

# Imbalance Management TenneT

## Findings of the comparative analysis between CA Germany and CA Netherlands

April 2012

This presentation is intended for the meeting participants only

## Content

- Background and scope of the report
- Required reserve power and control energy
- Imbalance and Area Control Error
- Economic and technical evaluation
- Conclusions and Recommendations



## Background and scope of the report

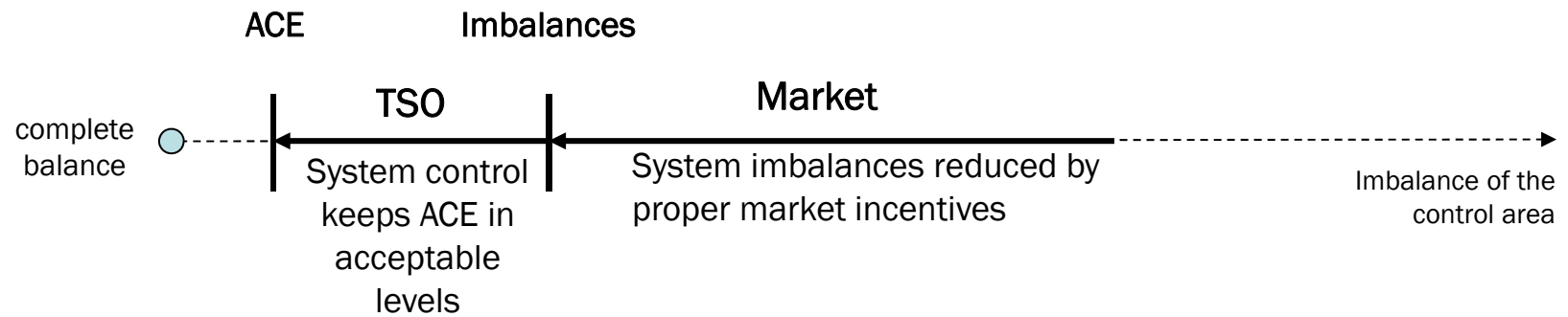
### *Identifying the merits of the system control practice in NL and DE*

- The ongoing integration of the European electricity systems leads to a growing need of cooperation and harmonization of system control policies across Europe
- TenneT compared the system control policies in NL and DE in order to identify the merits of each system
- Two studies have been conducted
  - Early 2010: Comparison of the two systems based on publically available data
  - Late 2010/Early 2011: Enhanced comparison based on TenneT's data, including assessment of control effectiveness and robustness
- Scope of this presentation is to share and to discuss the observations, conclusions and recommendations with market parties



## Background and scope of the report

### *The concept of system control*



## Content

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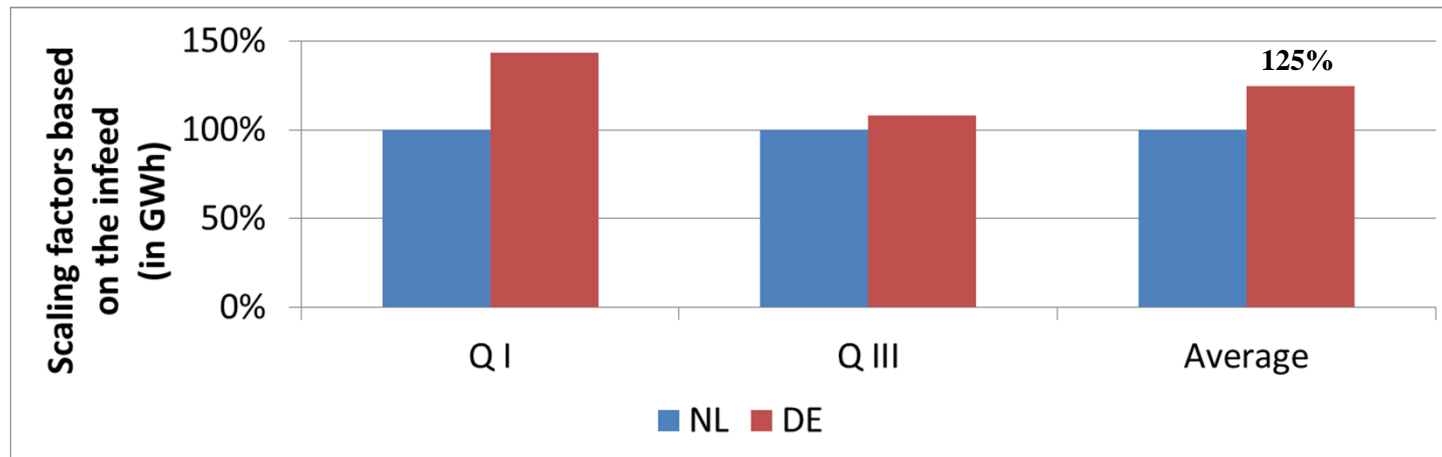
## Required reserve power and control energy *Acquisition and activation of SR and TR*

