

9<sup>th</sup> Conference on Energy Economics and Technology

# FUTURE DEVELOPMENT OF THE EUROPEAN MARKET FOR SYSTEM RESERVE

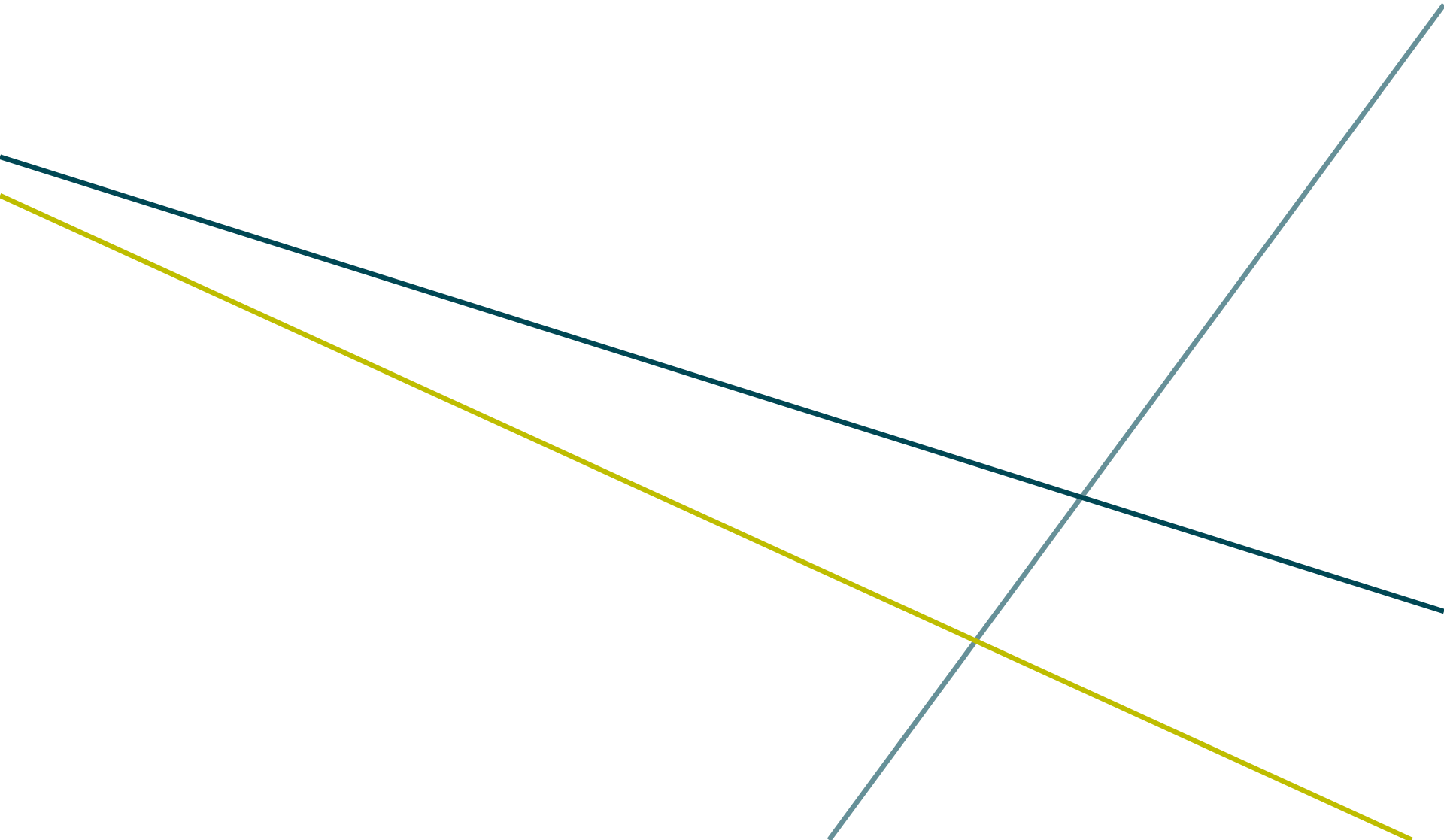
DR.-ING. ULF KASPER / EXPERT CONTROL RESERVE

Dresden, April 11<sup>th</sup>, 2014

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# 01 Introduction



Introduction

# BACKGROUND AND MOTIVATION

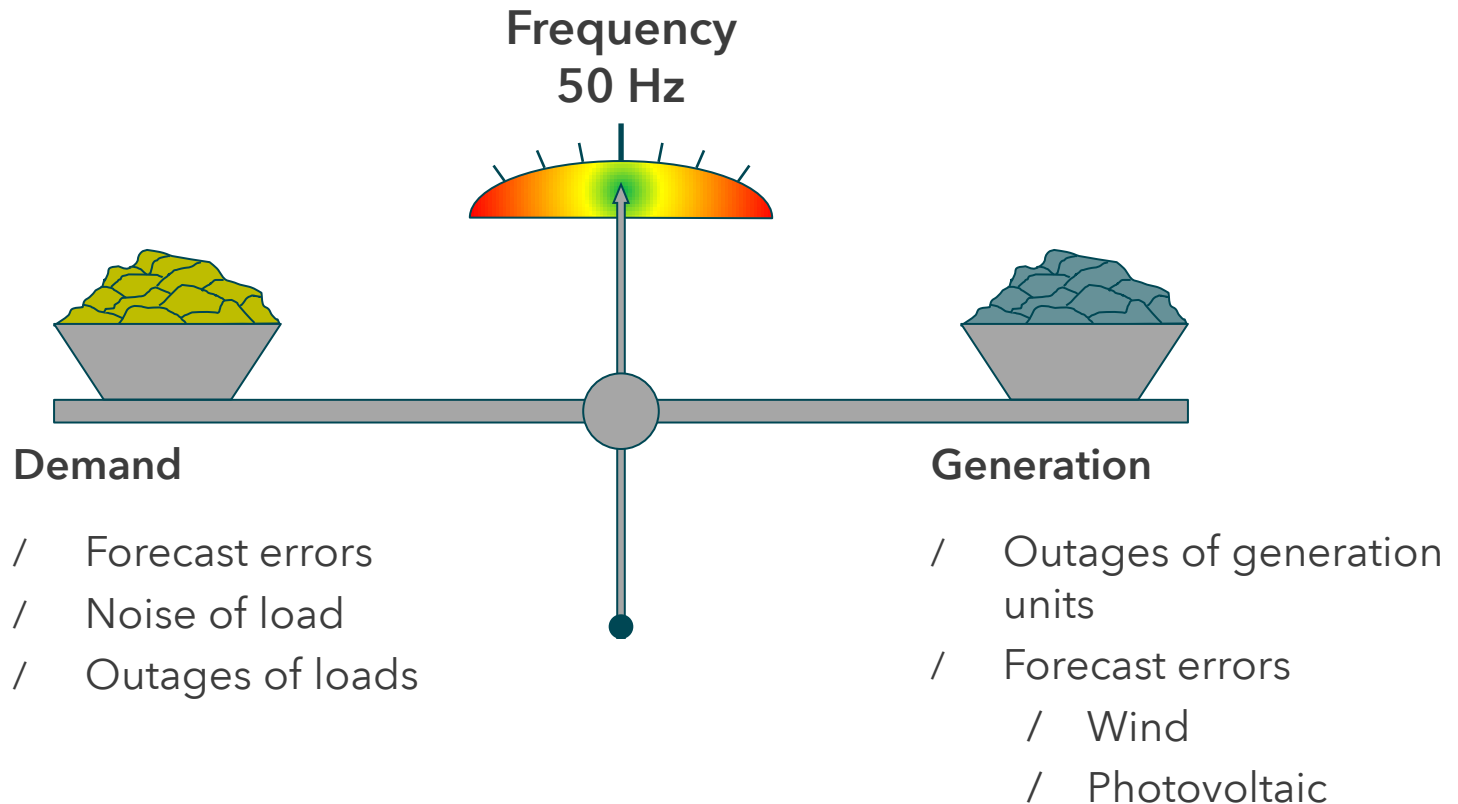
- / Provision of system services in order to ensure secure system operation
  - / Frequency stability
  - / Voltage stability
  - / Rebuilding of supply
  - / System operation
- / Three reserve qualities for frequency stability of Transmission System Operators (TSOs)
  - / Primary control reserve (PCR)
  - / Secondary control reserve (SCR)
  - / Tertiary reserve (TR)

Participation in markets for reserve contributes considerably to the contribution margin of generation units.

