



Cross-Border Exchange of Balancing Energy and Operational Reserves: Benefits and Issues

Potential Cross-Border Balancing Cooperation between Elia and Tennet

Stakeholder Workshop
Brussels, February 1st, 2013



Agenda

- Introduction

- Exchange of Frequency Containment Reserves (FCR)
- Exchange of Frequency Restoration Reserves (FRR)
- Exchange of Replacement Reserves (RR)
- Impact on Imbalance Settlement
- Summary

Introduction: Objectives and Requirements

- Interest of key market stakeholders
 - Balancing Service Providers want to sell their products at a profitable margin
 - Balance Responsible Parties need manageable price risks from imbalances
 - TSOs interested in access to additional sources of reserves and balancing services as well as in optimizing the use of available resources
 - Load want to keep under control /lower tariffs for ancillary services
- TSOs must safeguard operational security at all times
 - Mutual 'insurance obligation' between TSO in continental European synchronous zone
 - Performance obligation for Frequency Containment and Frequency Restoration processes
 - Reserve replacement assigned to market in Belgium and the Netherlands
- In accordance with European rules, TSOs shall facilitate the cross-border exchange of balancing services
- However, cross-border exchange of balancing services shall not distort:
 - Local TSO responsibility
 - Security of Supply
 - Imbalance prices

Potential benefits of cross-border collaboration

Netting of imbalances (ENERGY)

Definition: avoidance of counter acting activation of balancing energy

Requirements: available transmission capacity

Expected result: lower regulation volumes

Application: FRR

Common merit order (PRICE)

Definition: integration of individual merit order of balancing energy offers into common merit order

Requirements: available transmission capacity

Expected result: lower combined expenditures for procurement of balancing energy

Application: automatic and manual FRR

Reserve sharing (CAPACITY)

Definition: mutual provision of operational reserves among TSOs

Requirements: available transmission capacity

Expected result: lower size of amounts of procured reserves

Application: compliance, mutual support

Exchange of reserves (PRICE)

Definition: reserves are procured in a coordinated way (TSO-TSO, TSO-BSP)

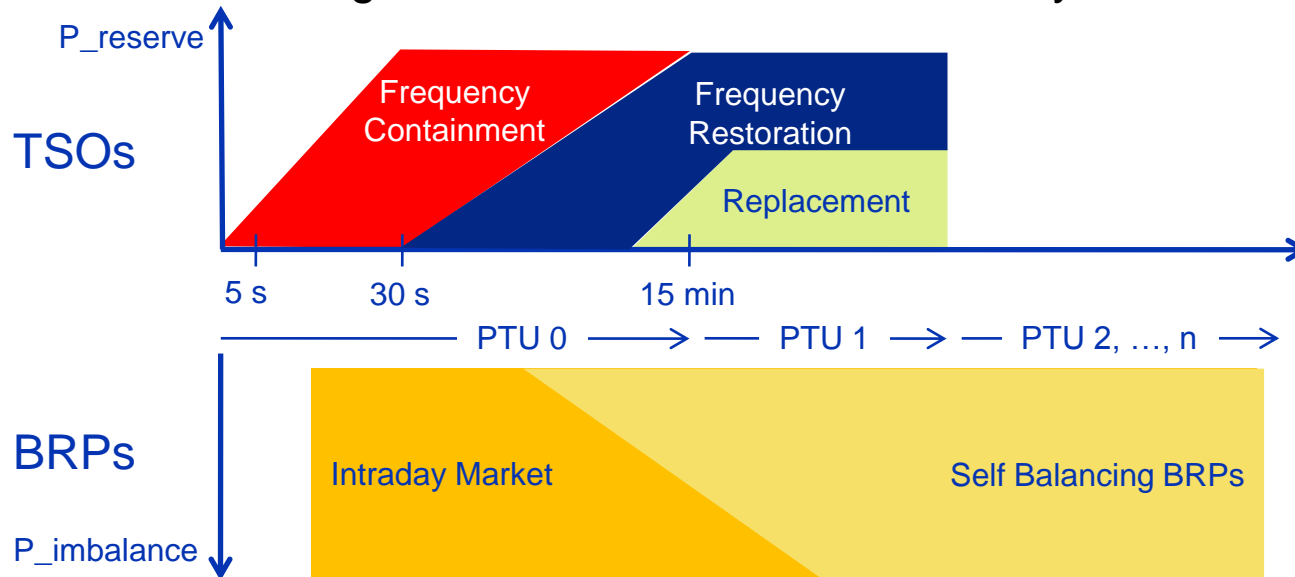
Requirements: available transmission capacity