	NL	DE
<b>Auction system for reserve capacity</b>	SR: annual auction (symmetric) TR: annual auction	SR: monthly auction (positive and negative separately) TR: daily auction (positive and negative setarately)
<b>1 Volume acquired</b>	SR: fixed amount of 300 MW, acquired by bidding ladder TR: fixed amount of 300 MW acquired	SR: all required volume auctioned (volume according to analytical model) TR: all required volume auctioned (volume according to analytical model)
<b>Remuneration of reserve capacity</b>	Pay-as-bid	Pay-as-bid
<b>Bidding ladder for dispatch</b>	Capacity acquired via auction, including daily bids of residual market	Capacity acquired via auction, no additional bids allowed
<b>2 Energy prices</b>	Changes up to one hour before real-time	Prices set at time of auction
<b>Remuneration of control energy</b>	Uniformal marginal price	Pay-as-bid
<b>Publication of bid ladder</b>	Day-ahead	After capacity auction
<b>3 Publication of activated bids</b>	Published in real-time, together with activated control capacity	Not published
<b>4 Imbalance price</b>	One price system based on marginal price, but two prices based on marginal prices in case of activation of upwards and downwards regulation within one settlement period	One price system based on actual costs
<b>Publication of imbalance prices</b>	The day after	Several weeks after

\* Since July 1<sup>st</sup> 2011 TenneT DE has introduced weekly auctions for SR

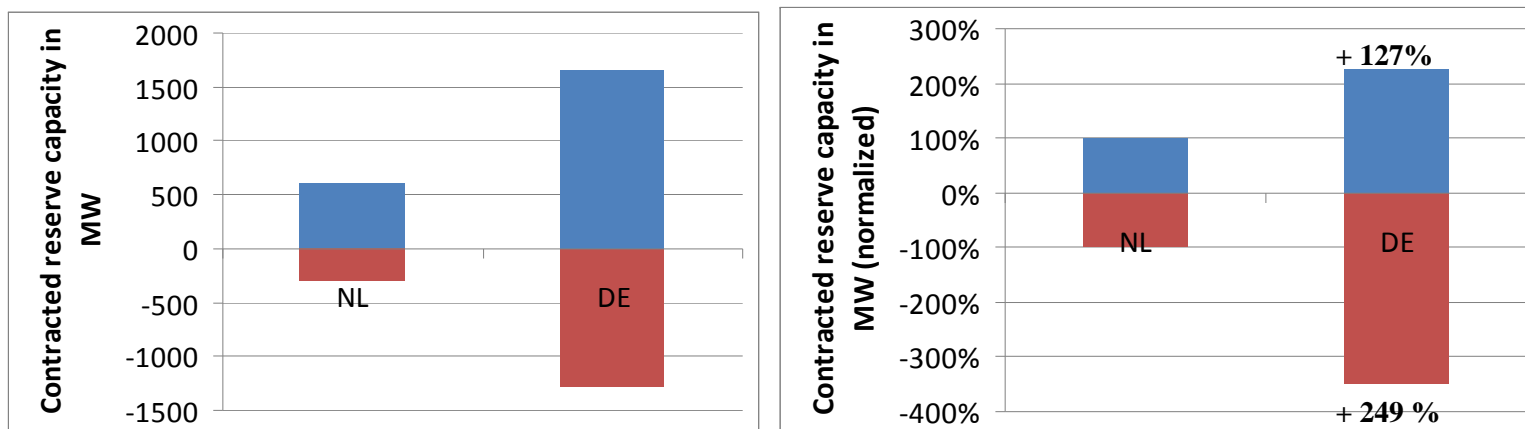
## Required reserve power and control energy *Assumptions and prerequisites*