Introduction

# CONTROL RESERVE

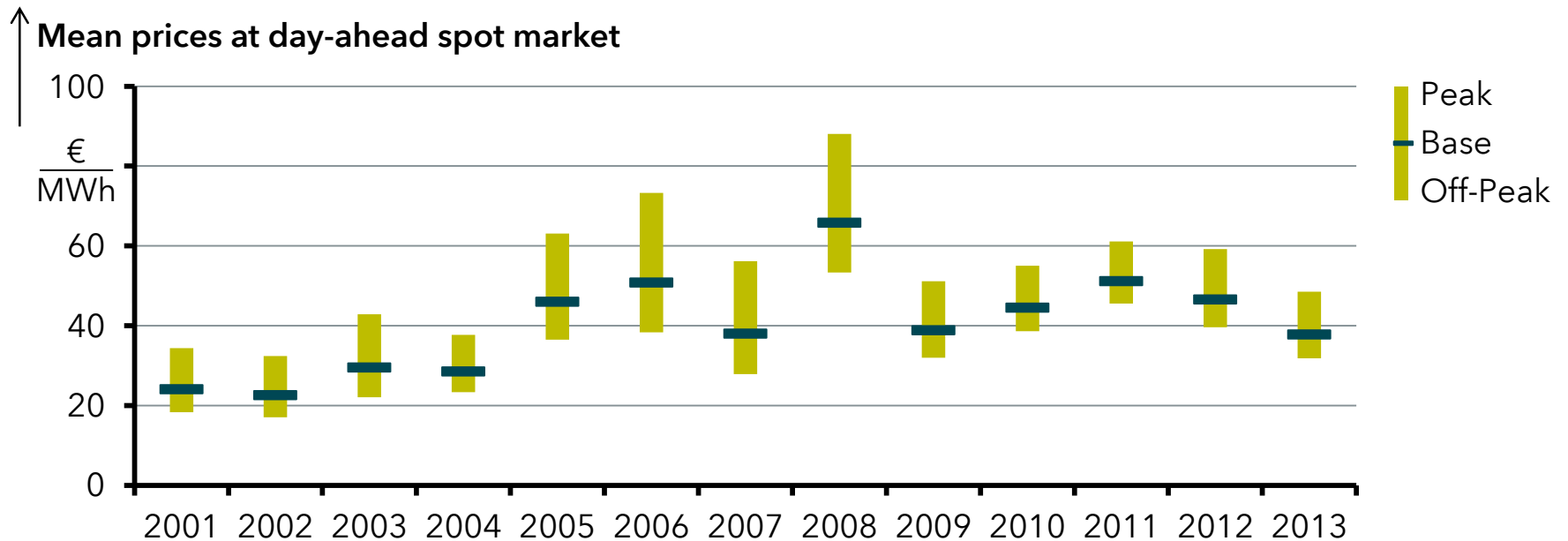
- / Control reserve ensures the continuous balancing of generation and demand in a synchronously interconnected system



Introduction

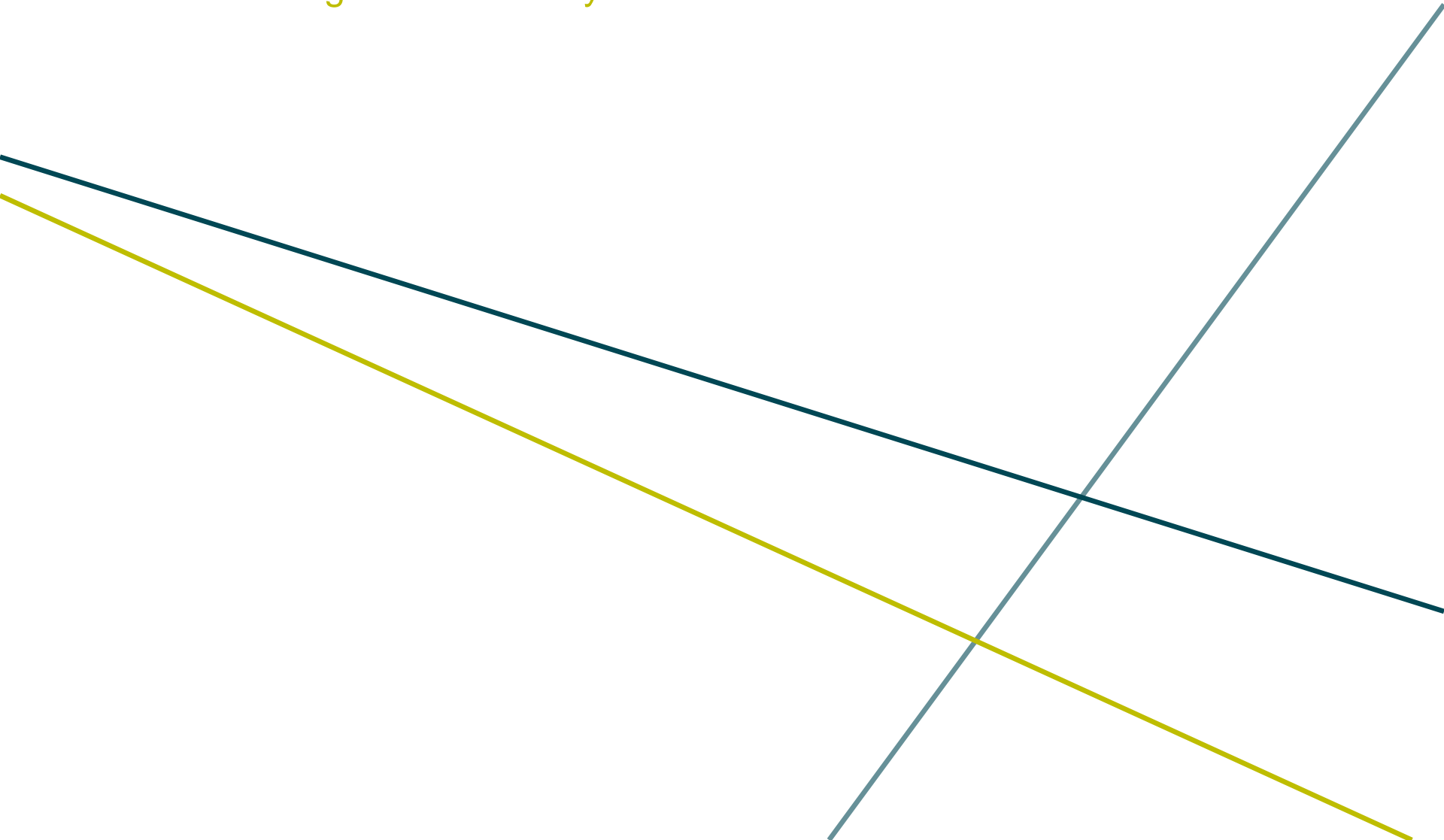
# SCHEDULED ENERGY

/ Development of the mean prices of the German day-ahead spot market (scheduled energy)



Increasing interest in markets for system reserve due to declining potential revenues from day-ahead market

# 02 Existing Markets for System Reserve

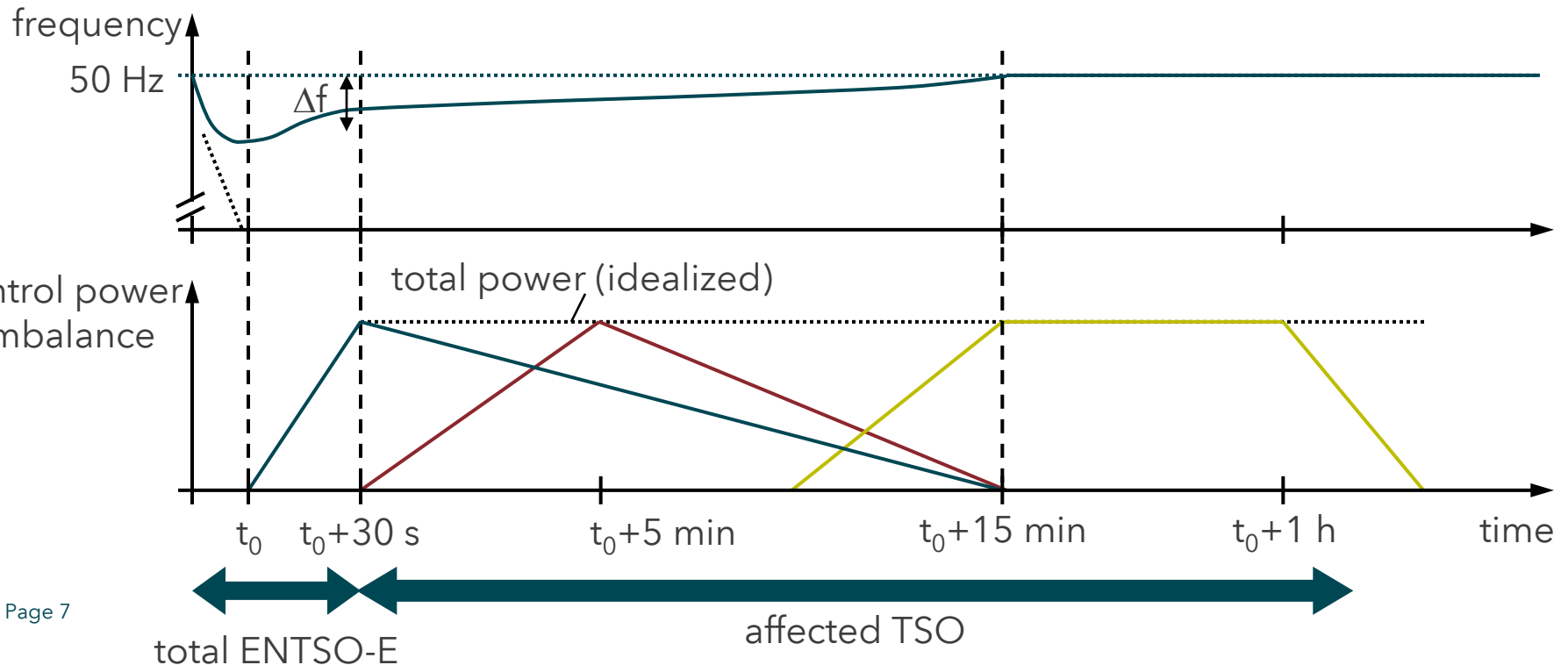


Existing Markets for System Reserve

# RESERVE QUALITIES

/ Specification of different reserve qualities according to effectiveness

<p><b><u>Primary Control Reserve</u></b>                  - automatic activation                  - up to 15 min</p>	<p><b><u>Secondary Control Reserve</u></b>                  - automatic activation                  - 30 s to 15 min</p>	<p><b><u>Tertiary Reserve</u></b>                  - semi-automatic activation (MOLS)                  - min. 15 min</p>
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## Existing Markets for System Reserve