Expected result: lower combined expenditures for procurement of control reserves

Application: FCR and automatic & manual FRR

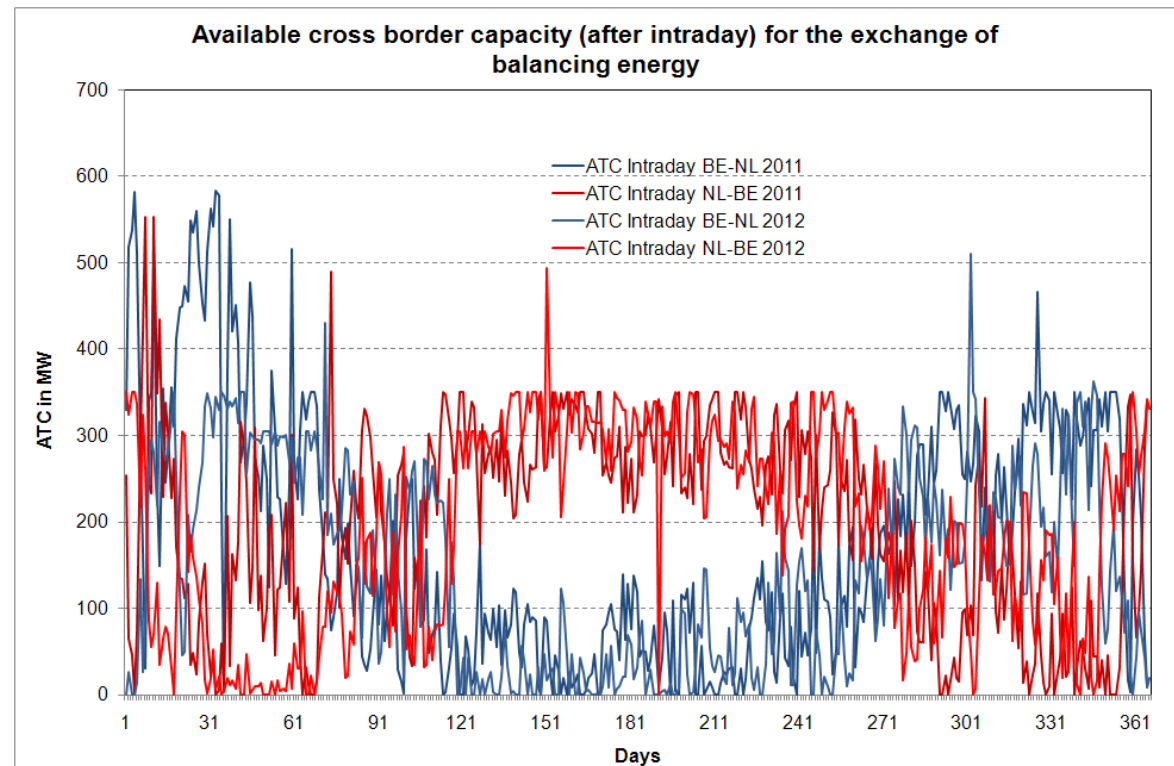
Scope of potential services

- Elia and TenneT basically rely on 3 different types of balancing services:
 - Frequency Containment Reserves (FCR)
 - Manual and Automatic Frequency Restoration Reserves (FRR)
 - Replacement Reserves (RR, for PTU+1)
- Replacement reserves for PTU+2 are not normally activated by ELIA and TenneT, because market participants are doing this in the intra-day market and/or by means of self balancing because of correct incentives by imbalance prices



Potential benefits/costs of X-border exchange and activation of FRR: Available cross border capacity

- The figure below shows substantial available cross border capacities after intraday nominations for the exchange of balancing energy
- In tendency, there is unused cross border capacity for the export from the Netherlands in the summer half year, whereas export from Belgium is rather feasible in the winter half year
- Since end of 2012, TSOs are in a position to increase intraday ATC compared to day ahead ATC



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FCR: Potential benefits and general feasibility

- Required volumes of FCR
 - Determined for the whole synchronous area in continental Europe (former UCTE)
 - Total volume split across individual TSOs (pro-rata annual consumption)
 - Although the cross-border exchange of FCR is principally possible, it leads to a redistribution of the required volumes between different TSOs only
 - Balancing energy from FCR is not accounted for and not remunerated
 - The provision of FCR in the Netherlands is currently a compulsory service of grid connected parties (represented by their BRP)
 - Joint procurement possible only after the commercialisation of this service in the Netherlands
 - Alternatively, Belgium could try to procure FCR from the Netherlands by means of the TSO-BSP model (at least for a transitional period)
 - Option: Common weekly procurement with NL-DE-BE, however BE is doing yearly XB procurement R1 with France)
- **Cross border collaboration is only possible by exchange of FCR obligations (capacity MW) between TSOs**

