries – high degree of coordination necessary
- Different frameworks for energy pricing

Experience

- **6 years of experience** with Imbalance Netting in Germany
- **More than 2 years** of experience with Imbalance Netting between different countries, **value of netted imbalances in IGCC exceeds €100 Million**

Outlook

- Further technical improvements will increase operational transparency and efficiency
- Multilateral governance structure