# RESERVE QUALITIES (2014/04/10)

	PCR	SCR	TR
Mean demand	±568 MW	+1,998 MW -1,919 MW	+2,464 MW -2,801 MW
Activation time	30 seconds	5 minutes	7,5 - 22,5 minutes
Tender period	Weekly	Weekly (HT/NT)	Daily (4-h-product)
Min. bid volume	±1 MW	+5 MW/-5 MW*	
Bid increment	±1 MW	+1 MW/-1 MW	
Allocation	Merit order of reserve capacity prices		
Call	Not selective	Merit order of reserve energy prices	
Remuneration	Capacity prices	Capacity and energy prices	

\* For tertiary reserve undividable bids with a volume up to 25 MW are allowed.

Existing Markets for System Reserve

# AUCTION METHOD (I)

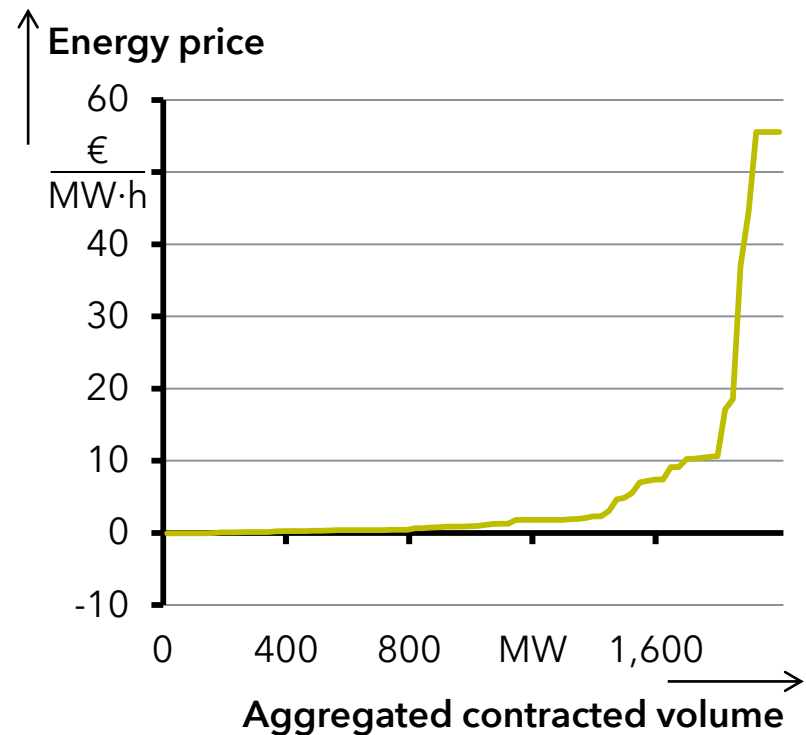
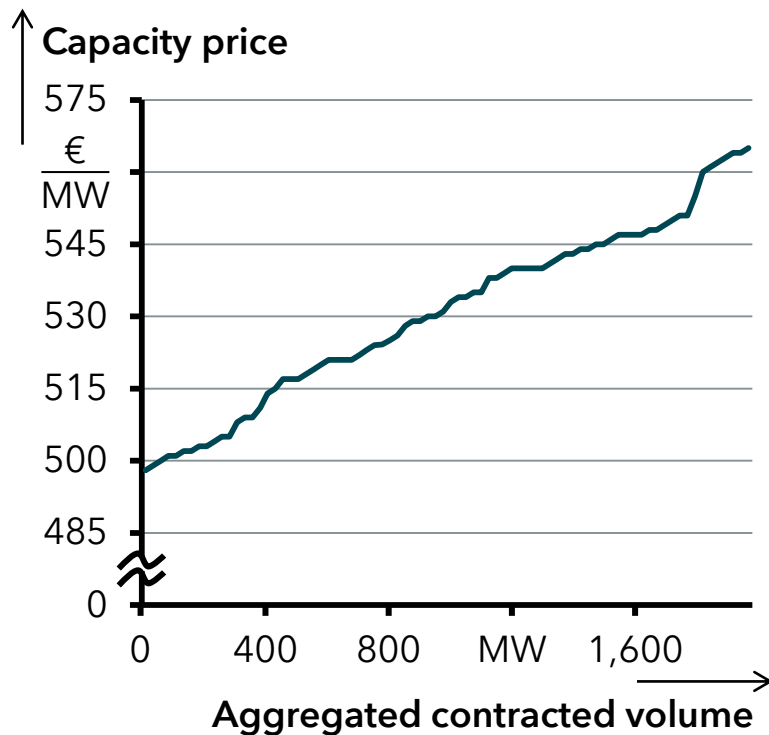
- / Multi part pay-as-bid auction
  - / Bid acceptance according to merit order of all bids of type A (i. e. capacity price)
  - / Reserve demand according to merit order of all bids of type B (i. e. energy price)
- / In case of acceptance, each participant receives his individual fee
- / Suitable approach for markets with limited liquidity and/or dominant market participants

Strategic bids may be a possible consequence of a market design based on pay-as-bid auctions

Existing Markets for System Reserve

# AUCTION METHOD (II)

/ Merit order of capacity and energy bids for SCR (low tariff) in February 2014

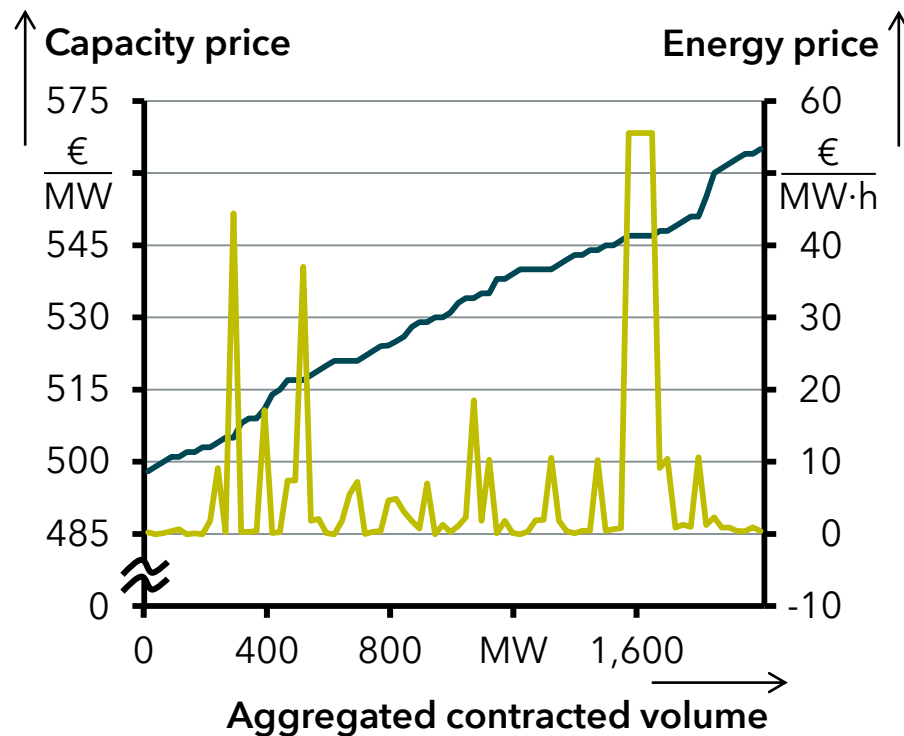


To some extent strategic bids (e. g. low capacity price, high energy price) due to pay-as-bid auction