FCR: Practical issues

- The exchange of FCR might be constrained by TRM, but also limitations due to compliance (former UCTE Policy 1, Load Frequency Control & Reserves Code)
 - The planned commercialisation of this service in the Netherlands could immediately be designed with a view on facilitating the cross-border exchange of FCR and compatibility with Belgium, in particular with regards to:
 - Product definition
 - Principles for selection and remuneration
 - Given the use of different products in Belgium today, one may imagine 2 options:
 1. Exchange of a single standardised product
 2. Exchange of multiple standardised products
 - Decision ultimately represents choice between limited complexity and desire for maximal use of available technical potential
 - Legal obligation in BE for yearly procurement of reserves
- **Cross-border exchange might require some changes in both countries**

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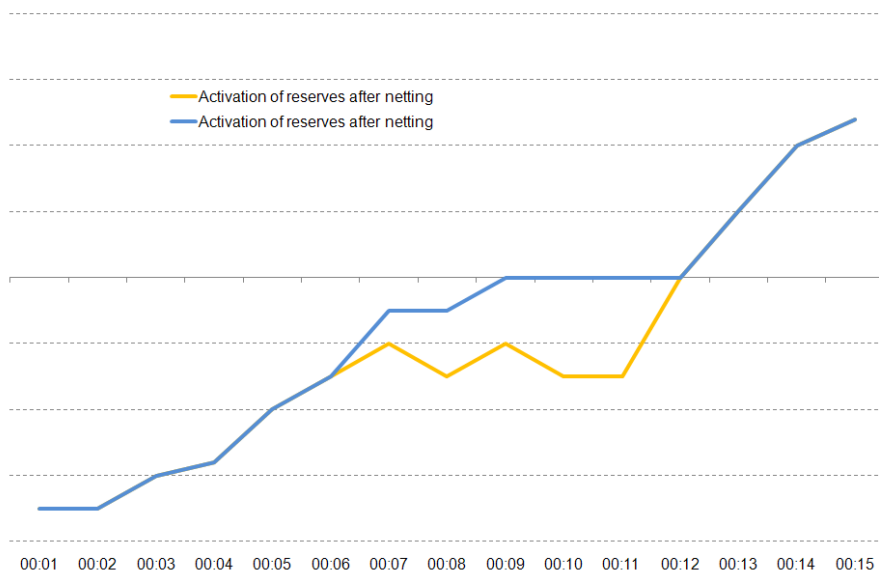
FRR: Potential benefits and general feasibility

- FRR are the main balancing product in both countries; however, the Netherlands prefer Automatic FRR, whereas balancing in Belgium mainly builds upon Manual FRR
 - FRR account for the bulk of contracted reserves and balancing energy provided
 - FRR are the major (if not exclusive) driver for imbalance prices
 - Participation of both TSOs in IGCC avoids counteracting activation of automatic FRR
- **FRR as the ‘optimal product’ for cross-border exchange and activation in theory**

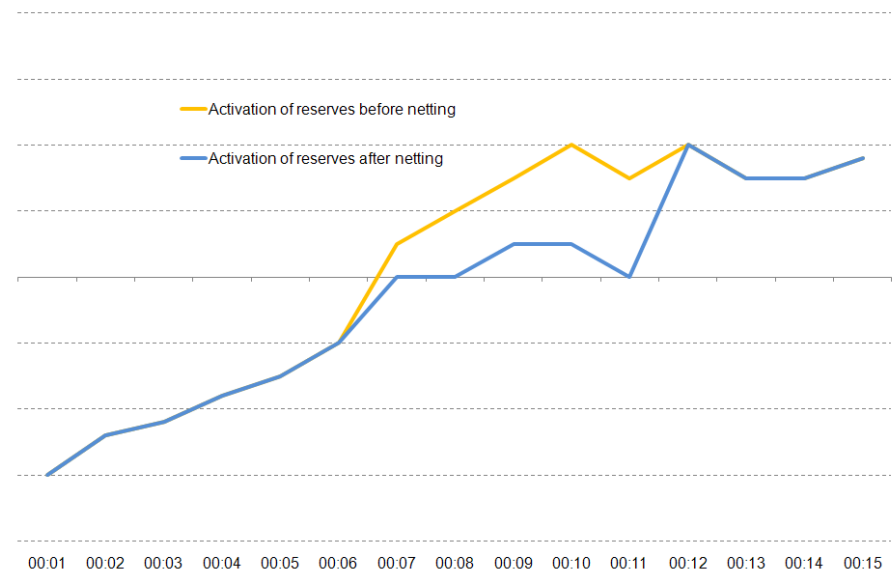
Potential benefits of X-border activation of automatic FRR: Netting of imbalances

