Stakeholder Workshop on EB GL Implementation

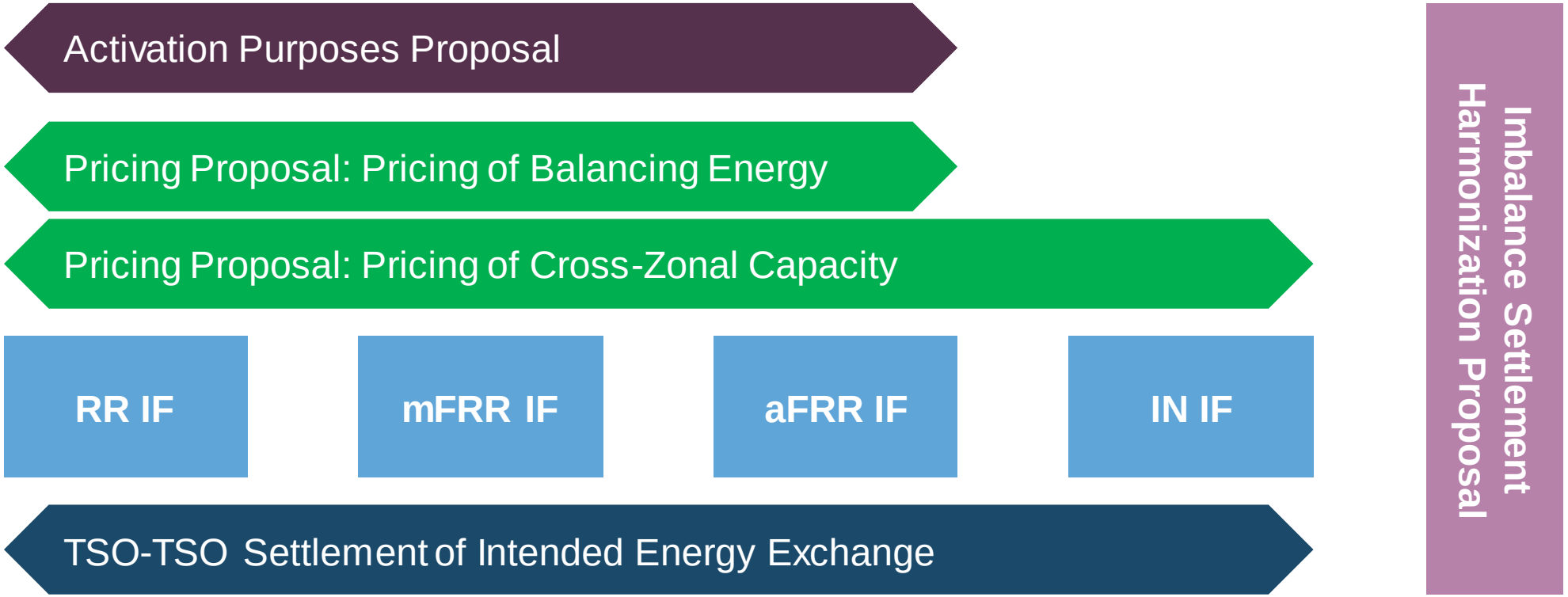
Kjell Arne Barmsnes

Convenor ENTSO-E WG AS

EB GL Stakeholder Workshop
20.06.2018-21.06.2018

What to Expect from the Two Days

- **Presentation of *all* Implementation Frameworks**
- **Pricing Proposals for all processes including the interaction with the Activation Purposes**
- **Imbalance Settlement Harmonization**
- **Outlook on TSO-TSO settlement**



Implementation Framework Development

Imbalance Netting IF

Approved by all TSOs on 09.11.2017
Public consultation
15.01.2018 – 15.03.2018
NRA shadow opinion 13.03.2018

RR IF

Approved by all TSOs on 15.06.2017
Public consultation
30.02.2017 – 04.02.2017
NRA shadow opinion 04.2017

Activation Purposes

Public consultation expected for
End of August – End of October

aFRR IF

Approved by all TSOs on 29.03.2018
Public consultation
26.04.2018 – 29.06.2018
NRA shadow opinion <02.07.2018

mFRR IF

Approved by all TSOs on 15.05.2018
Public consultation
15.05.2018 – 16.07.2018
NRA shadow opinion 19.07.2018

Pricing

Public consultation expected for
End of August – End of October

Agenda Day 1

From		To	Item
10:00	-	10:25	**Welcome**: Agenda and Topics Next Consultation
10:25	-	11:25	Imbalance Settlement Harmonisation
11:25	-	12:25	IN Implementation Framework
12:25	-	13:00	Lunch
13:00	-	14:30	RR Implementation Framework
14:30	-	15:00	aFRR/mFRR Implementation Framework
15:00	-	15:15	Break
15:15	-	15:45	aFRR Implementation Framework
15:45	-	16:45	mFRR Implementation Framework
16:45	-	17:00	Summary of Day One

Agenda Day 2

From		To	Item
10:00	-	10:30	General Principles for Pricing and Settlement
10:30	-	12:00	Pricing, settlement and activation purposes methodology for: mFRR and RR (1/2)
12:00	-	12:35	Lunch
12:25	-	13:35	Pricing, settlement and activation purposes methodology for: mFRR and RR (2/2)
13:35	-	15:05	Pricing and settlement methodology for: aFRR & Imbalance Netting (1/2)
15:05	-	15:20	Break
15:20	-	16:05	Pricing and settlement methodology for: aFRR & Imbalance Netting (2/2)
15:30	-	16:15	Q&A
16:15	-	16:30	Closing the Workshop

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Imbalance Settlement Harmonisation Proposal

Dr F. A. Nobel

Convener ISH Project Team

EB GL Stakeholder Workshop
20.06.2018-21.06.2018

Imbalance settlement harmonisation

Decisions ENTSO-E MC, May 29th 2018

3.15 All TSOs acknowledge the developments on the proposal on imbalance settlement harmonisation.

3.16 All TSOs acknowledge that the proposal will be sent to the SPOC NRAs for feedback on the proposal so that the project team can progress with their work.

ISH draft proposal background

- The EBGL mandates all TSOs to draft a proposal for imbalance settlement harmonisation ("ISH proposal") by 18 December 2018.

- WG AS has prepared a draft proposal following the specifications enclosed in the EBGL Art. 52(2).

- The ISH draft proposal achieves to define:
  - an exhaustive list of all the possible components that may be used to calculate the imbalance prices, as well as for the calculation of the values of avoided activation;
  - an exhaustive list of the possible conditions for which dual pricing may be proposed by a TSO to its relevant regulatory authority;
  - how positions, imbalances, allocated volumes and imbalance adjustments shall be calculated;
  - smooth transition from dual to single position (for self dispatch model) no later than application of ISP = 15 min
  - Mandatory reporting by TSO to BRPs of allocated volume, adjustments and imbalances.

- This all-TSO proposal allows each TSO and NRA to develop appropriate national Terms and Conditions to accommodate national business processes.

Delimitations ISH draft proposal

Harmonized elements of imbalance settlement in EBGL:

- **ISP** 15 minutes (exemptions, derogation allowed)
- **No** exemptions to balance responsibility
- Calculation of imbalance BRP in self dispatch model based on **trade schedules only**
- **Each NRA shall ensure** that its TSOs do not incur economic gains or losses with regard to all energy settlement process: balancing energy, imbalance, intended/unintended exchanges

Not-harmonized elements of imbalance settlement in EBGL, untouched by ISH proposal:

- Distinction between central dispatch model and self dispatch model
- NRA **methodologies** of financial neutralization TSO
- Gate Closure Times internal commercial trade schedules
- Calculation of activated volume of balancing energy: requested or metered.

Delimitations ISH draft proposal

Areas for imbalance price & volume determination by each TSO*, are delineated by TSOs in national Terms and Conditions [for BRPs]:

- Imbalance area, respectively
- Imbalance price area

Unlinked to Synchronous Zone/LFC Block/LFC Area/System/Balancing Area delineations

Out-of- scope of ISH draft proposal; elsewhere and not yet, or regionally** (ACE, ramping, k∆f) determined:

- Balancing energy volume and price determinations (connecting TSO BSP)***
- Intended exchanges (aFRR, mFRR, RR) volume and price determinations (TSO-TSO)***
- (Un)intended exchanges between Synchronous Zones volume & price determinations****
- Number of balancing energy prices per ISP per imbalance area

*Connecting TSO or any 3rd party entrusted with settlements in accordance with the EBGL Article 13 ; **PT FSkar; ***PT PSAP; **** tbd

ISH draft proposal

- **Main components** of imbalance prices: An exhaustive list of main components is proposed.
  - Each TSO may only use the following **prices** as main component for calculating the imbalance price (per imbalance area, ISP and direction):
    a) Value of avoided activation (VoAA) of balancing energy from FRR or RR;
    b) As connecting TSO: price(s), per direction, of standard or specific products for FRR energy and (where applicable) RR energy and (where applicable) imbalance netting; or by the integrated scheduling process and (where applicable) imbalance netting;
    c) As requesting TSO: price(s), per direction, for requested intended exchanges of energy;
    d) A scarcity component (if approved by local NRA).
  - Each TSO may only use the following **volumes** for calculating the imbalance price (per imbalance area, ISP and direction): volume, per direction and product, of standard or specific products for FRR energy and (where applicable) RR energy and (where applicable) imbalance netting; or by the integrated scheduling process and (where applicable) imbalance netting.

ISH draft proposal

- **Value of avoided activation** (VoAA) of FRR or RR: Price (single or dual) for each ISP during which there has been no activation of balancing energy in either direction in the imbalance price area. For the calculation of the VoAA, each TSO may use only the following prices and volumes:
  - As *connecting* TSO: price(s), per direction, for the volume of balancing energy from standard or specific products for FRR and (where applicable) RR, *available* to this TSO for this ISP, or by the integrated scheduling process;
  - As *requesting* TSO: price(s), per direction, for the intended exchange of energy available to the TSO to request for this ISP.

- **Single/dual pricing**: Each TSO is to implement single imbalance pricing no later than application of ISP = 15 min. Minimum conditions for a TSO to request relevant regulatory authority to apply dual pricing are defined:
  - ISP > 15 min (exception), or
  - TSO requests activation of both positive and negative balancing energy from FRR or RR, or
  - no activation has occurred, or
  - due to specificities of the local market/area, or
  - because costs of balancing energy are entirely to be covered by the BRPs.

All TSO position on imbalance pricing

- This all-TSO proposal allows each TSO and NRA to develop appropriate national Terms and Conditions to accommodate national business processes.

- National responsibility and privilege to determine imbalance price, using some, or all components from the proposed exhaustive list, but not any other components as the *main* components for determining the imbalance price:
  - For single imbalance pricing (default)
  - For dual imbalance pricing (if, and when applicable for any ISP and imbalance areas)

Overview, after WG AS meeting June 13th

Definition/Methodology	Harmonized	Localized	Remarks
Standard product FRR, RR	X		
Specific product FRR, RR		X	
TSO Demand RR		X	
TSO Demand mFRR		X	
TSO Demand aFRR	X		Principles in SOGL
Balancing energy volume		X	
Balancing energy price per direction*	X		Number of prices: RR: 0 or 1; FR: 0, 1 or more
Balancing energy special product		X	
Imbalance volume	X		
position	X		
adjustment		X	depends on balancing energy volume
allocated volume	X		
Neutralization TSO		X	NRA responsibility
Imbalance price per direction*		X	Number of prices 1, default single, main components
* for a given imbalance area, for a given ISP			

Q&A

It's time for your questions.

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Imbalance Netting Implementation Framework

Markus Maurer

Convener ENTSO-E PT IN

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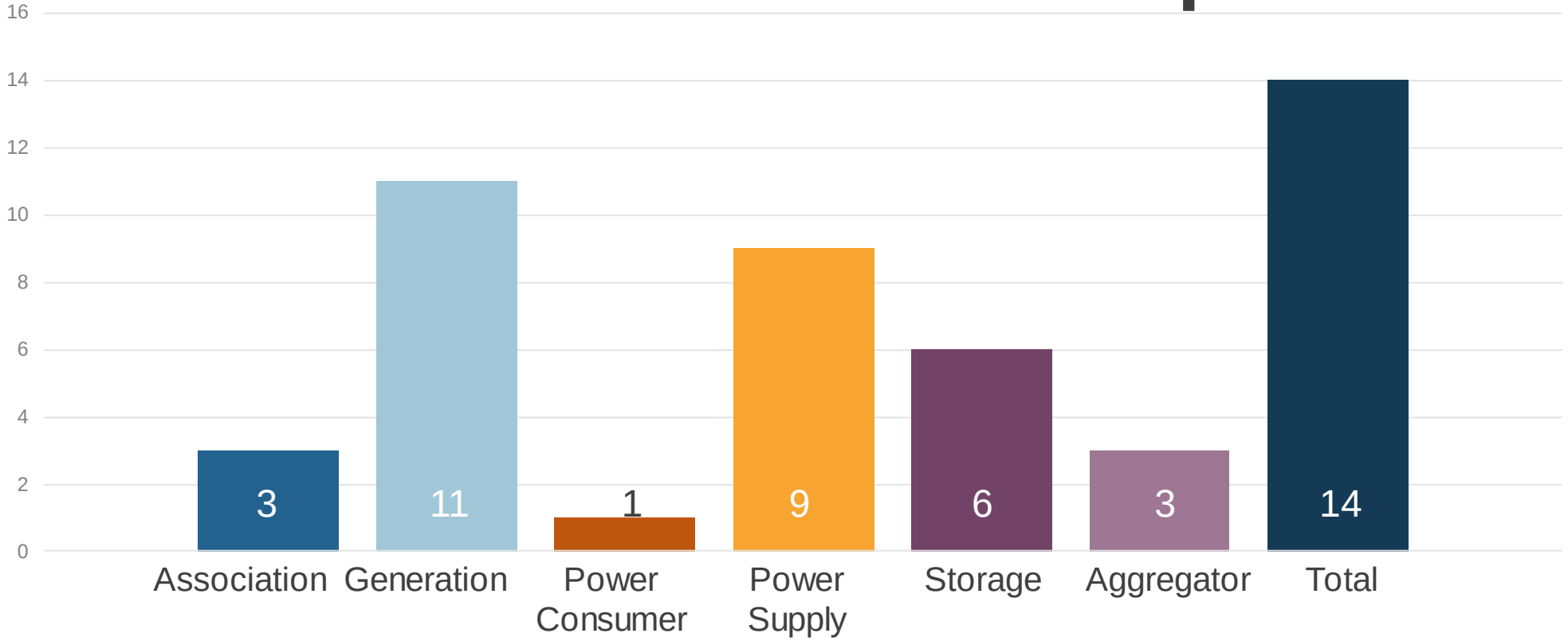
Consultation Overview - Participants



IN IF public consultation between 15 Jan – 15 March

- 14 responses from stakeholders.
- Formal **NRA** shadow opinion received on 15 March.

NRA feedback and PT IN considerations

Recitals

- Elaborate on the expected impact of the IN-Platform on the objectives of the GLEB.
  TSOs further elaborated on the objectives.

Subject matter and scope

- Specify to whom it applies and to whom it does not.
  TSOs added further clarification.
- Distinguish between all TSOs proposing the IN IF and those using the platform.
  TSOs further clarified that this distinction is done by using “All TSOs”, “Member TSOs” and “Participating TSOs”.

NRA feedback and PT IN considerations

High-level design of the IN-Platform

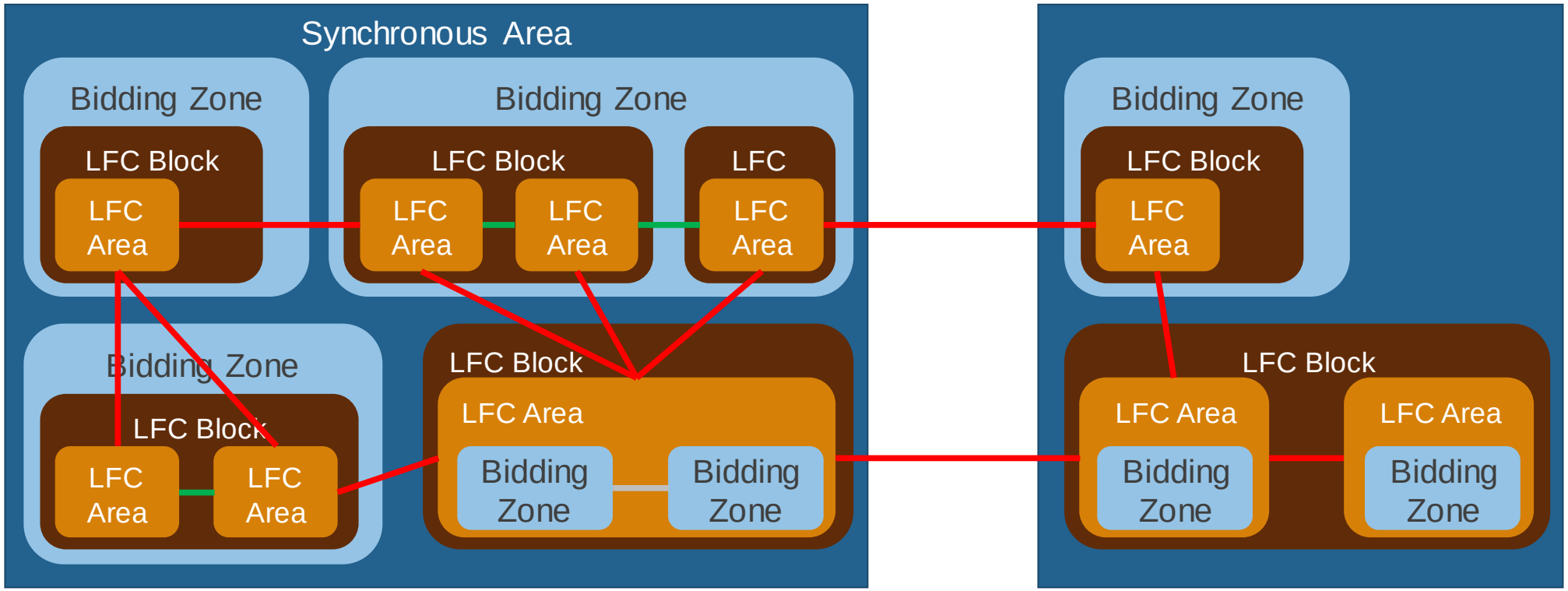
- Include description, inputs and outputs of the functions.
- Functions: IN process, TSO-TSO settlement and CZC determination.
  - Determination of remaining CZC after ID needs to be defined as a function in the platform, taking into account the CCM in the previous timeframe (being either FB or ATC) as well as the method determining the part of the CZC available to the IN-Platform.

  TSOs propose to not pre-conclude on the creation of a CZC function in the implementation framework as this is a detailed implementation issue, however to foresee the possibility if and when it is applicable

  TSOs further elaborated on the description of CZC and the usage of it and shifted it to the high level description
- NRAs also ask to further clarify the term “borders” (set of physical transmission lines linking adjacent LFC areas).

  TSOs further clarified the term border

Possible Configurations – Impact on CZC



- CZC of border calculated in accordance with Article 37 of the GLEB
- CZC on this border is considered infinite or equal to the respective technical limit (e.g. bound by number of digits)
- CZC on this border is not considered and by this equals to infinite in the process

Cross-Zonal Capacity and Limits

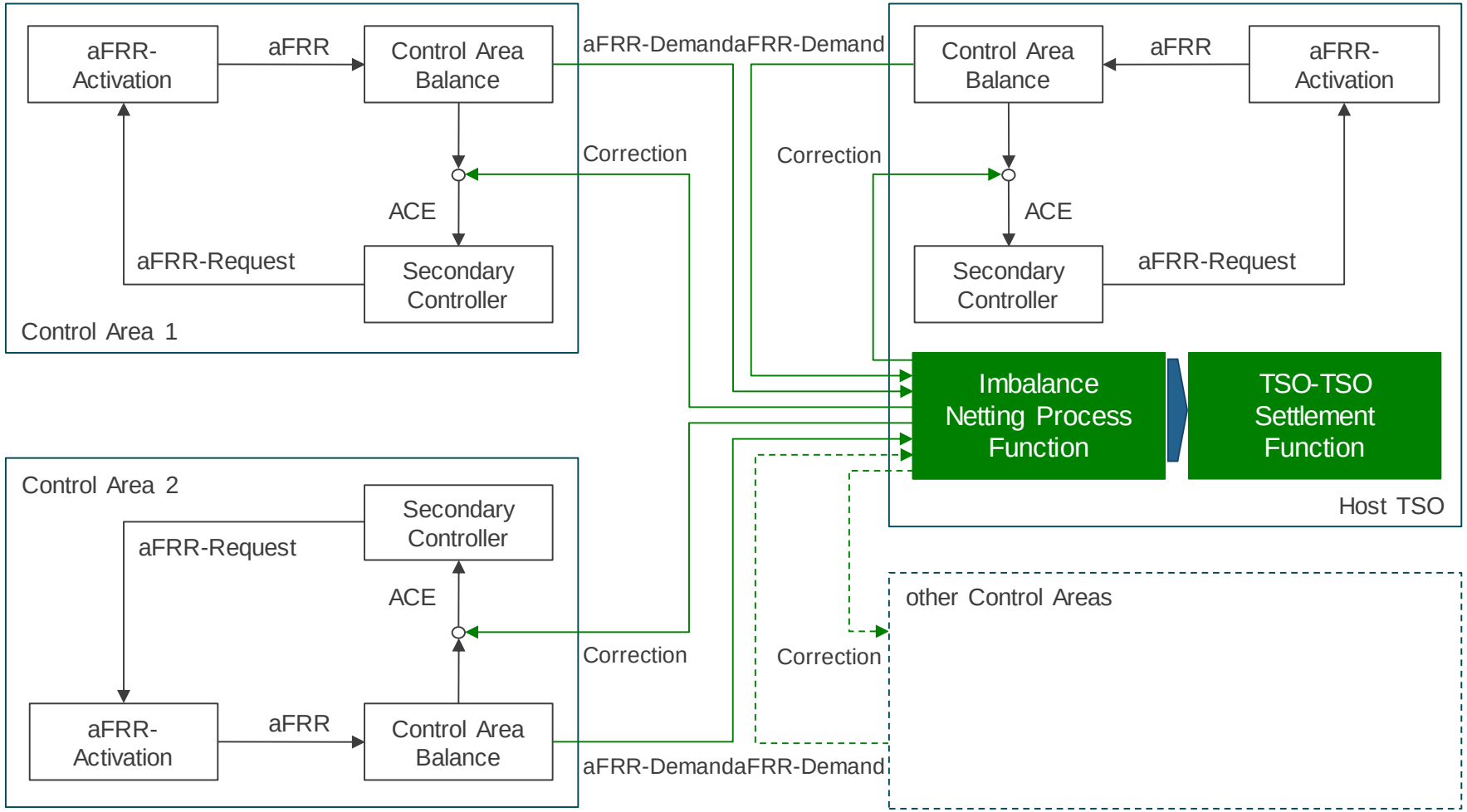
Normal operation:

- CZC after intraday and previous balancing actions (RR & mFRR) is used
- In aFRR optimization implicit netting is performed, remaining CZC is used for IN → see optimization regions

Operational security constraints:

- In case of operational security issues affected TSOs can put further limits to ensure stable system operation

Proposal of functions



NRA feedback and PT IN considerations

Description of the algorithm:

- NRAs suggest leaving out of the IN IF any potential future merge between the IN-Platform and the aFRR-Platform.

  TSOs removed this part

- NRAs ask to justify that pre-netting (optimisation regions) will not lead to discriminatory distribution of benefits.

  TSOs further clarified the usage and included a monitoring paragraph and further detailed the justification in the Explanatory Document

Language:

- A language article is missing.

  TSOs included a language article.