Existing Markets for System Reserve

# AUCTION METHOD (II)

/ Merit order of capacity and energy bids for SCR (low tariff) in February 2014

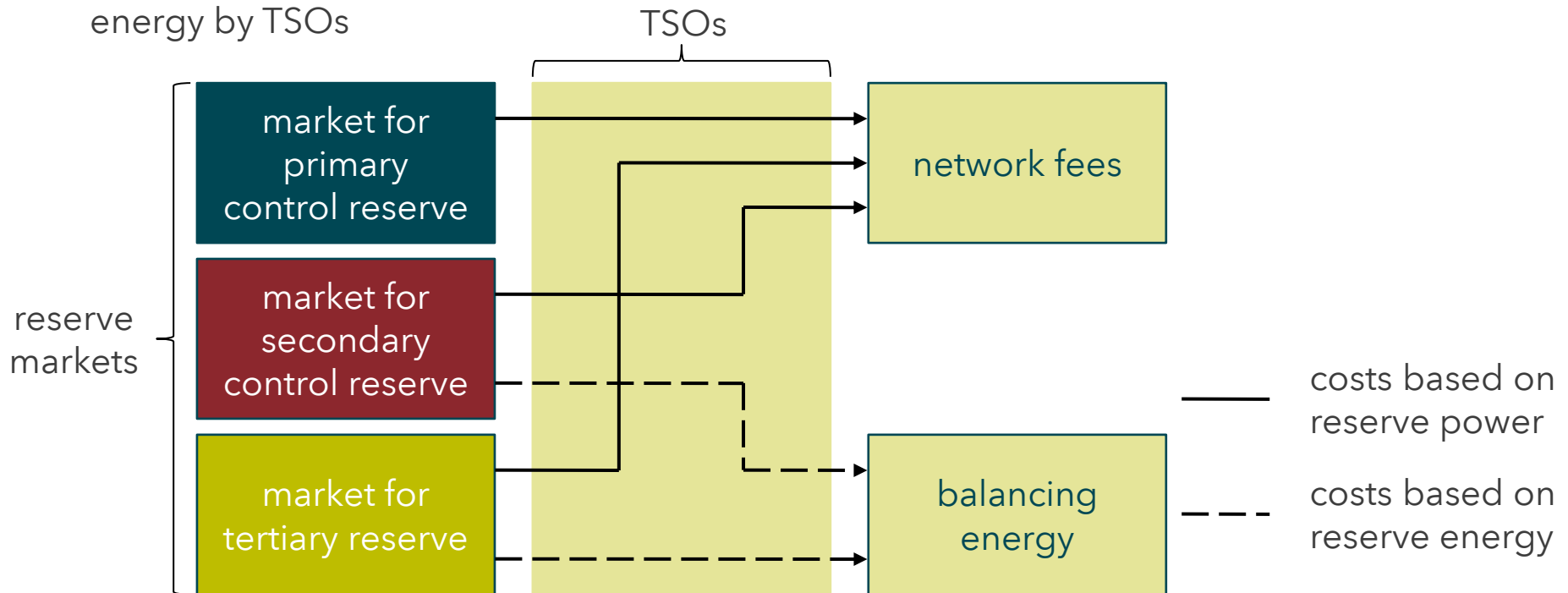


To some extent strategic bids (e. g. low capacity price, high energy price) due to pay-as-bid auction

Existing Markets for System Reserve

# COST ALLOCATION (I)

/ Distribution of costs for provision of reserve power and reserve energy by TSOs



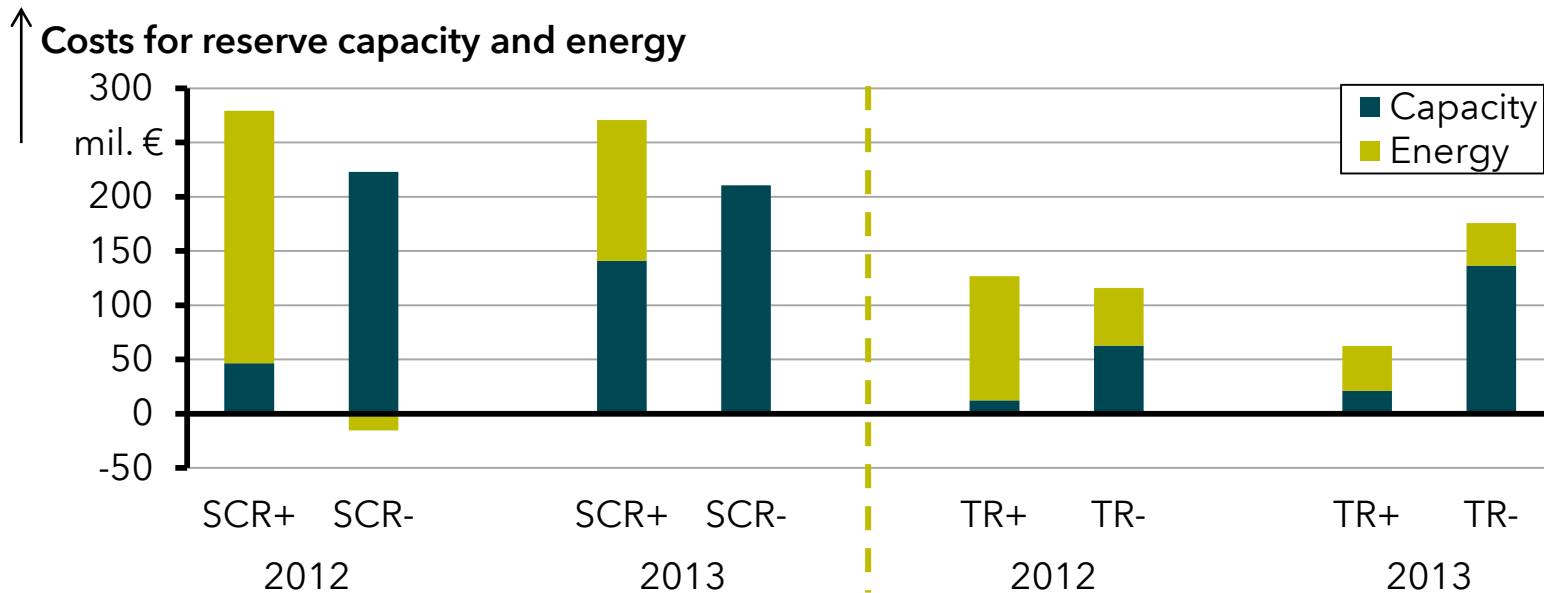
Provision of reserve power: network fees of all participants

Provision of reserve energy: balancing energy of the accounting grid responsible

Existing Markets for System Reserve

# COST ALLOCATION (II)

/ Development of the TSOs' costs (i. e. revenues of market participants) for reserve capacity and energy in Germany

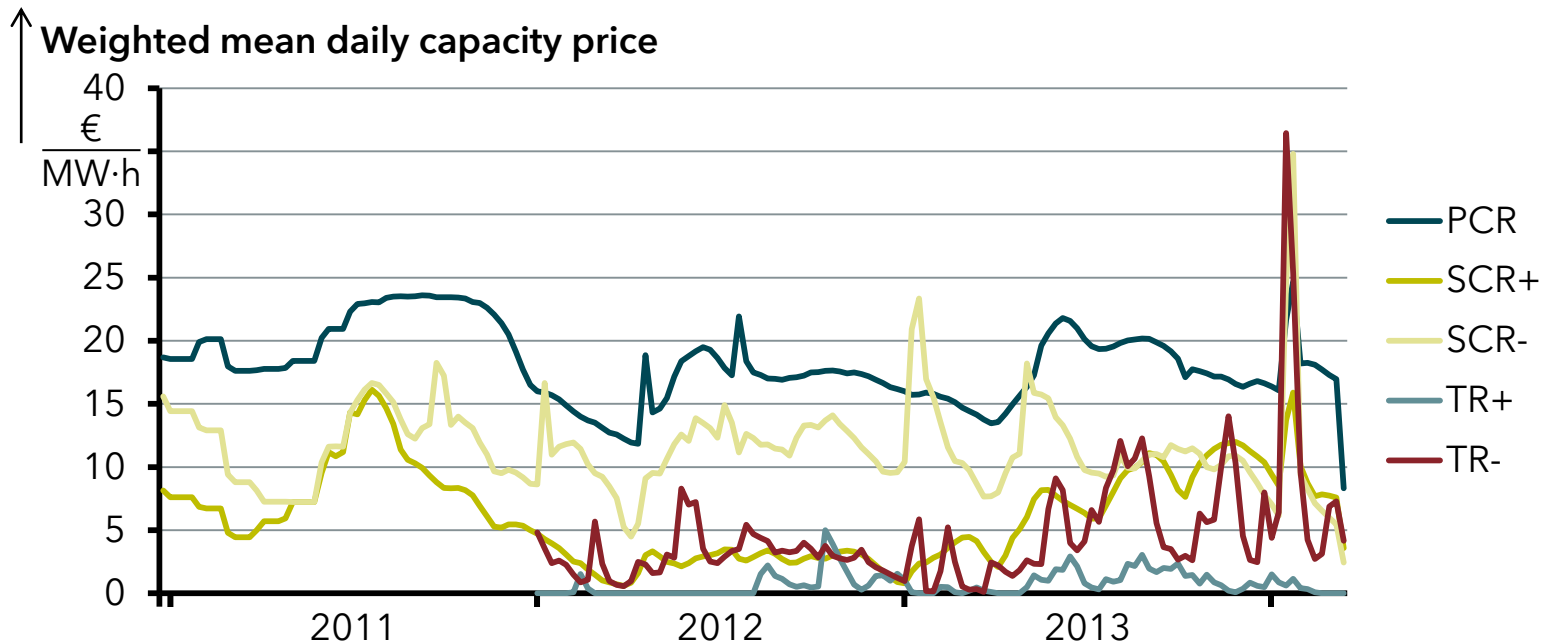


Overall financial volume limited (especially for TR)  
Higher prices/costs for SCR than TR