- Without netting, TSO A is regulating down whilst TSO B is regulating up
- Through netting, TSO A can 'export' its positive imbalance to TSO B
 - TSO A avoids use of downward regulation
 - TSO B reduces its need for upward regulation

TSO A



TSO B



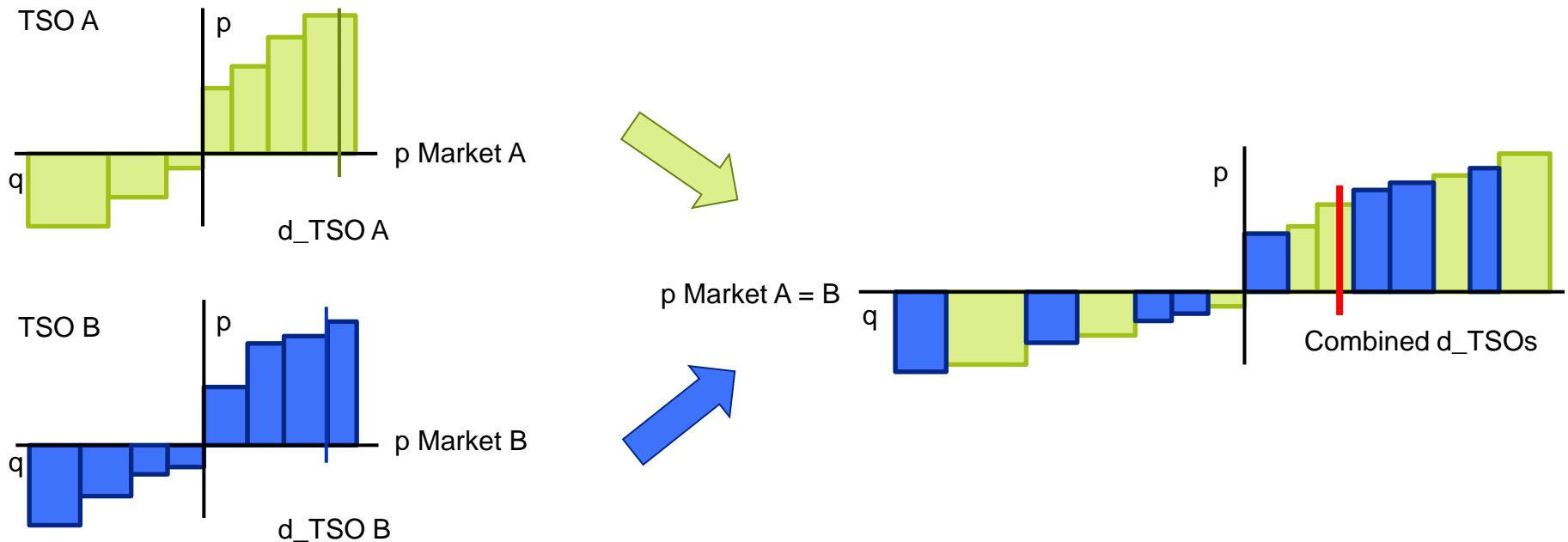
Potential benefits of X-border activation of automatic FRR: Netting of imbalances

- Better control quality, through lower Area Control Error
 - Lower volume of balancing energy needed for TSOs
 - Lower sales of balancing energy volumes by BSPs
 - Lower imbalance price spreads for BRPs
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- **Lower cost of balancing for BRPs and consumers**
 - **Significant share of potential benefits already used today**

Benefits of X-border activation of FRR:

Common merit order

- Combining the offers for balancing energy into a common merit order helps to reduce the overall cost of balancing
- Prerequisite: Market price in market A and B is identical; in case of price differentials congestion between markets thus limiting X-border activation



Potential benefits/costs of X-border activation of FRR: Common merit order

- TSOs:
 - + Ideally access to a larger number of and more diverse offers
 - More complex operational system
 - BSPs:
 - + More sales volumes for cheap BSPs
 - Less sales volumes for expensive BSPs
- } *Redistribution*
- BRPs:
 - ± Reduced or higher spread and volatility of imbalance prices in dependence of cross border balancing price
 - ± But, more extremes possible
 - ± Could lead to a general price shift in one country
 - LOAD
 - ± Increase/decrease in the balancing component of the energy part of the retail price

Potential benefits/costs of X-border exchange of FRR:

Reserve sharing

- Sharing of reserves allows to lower the level of operational reserves to be procured domestically.
- Congestion is assumed to constraint the exchange of operational reserves only in one direction.
- Subsequently, TSO A can in the example below draw upon the minimum of the shared reserves with TSO B and C.