Principles of the algorithm I

- Proportional distribution
- Non discrimination

- Each TSO calculates the aFRR demand of its LFC area;
- The aFRR demands and limits are sent to the imbalance netting process function;
- The imbalance netting process function calculates the corrections whilst respecting the limits; and
- The corrections are sent to the TSOs and are used by them;

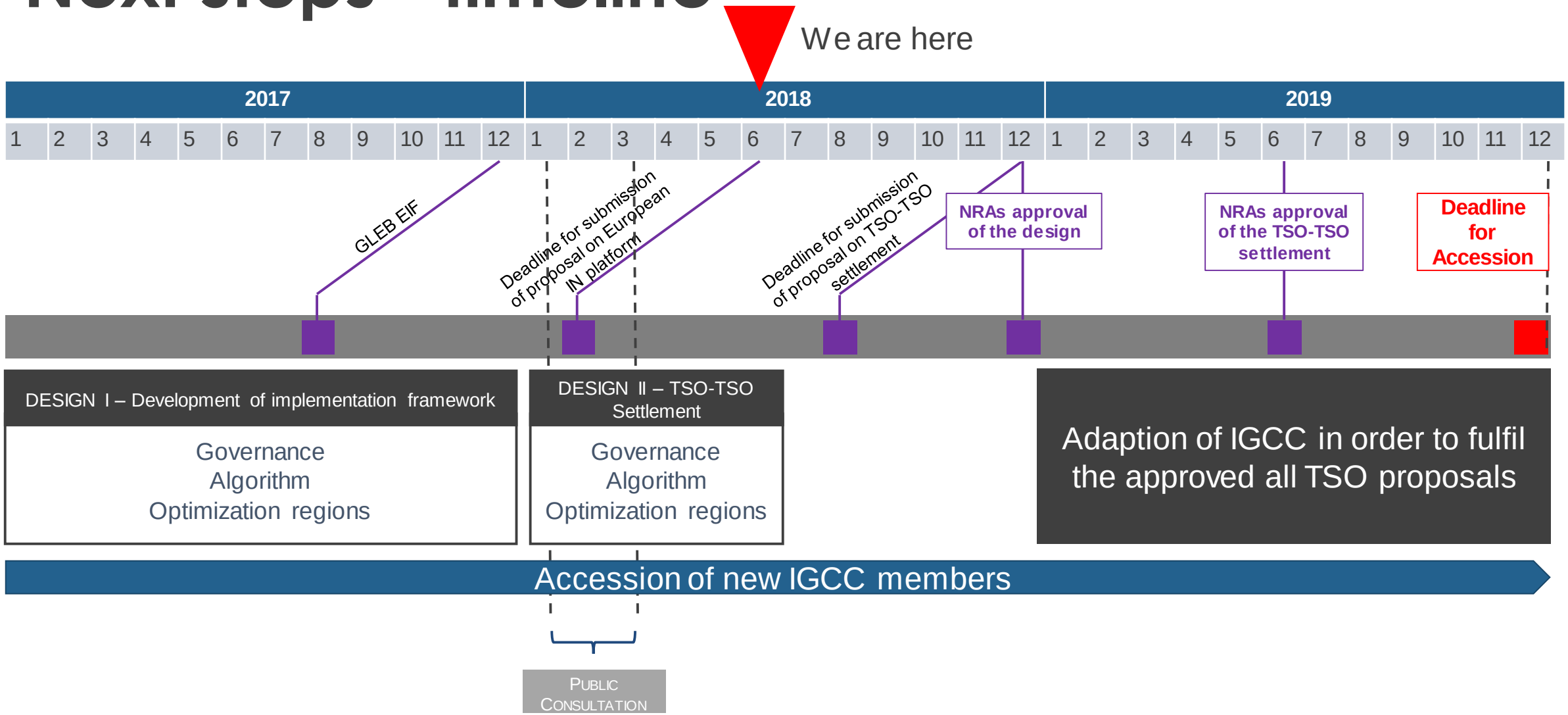
Principles of the algorithm II – Optimization regions

- Optimization regions allowed for control blocks with prior access to transmission capacities
- **aFRR cooperations** can form an **optimization region** with prior access to transmission capacities.
- The optimal distribution of activations in an optimization region obtained as a result of an aFRR cooperation shall be respected by the imbalance netting optimization process function, without reducing the overall netting volume
- In case an aFRR cooperation forms an optimization region, the remaining TSO are also allowed to participate in an optimization region
- This is valid as long as the **geographical region** of the member TSOs participating in the **IN-platform** differs from the **geographical region** of the member TSOs participating in the **aFRR-platform**

Stakeholder feedback summary

- No feedback with impact on platform design was received
- Mainly further explanation and details were requested
  - Publication of results → no requirement from GLEB, however TSOs agreed to publish the exchanged volumes (status quo)
  - Missing reference to periodical reports → TSO included an article on reporting
  - Description of stakeholder involvement (implementation, changes) → TSOs further elaborated on how stakeholder are involved (information via webpage, implicitly in changes via consultation)
  - Description of fallback approach → not mandatory for IN, however included in explanatory document
  - Further details on optimization regions → further detailed and further examples in explanatory document included
  - Interaction between IN- and aFRR-Platform → further detailed and further examples in explanatory document included
  - Process with questions → stakeholder feedback and how it is incorporated will be published on ENTSO-E webpage

Next steps - timeline

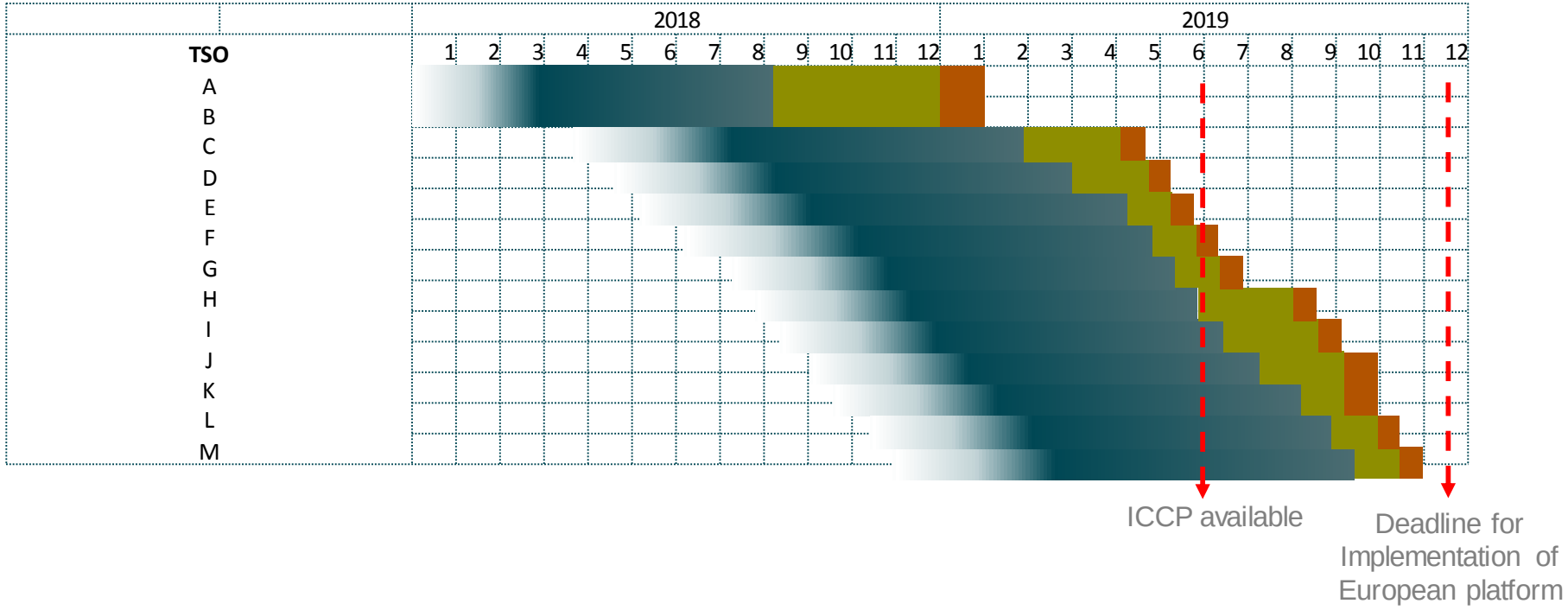


Further proceeding

- Imbalance Netting Implementation Framework is submitted by all TSO to all NRA individually
- NRAs have 6 months to approve or ask for an amendment
- After approval of the INIF – TSOs will implement the necessary changes to IGCC
- Accession of remaining TSOs to IGCC

Indicative Accession Timeline

- Technical IGCC accession has to be performed sequentially to enable sufficient testing and ensure stable system operation
- Overall as the amount of energy exchanges by IGCC will increase with the expansion of the cooperation, the aFRR activation is expected to decrease in the countries participating in IGCC
- Indicative Accession order of TSOs based on SCADA updates possibilities;



Communication/SCADA implementation Interoperability tests (SCADA 4.7) Operational tests (SCADA 4.7)

Q&A

It's time for your questions.

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RR Implementation Framework

Amine Abdala

Head of TERRE Project

EB GL Stakeholder Workshop
20.06.2018-21.06.2018

Introduction

Replacement Reserves Implementation Framework

- As required by the GLEB, **all TSOs using RR have 6 months after the EIF of GLEB to submit a proposal for the RRIF.** The **deadline is thus 18 June 2018**.

- The work is handled by the TERRE project, in which all TSOs using Replacement Reserves are represented**.**

- In addition, an **explanatory document** to the RRIF has been written to help stakeholders' understanding.

Replacement Reserves Implementation Framework

- RRIF is **developed by all Transmission System Operators performing the reserve replacement process** pursuant to Part IV of Regulation (EU) 2017/1485 of 2 August 2017 regarding the RRIF for a European platform for the exchange of balancing energy from replacement reserves (referred to as "**RR-Platform**").

- RRIF takes into account the general principles and goals set in Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing ("**GL EB**"), Commission Regulation (EU) 2017/1485 establishing a guideline on electricity transmission system operation ("**GL SO**") as well as Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-zonal exchanges in electricity ("**Electricity Regulation")**

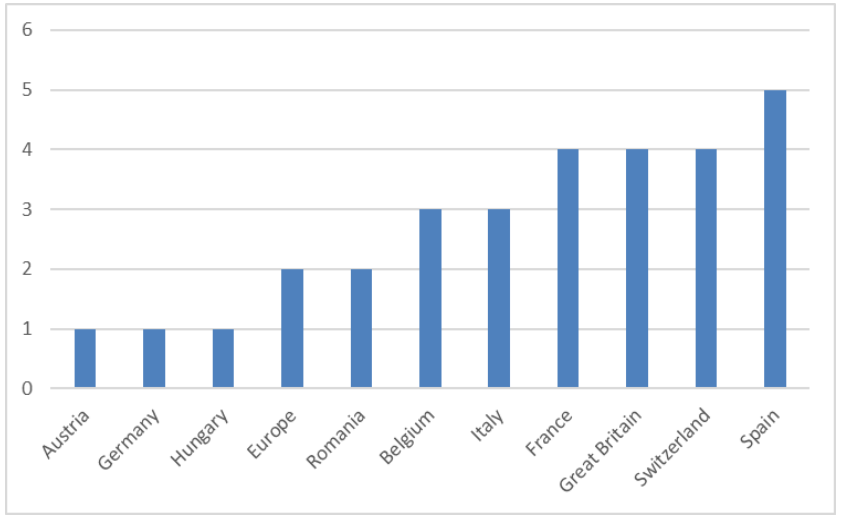
- RRIF lays down the **design**, **functional requirements, governance and cost sharing for the RR-Platform**. In addition, the RRIF **contains the proposal for the entity to perform the functions of the proposal**. The European RR-Platform shall be able to perform the functions described in Article 5 on this RRIF and as described in the Article 19(3) of the GL EB

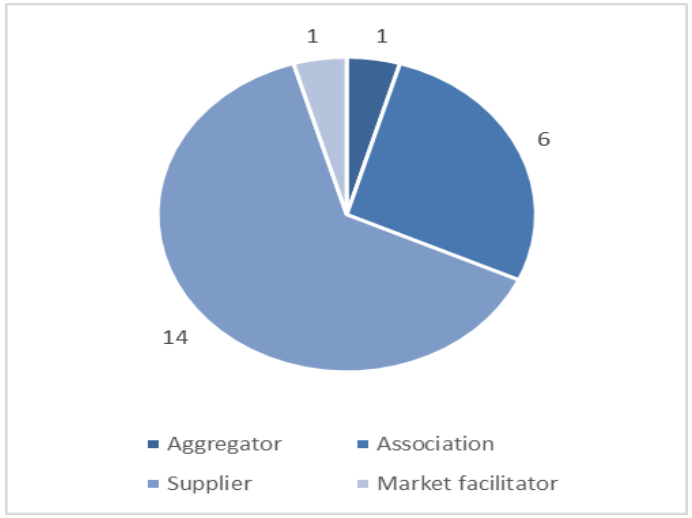
- RRIF proposal **fulfil** the content described by the **Article 19(3) of the GL EB**

- RRIF proposal **fulfil** the content described by the **Article 3 of the GL EB**

Replacement Reserves Implementation Framework

- RRIF was submitted to public consultation between the 21 February and the 4 April 2018.
- 23 answers from stakeholders, including a shadow opinion from NRAs were received and assessed by the TERRE project, in which all TSOs performing reserve replacement process are represented.
- Stakeholders feedbacks: 4 different energy sectors and 11 different countries have provided their feedback on the consultation.





- The RRIF + the Explanatory Document + Assessment of stakeholder feedbacks composed the approval package submitted to the RR NRAs.
- This package will be published on TERRE website.

Main stakeholder concerns

Main feedbacks

1. Elasticity of need
2. Counter Activation
3. Maximisation of Social Welfare
4. BEGCT definition
5. Unavailable bids
6. RR Product incentivized shape
7. Harmonisation of bid formats
8. Number of clearing / gates and reduction of cross border scheduling step
9. Involvement of BSPs in the project governance
10. More information on the parallel run phase
11. Participation of BSP located in non-RR TSOs

Main updates

RR IF main updates

- **BEGCT definition** (Article 7 of the RR IF) : new proposal
  - *The gate closure time (GCT) for the submission of Bids to the connecting TSOs by BSPs will be 55 minutes before the period which is concerned by the activation of the RR standard product to satisfy the TSO balancing energy need.*
  - *For an interim period of no more than twelve months after the entry into operation of the RR-Platform, the GCT for Bids will be 60 minutes before the period which is concerned by the activation of the RR standard product to satisfy the TSO balancing energy need.*

- **TSO-TSO GCT definition** (Article 8 of the RR IF) : new proposal
  - *The gate closure time for the submission of the Bids to the common merit order lists by the connecting TSO shall be 40 minutes before the period which is concerned by the activation of the RR standard product to satisfy the TSO balancing energy need.*

- **"Appointed entity" proposal** (Article 10.1 of the RR IF)
  - The RR TSOs will Designate the Entity(ies) 6 months after the RRIF submission.

RR IF main updates

- **“Counter activation” proposal** (Article 13.5 of the RR IF): new proposal
  - *For the go-live of the RR-Platform the AOF will allow the counter activations. No later than twelve months after the go-live of the RR-platform, the AOF will minimise the counter activations which at least may not serve the balancing purpose.*

- **Functions proposal** (Article 5 of the RR IF)
  - 3 Functions proposed instead of 4 (AOF, ATC and TSO-TSO Settlement
  - Removal of CMOL for function list

Q&A

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Overview and common provisions in the aFRR and mFRR IFs

Pavel Zolotarev

Convener ENTSO-E PT aFRR

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Alignment between FRR Projects

FRR Implementation Framework	Consistency aFRR and mFRR
Whereas	
1. Subject matter and scope	
2. Definitions and interpretation	
3. High-level design of the FRR-Platform	
4.The roadmap and timeline for the implementation of the FRR-Platform	
5. Functions of the FRR-Platform	
6. Definition of the standard FRR balancing energy product	
7. Balancing energy gate closure time for the standard FRR balancing energy product bids	
8. TSO energy bid submission gate closure time for the standard FRR balancing energy product bids	
9. Common merit order lists to be organised by the activation optimisation function	
10. Description of the optimisation algorithm	
11. Proposal of entities	
12. Governance	
13. Decision Making	
14. Categorization of costs and detailed principles for sharing the common costs	
15. Framework for harmonisation of terms and conditions for BSPs related to FRR-Platform	
16. Publication and implementation of the FRRIF	
17. Language	

Content Identical

Mostly identical

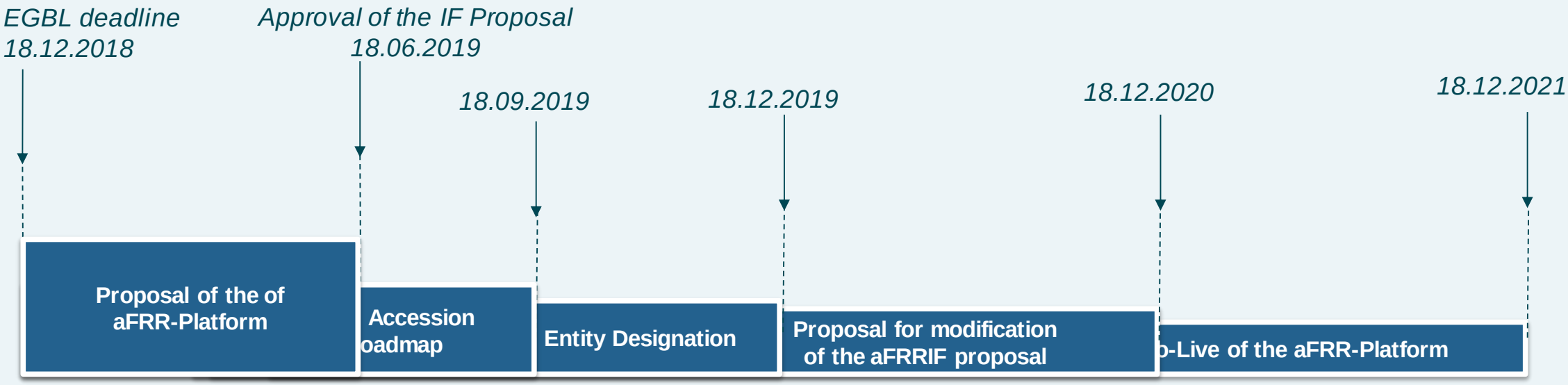
Specific to each one

Project Timeline

Art. 4 - The roadmap and timeline for the implementation of the aFRR-Platform and mFRR-Platform
What do the IFs say:

- By **30 months** after the approval of IF, implementation project shall fulfil all requirements defined in the IF and further requirements of EBGL.
- **Timeline for the project implementation is presented in the Explanatory document** (see below)

Implementation Timeline According to EGBL



Content Overview - Art. 11 - 14

Art. 11 - Proposal of entities
What does the IF say:

- **TSOs shall appoint a TSO or a company owned by TSOs**
- The designation of entities is required 6 months after approval of the implementation frameworks

Art. 12 & 13 - Governance & Decision making
What does the IF say:

- Governance bodies of the platforms (Steering Committee and Expert Group)
- Decision making processes (without prejudice to EBGL)

Art. 14 - Categorization of costs and detailed principles for sharing the common costs
What does the IF say:

- Definition of common, regional, national costs
- Definition of the cost sharing key (as defined in EBGL)

Content Overview - Art. 15 - 17

Art. 15 - Framework for harmonisation of terms and conditions for BSPs related to aFRR-Platform
What does the IF say:

- **Process to identify harmonization issues, conduct a stakeholder survey every 3 years** (starting 3 years after start of operation of the aFRR-Platform), prioritize harmonization options, consult and develop a harmonization proposal
- First proposal to be submitted 3 years after the platform becomes operational

Art. 16 - Publication and implementation of the aFRRIF
What does the IF say:

- Requirement to publish the Implementation Framework without undue delay
- Cross-reference to the timeline referred on Article 4 (Roadmap and Timeline for Implementation)

Art. 17 - Language
What does the IF say:

- **English as a reference language**

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aFRR Implementation Framework

Pavel Zolotarev

Convener ENTSO-E PT aFRR

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Alignment between FRR Projects

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11. Proposal of entities	
12. Governance	
13. Decision Making	
14. Categorization of costs and detailed principles for sharing the common costs	
15. Framework for harmonisation of terms and conditions for BSPs related to FRR-Platform	
16. Publication and implementation of the FRRIF	
17. Language	

Content Identical

Mostly identical

Specific to each one

Content Overview - Art. 1 and Art 2

Art. 1 - Subject matter and scope
What does the IF say:

- The implementation framework is the common proposal of all TSOs in accordance with **EBGL Articles 21**.
- These proposal applies solely for the exchange aFRR, but The **aFRR-Platform** implements an imbalance netting process by netting of the aFRR demands and **supersedes IN process after all member TSOs using IN process has become members of aFRR-platform**.
- The aFRRIF is not applicable for TSOs of the synchronous areas IE/NI, GB and Baltic, as long as they do not perform the automatic frequency restoration process in accordance with Article 145 of SOGL.

Art. 2 - Definitions and iinterpretations
What does the IF say:

- The know terms used shall have the meaning given to them in "definitions" in Art. 2 of Electricity Regulation, Art. 2 of SOGL and Art. 3 EBGL.
- **The aFRRIF naturally also defines FRCE adjustment process**.

General Overview

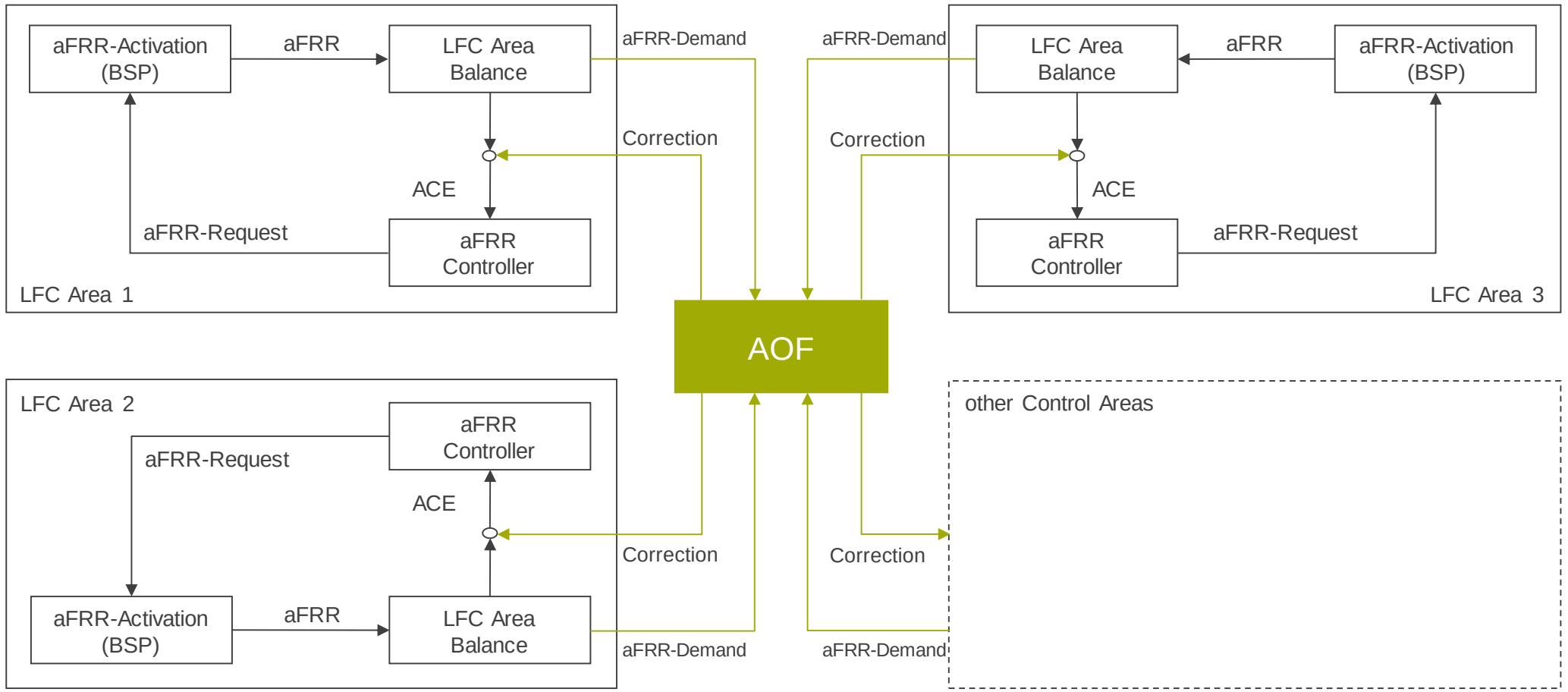
Main Content of the Implementation Frameworks

- High-level description of functions
- Standard products (n/a for IN)
- Balancing Energy gate closure time (n/a for IN)
- TSO gate closure time (n/a for IN)
- High-level description of optimization algorithms
- Categorization of costs
- Decision making and governance
- Harmonization framework

Out of Scope

- Pricing of standard products and pricing of cross-zonal capacity
- TSO-TSO-Settlement
- Activation purposes and their consideration for settlement

Basic Principle



The BSP will receive the activation request from Connecting TSO!