Existing Markets for System Reserve

# PRICE DEVELOPMENT AT RESERVE MARKETS

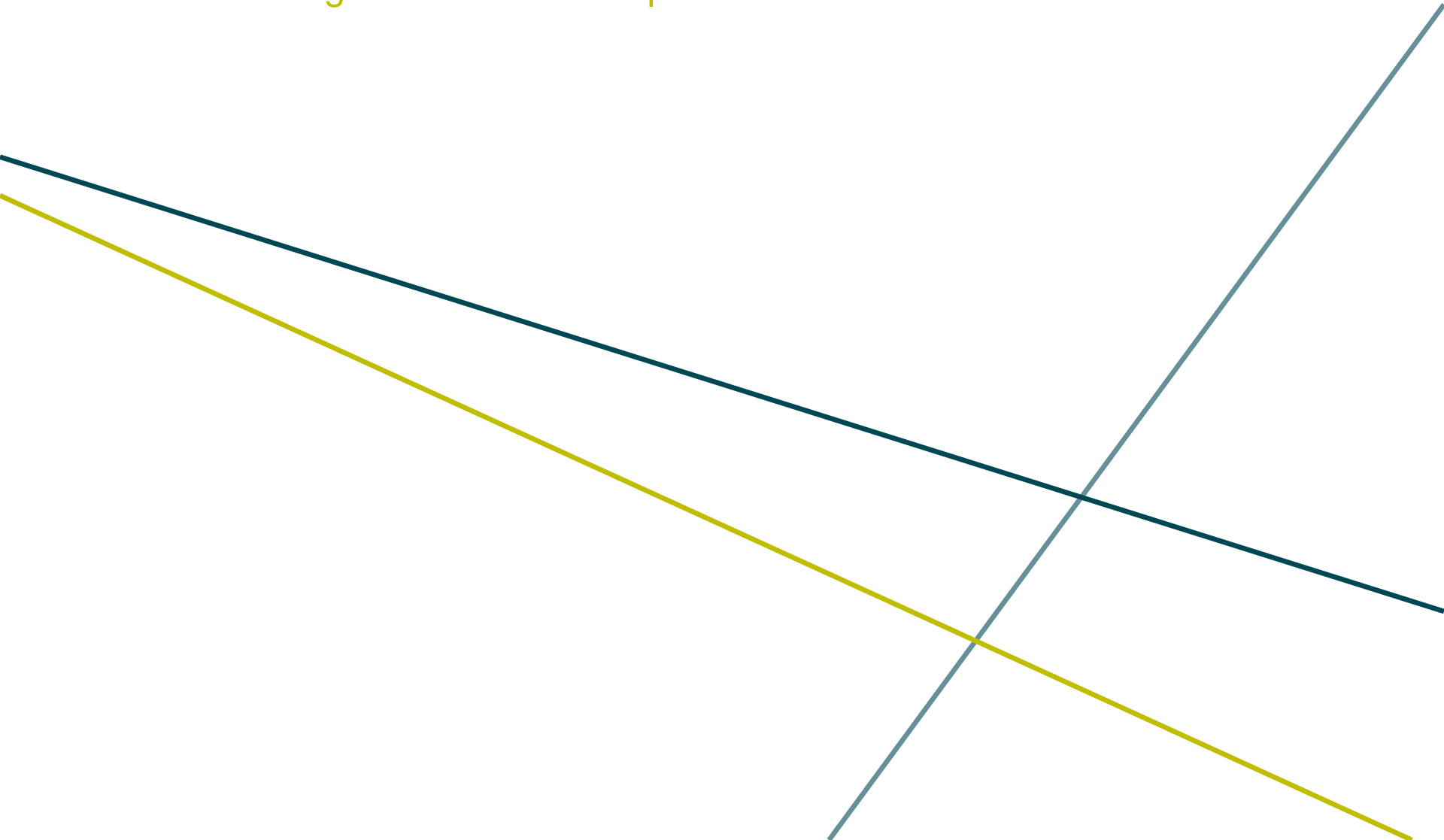
/ Illustration of the weighted mean daily capacity prices per market



Increase in price volatility

Price peaks during turn of the year due to tender of additional volumes

# 03 Existing International Cooperation





Existing International Cooperation

# INTERNATIONAL GRID CONTROL COOPERATION

## German Control Cooperation (GCC)

- / Cooperation of German TSOs
  - / Prevention of counteracting reserve activation (netting)
  - / Common dimensioning of reserve
  - / Common procurement of SCR
  - / Cost-optimized reserve activation

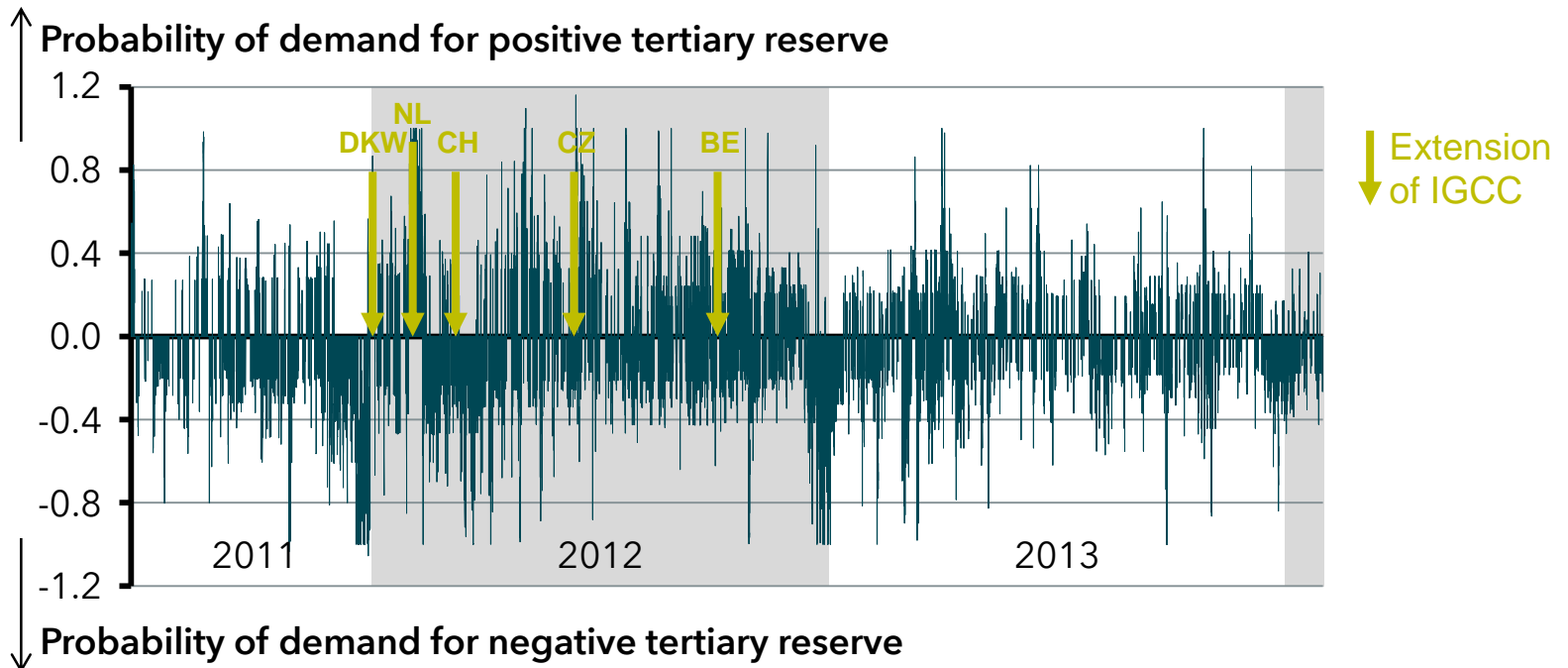
## International Grid Control Cooperation (IGCC)

- / Cooperation of German TSOs, DKW, NL, CH, CZ and BE
- / Reduction of reserve activation by cross-border netting
- Ongoing negotiations concerning participation of further countries (FR, AT, Nordic)

Existing International Cooperation

# TERTIARY RESERVE DEMAND

/ Illustration of the quarter hourly reserve signal in the German Control Cooperation