- The analysis of the control volumes is based on the sum of SR and TR
- Basis of the comparison are the 15 minutes settlement time intervals
- The analysis is based on the data of Q I and Q III of 2010. For illustration purpose, the average of the two quarters is shown
- The control volumes and imbalances have been made comparable using a scaling factor based on the planned infeed in GWh



## Required reserve power and control energy

### *Contracted reserve capacity for TenneT NL and TenneT DE*



- TenneT DE contracted significantly more capacity than TenneT NL, particularly for negative reserve
- Please note:
  - Capacity auctions in Germany were monthly or daily, while they are annually in NL
  - Contracted capacity equals not available capacity

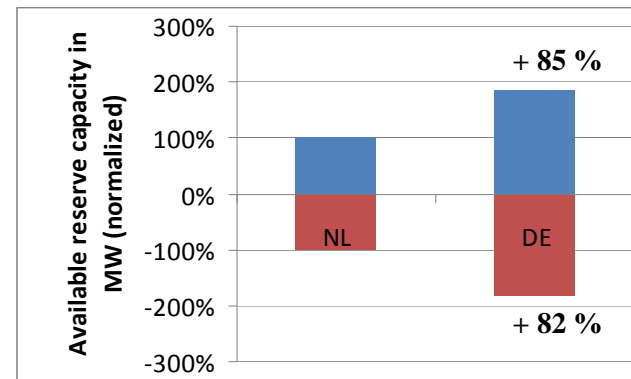
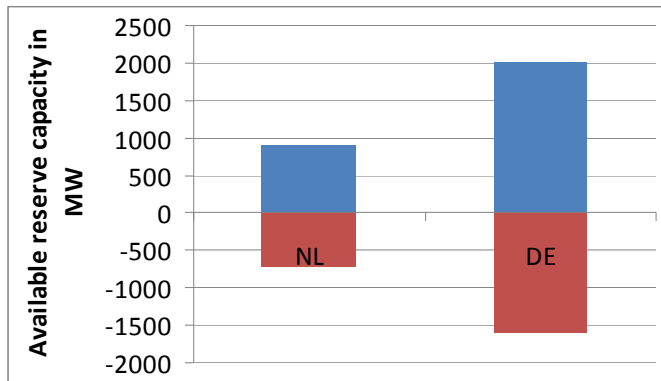