Content Overview - Art. 3

Art. 3 - High-level design of the aFRR-Platform
What does the IF say:

- Platform will establish a cross-border aFRR activation process in accordance with Article 147 and Article 149 of SOGL for all LFC areas
- The Platform optimises the activation of standard product bids located in all LFC areas while respecting the constraints.
- The amount of simultaneous **counter-activations should be minimized**
- **Netting of opposite aFRR demands** implicit via the activation optimisation function.
- Each participating **TSO shall be allowed to access a higher amount of aFRR than submitted to the CMOL**
- **The connecting TSO calculates set-point for activation and is responsible for prequalification conditions & TSO-BSP settlement**

What do we say additionaly - Access a higher amount of aFRR than submitted:

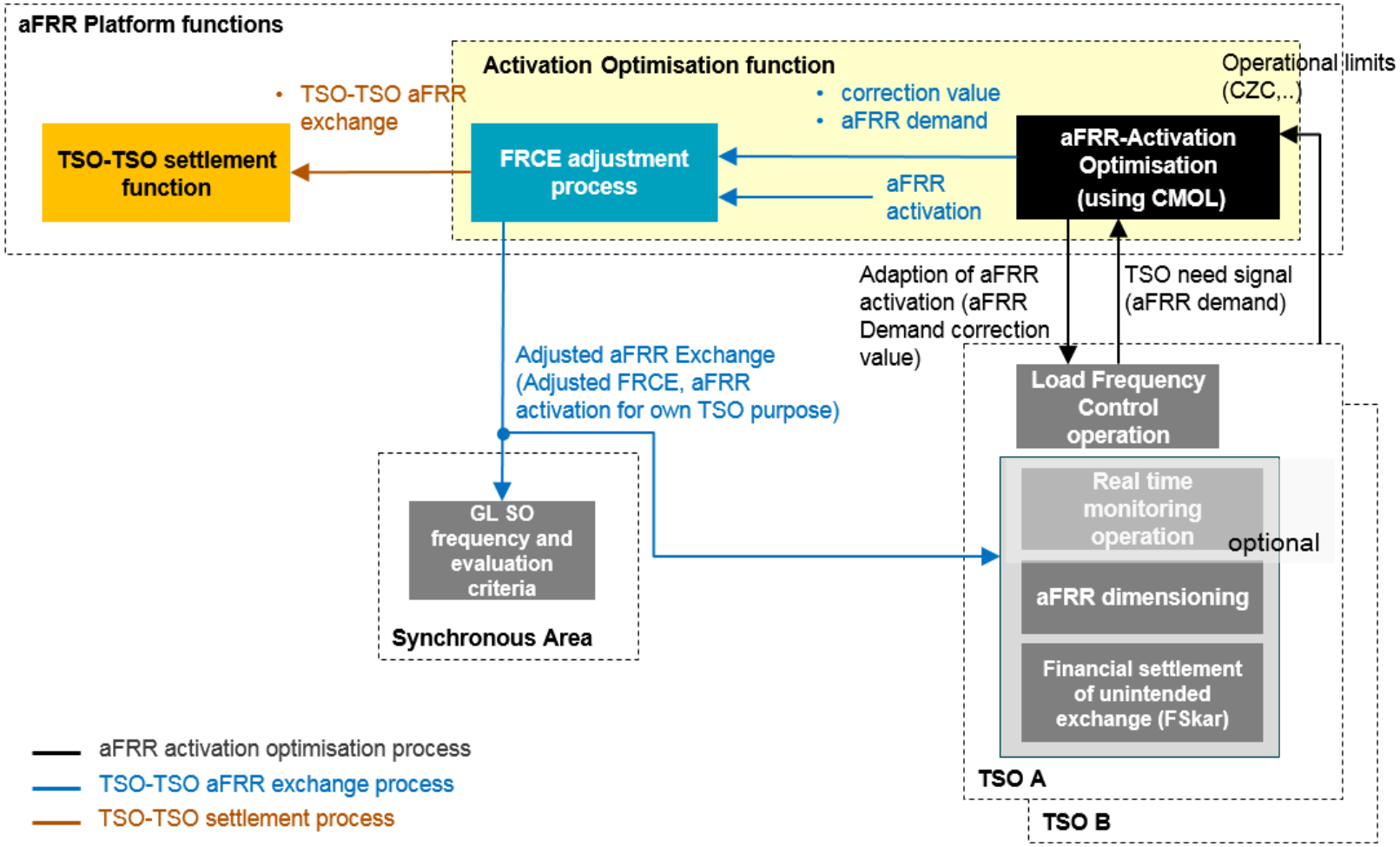
- There is a general benefit in allowing TSOs access to as much aFRR as possible, as this enables them to regulate their FRCE to zero and by that restore the system frequency;
- Neither the probabilistic nor the deterministic part of FRR reserve dimensioning are depending on activated aFRR. Therefore, the FRR dimensioning should not radically change due to the Full Access to CMOL;
- The guarantee of priority access to local volumes submitted to the platform will be managed in the algorithm ; the guarantee applies to configuration where exchange or sharing of reserve are performed between LFC Areas and LFC Blocks;
- Restrictions of aFRR satisfaction up to submitted volume are technically possible with following implications that it may lead to limitation of the netting potential of the aFRR Platform in the target situation where IN process and aFRR process will be merged
- Restriction of aFRR satisfaction up to submitted volume will need local features adaptations to guarantee bids outside the C

Content Overview - Art. 5

Art. 5 - Functions of the aFRR-Platform
Whas does the IF say:

- **Functions**: Activation optimisation function (**AOF**) & **TSO-TSO settlement** function.
- **TSO will submit at least the following inputs to the AOF**:
  - ✓ the demand for each of its LFC areas;
  - ✓ the available cross-zonal capacity;
  - ✓ the list of standard product bids for its LFC area (AOF will merge the lists to common merit order lists in accordance with Art. 3 EBGL)
- The aFRR exchange shall include the FRCE adjustment with a **maximum ramping period of 7.5 minutes** (**by 18 December 2025 of 5 minutes**).

There is More…



Content Overview - Art. 6

Art. 6 - Definition of standard aFRR balancing energy product
What does the IF say:

- ❑ The first validity period of each day shall begin at 00:00.
- ❑ **Bid can be activated and deactivated at any moment within the validity period.**

Input	aFRR Standard Product
Demand	Inelastic
Price	€/MWh
Preparation Period	n/a
Ramping Period	n/a
Full Activation Time	5' (from 18.12.2025)
Minimum Quantity	1 MW
Bid Granularity	1 MW
Minimum Duration of Delivery	n/a
Indivisible Bids	no
Activation Granularity	divisible activation
Validity Period	15 minutes

We say additionally:

- ❑ Results of TSOs' qualitative technical and economical assessment of FAT values of 7,5' and 5' have that both options have unacceptable impacts for some TSOs
- ❑ In order to mitigate for such negative impacts of both option TSOs have proposed two step harmonization approach to the FAT:

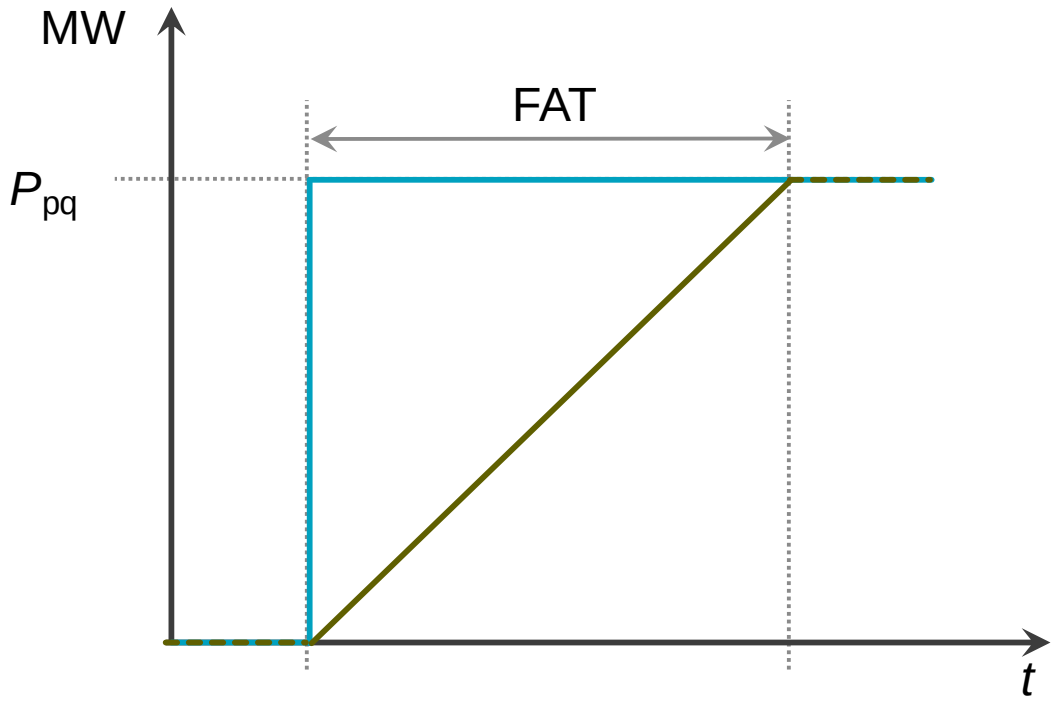
i. No harmonisation of FAT at the go-live of the platform, but the FRCE adjustment **process of maximum ramping period of 7.5 minutes**.

ii. **As of 18 December 2025 the FAT will be set at 5 minutes**, with the FRCE adjustment process of also a maximum ramping period of 5 minutes

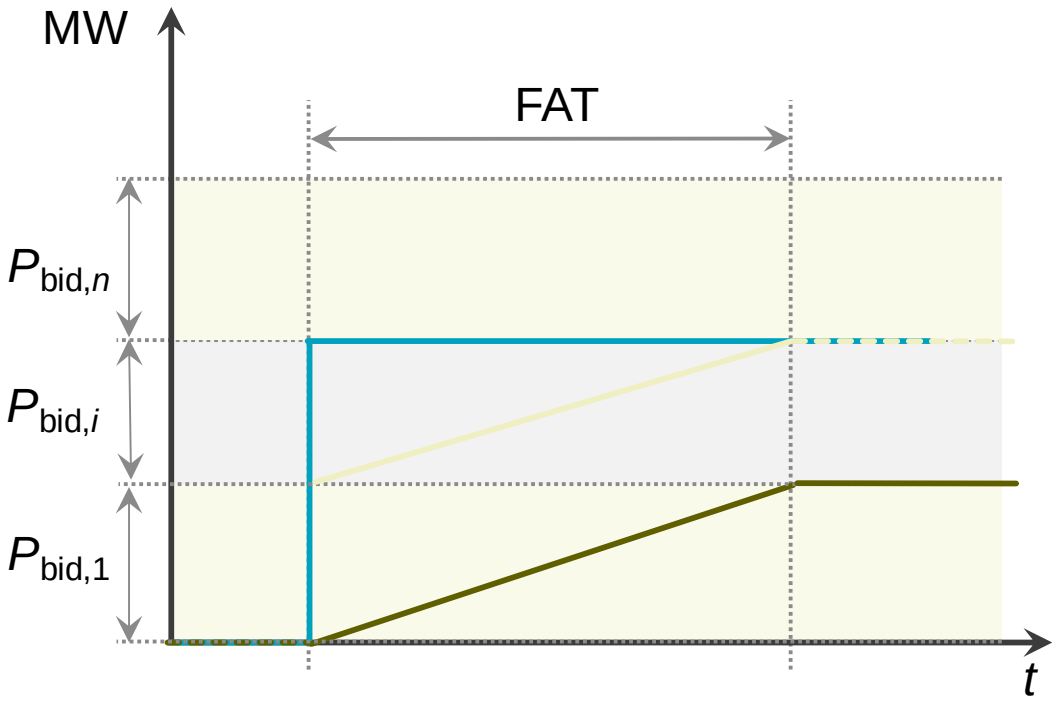
- ❑ The **manageable complexity** at the AOF level of minimum bid size of 1 MW, **has to be confirmed** during or after the IT implementation of the AOF
- ❑ The connecting TSO may include the possibility to link the bids to the state of activation of reserves from another balancing process in accordance with the National Terms and Conditions.

Full Activation Time

Prequalification



Bid Activation / Balancing



FAT = X minutes, while in the prequalification phase FAT refers to the activation of the whole volume which is to be prequalified, **for the CMO the FAT refers to the time to activate a bid**

Content Overview - Art. 7 and Art. 8.

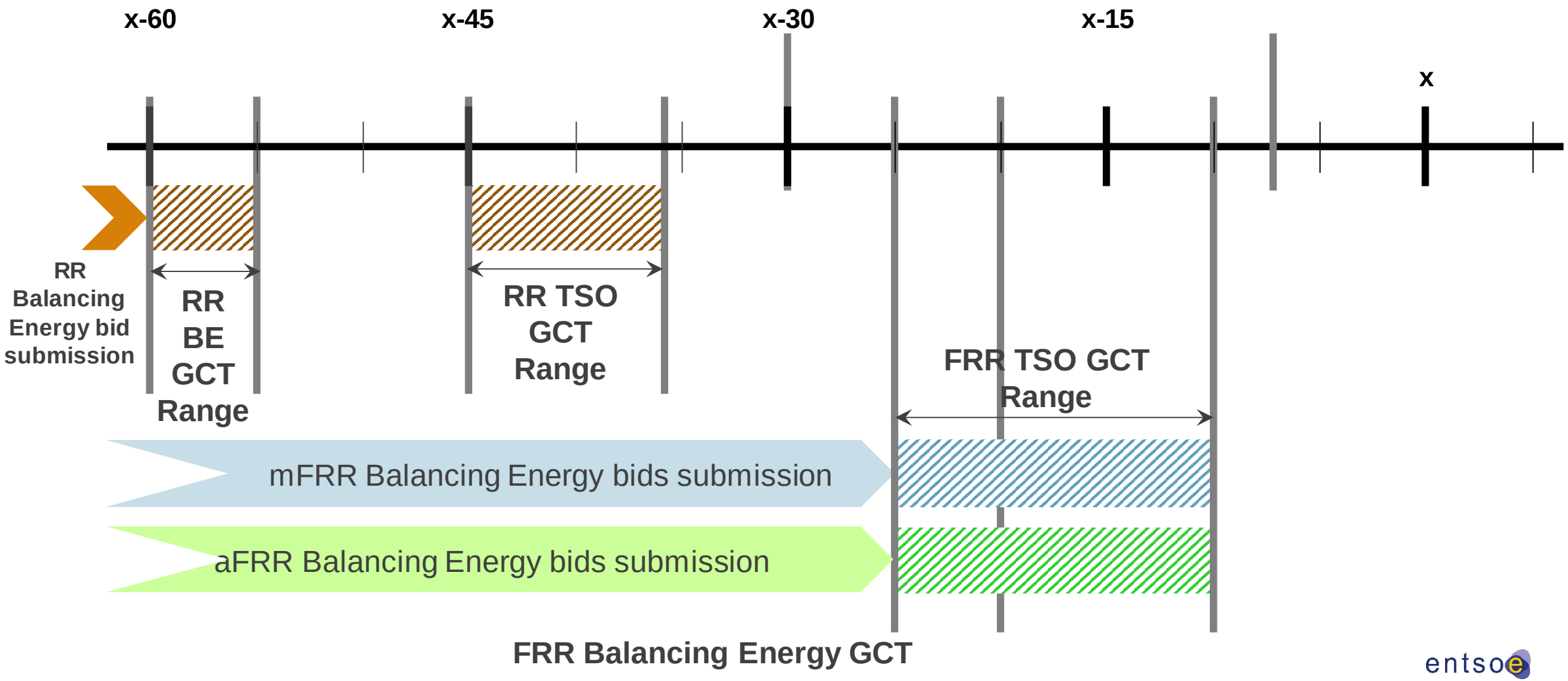
Art. 7 - Balancing energy gate closure time for the standard aFRR product bids
What does the IF say:

- **BE** (BSP) **GCT 25 minutes before the beginning of the validity period of the respective standard aFRR balancing energy product bid.**

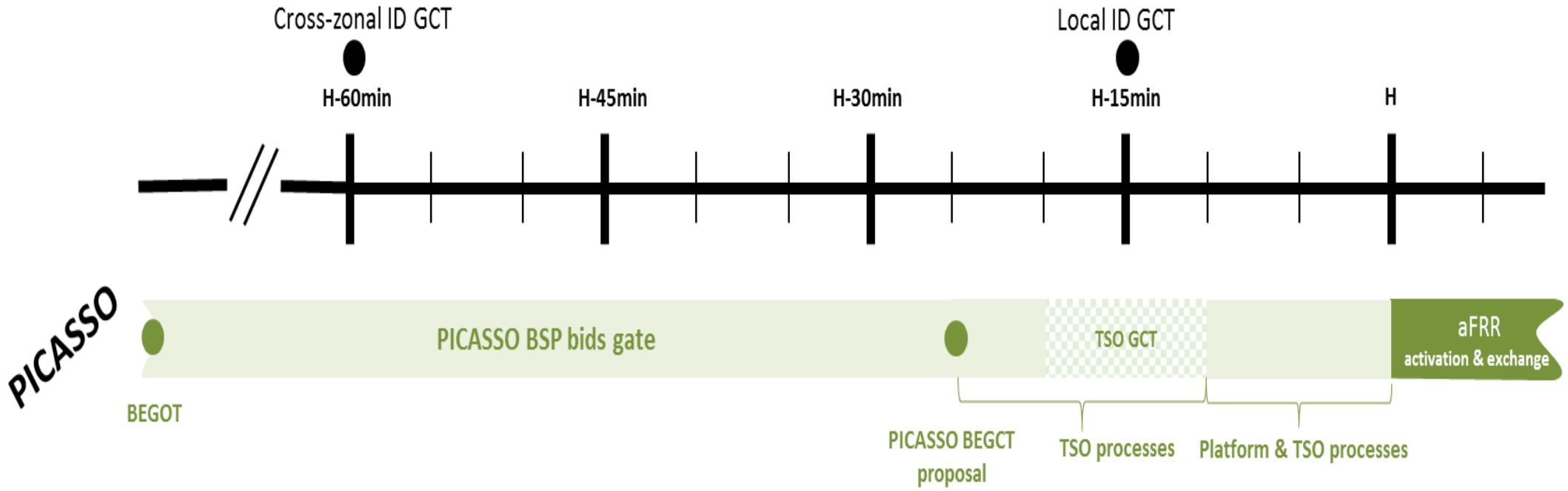
Art. 8 -TSO energy bid submission gate closure time for the standard aFRR balancing energy product bids
What does the IF say:

- **TSO GCT between 20 minutes to 10 minutes before the beginning of the validity period of the respective standard aFRR balancing energy product bid.**

Gate Closure Time Overview



aFRR Process



Content Overview - Art. 9 and Art. 10

Art. 9 - Common merit order lists to be organised by the activation optimisation function
What does the IF say:

- **BSPs will submit bids to the connecting TSO, and then TSO submits these bids to the Platform** (CMOL)
- **Platform will create two CMOLs for each validity period for aFRR**
- TSOs with central dispatching model will convert integrated scheduling bids received from the BSPs into available bids and submit to CMOL

Art. 10 - Description of the optimisation algorithm
What does the IF say:

- Inputs for optimisation algorithm are CMOL & available cross-zonal capacity (CZC); CZC inside the LFC area shall not be considered
- Algorithm shall result in maximising of satisfaction of TSO demands, minimising the total energy activated (also minimising cross-border exchange)
- Outputs of optimisation algorith are the activations of bids, the volume of demands, used CZC, net position & cross-zonal marginal volume/price

Property	aFRR AOF
Demand	inelastic
Cost Minimization	yes
Minimization of Counteractivation	yes
Minimization of Exchanges on Borders	yes
Main Constraints	available CZC
	power balance equation
	sum of all exchanges = 0

Content Overview - Art. 11 - 14

Art. 11 - Proposal of entities
What does the IF say:

- **TSOs shall appoint a TSO or a company owned by TSOs**
- The designation of entities is required 6 months after approval of the implementation frameworks

Art. 12 & 13 - Governance & Decision making
What does the IF say:

- Governance bodies of the platforms (Steering Committee and Expert Group)
- Decision making processes (without prejudice to EBGL)

Art. 14 - Categorization of costs and detailed principles for sharing the common costs
What does the IF say:

- Definition of common, regional, national costs
- Definition of the cost sharing key (as defined in EBGL)

Content Overview - Art. 15 - 17

Art. 15 - Framework for harmonisation of terms and conditions for BSPs related to aFRR-Platform
What does the IF say:

- **Process to identify harmonization issues, conduct a stakeholder survey every 3 years** (starting 3 years after start of operation of the aFRR-Platform), prioritize harmonization options and develop a harmonization proposal
- First proposal to be submitted 3 years after the platform becomes operational

Art. 16 - Publication and implementation of the aFRRIF
What does the IF say:

- Requirement to publish the Implementation Framework without undue delay
- Cross-reference to the timeline referred on Article 4 (Roadmap and Timeline for Implementation)

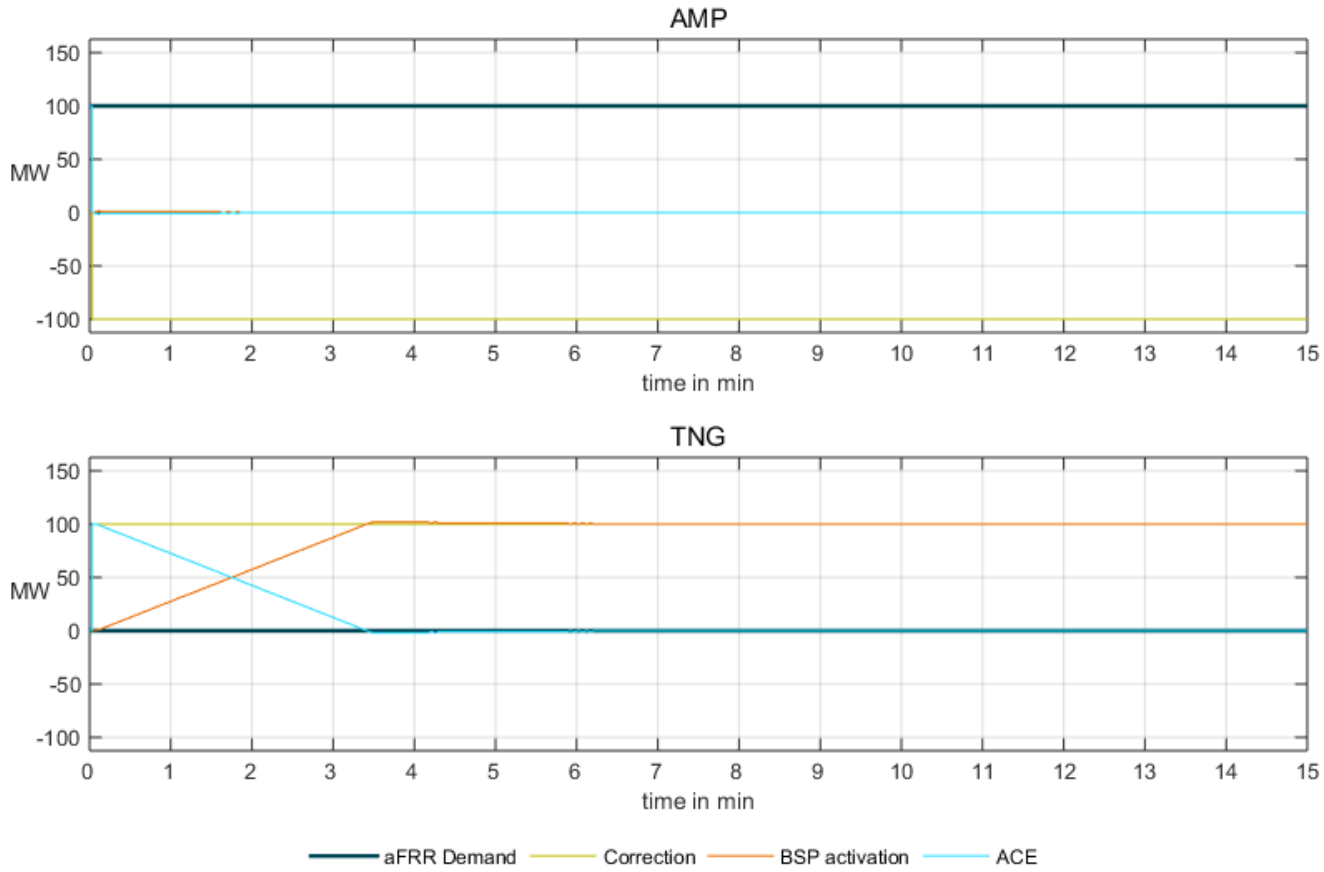
Art. 17 - Language
What does the IF say:

- **English as a reference language**

Q&A

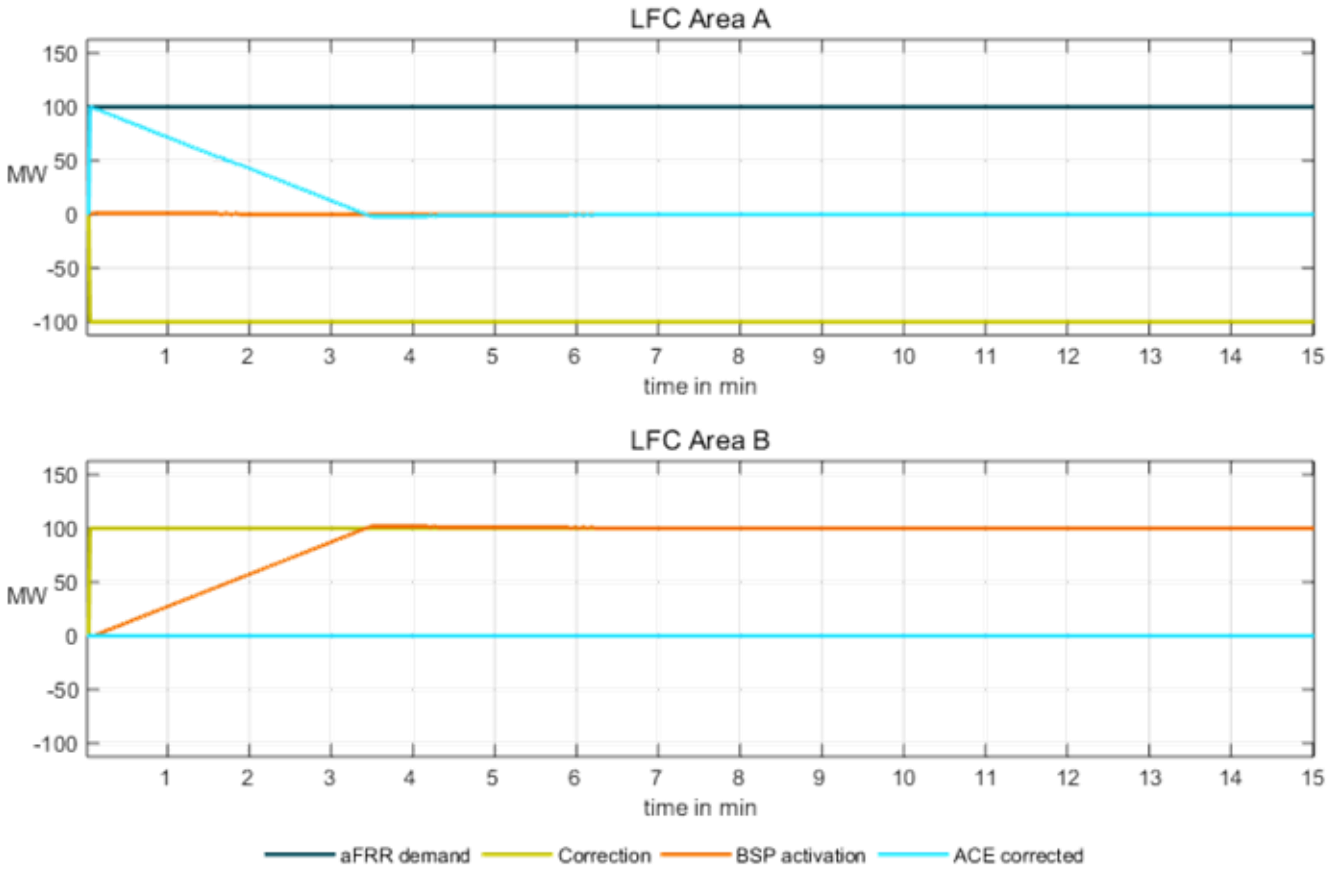
It's time for your questions.