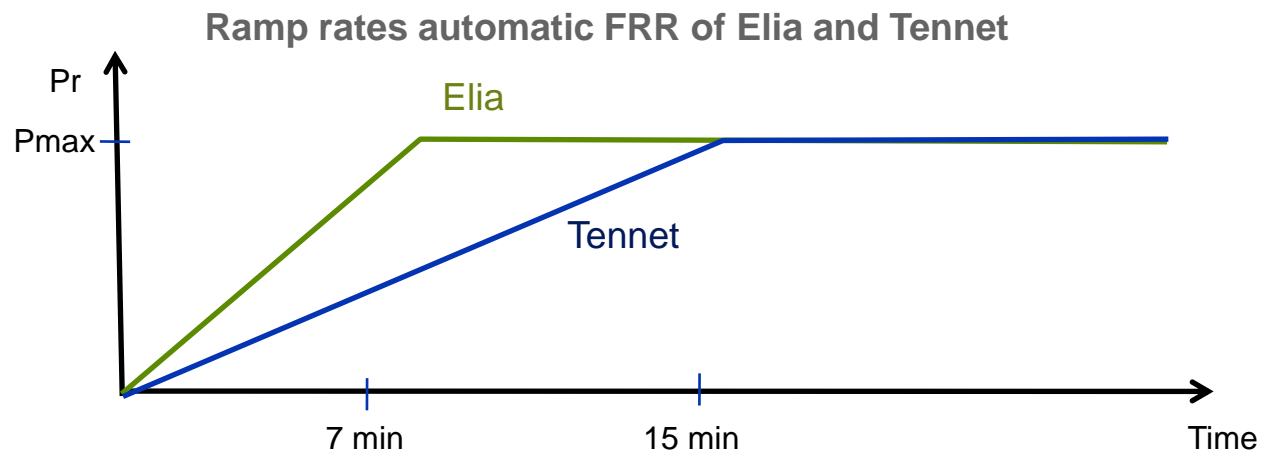
Practical issues of X-border exchange and activation of automatic FRR 1/4

- Use of two fundamentally different FRR products (manual vs. automatic) as well as differences in detailed market design
- Both countries use advanced tenders and operate a daily balancing market
- Cross-border exchange principally offers significant benefits, i.e. by means of joint contracted reserves, netting, or the use of a common merit order
- The free volumes for the X-border exchange of automatic FRR are limited
- Often regulating needs in consecutive PTUs are in the same direction and automatic FRR are heavily used

- **Need to consider various differences in detail**

Practical issues of X-border exchange and activation of automatic FRR 2/4

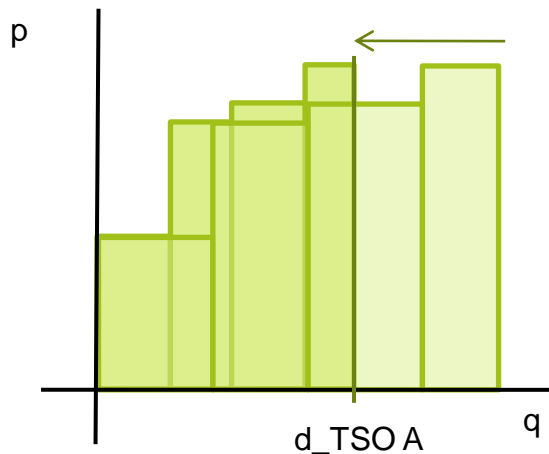
- Different product qualities, i.e. required ramp rate in Belgium (15%/min) twice as high as in the Netherlands (7%)
- Combined use may result in uneven energy contributions from both countries
- Risk of deteriorating regulation quality and/or need for additional volumes if Elia accepted slower FRR
- Conversely, the introduction of more stringent requirements might negatively impact the cost and availability of this service in the Netherlands
- Assure compatibility with the European standard requirements



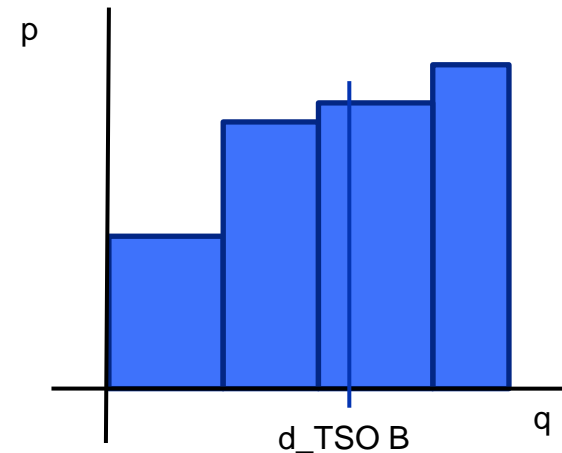
Practical issues of X-border exchange and activation of automatic FRR 3/4