## Required reserve power and control energy

### *Available reserve capacity*

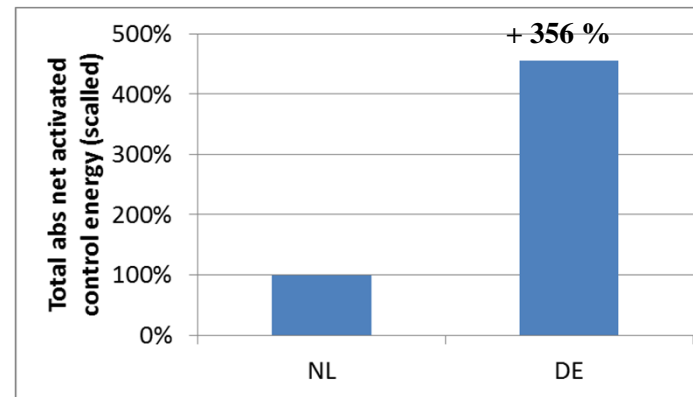
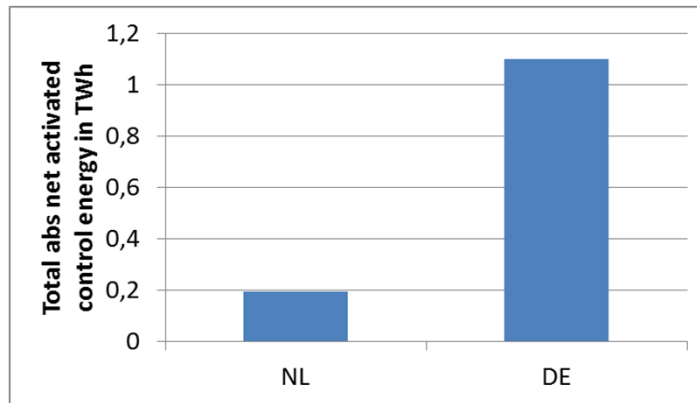
- In NL, all capacity that is offered into the bid ladder is considered available capacity
- In DE, TenneT participates in the GCC and has more capacity available than contracted. The theoretical capacity required by TenneT, if it did not participate in the GCC, is used as a proxy for the available capacity.



- Significantly more reserve capacity available for TenneT DE than for TenneT NL
- Both, the opening of the bidding ladder to all eligible bidders (in NL) as well as the participation in the GCC (DE) increase the available capacity significantly



## Required reserve power and control energy *Activated control energy*

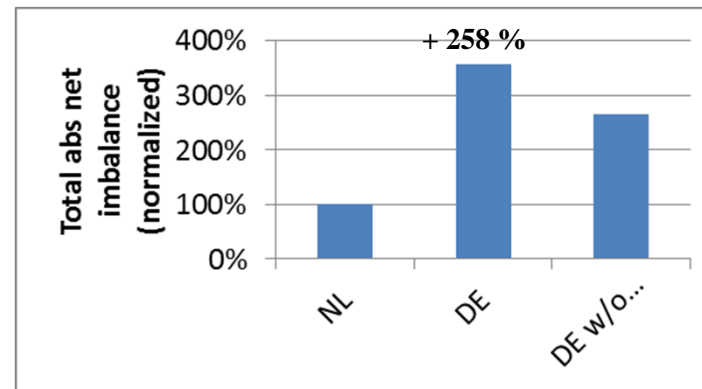
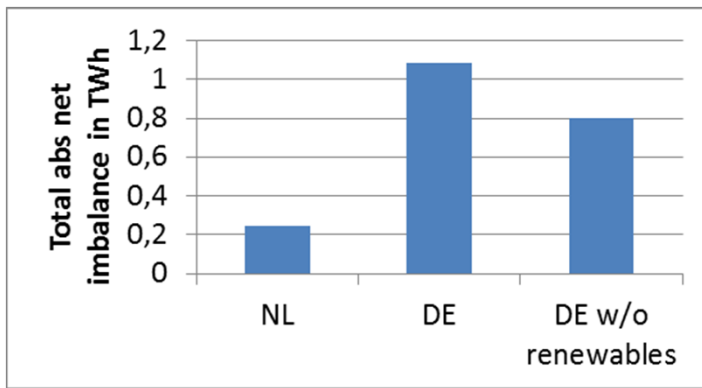


- In TenneT DE, significantly more control energy (the total absolute sum of SR and TR) is activated than in NL
- The reason for the higher control energy activation may be higher imbalances and/or lower remaining ACE due to control power activation