Without FAP (ACE-Adjustment)



In the control concept, FRCE (ACE) is transferrred to the exporting area.

With FAP (ACE-Adjustment)



The FRCE Adjusment transfers the ACE back to the TSO with the imbalance

Agenda Day 1

From		To	Item
10:00	-	10:25	**Welcome**: Agenda and Topics Next Consultation
10:25	-	11:25	Imbalance Settlement Harmonisation
11:25	-	12:25	IN Implementation Framework
12:25	-	13:00	Lunch
13:00	-	14:30	RR Implementation Framework
14:30	-	15:00	aFRR/mFRR Implementation Framework
15:00	-	15:15	Break
15:15	-	15:45	aFRR Implementation Framework
15:45	-	16:45	mFRR Implementation Framework
16:45	-	17:00	Summary of Day One

mFRR Implementation Framework

Martin Høgh Møller

Convenor MARI SC

EB GL Stakeholder Workshop
20.06.2018-21.06.2018

Alignment between FRR Projects

FRR Implementation Framework	Consistency with aFRR
Whereas	
1. Subject matter and scope	
2. Definitions and interpretation	
3. High-level design of the FRR-Platform	
4.The roadmap and timeline for the implementation of the FRR-Platform	
5. Functions of the FRR-Platform	
6. Definition of the standard FRR balancing energy product	
7. Balancing energy gate closure time for the standard FRR balancing energy product bids	
8. TSO energy bid submission gate closure time for the standard FRR balancing energy product bids	
9. Common merit order lists to be organised by the activation optimisation function	
10. Description of the optimisation algorithm	
11. Proposal of entities	
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15. Framework for harmonisation of terms and conditions for BSPs related to FRR-Platform	
16. Publication and implementation of the FRRIF	
17. Language	

Mostly identical

Specific to each one

Content Identical

Content Overview - Art. 1 and Art 2

Art. 1 - Subject matter and scope
What does the IF say:

- The implementation framework is the common proposals of all TSOs in accordance with **EBGL Articles 20**.
- These proposal applies solely for the exchange mFRR.
- The proposals for pricing, cross-zonal capacity allocation (Art. 30) & TSO-TSO settlements rules (Art.50) **will be treated in a separate documents**.

Art. 2 - Definitions and Interpretations
What does the IF say:

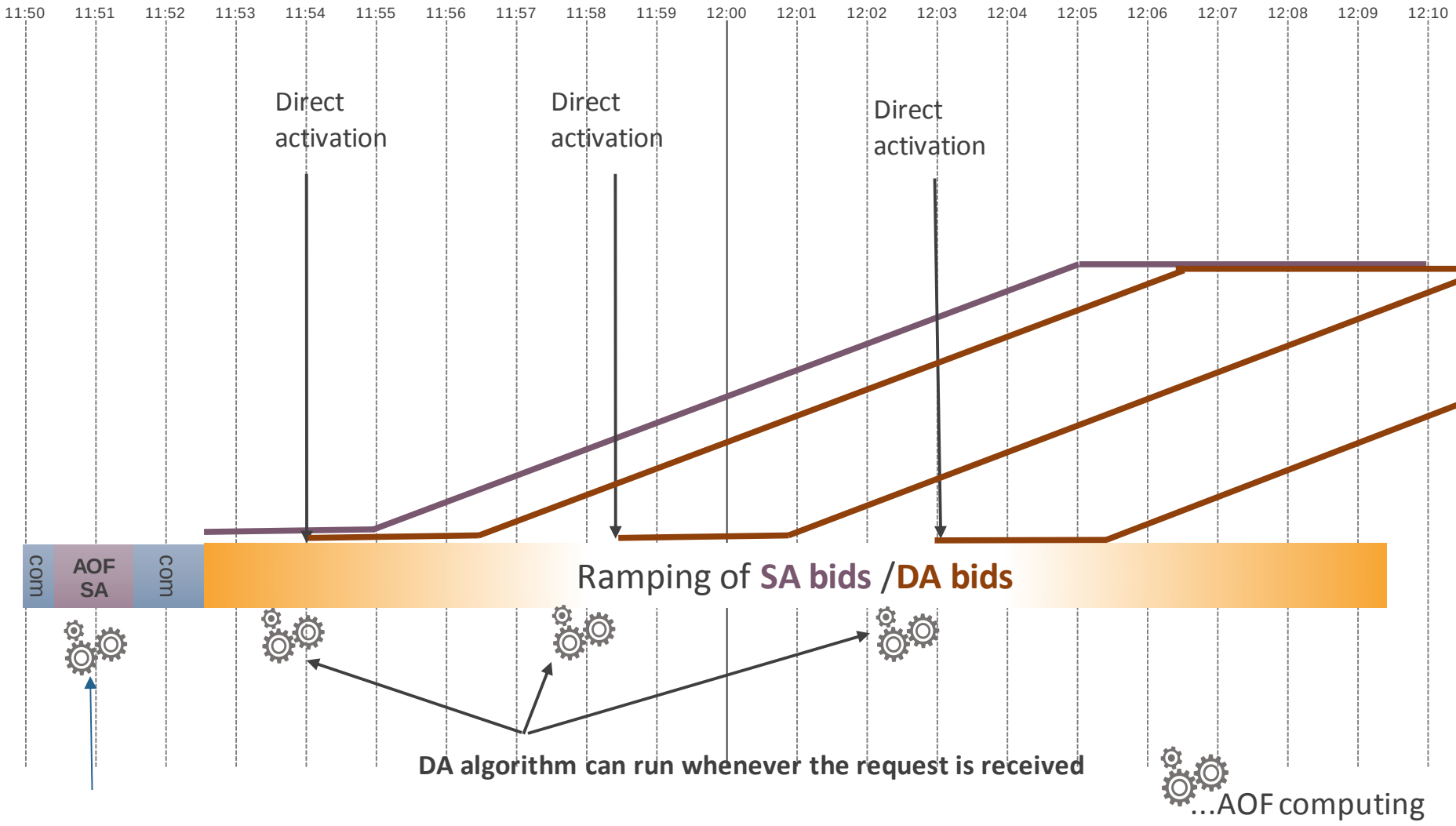
- The known terms used shall have the meaning given to them in "definitions" in Art. 2 of Electricity Regulation, Art. 2 of SOGL and Art. 3 EBGL.
- There are additional terms specific the mFRR Platform such as: **elastic & inelastic demand; Scheduled & direct activatable bids; Divisible & indivisible bids**

Content Overview - Art. 3

Art 3. - High-level design of the mFRR-Platform
What does the IF say:

- Platform will establish a **cross-border mFRR activation process** in accordance with Article 147 and Article 149 of SOGL for all LFC areas.
- The Platform will **optimise the activation of standard product bids** located in all LFC areas while respecting the constraints.
- The **sum of all manual frequency restoration power interchange is equal to zero**
- **Scheduled & direct activatable bids.**
- Each participating TSO shall have **access at all times** to the volume of the submitted bids if required.

Process Illustration for quarter-hour between 12:00 and 12:15



Bids submitted to TSO GCT 11:35

Bids submitted to platform

CMOL SA+DA/ SA only

CMOLs with remaining DA bids

Content Overview - Art. 6

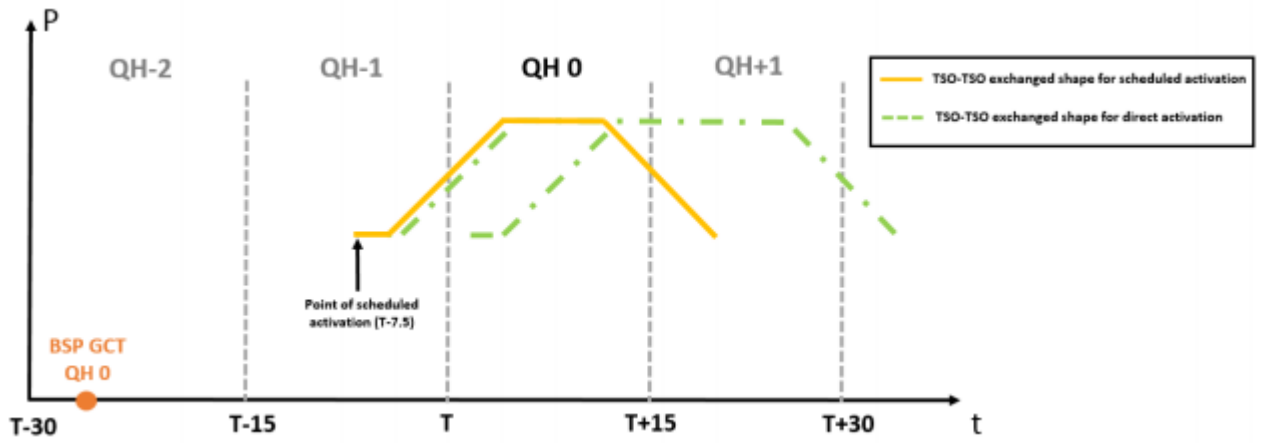
Art. 6. - Definition of standard mFRR balancing energy product
What does the IF say:

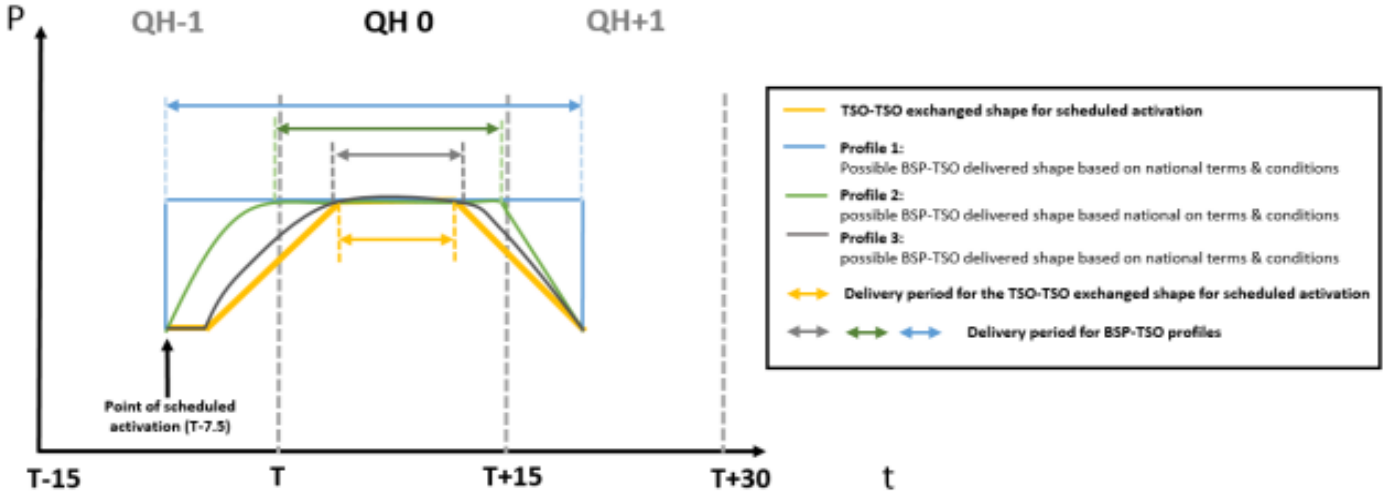
- Definition of the standard product specifically the standard mFRR product bid characteristics and the variable characteristics of the standard mFRR balancing energy product bid
- **A scheduled activation** can take place **at the point of scheduled activation only**.
- **A direct activation can take place anytime** during the 15 minutes **after** the point of **scheduled activation**.

Input	mFRR Standard Product
Demand	Shall be - Elastic / inelastic
Price	0.01 €/MWh
Preparation Period	≤ 12.5 minutes
Ramping Period	≤ 12.5 minutes
Full Activation Time	12.5 minutes
Minimum Quantity	1 MW
Bid Granularity	1 MW
Minimum Duration of Delivery	5 minutes
Indivisible Bids	Allowed
Activation Granularity	1 MW (if divisible)
Validity Period	According to the process

Bid characteristics
under national responsibility

- **A number of bid characteristics are determined under national responsibility**
  - ✓ Preparation time (max 12.5')
  - ✓ Ramping time (max 12.5')
  - ✓ Deactivation period
  - ✓ Maximum duration of delivery period
  - ✓ Min duration between end of deactivation period and following activation period (variable characteristic)
  - ✓ Maximum duration of an activation (variable characteristic)





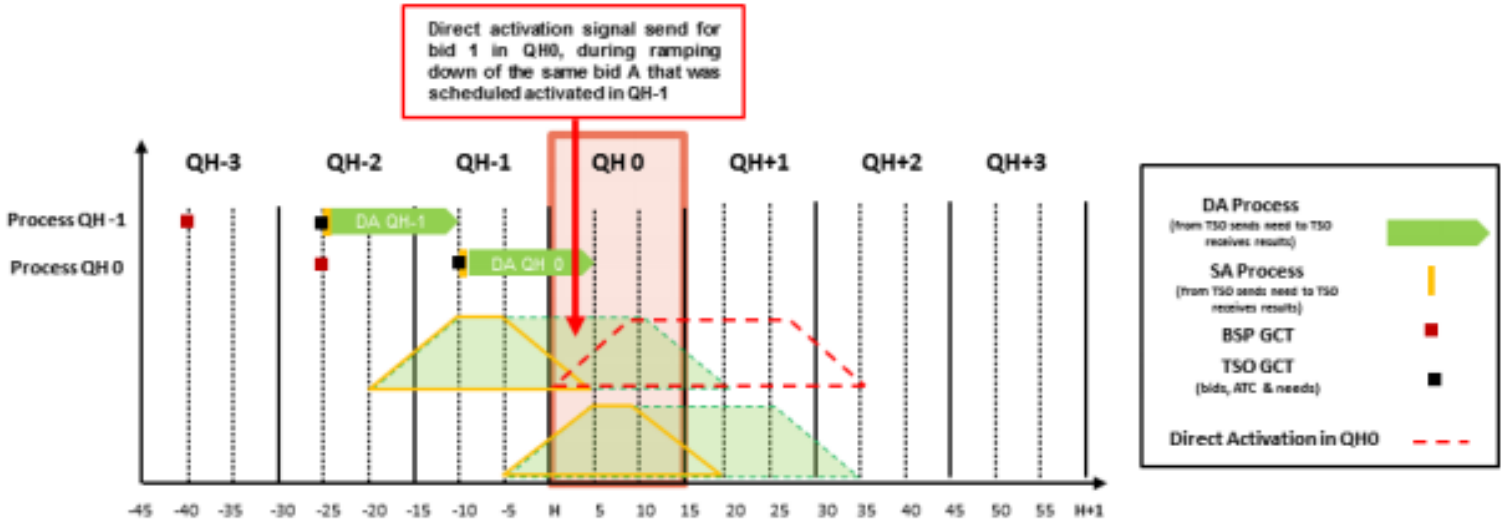
Linking of Bids

- Technical linking
  - BSP is required to indicate which bids of consecutive quarter hours that belong to the same underlying assets in order to avoid unfeasible activations

- Economical linking (allowed if complexity of algorithm not increases too severely)
  - Parent child
  - Exclusive group orders

Technical linking

- It is not possible for BSP to remove bids next quarter-hour when getting the activation signal in preceding quarter-hour.



SA QH-1➔SA QH0 ✔

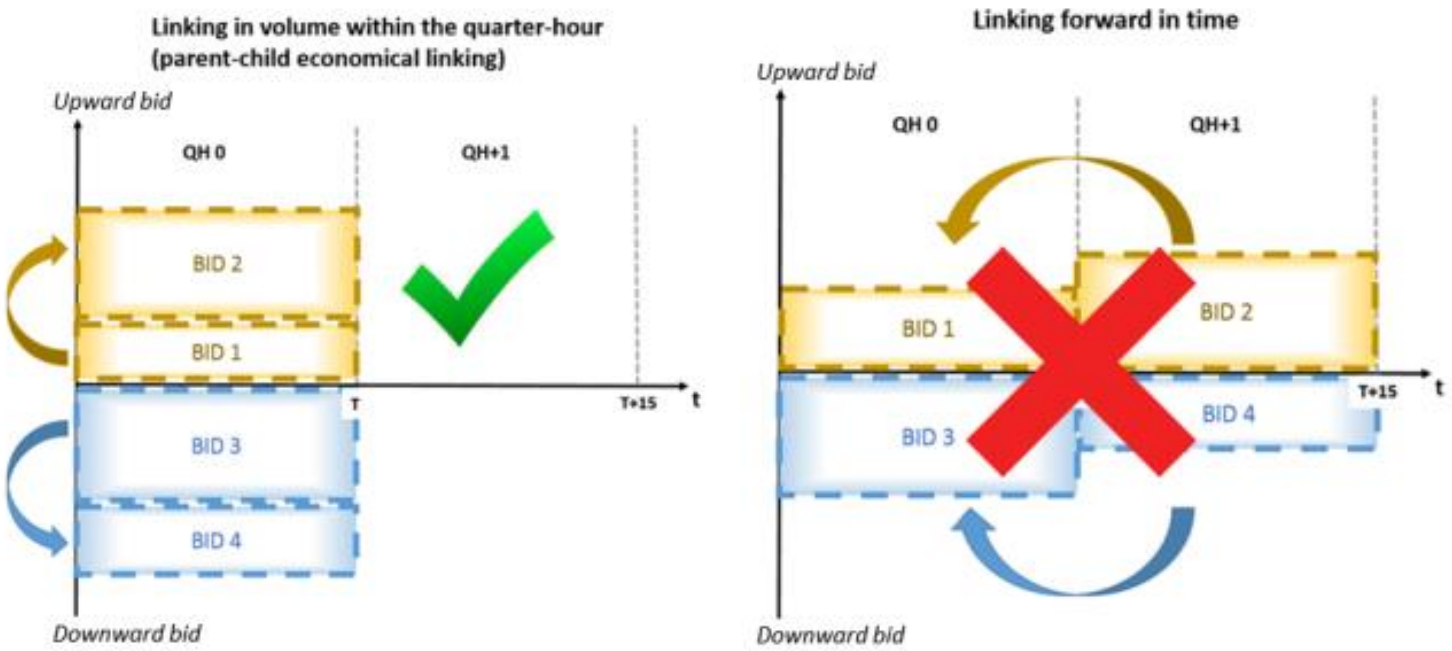
DA QH-1➔SA QH0 ✘

DA QH-1➔DA QH0 ✘

SA QH-1➔DA QH0 ✘

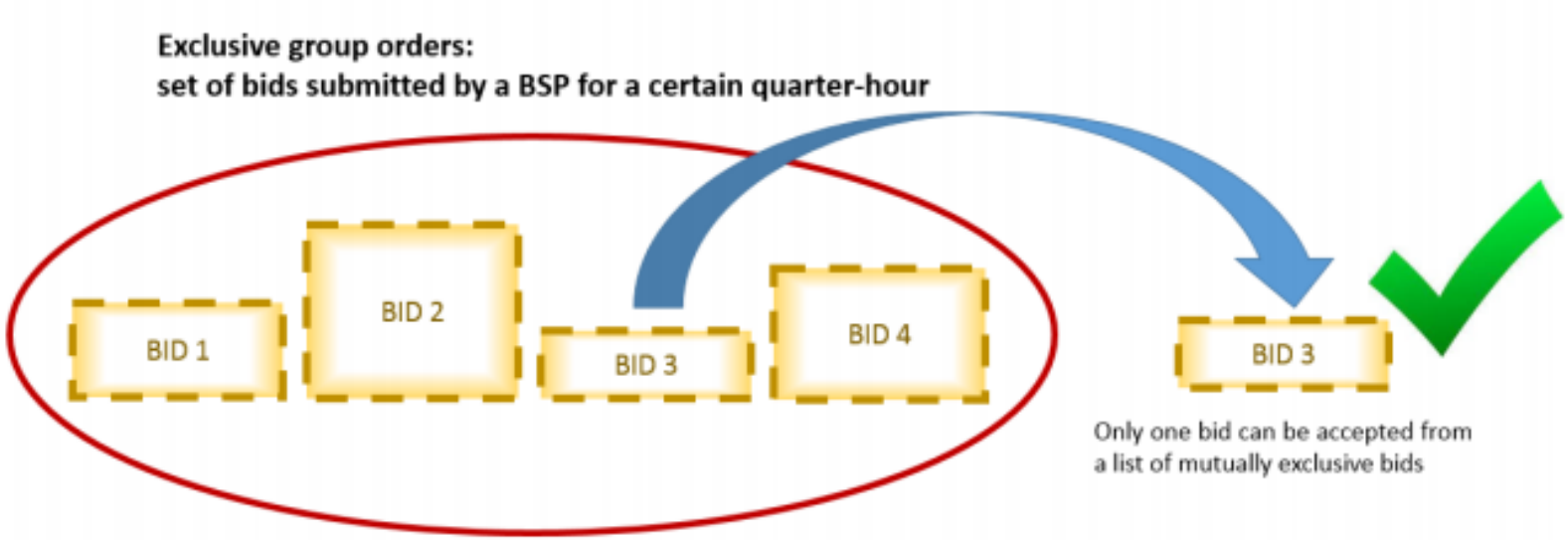
Parent-Child linking

- Dependencies between bids of the same quarter-hour



Exclusive group orders

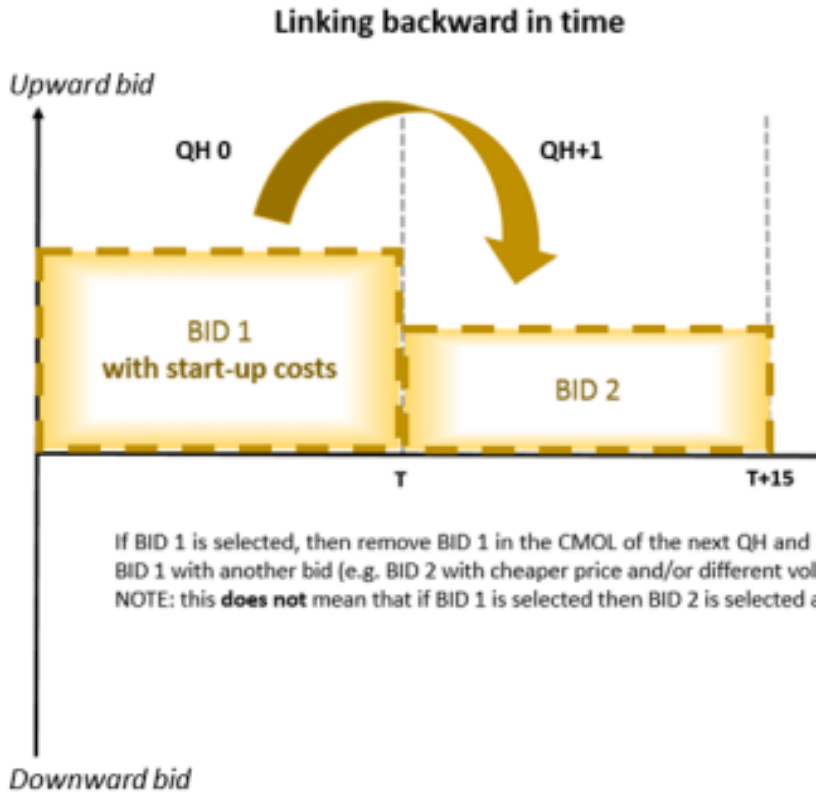
- Only one bid can be select from a set of bids



Under investigation

Conditional bids with linking backward in time

- ❑ Bid price dependent on whether bid is activated in preceding quarter-hour
- ❑ Enable BSP to include star-up costs more efficiently in the bids



Content Overview - Art. 7 and Art. 8.