- Different principles for activation, i.e. whilst Elia activates all pre-contracted offers in parallel (pro-rata), TenneT selects automatic FRR in accordance with the merit order and activates the pre-selected bids in parallel
- Difference further reinforces the impact of different ramp rates (see previous slide)
- Very different pricing principles

TSO A: pro-rata activation of 60% of automatic FRR



TSO B: merit order based activation of 60% of automatic FRR



Practical issues of X-border exchange and activation of automatic FRR 4/4

- Very different prices signals:
 - direct link between of balancing energy and system imbalances in case of activation by means of a merit order
 - Inelastic prices in case of parallel activation. i.e. prices for automatic FRR independent of volume of activated R2
 - Price caps for balancing energy in Belgium with pay as bid pricing
 - Bid price caps for pre-contracted capacity in the Netherlands, but bid caps will be overridden by marginal pricing

- The different price signals reflect the fundamental design philosophy for the balancing mechanisms

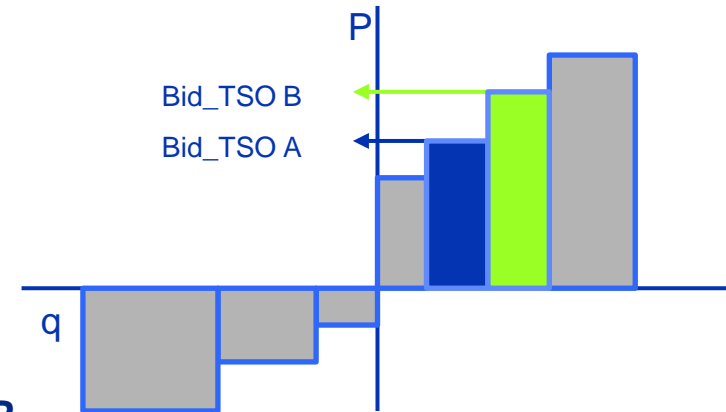
Manual FRR: Practical issues 1/2

- Very limited use of manual FRR in the Netherlands
 - Fundamentally different products, i.e. use of directly-activated FRR in Belgium as opposed to schedule-activated FRR in the Netherlands
 - Use of explicit bids in the Netherlands vs. implicit bidding in Belgium, i.e.
 - Dutch BSPs explicitly offer prices and volumes of balancing energy
 - Belgian BSPs offer a set of prices only, whilst available volumes are derived from production schedules by Elia
- **X-border exchange requires substantial changes of products, processes, systems, agreements and regulations in one or both countries**

Manual FRR: Practical issues 2/2

- Different problems related to remuneration at marginal price
 1. **High imbalance prices in one country because in the other country there's a big imbalance**
(general problem of coupling systems with marginal pricing)
 2. **Not possible for a TSO to guarantee cost efficient activation of available balancing energy**
Example: Activation of cheaper manual FRR in NL by ELIA becomes more expensive if NL activates more expensive R2

Example: TSO A activates the blue bid for a particular PTU. TSO B afterwards activates the green bid for the same PTU. TSO A would have to pay the price of the green bid for the activation of the blue bid.



- **Require fundamental changes at least for manual FRR**
- **Additionally need to consider impact on imbalance settlement (see below)**

Issues for XB activation of energy: Manual FRR 1/2

- Modifications required in market design in one of both countries to allow XB collaboration
 - Scheduled products in NL vs direct activated in BE
 - Explicit bidding (NL) vs. Implicit bidding (BE)
 - Marginal pricing (NL) vs. Pay-as-bid (BE)

- Potential win-win solutions for both countries?
 - Marginal imbalance prices NL are predominantly set by R2 and not by manual FRR (major exception “Noodvermogen”)
 - Merit order logic in BE – only high marginal imbalance prices if more expensive manual FRR are activated
 - Difficult to accept “pure marginal pricing“ on the border for BE, because leads to an increase in imbalance prices;
 - Quid increase welfare?
 - Quid optimal XB dispatch if ex-post marginal prices might increase (due to R2 activations)?

Issues for XB activation of energy: Manual FRR 2/2

- Potential win-win solutions for both countries?
 - Both TSOs are publishing in real time imbalance tariffs and are incentivizing market players to react:
 - How to combine marginal pricing/ import of price signals of other TSOs with reactions of market players on price signals/local TSO responsibility?
 - But pay-as-bid on border implies pay-as-bid in NL => difficult to be accepted by Dutch market players on bidladder

- Innovative pricing mechanism required on border?