## Imbalance and Area Control Error

### *Imbalances*

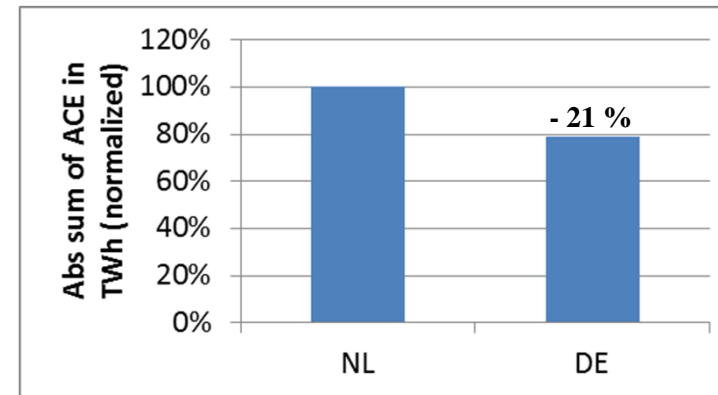
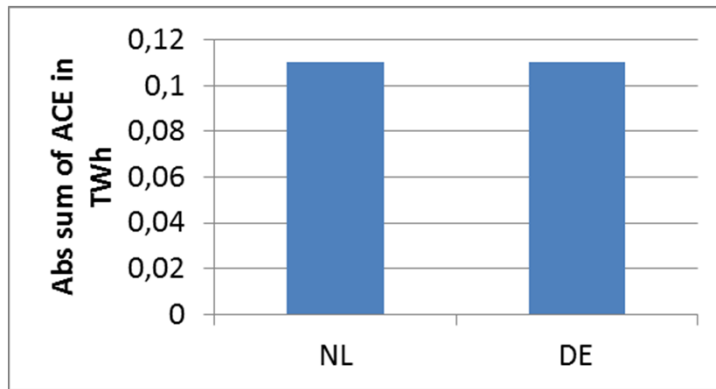


- The imbalances in the TenneT DE control area are significantly higher than in NL, but they cannot explain the difference in activated control energy alone
- Renewables are an important driver for imbalances. However, imbalances in the TenneT DE control area are significantly higher than in the TenneT NL control area, even if the impact of renewables has been eliminated



## Imbalance and Area Control Error

### *Area Control Error*



- The absolute ACE in the TenneT NL and TenneT DE control areas are of comparable size.
- The normalized ACE (based in planed infeed) in the TenneT DE control area is lower. The relatively lower ACE in the TenneT DE control area provides another contribution to the higher activated control energy.
- A lower remaining ACE represents a higher control quality.



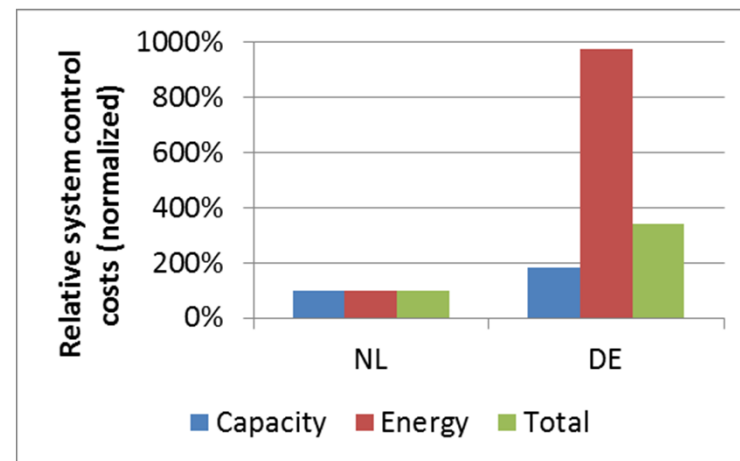
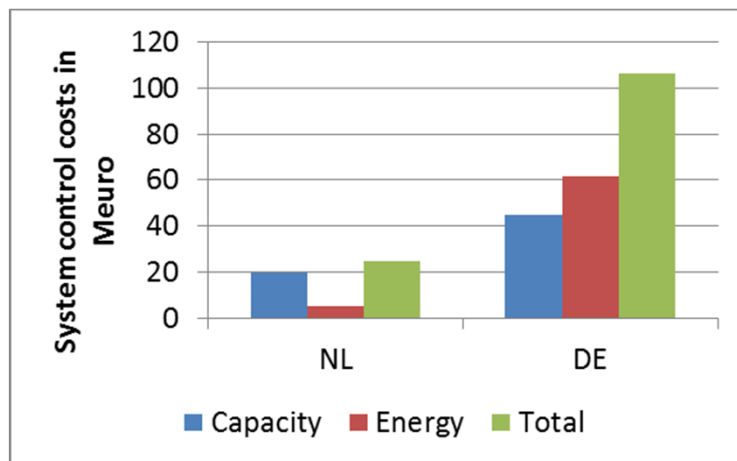
## Economic and technical evaluation *Overview*