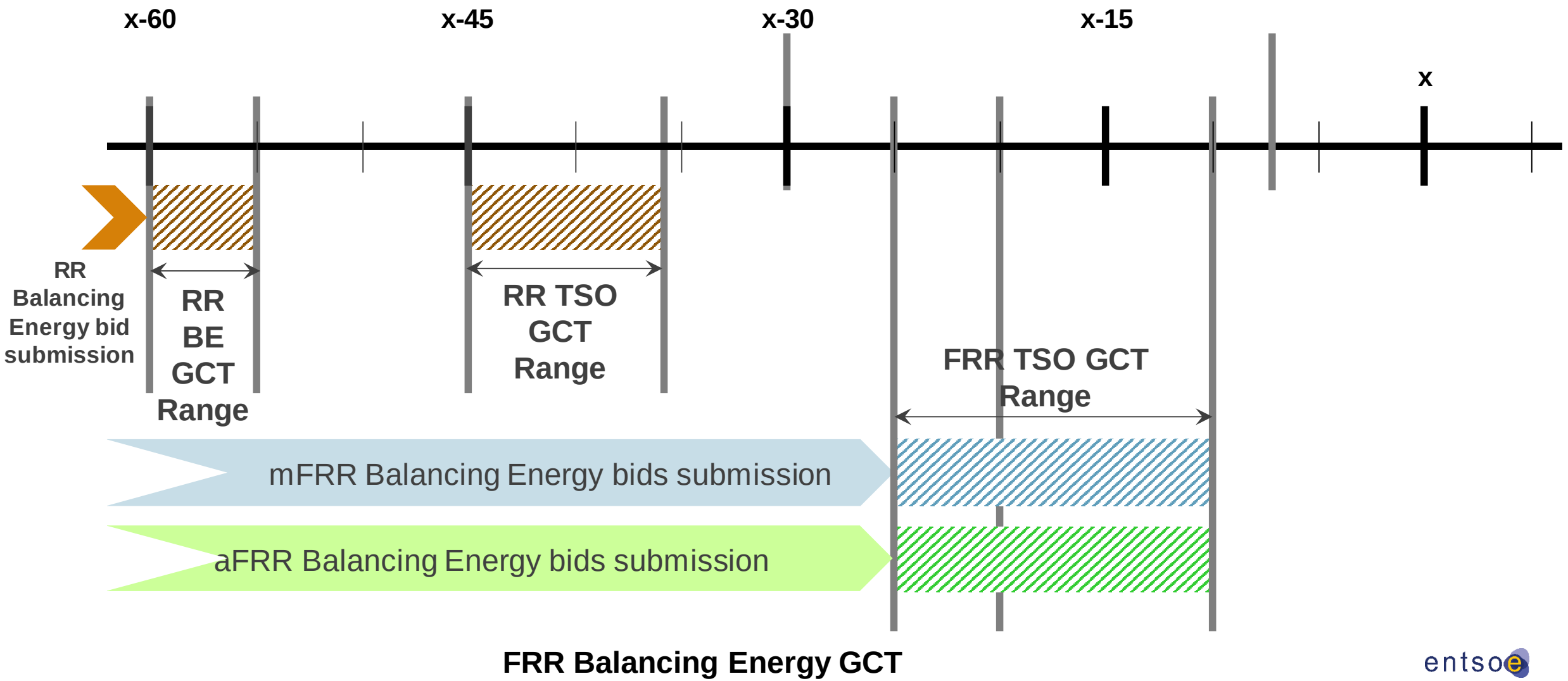
Art. 7. - Balancing energy gate closure time for the standard mFRR product bids
What does the IF say:

- **BE** (BSP) **GCT 25 minutes before the beginning of the quarter hour for which the BSPs place the respective standard mFRR product bid.**

Art. 8. -TSO energy bid submission gate closure time for the standard mFRR balancing energy product bids
What does the IF say:

- **TSO GCT between 25 minutes to 10 minutes before the beginning of the quarter hour for which the BSPs place the respective standard mFRR product bid**.
- = maximum 15 minutes for TSO to assess availability of bids for the platform

Gate Closure Time Overview



Content Overview - Art. 9 and Art. 10

Art. 9 - Common merit order lists to be organised by the activation optimisation function
What does the IF say:

- **BSPs shall submit bids to the connecting TSO**, and then **TSO submits these bids to CMOL**
- Platforms shall create two CMOLs for **each quarter hour for mFRR** (positive/negative direction)
- For mFRR-Platform there are recognized 2 **CMOLs from scheduled** and **2 CMOLs from direct activatable auction**

Art. 10 - Description of the optimisation algorithm
What does the IF say:

- **Inputs for optimisation algorithm** are CMOLs, TSO demands & available cross-zonal capacity (CZC); CZC inside bidding zones or LFC areas shall not be considered
- Algorithm shall result in maximising of social welfare, minimising the total energy activated (also minimising cross-border exchange)
- **Outputs** of optimisation algorith are the activations of bids, the volume of demands, used CZC, net position & cross-zonal marginal price

mFRR CMOL and AOF: Overview

Input	mFRR AoF
Demand	✓ elastic and inelastic for schedule activation ✓ Inelastic for direct
CMOLs	✓ One with positive bids ✓ One with negative bids
CMOLs to AoF	✓ Both for schedule activation ✓ Per direction of demand in direct activation
Available CZC	Per Border

Property	mFRR AOF
Social welfare maximisation	yes
Counteractivation	yes
Minimization of Exchanges on Borders	yes
Main Constraints	available CZC
	power balance equation
	sum of all exchanges = 0

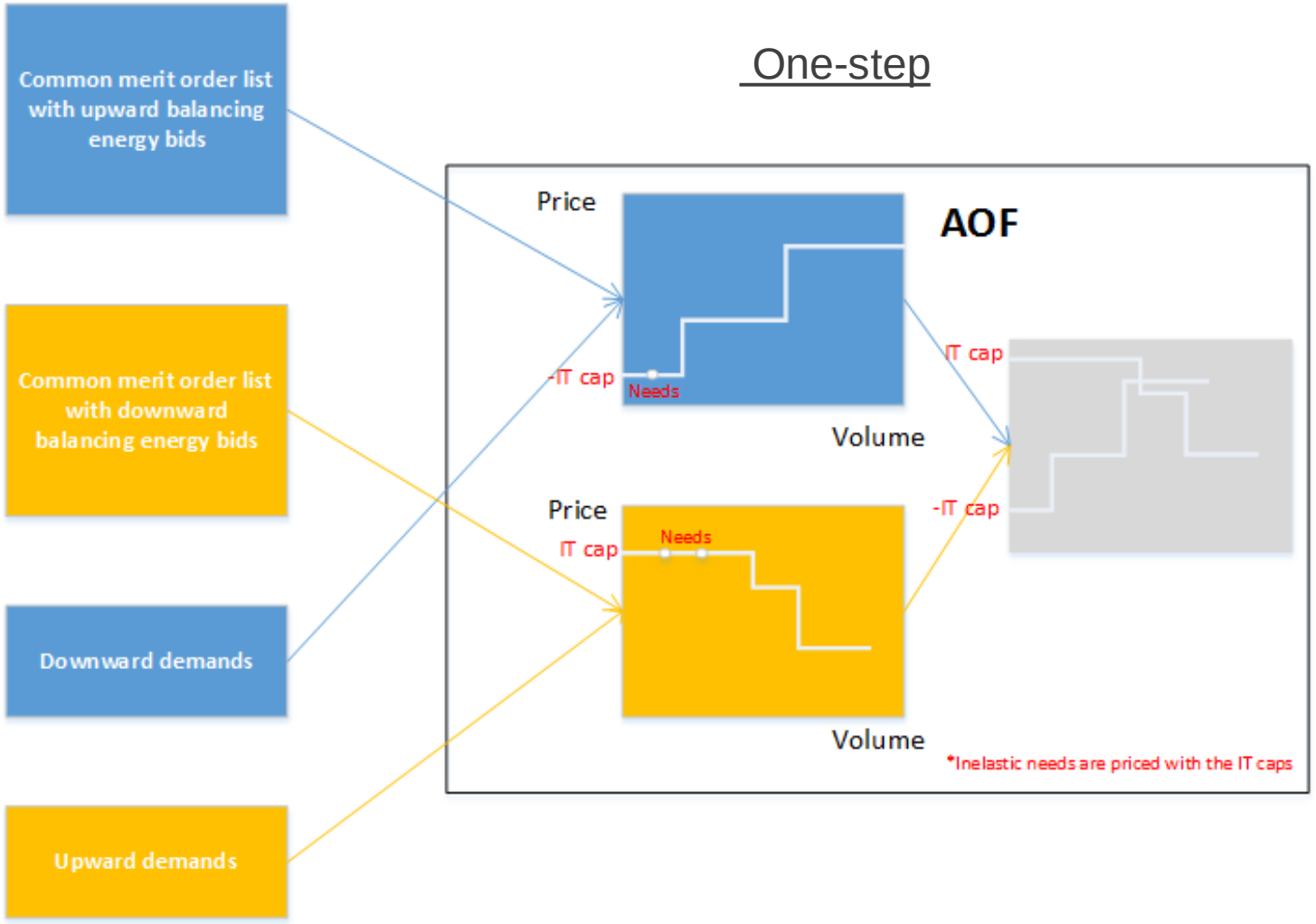
mFRR CMOL and AOF:
1 Algorithm, 1 product and 2 types of activation

- Schedule activation: once per quarter interval
  - ✓ Both CMOLs and all TSO needs are input in the Algorithm
  - ✓ Available cross zonal capacity

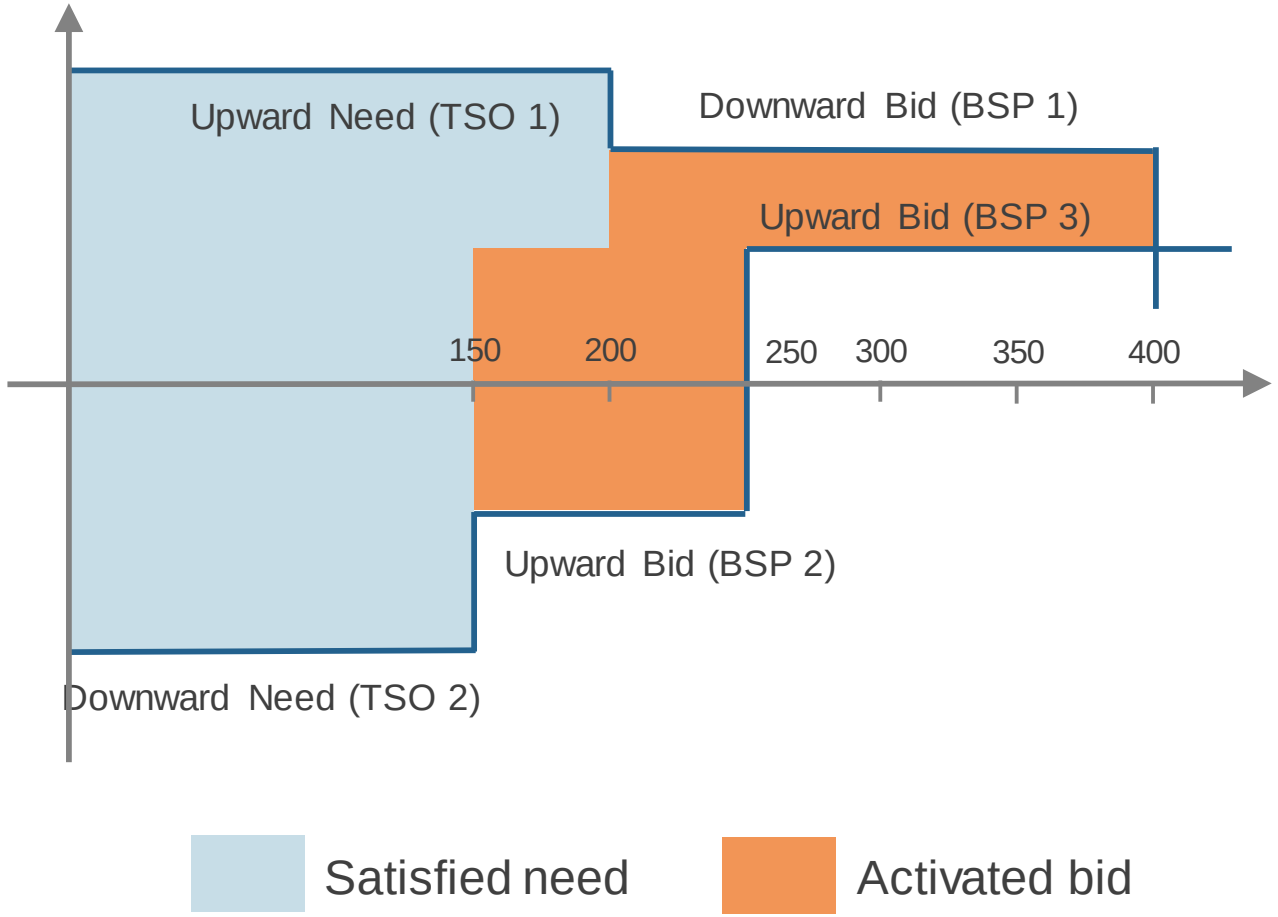
- Direct activation: continuous manner – at any point of time between two schedule activations
  - ✓ One CMOL and depending on the TSO need submitted are input to the Algorithm
  - ✓ Available cross zonal capacity

mFRR CMOL and AOF: Inputs to AOF

CMOLs, TSO needs and available cross zonal capacity



mFRR CMOL and AOF:
Example: inelastic needs and divisible bids

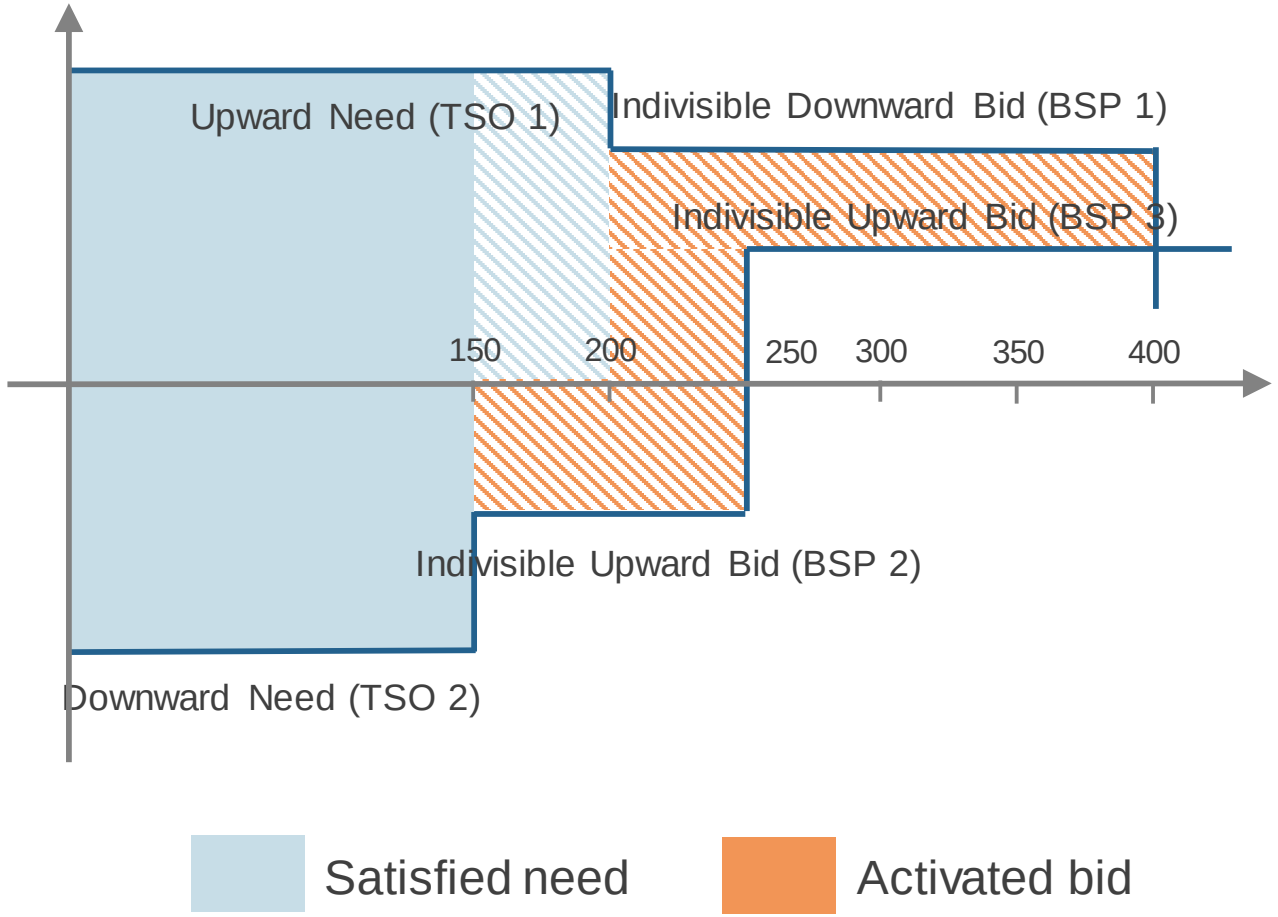


Comment

Without any restriction on counter-activations, the social welfare reaches its theorical maximum.

The resulting marginal price is intuitively based on the **sumbmitted mFRR balancing energy prices** and **the available cross zonal capacity.**

mFRR CMOL and AOF:
Example: inelastic needs and indivisible bids

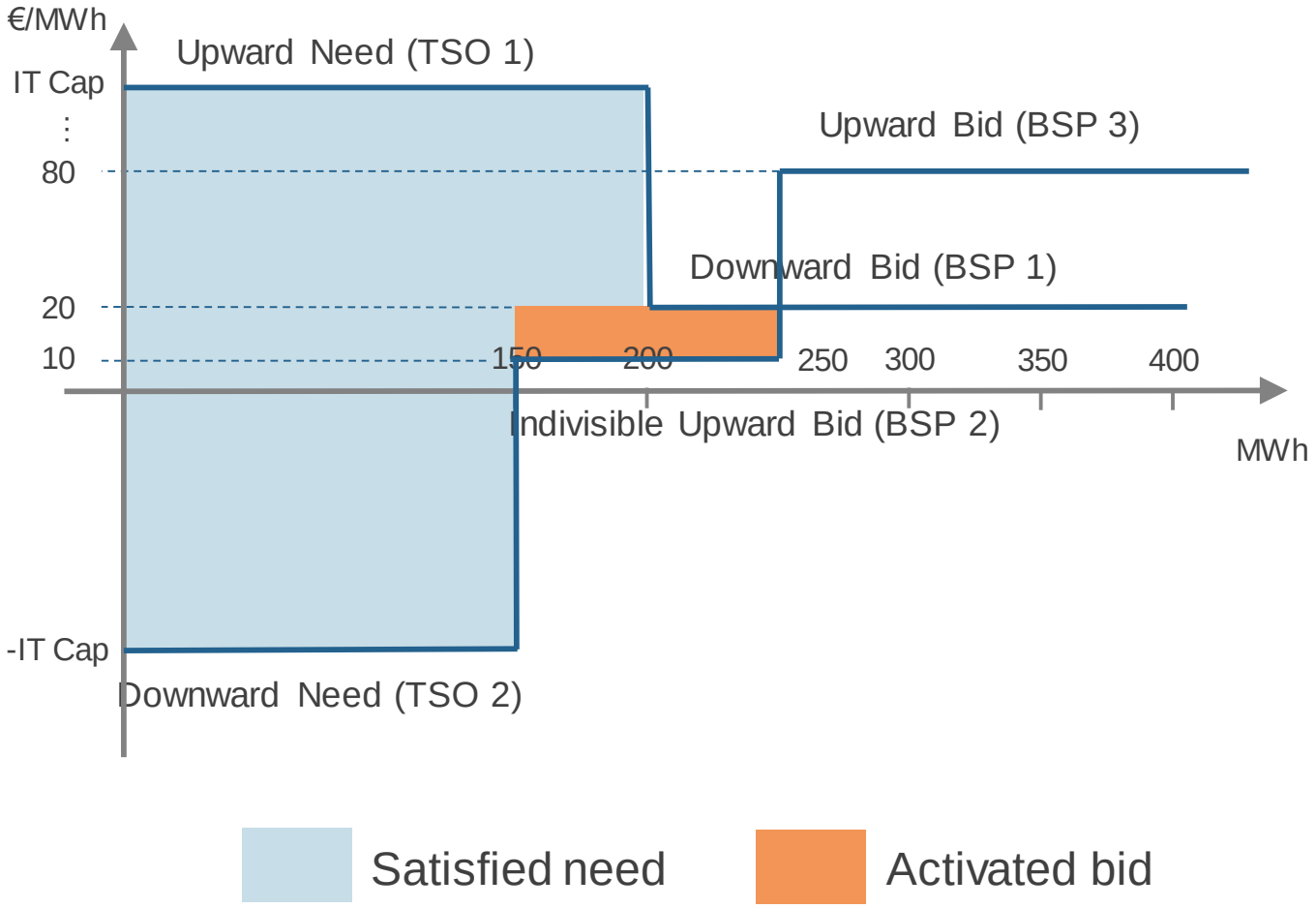


Comment

Without any restriction on counter-activations, the social welfare reaches its theorical maximum.

In the example aside, if counteractivations were restricted, because of indivisible offers, no activation can take place therefore **the inelastic need would be left unsatisfied**

mFRR CMOL and AOF:
Example: cost efficient satisfaction of needs



Comment

Counter-activations help to satisfy the needs in a cost efficient way with intuitive pricing result.

In the example aside, allowing counteractivation would result into a marginal price of 20€/MWh.

If counteractivations were not allowed the Upward Bid from BSP 3 would be partially acticated and the resulting price would be 80 €/MWh

Summary/conclusion

- The same algorithm and product is used in two types of activation:
  - ✓ Schedule activation: Algorithm runs once per quarter interval when there are TSO needs submitted to MARI
  - ✓ Direct activation: Algorithm runs when a TSO need for direct activation is submitted to MARI

- Netting and upwards and downwards activations in one-step leads to the activation of the most cost-effective bids in schedule activation

- Allowing schedule counter-activations:
  - ✓ Avoids the risk of non satisfaction of inelastic demand due to the indivisible bids
  - ✓ Avoids the introduction of additional variables and constraints which can increase the computation time
  - ✓ Results are costs efficient and prices reflect the submitted mFRR balancing energy prices and the available CZC
  - ✓ Results are traceable and understandable based on the submitted mFRR balancing energy volumes and prices and the available CZC

Q&A

It's time for your questions.

Agenda Day 1

From		To	Item
10:00	-	10:25	**Welcome**: Agenda and Topics Next Consultation
10:25	-	11:25	Imbalance Settlement Harmonisation
11:25	-	12:25	IN Implementation Framework
12:25	-	13:00	Lunch
13:00	-	14:30	RR Implementation Framework
14:30	-	15:00	aFRR/mFRR Implementation Framework
15:00	-	15:15	Break
15:15	-	15:45	aFRR Implementation Framework
15:45	-	16:45	mFRR Implementation Framework
16:45	-	17:00	Summary of Day One

Agenda Day 2

From		To	Item
10:00	-	10:30	General Principles for Pricing and Settlement
10:30	-	12:00	Pricing, settlement and activation purposes methodology for: mFRR and RR (1/2)
12:00	-	12:35	Lunch
12:25	-	13:35	Pricing, settlement and activation purposes methodology for: mFRR and RR (2/2)
13:35	-	15:05	Pricing and settlement methodology for: aFRR & Imbalance Netting (1/2)
15:05	-	15:20	Break
15:20	-	16:05	Pricing and settlement methodology for: aFRR & Imbalance Netting (2/2)
15:30	-	16:15	Q&A
16:15	-	16:30	Closing the Workshop

General Principles for Pricing, Settlement and Activation Purposes

Pavel Zolotarev

Convenor ENTSO-E PT PSAP

EB GL Stakeholder Workshop
20.06.2018-21.06.2018

EB GL Requirements

Art. 30: Pricing for balancing energy used for exchange or imbalance netting

- ”[...] *develop a proposal for a methodology to determine prices for the balancing energy that results from the activation of balancing energy bids for the* ***frequency restoration*** […] *and the* ***reserve replacement*** *process* […].”

  “Such methodology shall:
  (a) be based on marginal pricing (pay-as-cleared)
  (b) define how […] *balancing energy bids activated for purposes other than balancing affects the balancing energy price* […].