High short-term reserve demand in spite of limited mean reserve demand

Existing International Cooperation

# COMMON PROCUREMENT OF RESERVE

## DE-NL

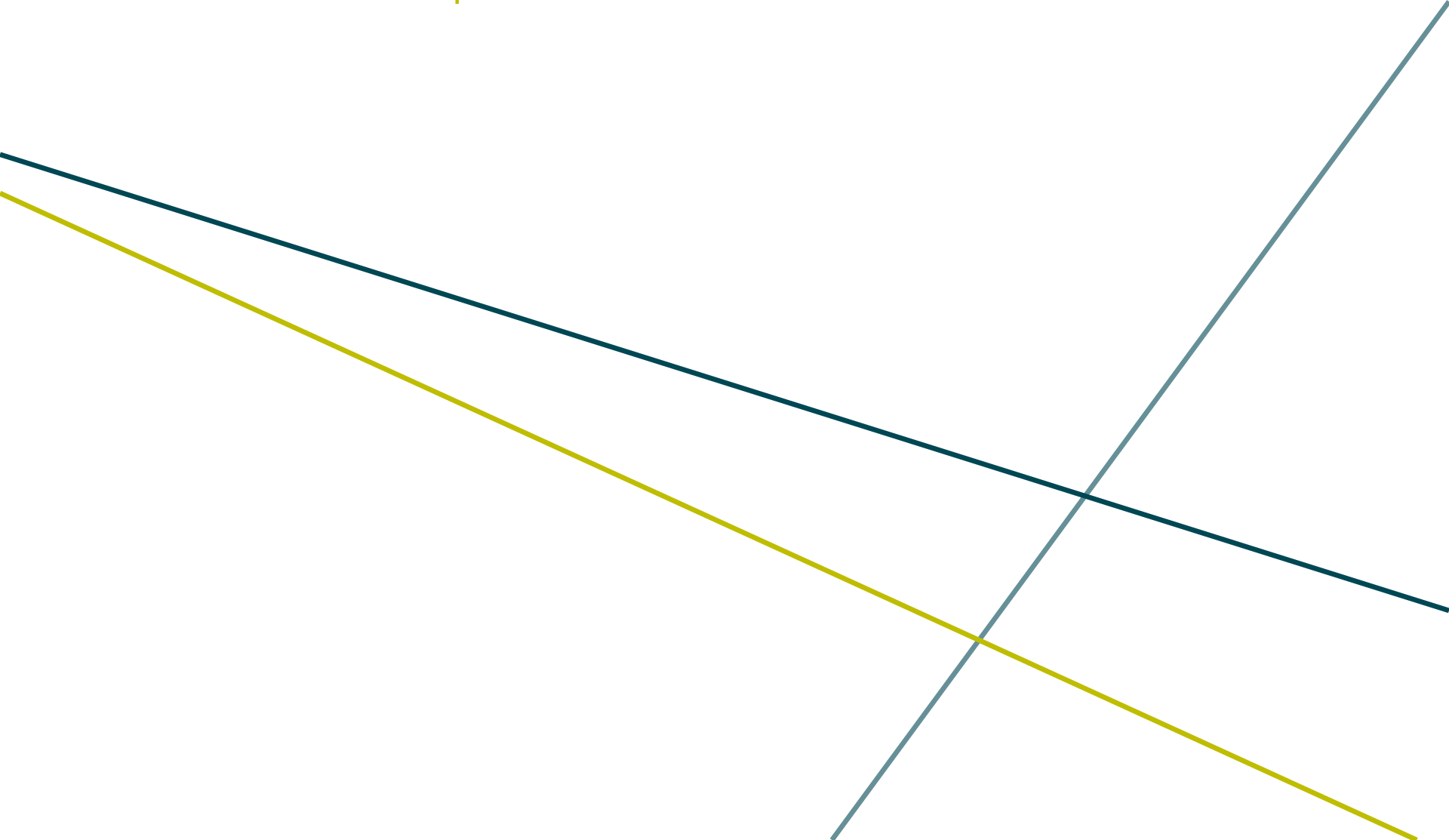
- / Common procurement of PCR
- / NL participates with 35 MW in German auction  
([www.regelleistung.net](http://www.regelleistung.net))

## DE-CH

- / Common procurement of PCR
- / 1<sup>st</sup> CH-internal auction: tender of national share of reserve
- / 2<sup>nd</sup> auction: participation in German auction (25 MW) via  
([www.regelleistung.net](http://www.regelleistung.net))

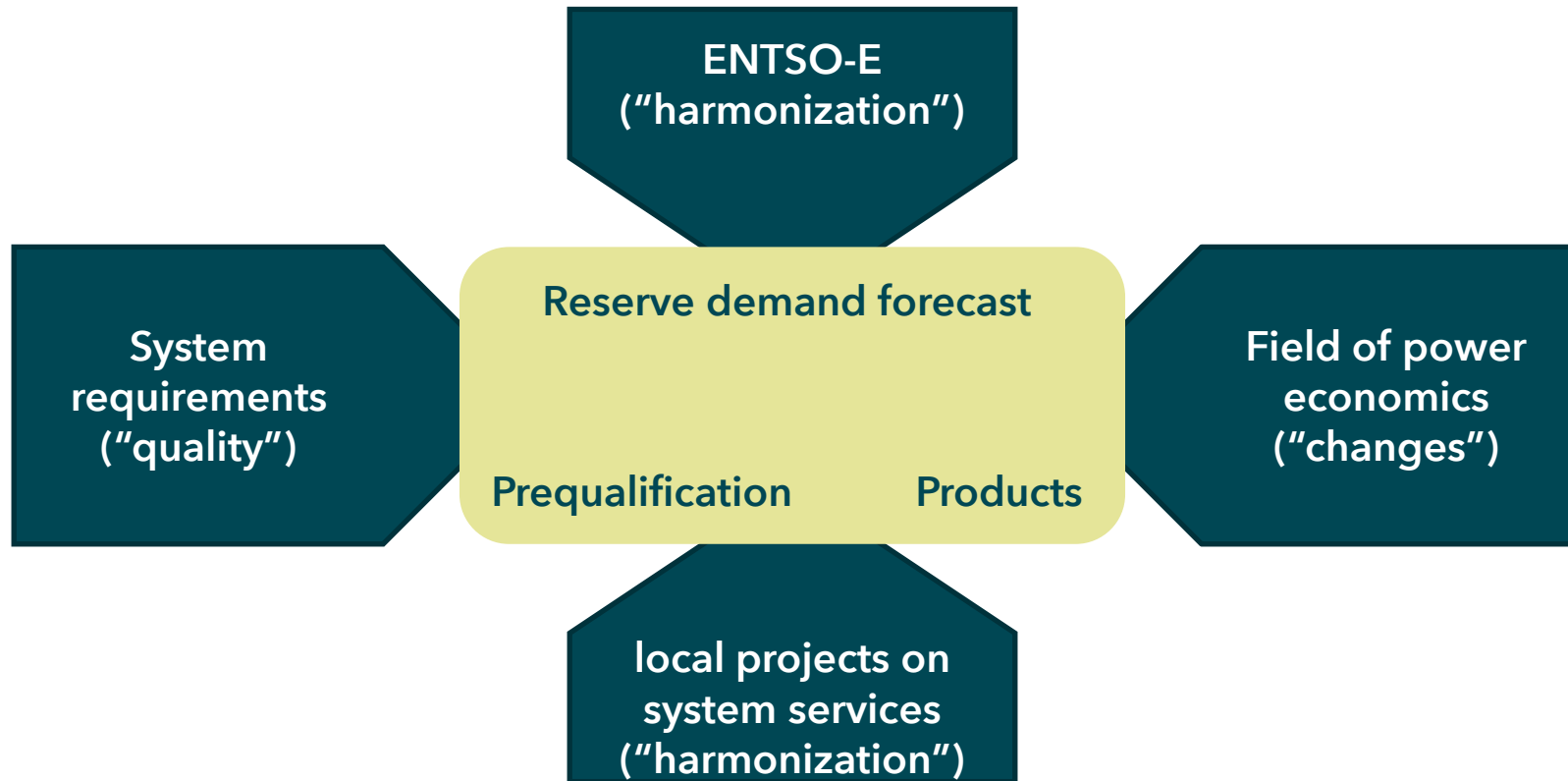
International discussion on extending common procurement

# 04 Future Developments



Future Developments

# BACKGROUND AND MOTIVATION

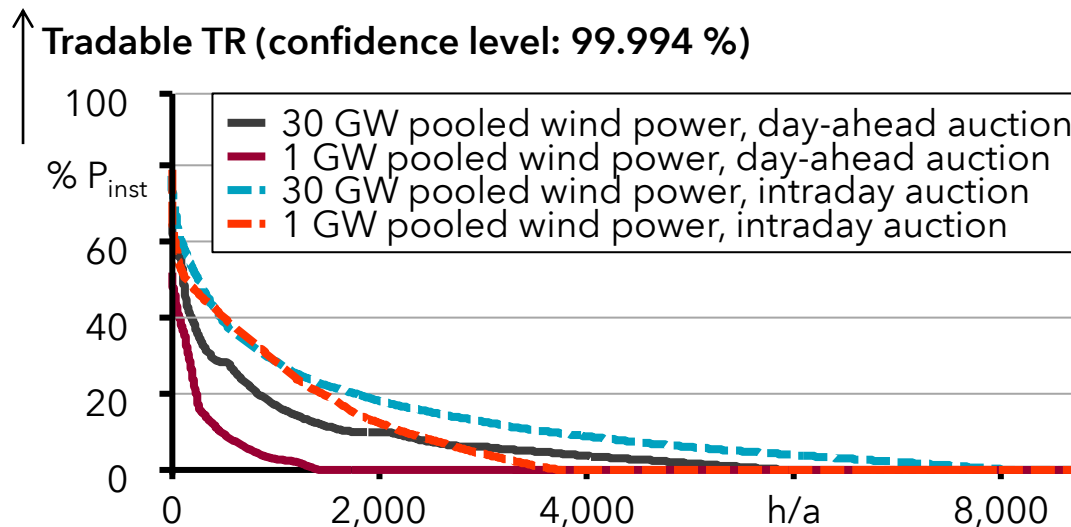


Projects due to market harmonization or changes in power economics  
 Requirement/Constraint: Continuously high level of system quality