Potential benefits/costs of X-border exchange of contracted FRR

- TSOs:
 - + Ideally access to more and more divers offers for control reserves and balancing energy
 - + Lower cost of operational reserves
 - + Lower prices (only in case of probabilistic dimensioning)
- BSPs:
 - + More sales volumes (capacity) for cheap BSPs
 - Less sales volumes for expensive BSPs
- BRPs:
 - No direct impact on costs or income
- LOAD / PRODUCTION (only BE)
 - + Decrease in tariffs for ancillary services

} *Redistribution*

Practical issues of X-border exchange of contracted FRR

- Cross-border exchange of contracted FRR may offer substantial benefits
 - The Netherlands offers a higher potential and a more diverse provider base
 - Expectation of price reductions in joint procurement
- However, the cross-border exchange of contracted FRR principally requires at least some harmonisation of the product characteristics and pricing principles
 - “2nd step” after the cross-border exchange of balancing energy from FRR
 - Alternative of TSO-BSP model (for a transitional period)?
- In addition, the exchange of contracted reserves seems likely to conflict with the restrictions of the FG Electricity Balancing on the reservation of cross-border capacity for the exchange of operational reserves
- **Exchange of contracted FRR may be difficult without prior integration of daily mechanisms for activation of the corresponding products**
- **Guaranteed availability to (unused) cross-border capacity and/or reservation of cross-border capacity likely to create additional barriers**

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X-border exchange and activation of Replacement Reserves

- Clear focus of FG Balancing on cross-border exchange of RR
 - Corresponding products principally exist in both countries, but both market designs principally aim at self-balancing via the intra-day market:
 - No operational reserves are procured, i.e. the theoretical use would be limited to the activation of balancing energy on a daily basis
 - Activation is strictly limited in practice
-
- **Potential benefits appear to be very limited**
 - **Potential ‘competition’ with intra-day wholesale market?**
 - **Hourly RR compatible with real time incentives through imbalance tariffs?**
 - **On balance, it may be more desirable to facilitate intra-day trading until briefly before real time than to introduce a new product for replacement reserves**

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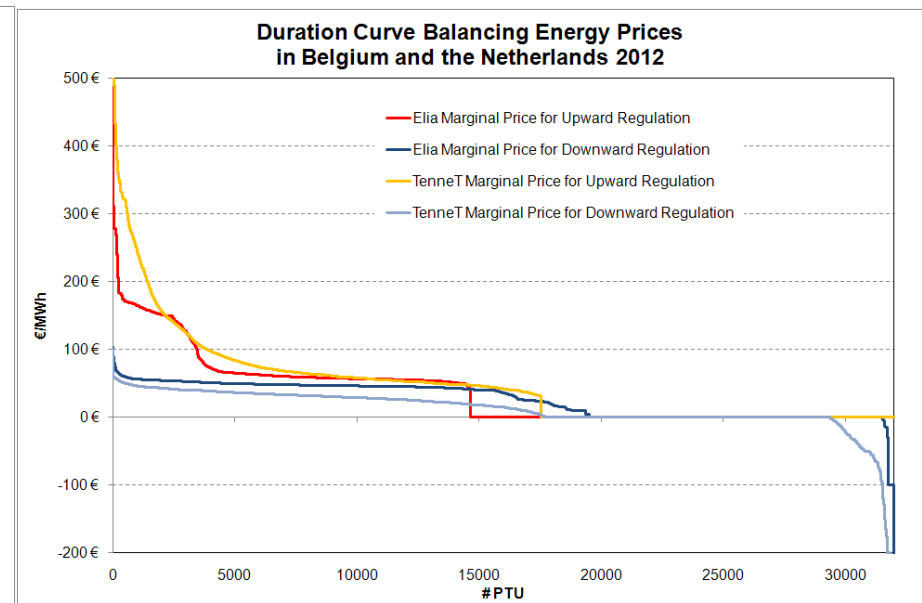
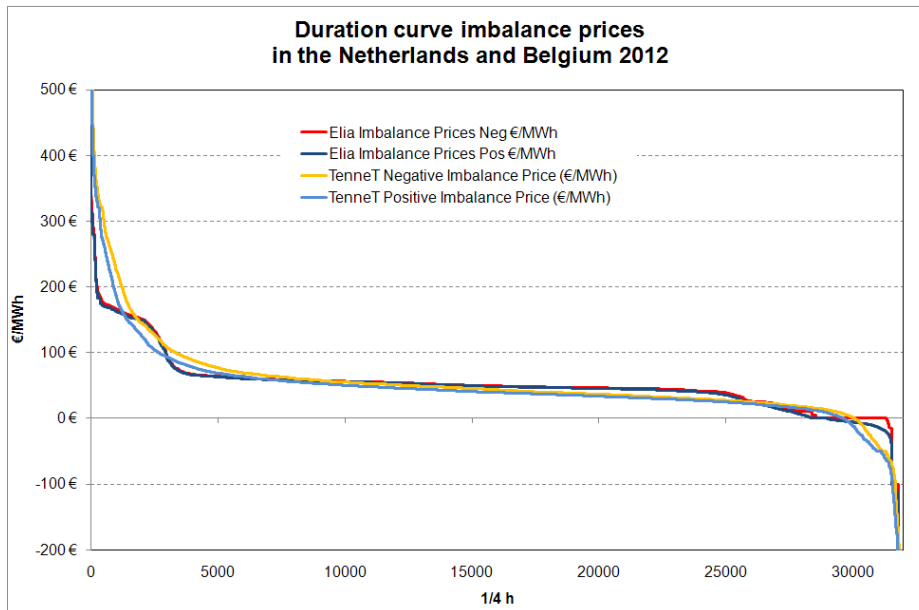
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Impact on Imbalance Settlement 1/2