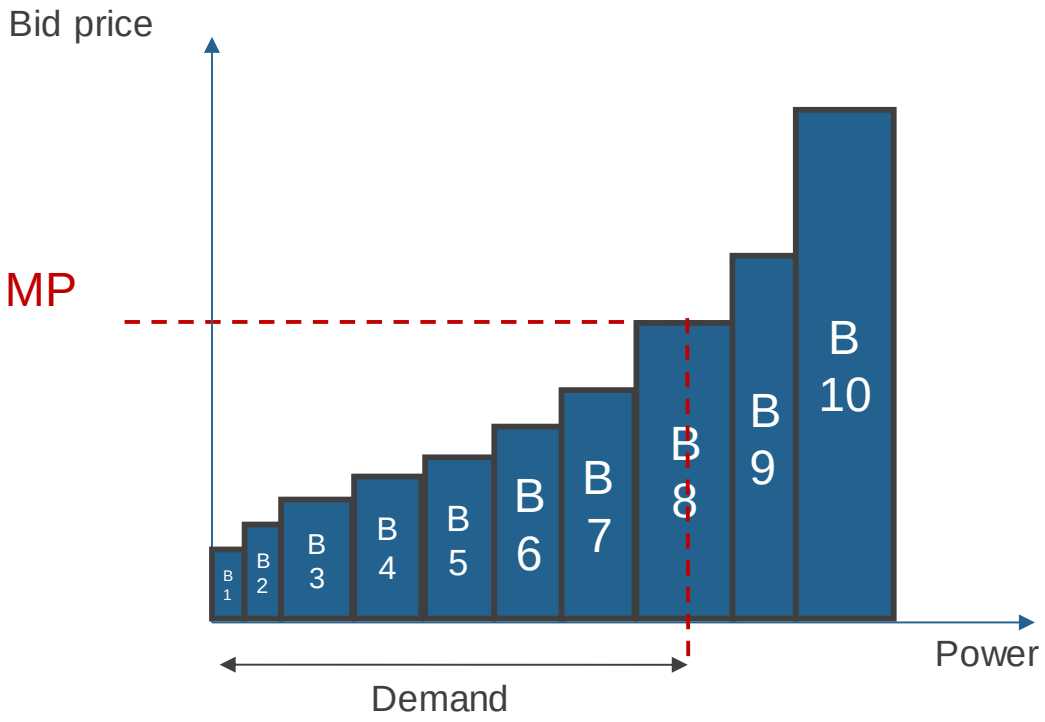
Art. 50:

- ”[...] *common settlement rules applicable to all intended exchanges of energy* […] as a result of one or more of the following processes:
  (a) the reserve replacement process
  (b) the frequency restoration process with manual activation;
  (c) the frequency restoration process with automatic activation;
  (d) the imbalance netting process.

Marginal Pricing as Basis for the Proposals

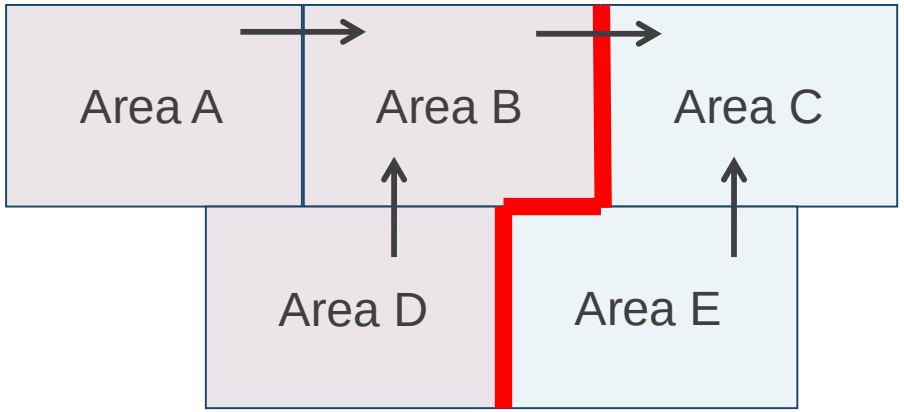
In this context, the Marginal Price (MP) represents the price of the last bid of a standard product which has been activated to cover the energy need for balancing purposes within a specified area.

- Same principle as day-a-head market
- Easy bid setting
- Lower bid prices (marginal cost bidding vs. markup in pay-as-bid)



Cross-Border Marginal Pricing (XBMP)

- The AOF will compute the balancing energy price per area.
- In the case there is no congestions between adjacent areas, the price will be the same in these areas
- In case there is a congestion – there will be a price split (principally like the day-ahead market)
- In the case of evolving congestions, the uncongested areas for RR could be different than from mFRR. Also the uncongested areas for mFRR could be different from the uncongested areas for aFRR



- In this example there is a congestion on the borders B→C, B→E and D→E
- Area A,B and D have the marginal price MP1
- Area C and E have the marginal price MP2

Uncongested area with marginal price = MP1

Uncongested area with marginal price = MP2

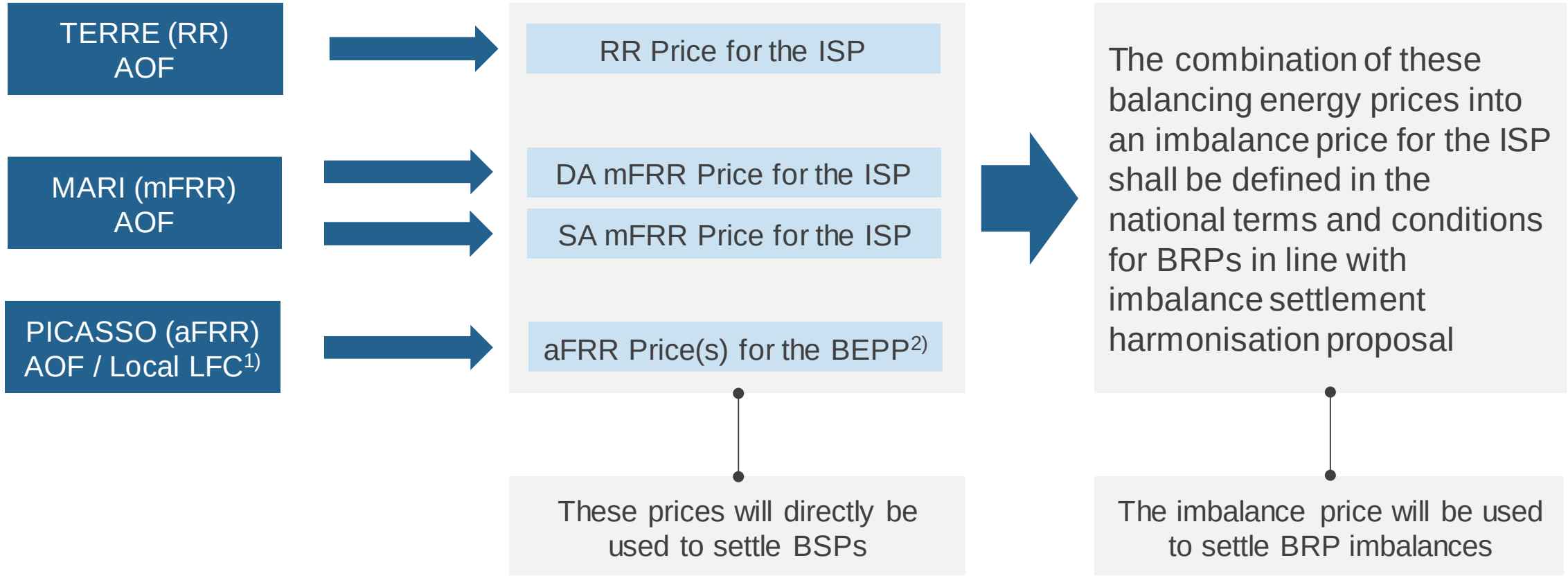
Balancing energy exhange on a border

Why Cross-Border-Marginal-Pricing?

- Marginal pricing is prescribed by EB GL.
- XBMP contributes to a level playing field within the platforms - BSPs providing the same service in an uncongested area are remunerated with the same price;
- Cross-Border Marginal Pricing is currently used for day ahead market coupling and thus ensures consistency.
- Nonetheless, the calculation of the marginal pricing has to take into account the differences between the different processes.
- The TSO-TSO settlement will be based on proportional cost sharing with congestion rent taking cross-border marginal pricing methodology as basis.

One Product – One Price

… or in other words – there will be no cross-product pricing



1) For further details, see the slides on aFRR balancing energy pricing

2) BEPP: Balancing Energy Pricing Period (to be defined, from 1 s to 15 min)

Pricing Proposal Structure

- The pricing proposal will be comparable to the implementation frameworks

- The pricing proposal will not repeat the implementation frameworks

- Draft structure:

  Whereas

  1. Subject matter and scope – *in accordance with Article 30 of EB GL*
  2. Definitions and interpretation – *same terminology for all processes where possible*
  3. General principles – *cross-border marginal pricing*
  4. Additional provisions for the RR platform – *including different activation purposes*
  5. Additional provisions for the mFRR platform – *including different activation purposes*
  6. Additional provisions for the aFRR platform – *including different activation purposes*
  7. Publication and implementation of the proposal – *cf. implementation frameworks*
  8. Language – *cf. implementation frameworks*

Activation Purposes

Process	Activation Purpose Balancing	Pricing for Balancing Purpose	Activation Purpose System Constraints*	Pricing for System Constraint Purpose Purpose
RR	yes	XBMP	yes	XBMP and pay-as-bid for bids identified in accordance with dry run
mFRR	yes	XBMP	yes	XBMP and pay-as-bid for bids identified in accordance with dry run
aFRR	yes	XBMP	no	n/a

*System constraints purpose is an activation purpose which does not serves the frequency control process targets in accordance with SO GL (frequency restoration process and reserve replacement process)

Activation Purposes Proposal Structure

- The activation purposes proposal (APP) will be comparable to the implementation frameworks

- The APP is a short proposal.

- Draft structure:

  Whereas

  1. Subject matter and scope – *in accordance with Article 29(3) of EB GL*
  2. Definitions and interpretation – *short definition list*
  3. Activation Purposes and Classification Criteria – *balancing and system constraints*
  4. Publication and implementation of the proposal – *cf. implementation frameworks*
  5. Language – *cf. implementation frameworks*

Q&A

It's time for your questions.

Agenda Day 2

From		To	Item
10:00	-	10:30	General Principles for Pricing and Settlement
10:30	-	12:00	Pricing, settlement and activation purposes methodology for: mFRR and RR (1/2)
12:00	-	12:35	Lunch
12:25	-	13:35	Pricing, settlement and activation purposes methodology for: mFRR and RR (2/2)
13:35	-	15:05	Pricing and settlement methodology for: aFRR & Imbalance Netting (1/2)
15:05	-	15:20	Break
15:20	-	16:05	Pricing and settlement methodology for: aFRR & Imbalance Netting (2/2)
15:30	-	16:15	Q&A
16:15	-	16:30	Closing the Workshop

MARI

Manually Activated Reserves Initiative

TERRE

(Trans European Replacement Reserves Exchange)

Pricing Methodology

Bid selection specifics

Matthias Eder, MARI Work Stream Pricing and Settlement
Amine Abdala, Head of TERRE Project

(Balancing stakeholder meeting, Brussels, 21st of June 2018)

Contents

TOPIC
Pricing methodology (I) – Bid selection specifics • Elasticity of demands • Counter-activations • Rejection of bids
Pricing methodology (II) – Volume and price determination • Volume determination for schedule and direct activations • Price determination for schedule and direct activations • Price Indeterminacy
Settlement of netted volumes • Settlement in case of „partial“ netting • Settlement in case of „perfect“ netting
Activation purposes other than balancing • Interconnector Controllability
Congestion Rent • Definition and calculation • Distribution

Pricing methodology (I) – Bid selection specifics

Elasticity of demands

- TSOs have different products to balance their system
  - Operators consider the prices of the different balancing products and the probability that the forecast imbalance will occur
  - Elasticity of demand will remove uncertainties, as the uncertainty will be represented by a price, and allow the TSO to utilize available resources efficiently.

- TERRE will allow elastic needs:
  - The ability to price a need will lead to a higher amount of needs submitted to the RR balancing platform
  - The RR TSOs commit to coordinate the transparency level on the principles used to calculate the price of the balancing energy needs with the NRAs.

- MARI will not allow elastic needs for the direct activation and it is still under study if elastic needs will be allowed for the scheduled activation.

Counter-activations (1/2)

- With the term counter-activations, we refer to the simultaneous activation of an upward and a downward bid in order to increase the social welfare.

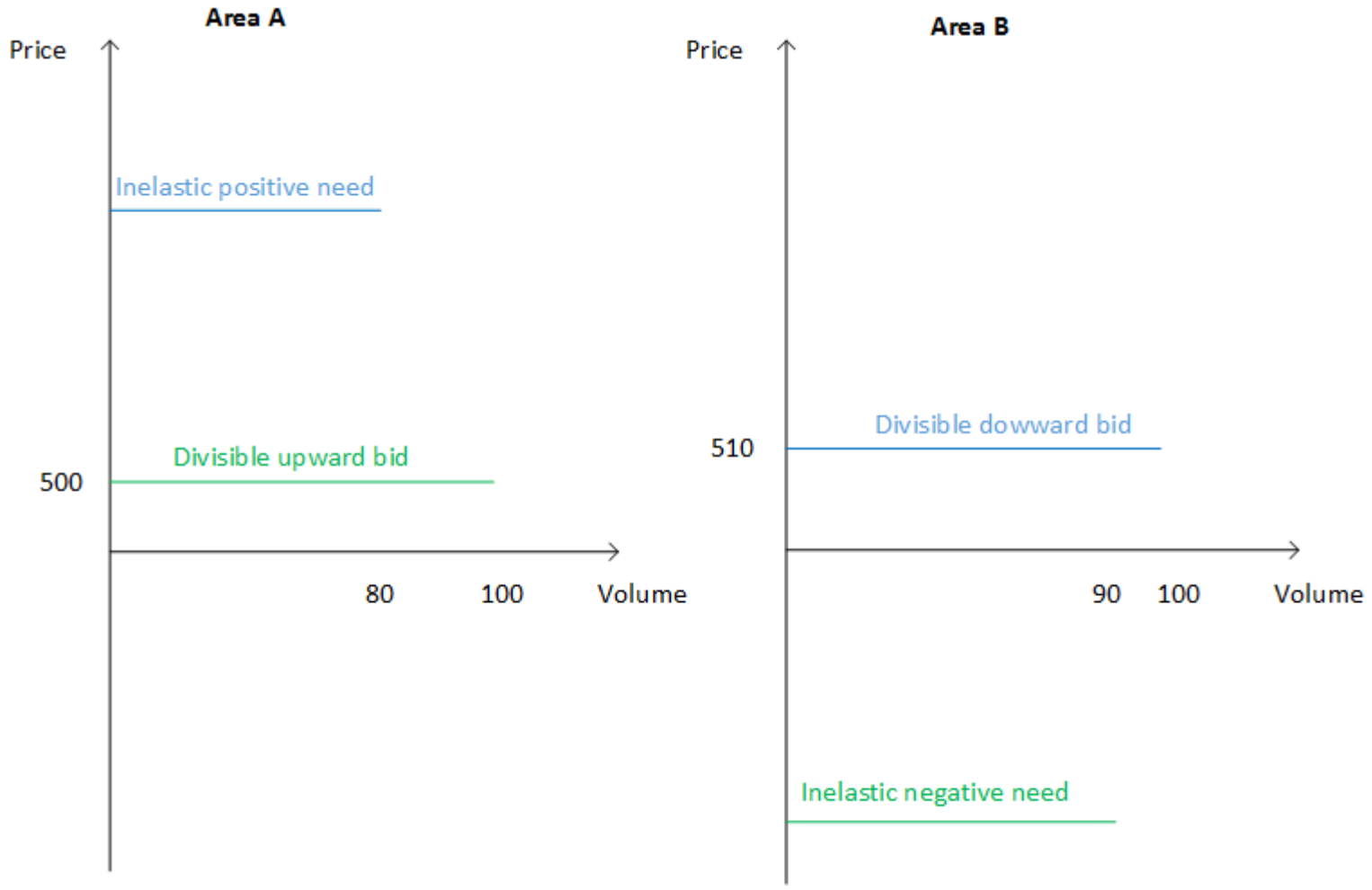
- TERRE will allow the counter-activations for the first 12 months of operation
  - After this period, counter-activations will be minimized:
    - Counter-activation quantities are considered to be the bid-to-bid matching quantities
    - Need-to-need matching has not priority over bid-to-need matching
    - Minimization of the weighted counter-activation quantity: sum of counter-activation quantities minus the normalized contribution of counter-activations to the social welfare

- MARI is still considering both options, i.e. allowance or prevention of counter-activations

Pricing methodology (I) – Bid selection specifics

Counter-activations (2/2)

- Allowance of counter-activations:
  - Satisfaction of both needs
  - Activation of 100 MWh DDB and 90 MWh DUB
  - Price indeterminacy between 500€ and 510€
- Minimization of counter-activations:
  - Satisfaction of both needs
  - Activation of 90 MWh DDB and 80 MWh DUB
  - Price indeterminacy between 500€ and 510€
- Restriction of counter-activations:
  - Satisfaction of both needs
  - Activation of 10MWh DDB
  - Price 510€



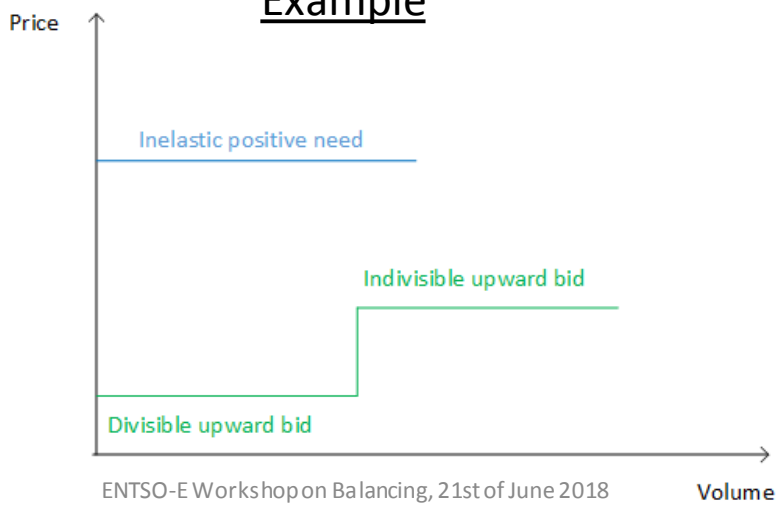
Rejection of bids

- Complex bid formats may lead to unforeseeably accepted and rejected bids if no further constraints are introduced

- **Unforeseeably accepted bids (UABs)**
  - The use of uplifts would be necessary to compensate these bids → deviation from XBMP
  - They will be allowed neither in TERRE nor in MARI

- **Unforeseeably rejected bids (URBs)**
  - Fully divisible URBs will be allowed in TERRE but not in MARI
  - Initial decision in TERRE was to prevent them
    - URB prevention can however lead to non-satisfaction of inelastic need

Example

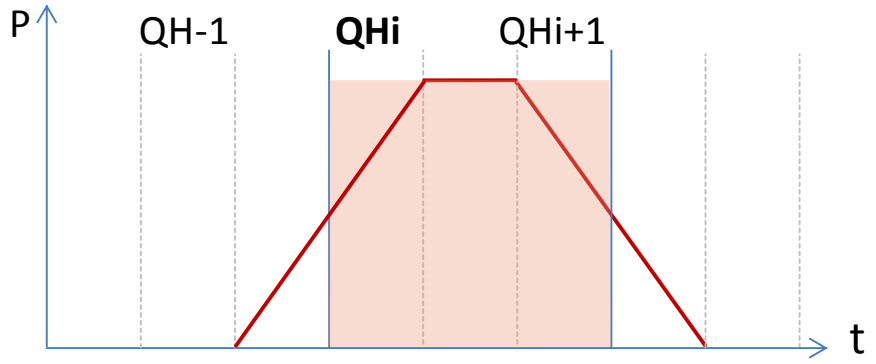


Pricing methodology (II) – Volume and price determination

Volume determination (I)

- Principles:
  - The total energy volume, i.e. the integral of the standard power profile, will be settled
  - The volumes will be settled in the form of blocks („block settlement“), in order to reduce the number of affected Balancing Energy Pricing Periods (BEP), i.e. quarter hours (QH) in case of MARI and TERRE, and simplify settlement processes.
  - Total volume settled = volume requested = $P_{required}$ x (Period between midpoint of upward-ramp and midpoint of downward-ramp)

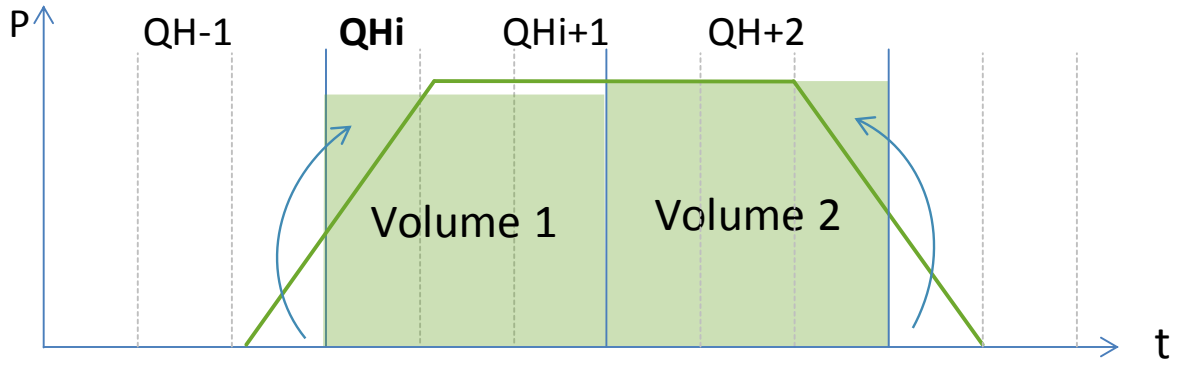
- **Scheduled Activation** (MARI and TERRE):
  - In the case of a Scheduled Activation, only 1 QH is affected



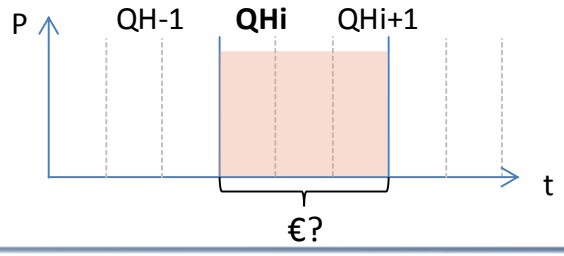
(QHi…the quarter hour the bid was submitted for)

Volume determination (II)

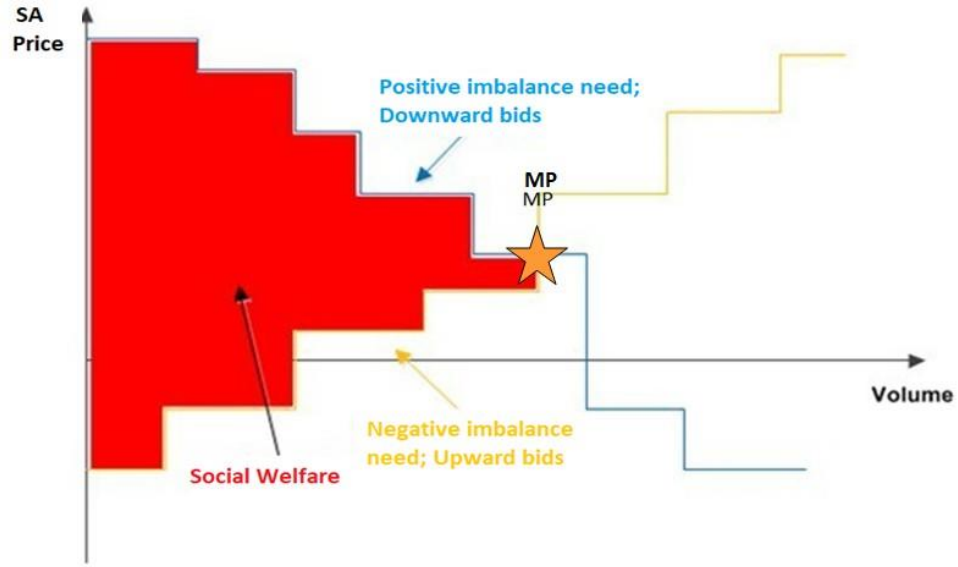
- **Direct Activation** (MARI):
  - In the case of a Direct Activation, 2 QHs are affected
  - hence, 2 blocks of volumes will be settled (and may be remunerated differenty)



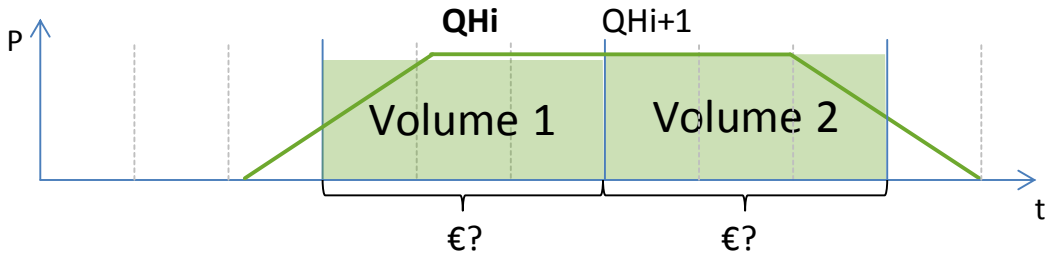
Price determination (I)



- Scheduled Activation (MARI and TERRE)
  - For the settlement of the schedule activated volume, the XBMP resulting from the scheduled clearing of the respective quarter hour will be applied



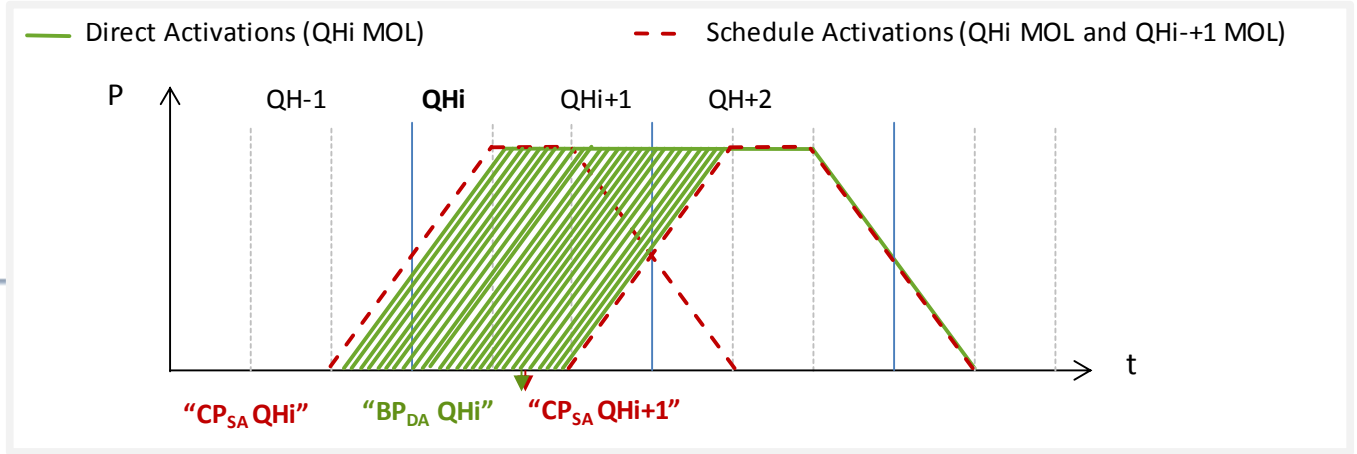
Price determination (II)



- Direct Activation (MARI)
  - Underlying Assumptions
    - One-step algorithm; activation separately for upward and downward; sequential
    - Direct Activation after Scheduled Activation (for a given QH)
    - Continuous DA-Process
    - Application of elastic demand (acc. to IF/ED)
  - Proposed basic principle:
    - One Marginal price for all upward activated DA of a respective QH
    - One Marginal price for all downward activated DA of a respective QH

      … determined after the point in time of the last possible DA.
    - Clearing price of scheduled activation sets the floor for the upward DA-price and the cap for the downward DA price.