Future Developments

# USAGE OF RENEWABLES FOR RESERVE BACKGROUND AND MOTIVATION

- / Annual duration curve of wind power generation tradable as TR in a day-ahead and intraday auction (simulation year 2012)
  - / 30 GW pooled wind power (total installed capacity in DE)
  - / 1 GW pooled wind power (exemplary wind pool)

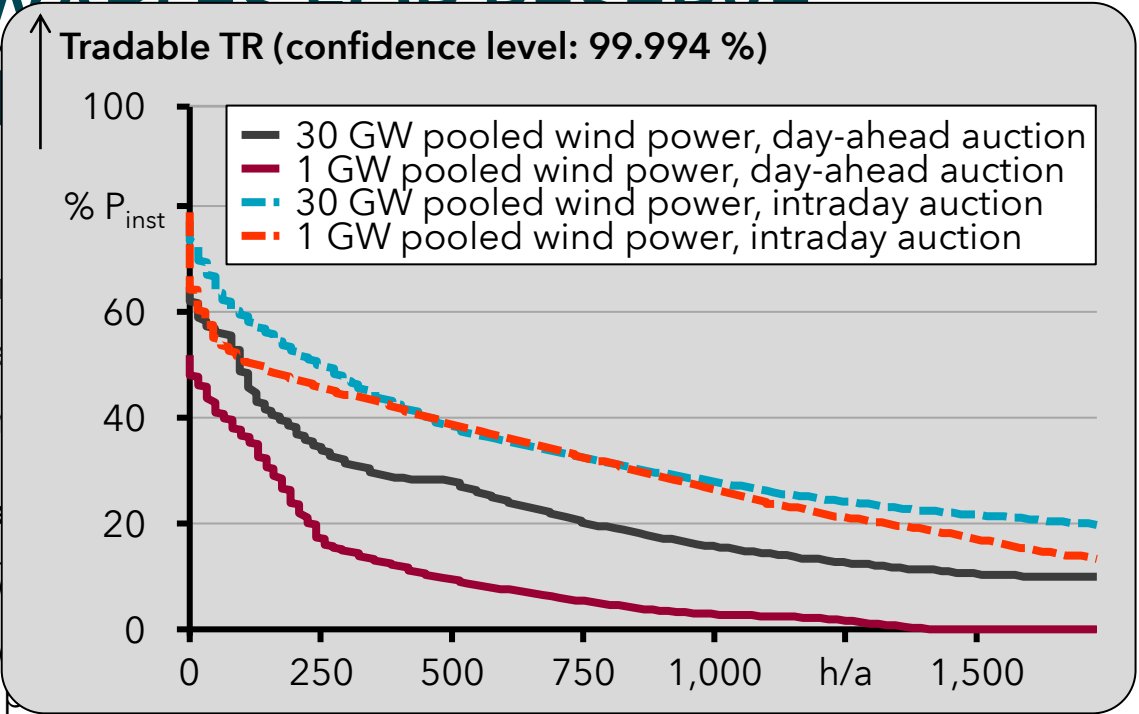
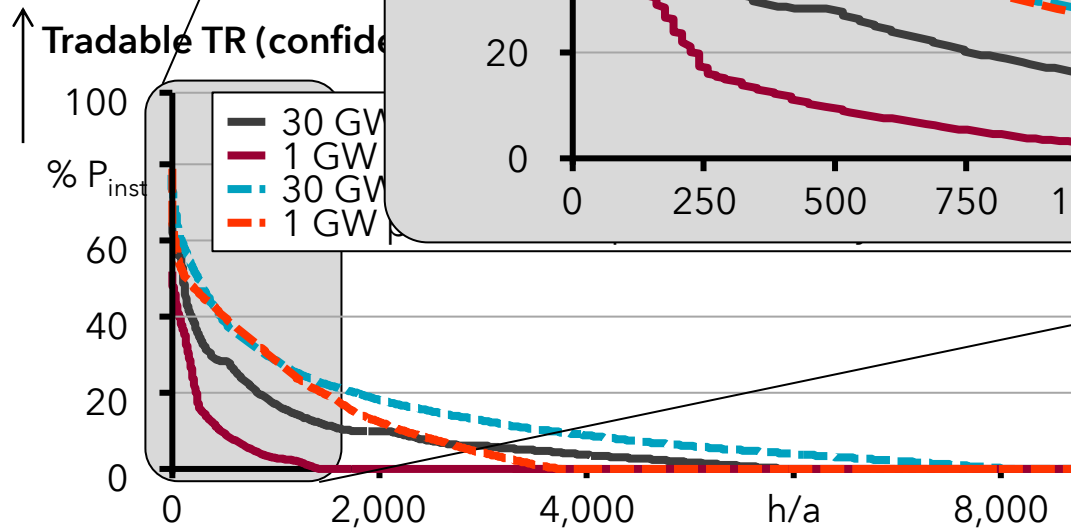


- Increase of tradable capacities due to intraday auctions
- Pool size increases “full load hours” but hardly relative quantity

Future Developments

# USAGE OF RENEWABLES FOR RESERVE BACKGROUND AND

- / Annual duration curve of wind ahead and intraday auction (situation 2015)
- / 30 GW pooled wind power
- / 1 GW pooled wind power



- Increase of tradable capacities due to intraday auctions
- Pool size increases "full load hours" but hardly relative quantity

## Future Developments

# USAGE OF RENEWABLES FOR RESERVE BALANCING PRODUCT/VOLUNTARY BIDS

- / Division of capacity and energy provision (e. g. market for TR)
  - / Day-ahead tender of capacity
  - / Intraday tender of energy (gate closure: on short-term before physical fulfillment)
- / Consideration of (quarter-hourly) voluntary bids for energy
  - / No capacity price
  - / Adjustment (downwards) of energy prices from already tendered capacity bids
- Expectation: Increasing costs for reserve capacity and decreasing costs for reserve energy

Participation of renewables in reserve markets based on voluntary bids  
Cost allocation for balancing energy should be adapted.



## Future Developments

# DAILY PROVISION OF SCR

## Expectations

- / Increase in the amount of available offers (market liquidity)
  - / Facilitation of market entry for participants with few units
  - / Easier assignment of units with volatile feed-in (short-term forecast quality)
- / More flexible dimensioning of required reserve capacities

## Open issues

- / Extension of international cooperation (daily vs. monthly/annual provision)
- / Gate closure (when before TR)
- / Product structure

Advantages and drawbacks due to daily provision

Specification by national regulator (and market participants) required

## Future Developments

# PAY-AS-BID VS. MARGINAL PRICING

## Motivation

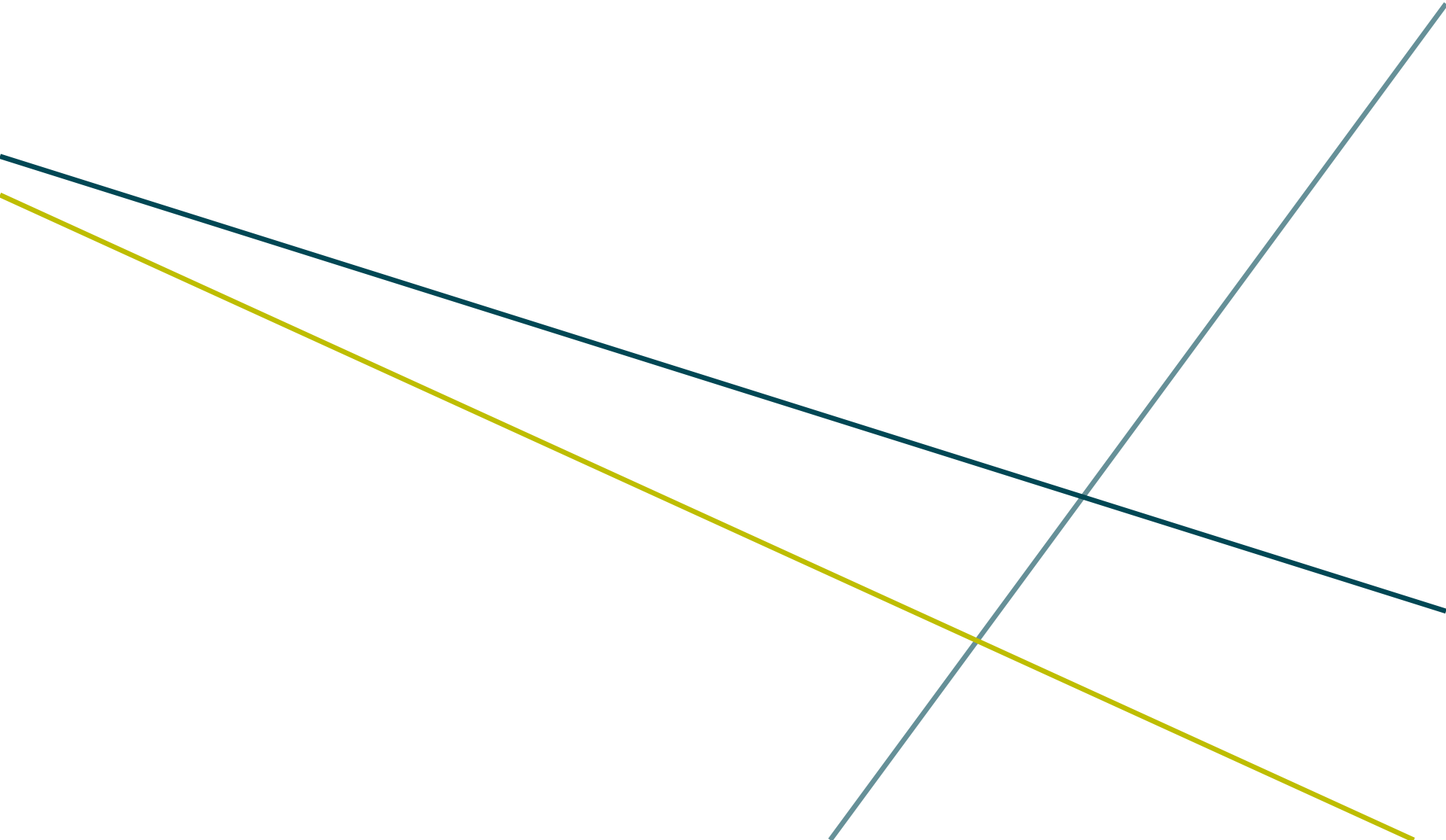
- / Introduction of marginal pricing for energy required on the long term due to European regulation
- / Increasing liquidity on markets for TR and SCR