- Economic evaluation
  - Extra costs for system control (difference between total system control costs and energy costs at spot prices)
  - Potential for “gaming”, i.e. trade-offs between the control power market and the balancing market
- Technical evaluation
  - Margin of available capacity, after imbalances have been balanced out
  - Control effectiveness, i.e. extent to which control measures lead to a reduction of the ACE



## Economic and technical evaluation

*Costs of system control are significantly higher in TenneT DE than in TenneT NL*



- The costs for contracting reserve capacity in TenneT DE is about twice as much as in TenneT NL
- The costs for activating energy is about 10 times higher in DE
- The total costs for system control is about factor 3 times higher in DE compared to NL



## Economic and technical evaluation

*One reason for the higher costs are the higher contracted and activated volumes*

- Higher contracted and activated volumes in TenneT DE. The main reasons may be:
  - More renewables
  - Lower ACE
  - Higher contracted volume due to market structure (capacity)
  - Higher activated volume (energy), as TenneT NL publishes the Dutch system balance position and balance energy price near real-time. This information is used by BRP's to actively reduce the system imbalance, utilizing non-contracted reserve power (this effect of decentralized dispatched control-power is called "passief meeregelen")

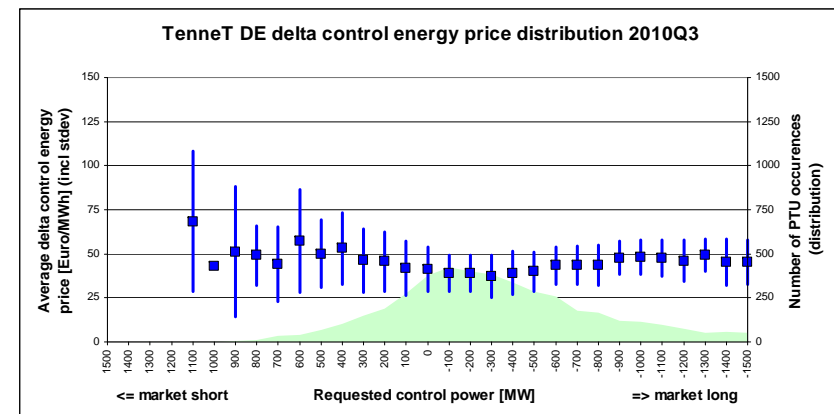
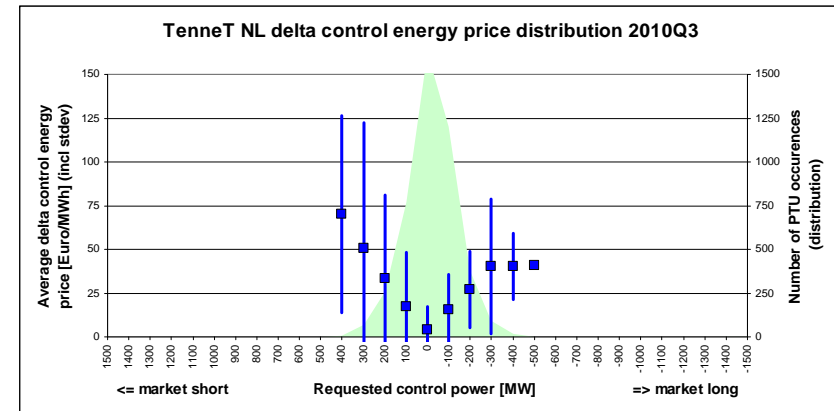