Price determination (III)



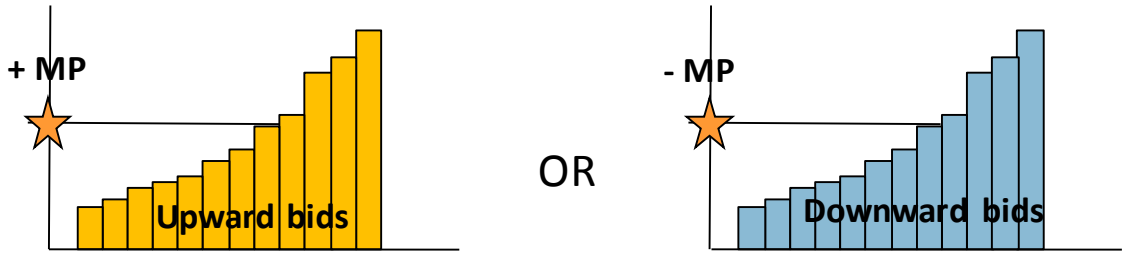
- Direct Activation (MARI)

  3 possible price components:

- **Marginal Prices of all Direct Activations**

  (of the main quarter hour (QHi) MOL)

  →**"MP$_{DA}$ QHi"**



(algorithm run executed separately for upward and downward)

- **Clearing Price of Schedule Activated Bids**

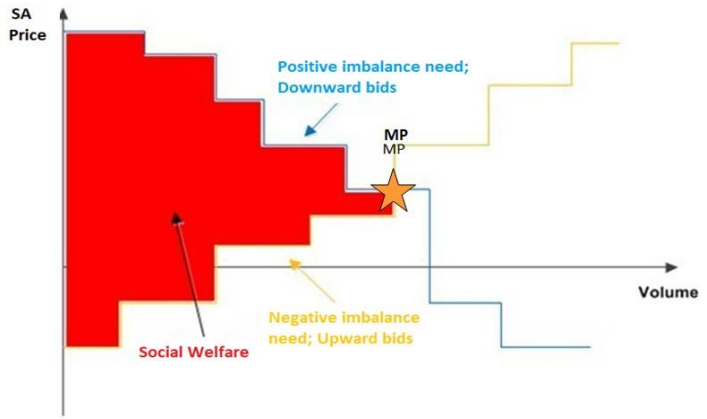
  (of the **main quarter** hour MOL)

  →**"CP$_{SA}$ QHi"**

- **Clearing Price of Schedule Activated Bids**

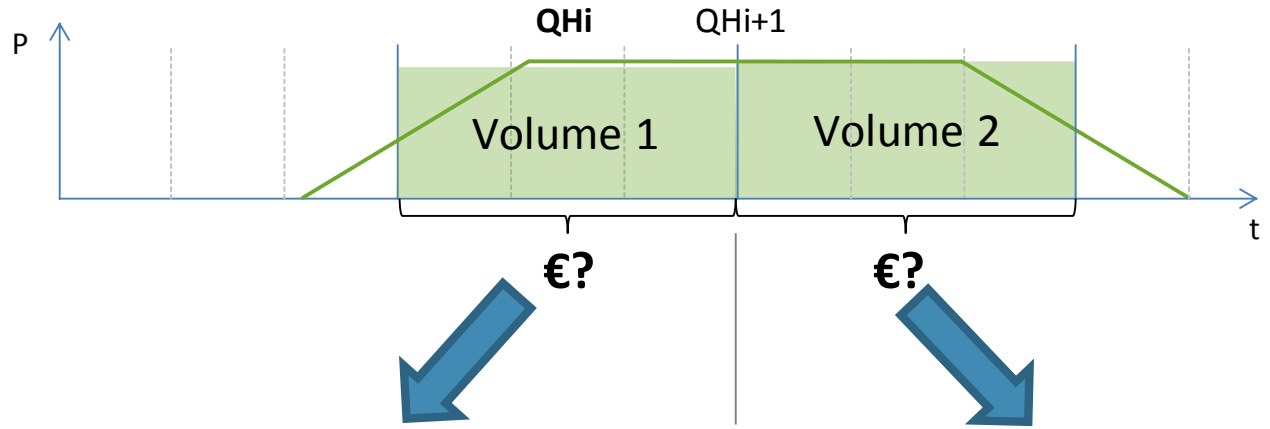
  (of the **subsequent** quarter hour MOL)

  →**"CP$_{SA}$ QHi+1"**



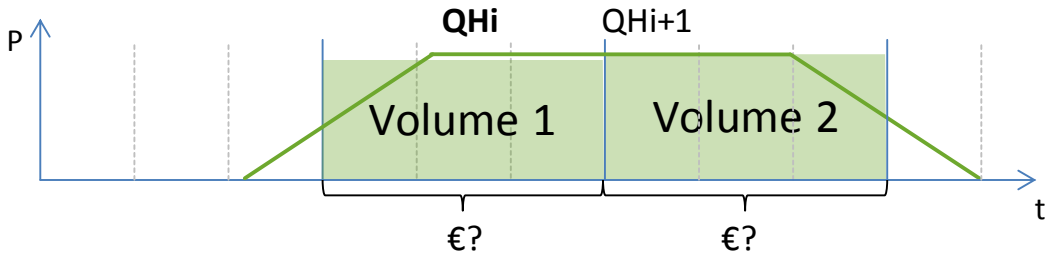
Price determination (IV)

- Direct Activation (MARI)
  - Pricing Options:



Options:	Settlement price for Direct Activated energy delivered in:	
	QHi	QHi+1
Option 1	MAXorMIN(CP_{SA} QHi; BP_{DA} QHi)	Max or Min(CP_{SA} QHi; BP_{DA} QHi)
Option 2	MAXorMIN(CP_{SA} QHi; CP_{SA} QHi+1; BP_{DA} QHi)	Max or Min(CP_{SA} QHi; CP_{SA} QHi+1; BP_{DA} QHi)
Option 3	MAXorMIN(CP_{SA} QHi; BP_{DA} QHi)	Max or Min(CP_{SA} QHi; CP_{SA} QHi+1; BP_{DA} QHi)
Option 4	MAXorMIN(CP_{SA} QHi; BP_{DA} QHi)	Max or Min(CP_{SA} QHi+1; BP_{DA} QHi)

Price determination (VI)



○ Direct Activation (MARI)

- The price of the DA bid from « CMOL QHi » should in principle be independent of the price of DA/SA bids from subsequent CMOL (« CMOL QHi+1 ») → Same price for both DA volumes V1 and V2
  The DA price should give incentive to submit DA(+SA) bids → the price should be at least equal to the XBMP of SA of CMOL QHi
  ➔ **Option 1**

- In option 1, specific cases can occur where BSPs would have been paid more for a volume delivered by the SA bid from "**CMOL QHi+1**" equivalent to the volume V2 of the DA bid from "CMOL QHi" → the price could be set at least to the XBMP of **SA of CMOL QHi and CMOL QHi+1**
  ➔ **Option 2**

- Option 2 gives higher incentives for DA, however sets higher costs for DA (and thus for BRPs). It is possible to reduce the costs but still always favor DA over SA in any case → **only the price of DA bid volume V2** could be set to at least to the XBMP of **SA of CMOL QHi and CMOL QHi+1**
  ➔ **Option 3**

- Costs can be reduced even more and still always favor DA over SA in any case → **the price of DA bid volume V2** could be set to at least to the XBMP of SA of CMOL **QHi+1 only**
  ➔ **Option 4**

	Implications
Option 1	Lower incentive for DA bids / lower costs
Option 2	Higher incentive for DA bids / higher costs
Option 3	Less incentive than option 2 / less costs than option 2
Option 4	Less incentive than option 3 / less costs than option 3

Price indeterminacy (I)

- Price indeterminacy is a special situation when identical bid and demand selection can lead to multiple optimal clearing price solutions

- To calculate the price in this case, we consider an upper and a lower price bound and the price is set at the middle of these bounds.
  - The last accepted bids and elastic needs are taken into account
  - The prevention of UABs for single BTU bids and the prevention of URBs for fully divisible bids and elastic needs are taken into account.
  - Indivisible bids are also taken into account, e.g. if the last accepted bid was indivisible → difference with Day-ahead market coupling
  - The following rule will be applied: "The midpoint price shall not be higher than the last accepted downward bid (or upward demand price) and the first rejected upward, and shall not be lower than the last accepted upward bid (or downward demand price) and the first rejected downward bid (in case of fully divisible bids)."

Settlement of netted volumes

Settlement of netted volumes
Definition

Netted volume:

virtual exchange of mFRR energy between cooperating LFC areas which results from netting of opposed mFRR demands.

- **“Partial Netting”:** Netting of demands occurs along with (counter-)activation of bids
- **“Perfect Netting”:** Netting of demands without occurrence of (counter-)activation of bids

Settlement of netted volumes
Price determination (I)

- Settlement of Partial Netted Volumes:

  Due to one-step approach of the algorithm, netted volumes cannot be distinguished from activated volumes.

  → Proposed solution: Application of XBMP for settlement of activated and netted volumes for both directions.

- Settlement of Perfect Netted Volumes :

  - In case only Inelastic Demands are involved: The algorithm would issue a XBMP of 0 €/MWh.
  - In case Elastic Demands are involved: The algorithm would issue a XBMP ≠ 0 €/MWh, based on demand prices of TSOs.

  →Possible Solutions:

  Solution 1: Application of one of the following price options in both cases of Perfect Netting (Elastic and Inelastic Demand).

  Solution 2:

  - Perfect Netting of Inelastic Demands: Application of one of the following options
  - Perfect Netting including Elastic Demands: Resulting XBMP ≠ 0 €/MWh

Settlement of netted volumes
Price determination (II)

Options:

- Option 1*: XBMP 0 €/MWh resulting from the algorithm
- Option 2*: Average of the lowest prices for upward and downward CMOLs
- Option 3: XBMP of avoided mFRR activation
- Option 4: Average price of avoided mFRR activation based on pay-as-bid settlement
- Option 5**: Settlement price based on local MP of avoided activations

(*…shortlisted options in MARI; **…solution foreseen in TERRE)

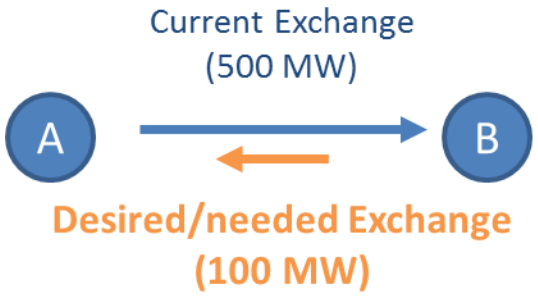
Activation purposes other than balancing

Interconnector Controllability

- Interconnection controllability:
  - For security reasons, TSOs can define limits for minimum / maximum flow to allow for control in certain system conditions.

- This concept is proposed to be incorporated in TERRE
- MARI is studying this possibility

- In order not to influence the marginal price due to activations for Interconnection Controllability actions, TSOs will run a constrained (with desired exchange) and an unconstrained (without desired exchange) algorithm
  - The activations result from the constrained run
  - The marginal prices result from the unconstrained run



Activation purposes other than balancing

Interconnector Controllability: Example (1/3)

Example

Algorithm run (unconstrained run) with ATC from TSO2 to TSO1 = 0, and ATC 1 to 2 = 50MW

TSO 1	50 € / MWh
TSO 2	40 € / MWh
TSO 3	40€ / MWh

- **Marginal Price is the result of the unconstrained run**

BSP	TSO	Offer direction	Offer quantity (MW)	Offer price (€/MWh)	Activated quantity (MW)
1	1	Upward	40	50	20
2	1	Upward	50	60	0
3	2	Upward	60	60	0
4	2	Downward	50	-35	0
5	3	Upward	80	30	80
6	3	Upward	90	40	20
7	3	Downward	50	-5	0

Activation purposes other than balancing

Interconnector Controllability: Example (2/3)

Constrained run: Optimization considers desire flow and gives the following results

BSP	TSO	Offer direction	Offer quantity (MW)	Offer price (€/MWh)	Activated quantity (MW)
1	1	Upward	40	50	40
2	1	Upward	50	60	10
3	2	Upward	60	60	0
4	2	Downward	50	-35	0
5	3	Upward	80	30	70
6	3	Upward	90	40	0
7	3	Downward	50	-5	0

Activation purposes other than balancing

Interconnector Controllability: Example (3/3)

Optimization considers desire flow and gives the following results

TSO 1	50 € / MWh
TSO 2	40 € / MWh
TSO 3	40 € / MWh

BSP	TSO	Offer direction	Offer quantity (MW)	Offer price (€/MWh)	Activated quantity (MW)
1	1	Upward	40	50	40
2	1	Upward	50	60	10
3	2	Upward	60	60	0
4	2	Downward	50	-35	0
5	3	Upward	80	30	70
6	3	Upward	90	40	0
7	3	Downward	50	-5	0

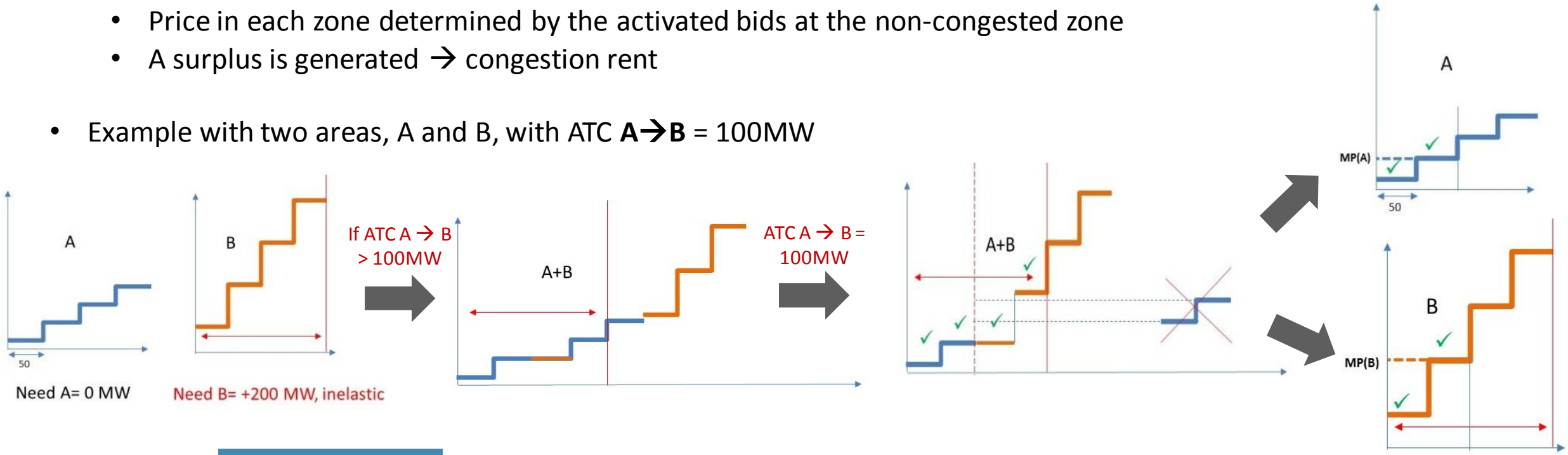
- The Marginal Price is the result of the unconstrained run.
- Uplifts will be given to BSPs **which were activated but had higher submitted, e.g. BSP1 and BSP2**
- TSO(s) requesting the Interconnection Controllability will bear the extra costs

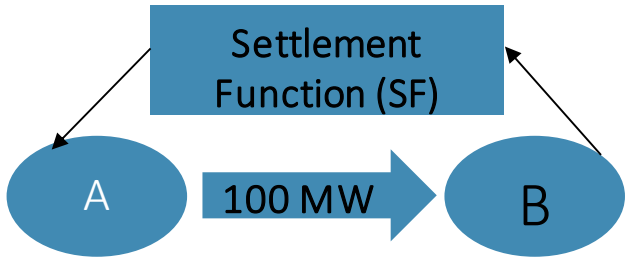
Congestion Rent

Definition and Calculation

- In case of congestion in one interconnector:
  - Different marginal prices at both sides
  - Price in each zone determined by the activated bids at the non-congested zone
  - A surplus is generated → congestion rent

- Example with two areas, A and B, with ATC **A→B** = 100MW





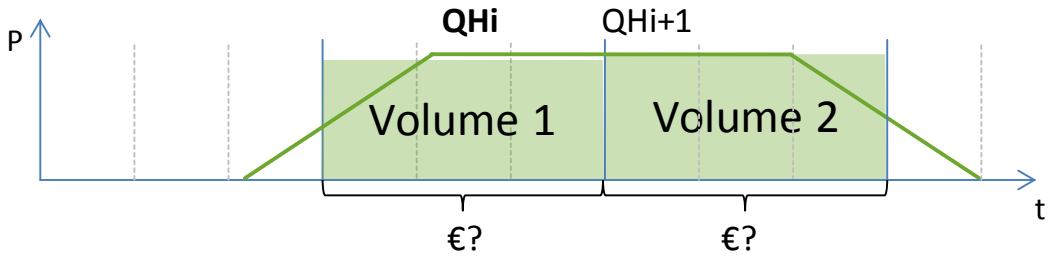
- **B→SF: 100 x MP_B**
- **SF→A: 100 x MP_A**
- **Surplus = [Schedule A→B] x (MP_B – MP_A)**

Q&A

It's time for your questions.

BACKUP

Price determination (V)



- Direct Activation (MARI)
  - Pricing options have been assessed and evaluated based on the following criteria:
    a. Pay at least bid price for all energies
    b. Price formulas for DA should not include prices (bid prices or clearing prices) of QHs which are not affected by the DA.
    c. No financial incentive for TSO to activate sooner or later, DA instead of SA (vice versa)
    d. Transparency (BSPs): Comprehensibility of price formation
    e. Simplicity (Implementation; Settlement-function; Local Settlement)
    f. BSP Cost Intensity
    g. Incentive to submit Direct Activatable bids

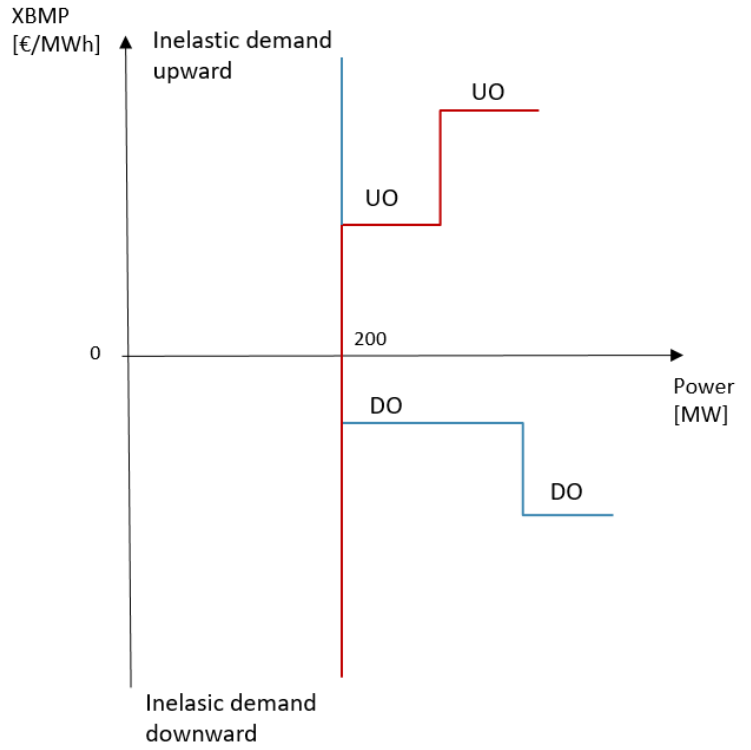
→Criteria a.-e. are seen equally fulfilled by all options; however they differ in regards to the opposing criteria “Cost Intensity” and the “Incentive to submit DA bids”

Settlement of netted volumes
Option 1

- Settlement price = XBMP of 0 €/MWh resulting from a regular algorithm run

- Benefits:
  - Simple method for a case with a low probability of occurrence

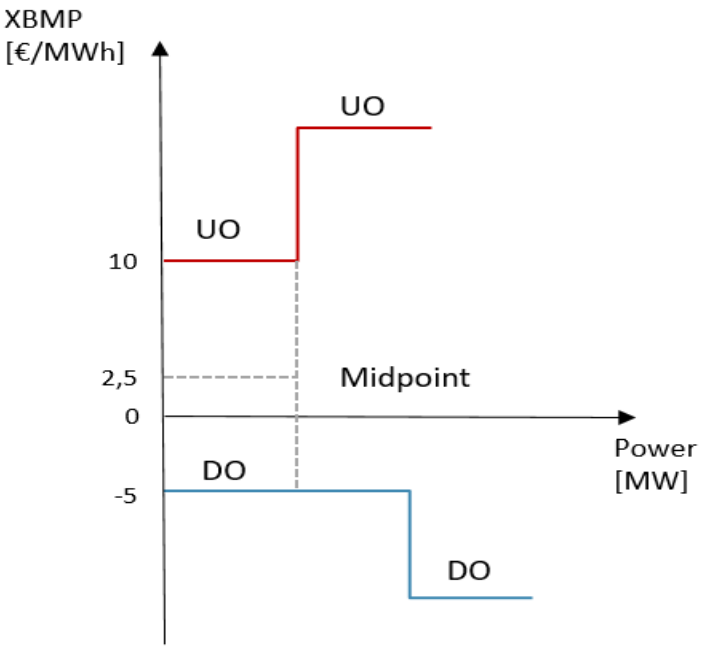
- Drawbacks:
  - Exchanged mFRR energy has no value



Settlement of netted volumes
Option 2

- Settlement price = average of the first prices of the respective upward and downward CMOLs

- Calculation example:
  - lowest upward bid price = 10 €/MWh
  - lowest downward bid price = -5 €/MWh
  - Settlement price = [(10 + (– 5)]/2 = 2,5 €/MWh



- Benefits:
  - similar concept to solution for indeterminacy, i.e. same rule for the selection of the midpoint price can be applied → consistency of prices
  - Relatively simple method for a case with a low probability of occurrence
  - Exchanged mFRR energy has a value ≠ 0 €/MWh

- Drawbacks:
  - Slightly more complexity for the algorithm function than in Option 1

Settlement of netted volumes
Option 3; 4; 5

- Option 3: Settlement price = XBMP of avoided mFRR activation

  Assumption: The volumes in the uncongested area are not netted but fully activated.

- Option 4: Settlement price = Average price of avoided mFRR activation based on pay-as-bid settlement

  Assumption: The volumes in the uncongested area are not netted but fully activated.