## Open issues

- / Possible abuse of market power
- / Changes in all accounting systems
- / Impact on balancing price

Changing from pay-as-bid to marginal pricing may be a reasonable result after the developments to come

# 05 Conclusions



## Conclusions

# SUMMARY AND OUTLOOK

- / Increasing interest in markets for system reserve due to declining potential revenues from day-ahead market
- / Pricing at reserve markets by pay-as-bid auction, afterwards imbalance settlement via balancing price
- / International cooperation via IGCC (netting) and common procurement of PCR
- / Discussions on facilitation of market entry for renewables by introduction of balancing market and/or daily provision of SCR

Conclusions

# QUESTIONS?

TRÄNSNET BW

Dr.-Ing.

**Ulf Kasper**

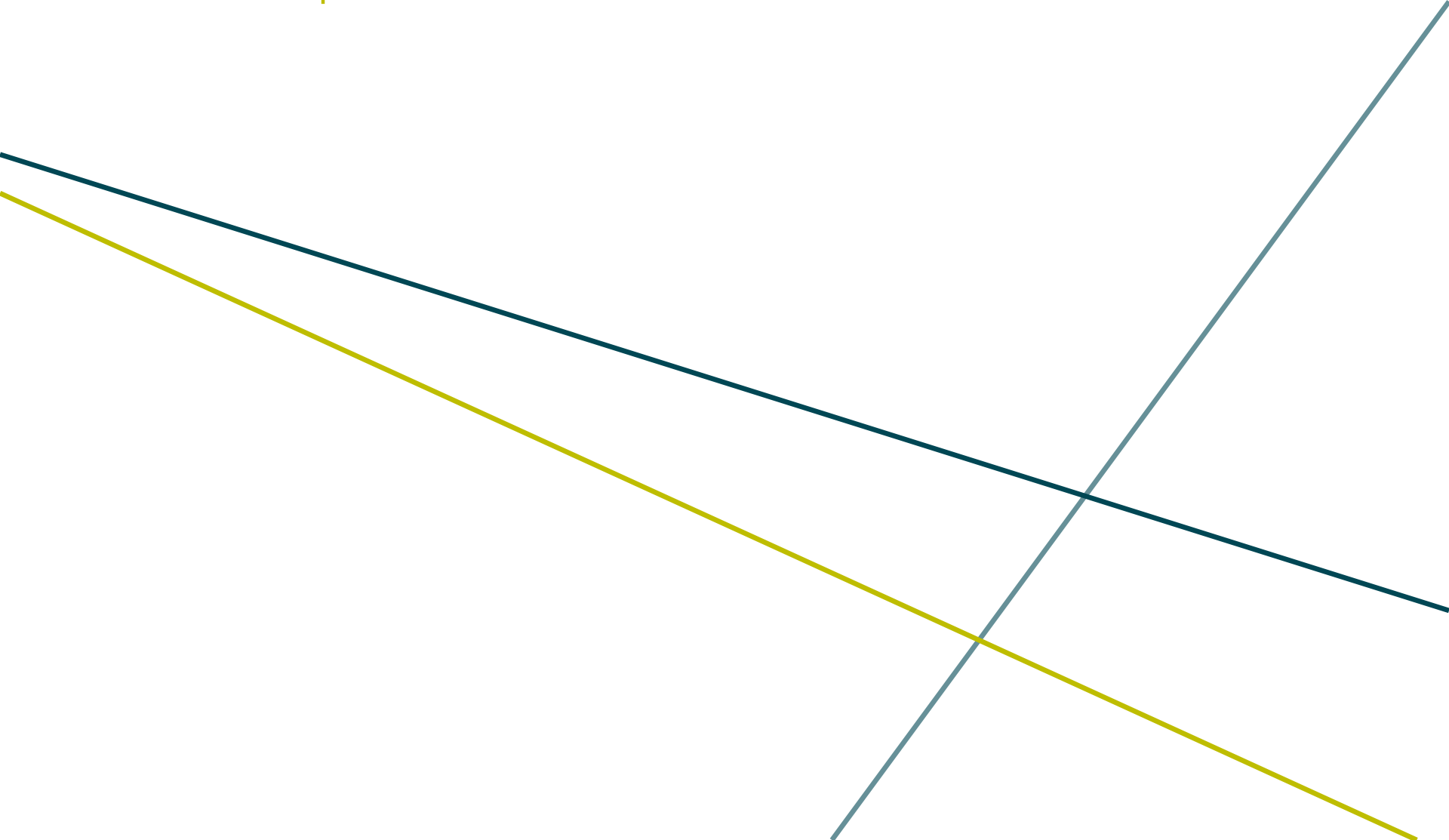
Expert Control Reserve

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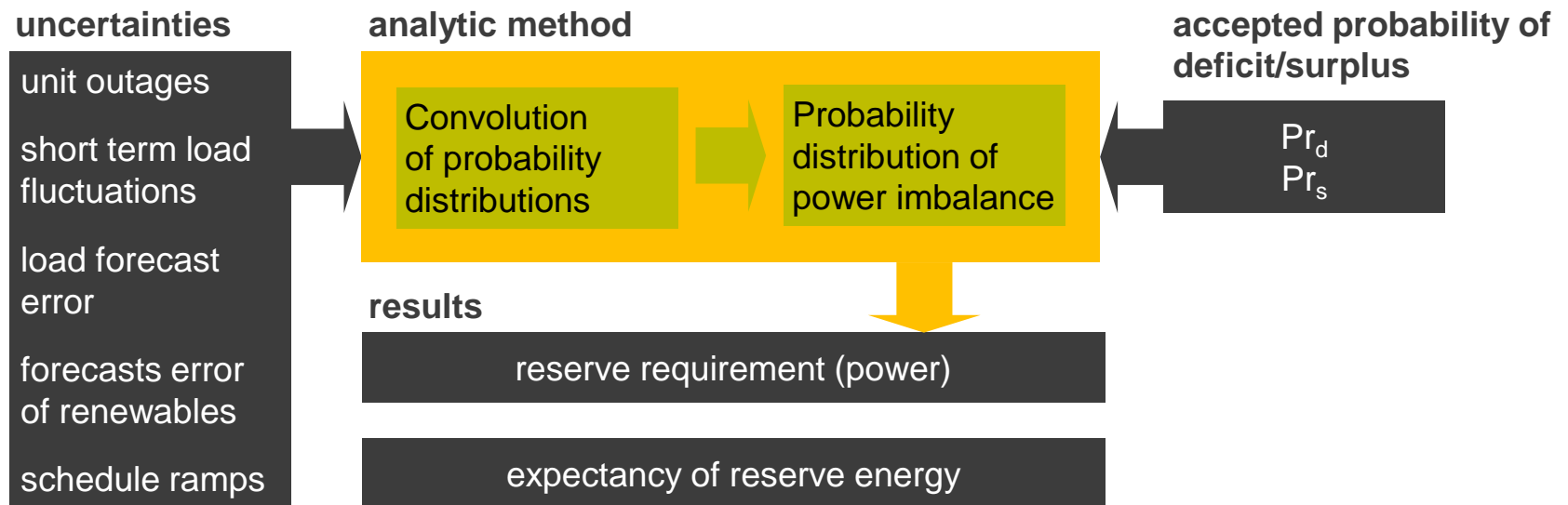
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00 Backup



Backup

# REQUIREMENTS FOR DIMENSIONING RESERVE



## Input data to be adapted

- / Distribution of schedule ramps from historical data
- / Parameters for fluctuation
- / Generation portfolio
- / Characteristics of forecast errors