## Economic and technical evaluation

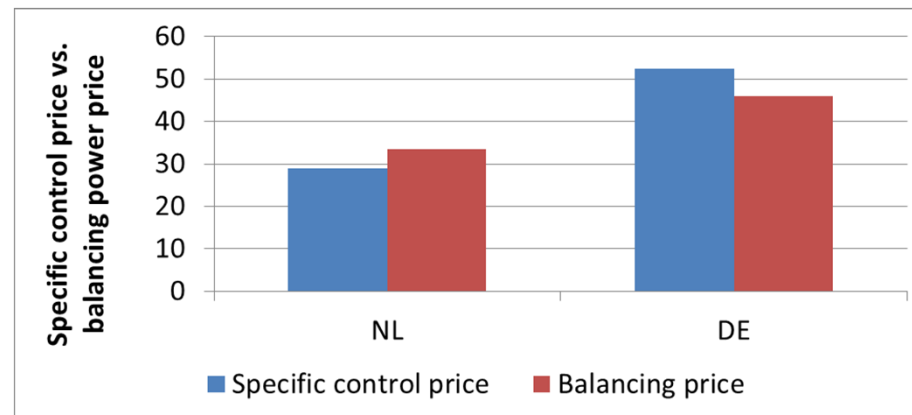
*Another reason for the higher costs are the higher prices for activated energy*

- Capacity prices are of similar size in both countries
- The average additional control price in NL was 29,0 €/MWh and in TenneT DE 52,5 €/MWh
- The main reason for the difference are not increasing prices for large control volumes, but higher prices for low control volumes
- Reasons for higher prices in TenneT DE may be:
  - Risk premium, as prices are set well in advance of real-time
  - Lack of effective competition, as only providers, who have concluded long-term contracts of SR, compete with each other





## Economic and technical evaluation *Scope for “gaming”*



- Prices for control energy are always equal or lower than the prices for balancing power in NL. This makes single imbalances unattractive.
- In the TenneT DE control area, control power is usually priced higher than balancing power, which makes it attractive for control power suppliers to trade-off one against the other



## Economic and technical evaluation

*With respect to the available capacity, the Dutch system appears to be similar or even more robust than the German system*