- Similar approach in both countries:
 - Focus on 'reactive approach', i.e. providing incentives for self-balancing
 - Price of imbalances is linked to (net) volume and prices/cost of balancing energy in each imbalance settlement period
 - Publication of cost of balancing energy and/or imbalance close to real-time
 - The 'export of balancing energy' may break this link, i.e.:
 - Imbalance prices may provide an incentive to increase (rather than reduce) the physical imbalance of the local system due to marginal pricing (add practical example)
 - The Dutch imbalance market may be exposed to an increasing frequency of dual imbalance prices
 - In addition, it is clear that cross-border integration may occasionally increase 'price spikes' in the balancing market, even when the average spread and/or volatility may reduce
- **Possible need to adjust pricing scheme(s), i.e. changes in rules, regulations**
- **Need to consider possible impacts on and incentives for local stakeholders**

Impact on Imbalance Settlement (2/2)

- Imbalance price duration curves show a similar shape for Belgium and the Netherlands.
- Belgian balancing energy prices resemble cost of generation ('capped prices')
- Marginal price for upward regulation in the Netherlands is steeper
- Activation prices in Belgium will be revised in 2013, there will be more "free" prices



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Selected Observations (1/3)

- Potential benefits for the cross-border activation of balancing energy mainly related to the Frequency Restoration Process
 - Some additional benefits for frequency containment reserves
 - Replacement reserves do not play a role in the balancing concept of both countries
 - Exchange of contracted reserves generally appears as more difficult and only small volumes offered for contracting in both countries
- Most obvious potential benefit for the frequency restoration process might be achieved through:
 - Imbalance netting; Both TSOs are already participating to IGCC
 - Reserve sharing: contract signed between TenneT and Elia for sharing of 300 MW.
- NL is having more volumes of unused FRR than BE; however it is unclear whether these volumes together with the unused Belgian volumes are sufficient to create a liquid cross-border balancing market

Selected Observations (2/3)

- In order to reap these benefits, substantial changes would be required in both countries, e.g. with regards to:
 - Product specifications, with trade-offs between integration and adequacy of local products to local resources
 - Processes and/or principles for activation and remuneration
 - (National) Rules and regulations
- The X-border activation of balancing energy is subject to available cross border capacity, congestion due to wholesale price differentials limits the potential for X-border balancing activations
- The X-border exchange of reserve capacity is only possible in case of reserved cross border capacity, in accordance with future, regulatory requirements this is only possible under strict conditions (i.e. cost-benefit analysis).

Selected Observations (3/3)

- In addition, the impact and / or the need for corresponding methodological adjustments of imbalance prices has to be considered
 - How to guarantee optimal cross-border use of manual FRR as marginal price might be increase ex-post due to activation of more expensive automatic FRR?
 - Imbalance prices are in general lower in BE than in NL; marginal price set in BE by R3 is lower than marginal price set by R2 in NL As R2 in NL a lot used there's a risk to have a imbalance price increase in BE (objective of cross-border collaboration to lower balancing costs)
 - Imbalance prices are used in both control areas as important local tool to trigger correct real-time reactions of balancing responsible parties. Especially in case of marginal pricing for the cross-border activation of balancing energy, local price signals may not reflect anymore the local imbalance situation.
- As a next steps, costs and benefits of various integration options need to assessed.

Your comments are highly appreciated

- This stakeholder workshop provides the opportunity to respond and to comment on the potential cross-border collaboration between Tennet and Elia
- Your responses and comments are highly appreciated and will serve Elia and Tennet in the second phase of the project to further develop and refine the options under discussion
- Please direct your responses and comments in writing to:
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