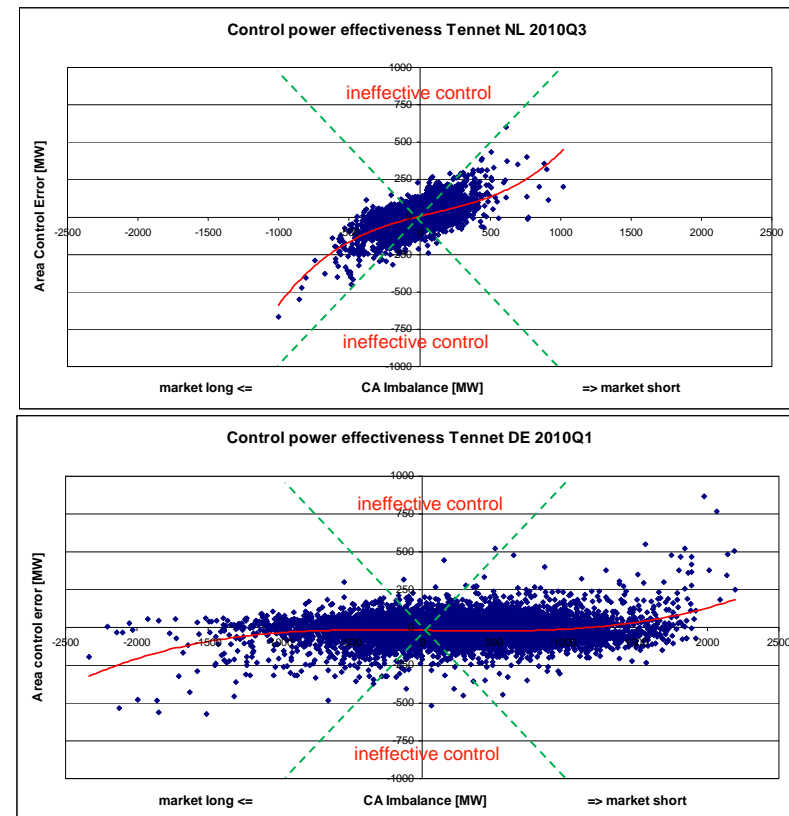
- One indicator is the average imbalance compared to the available capacity.
  - The imbalances to be controlled by TenneT NL amounted to 15% of the available capacity, while the imbalances for TenneT DE amounted to 28%
  - TenneT NL has therefore on average more capacity available, which was not needed to balance the system
- Another indicator is the number of hours where the free margin (available capacity minus imbalance) is less than a certain threshold.
  - During 5 settlement time periods the free margin was lower than 10% of the available capacity in NL, whereas this occurred over 52 hours in the TenneT DE control area



## Economic and technical evaluation

*Effectiveness of control appears to be high*

- The control activities of a TSO are the more effective, the more the activated control measures lead to a reduction of the ACE
- TenneT DE seems to be very effective in controlling the AC



## Conclusions

*The balancing costs of TenneT NL are significantly lower than for TenneT DE*

- Lower initial imbalances (factor 3..4)
  - The renewable energy contribution cannot explain the higher imbalance in TenneT CA Germany
  - The most likely explanation for this is the active deviation from planned in-feed / off-take by BRPs optimizing their position
    - Real-time feedback on actual market balance position and imbalance price in The Netherlands
    - Price difference between imbalance energy and the control energy in Germany
- Less contracted control capacity (factor 2)
  - Partly due to lower imbalances in NL
  - Also due to a different market structure, which allows contracting of only part of the required reserve capacity in NL
- Less activated control energy (factor 4..5)
  - Partly due to lower imbalances in NL
  - Partly due to lower ACE in TenneT DE
- Lower average delta control energy price (factor 1,5 .. 2)
  - Partly due to risk premium from time difference between setting prices and real-time
  - Lack of competition maybe another source of high energy prices



## Conclusions

*Both systems appear to be equally robust*

- The control system in DE seems to be very effective, as it leads to a lower ACE in spite of higher imbalances.
- The available reserve capacity in NL seems to be at least as high, even as it builds on making capacity available voluntarily in the day-ahead time-frame.
- The analysis did not provide any indication that the decentralized contribution in the Dutch system jeopardizes system robustness.



## Recommendations

- 1) Reduce control energy costs by introducing more flexibility and competition in the bidding process in Germany
  - Accept control energy bids of pre-qualified parties that are not part of the contracted capacity
  - Introduce more flexibility in bid pricing (allow changes up to 1 hour to delivery, prices per PTU)
  
- 2) Re-evaluate the incentives of market parties in Germany
  - Enable reduction of system imbalance using passive contribution of BRP's by considering to share more real-time system balance and balance energy price information with the market.
  - Prevent creation of additional imbalance by arbitrage opportunities of control energy suppliers by considering marginal control energy pricing.
  
- 3) Investigate extension of the GCC to The Netherlands





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