  Step 1: Calculation of average bid prices for each direction based on pay-as-bid settlement

  Step 2: Calculation of a settlement price which is a midpoint of the average bid prices per direction

- Option 5: Settlement price based on local MP of avoided activations (for each TSO of the uncongested area) → TERRE option

  Assumption: Each TSO is isolated, i.e. ATC = 0

  Step 1: Calculation of local MP for each TSO

  Step 2: Calculation of financial flows for each TSO → Import x LMP and Export x LMP for each TSO)

  Step 3: Calculation of total rent → sum of financial flows

  Step 4: Calculation of average rent → total rent / imports and exports

  Step 5: Calculation of settlement price for each TSO → (local MP - average rent) or (local MP + average rent) depending on whether a TSO imports or exports energy

Distribution (I)

- Congestion Rent generated due to RR and mFRR processes is considered as an income generated after an implicit allocation of available capacity in the context of balancing services.
- This interpretation would be the same as used in other timeframes such as day ahead market (Multi Regional Coupling).

Proposal for sharing of congestion rents originated as consequence of RR and mFRR activations:
To apply the same methodology as used for distribution of congestion income for DA.

The Congestion Income Distribution (CID) methodology was approved by ACER 14th December 2017

Distribution (II)

CACM CID Methodology (approved by ACER on 14th December 2017)

- Sharing keys for the Congestion Income (CI)
  - **CI calculated based on allocated capacities** – 50%-50% for the TSOs on each side of the BZ border
    - Exceptions: it is permitted to have a different sharing key when different ownership shares or different investment costs
  - **CI calculated based on external flow*** - attributed to TSO(s) of a bidding zone (BZ) for which the associated external flow was calculated and have interconnectors through which the external flows are realised.
  - **If a BZ border comprises several interconnectors with different sharing keys or is owned by different TSOs:**
    1. CI assigned to the respective interconnectors based on its contribution to the allocated capacity
    2. CI assigned to each interconnector shared between the TSOs on each side of the interconnector using the principles described in the first paragraph (exemptions possible).

(*) "External flow" = the calculated physical flow resulting from exchanges within a CCR from the SDAC that cannot be directly assigned to a bidding zone border of that CCR and therefore represents exchanges within a CCR, which are physically realised through borders outside of a CCR

Agenda Day 2

From		To	Item
10:00	-	10:30	General Principles for Pricing and Settlement
10:30	-	12:00	Pricing, settlement and activation purposes methodology for: mFRR and RR (1/2)
12:00	-	12:35	Lunch
12:25	-	13:35	Pricing, settlement and activation purposes methodology for: mFRR and RR (2/2)
13:35	-	15:05	Pricing and settlement methodology for: aFRR & Imbalance Netting (1/2)
15:05	-	15:20	Break
15:20	-	16:05	Pricing and settlement methodology for: aFRR & Imbalance Netting (2/2)
15:30	-	16:15	Q&A
16:15	-	16:30	Closing the Workshop

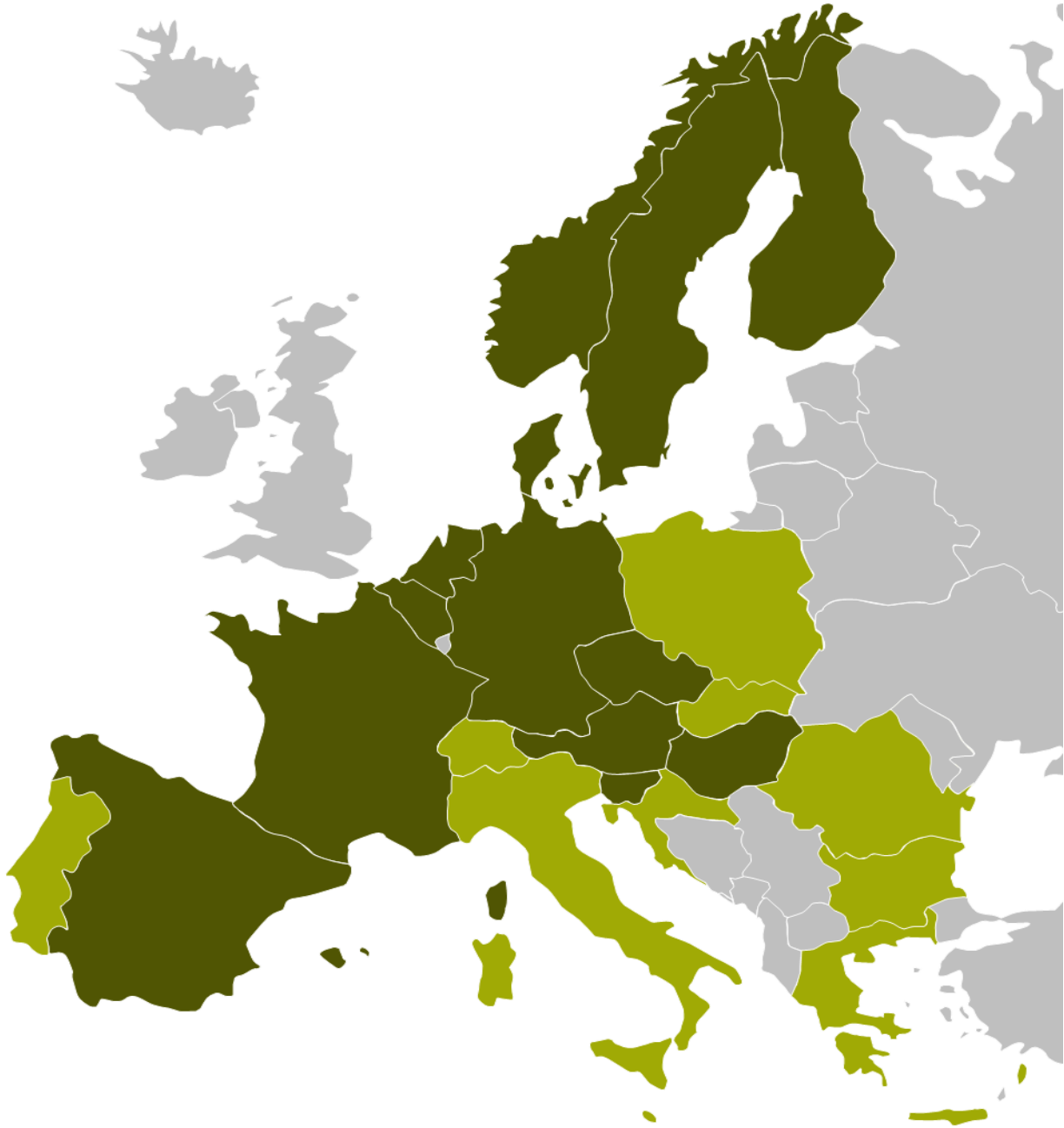
PICASSO

aFRR Platform Implementation Project

Pricing Methodology

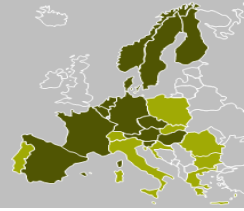
Paul Krall, PICASSO TF Pricing Leader
Esther Bos, PICASSO TF BEPP Leader
Bernard Campion, PICASSO TF Volume Determination Leader

EB GL Stakeholder Workshop
20.06.2018-21.06.2018

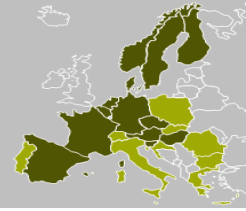


Content

PICASSO SH Workshop



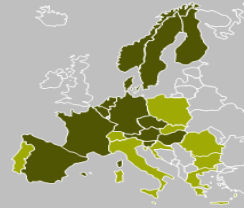
	SUBJECT	WHAT	WHO	TIMING
1	**Pricing & Settlement: Main Principles**	Information	Paul Krall	25 min
2	**BEPP**	Information	Esther Bos	30 min
3	**TSO-BSP Volume determination & Dummy Energy**	Information	Bernard Campion	15 min
3	**Questions**	Information	Bernard Campion	20 min



TOP 1. Pricing & Settlement: Main Principles

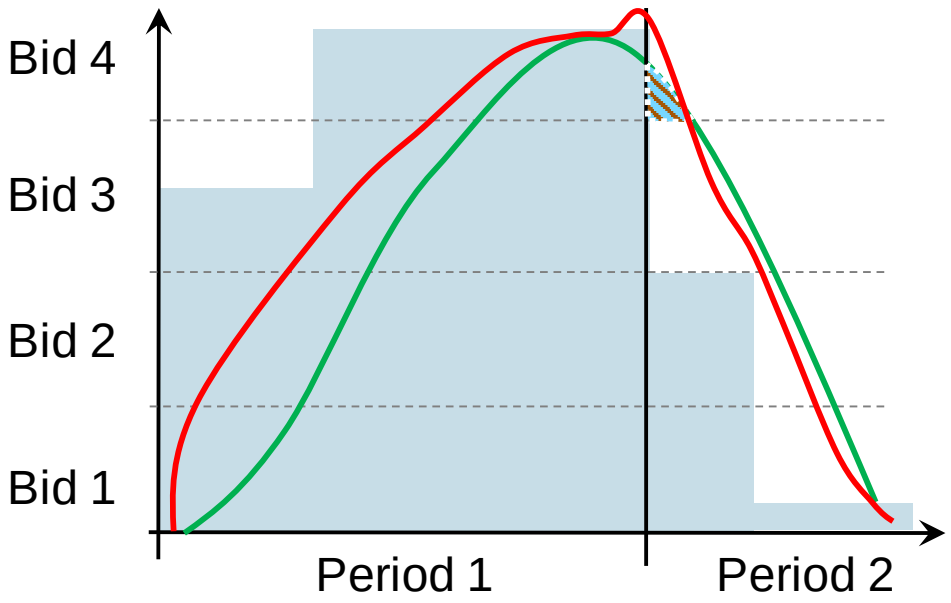
Pricing & Settlement: Main Principles

Overview



- **For price setting PICASSO TSOs agreed to use "Cross-Border Marginal Pricing" (XB-MP)**
  - Same price for uncongested area(s)
  - Compliancy with EBGL Art. 30
  - Takes into account pricing method in day-ahead and other balancing (i.e. mFRR & RR) markets
  - Best properties from market-theory point of view

- **Besides the general principles PICASSO TSOs set out the following settlement principles for evaluation of options:**
  1. Cross-border marginal price (XB-MP) shall be used for TSO-BSP and TSO-TSO settlement.
  2. Each bid with an accepted volume should be remunerated at least with the respective bid price
  3. Calculation of XB-MP shall be transparent and harmonized across PICASSO TSOs.
  4. XB-MP shall be legally robust and non-contestable.
  5. Undue price spikes (not reflective of system state) shall be avoided
  6. Full harmonization of TSO-BSP settlement volume determination not foreseen.
  7. TSO should remain cost-neutral.
  8. TSO-TSO settlement should not hinder agreed incentive to react faster.



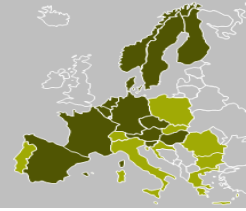
aFRR set-point

aFRR delivery

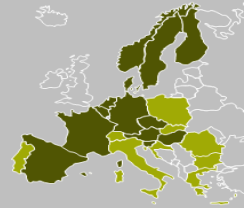
optimisation result
(possible selected bid definition)

Bid No.	Validity Period 1		Validity Period 2	
	Selected	Accepted	Selected	Accepted
Bid 1	yes	yes	yes	yes
Bid 2	yes	yes	yes	yes
Bid 3	yes	yes	no	yes
Bid 4	yes	yes	no	yes

- In aFRR, the **AOF result will not correspond to the aFRR set-point** and the **set-point** will not correspond to the **delivered aFRR**.
- Discrepancies between selected, accepted and activated bids allows for different pricing methodologies to be applied for aFRR products.



Price Setting



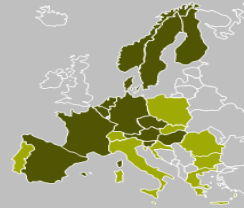
- **Degrees of freedom regarding the signal the XB-MP (see previous slide):**
  - XB-MP can be determined based on:
    - selected (e.g. by AOF)
    - accepted (different per LFC area e.g. Control Target)
    - and/or activated (e.g. aFRR activation) bids from CMOL.

  - Depending on the respected dynamic in the aFRR activation process the effect on prices may be substantial (e.g. in case of fast changing demand signals)

- **There exists a interlinkage with the topic of balancing energy pricing periods**
  - Demand sensitivity causes higher marginal prices determined period
  - BEPP influences period for which marginal prices are valid

- **In principle, 2 approaches can be differentiated:**

  1. Centralized solution: prices are determined based on platform signals (e.g. AOF signal)
  2. Decentralized solution: prices are determined locally by each TSOs based on local selection rules



Option A

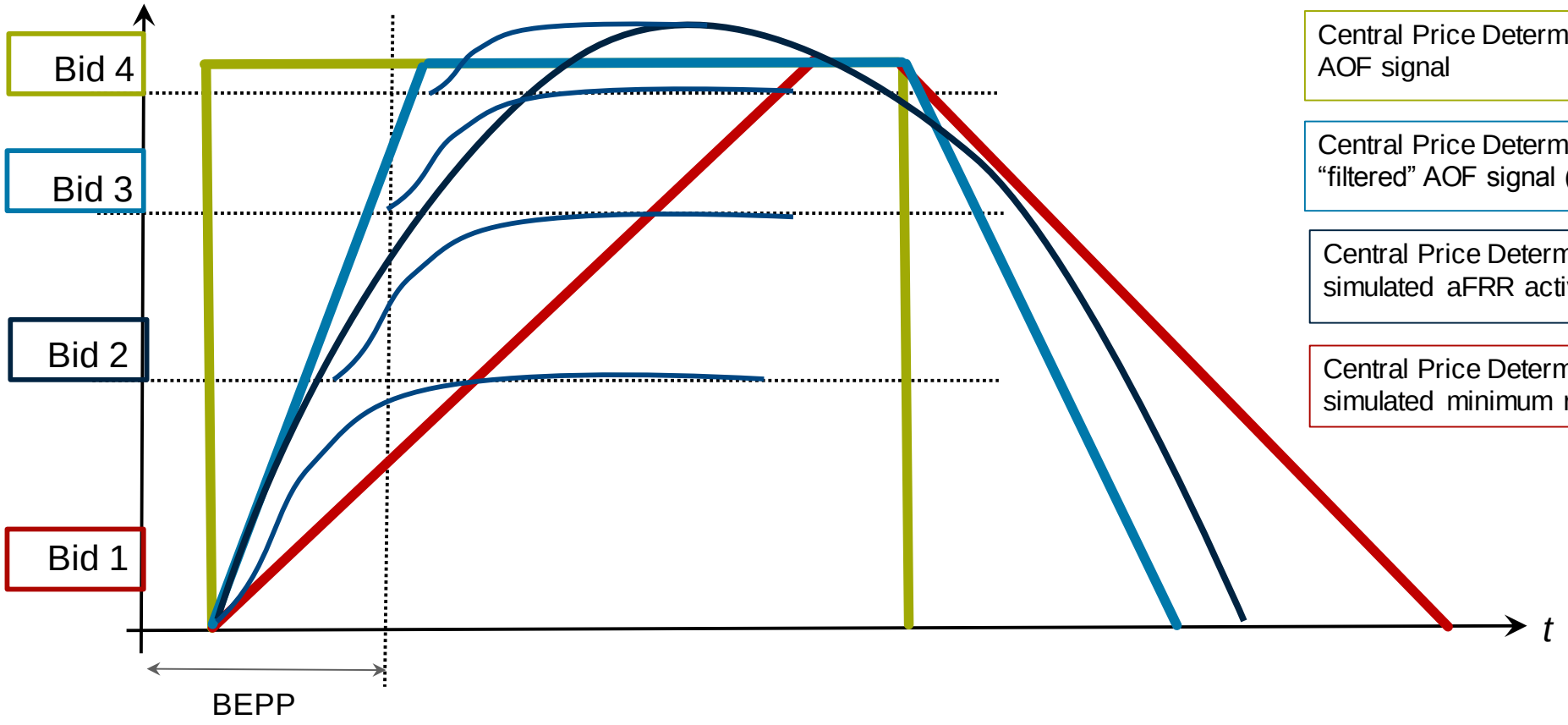
- Central Price Determination
  - AOF-Result
  - "Filtered" AOF-Result
    - Assumed PI filter
    - Simulation of aFRR activation
    - Simulation of min. req. for aFRR exchange

Option B

- Local Price Determination
  - Basis: local selection rules

Price Setting

Illustration: Central price determination (incl. sub-options)

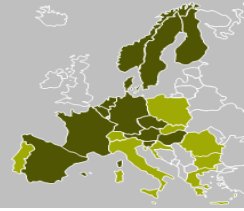


Central Price Determination - Pricing with AOF signal

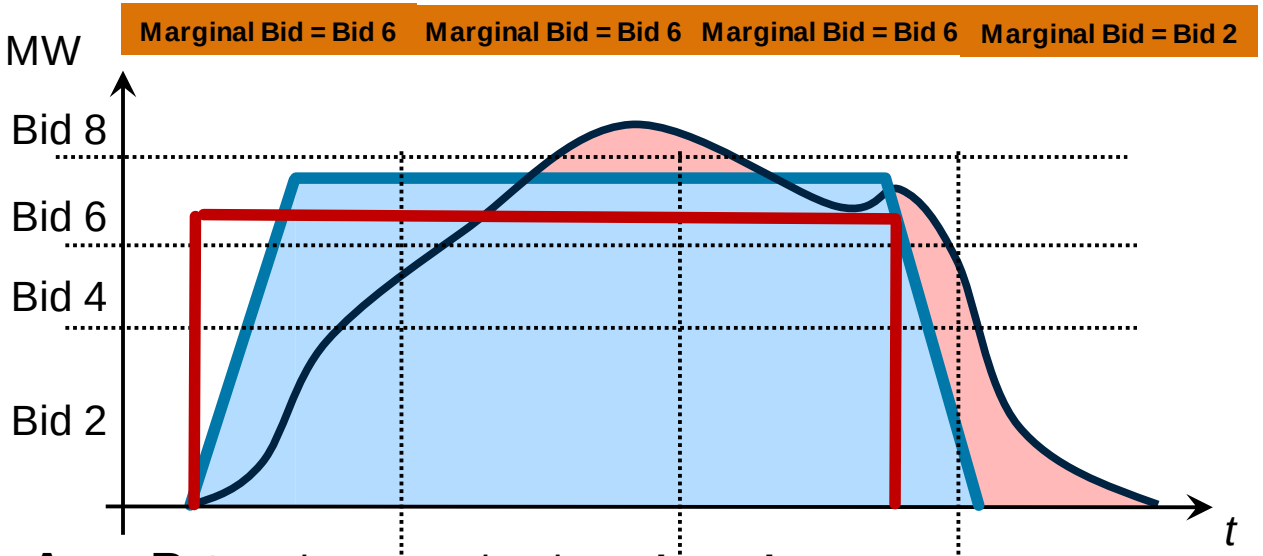
Central Price Determination – Pricing at "filtered" AOF signal (e.g. assumed PI-Filter)

Central Price Determination - Pricing with simulated aFRR activation

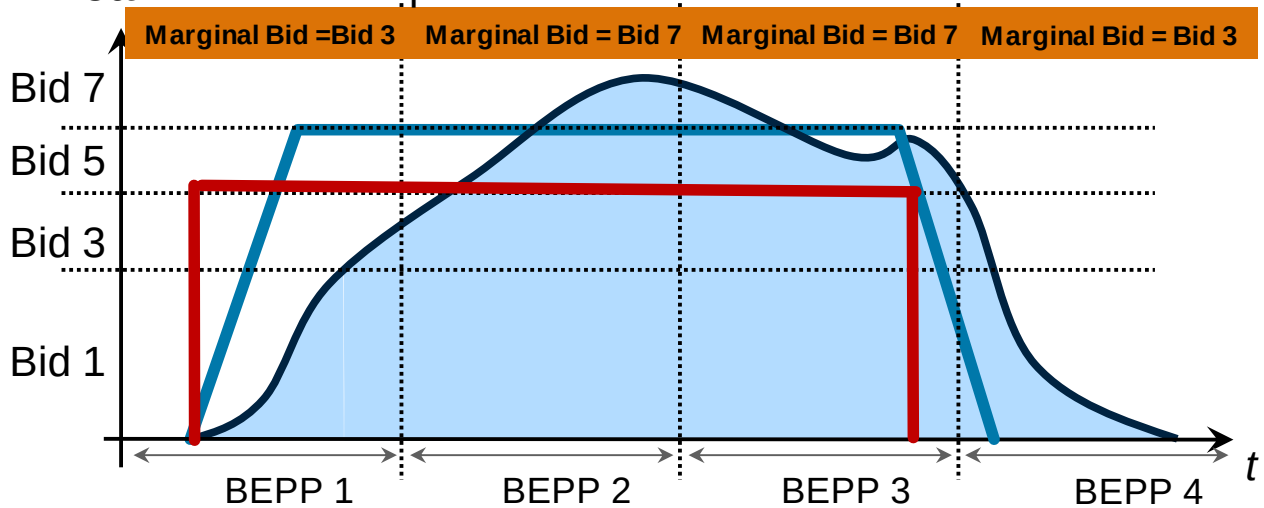
Central Price Determination - Pricing with simulated minimum requirement



Area A Local accepted volume **based on request**



Area B Local accepted volume **based on measurement**



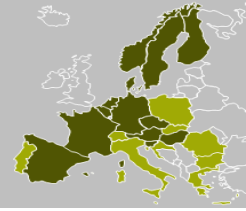
If a bid sets the marginal price for local activation, it should also set the marginal price in case of cross-border activation.

The more expensive bid will set the XBMP for the whole uncongested area. In the example:

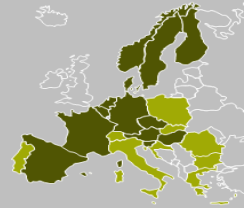
BEPP 1	BEPP 2	BEPP 3	BEPP 4
XB MP = Bid 6	XB MP = Bid 7	XB MP = Bid 7	XB MP = Bid 3
Bid from A	Bid from B	Bid from B	Bid from B

Accepted BSP volume

Rejected BSP volume
(remain local responsibility)



TSO-TSO Settlement



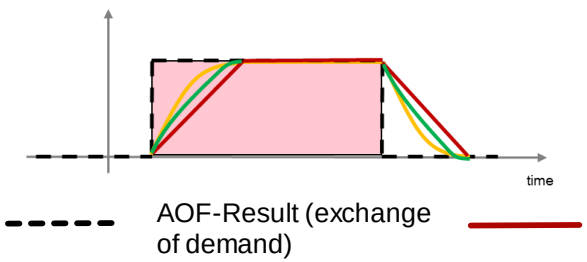
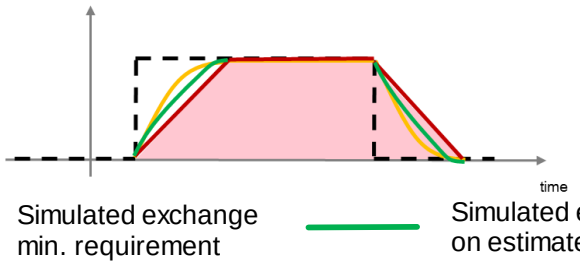
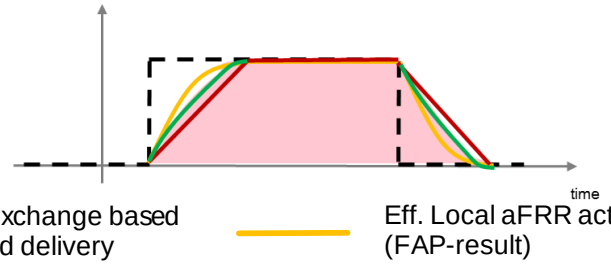
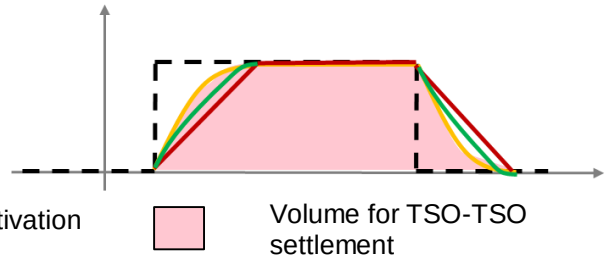
- **For TSO-TSO settlement PICASSO TSOs agreed in MoU to use "Proportional Cost Sharing"**
  - Full cost-recovery of the aFRR costs incurred in the Exporting Area from the Importing Area in case of no CZC limitations.
  - Calculation of congestion rent in case of CZC limitations

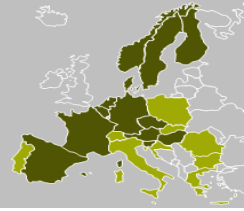
- **To calculate the TSO-TSO settlement amounts, TF Settlement proposes to calculate TSO-TSO settlement volumes (volume-based approach) and congestion rent, both per border, and price the volumes at XB-MP**
  - Alternative approach: based on local activation costs (cost-based approach).
  - However, for both approaches a determination of aFRR XB-exchange is necessary to determine the settlement amounts.

TSO-TSO Settlement

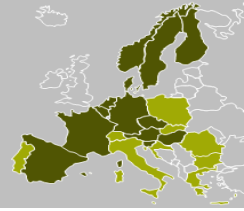
Options for volume based approach

- **Following options to determine TSO-TSO settlement volumes were identified:**

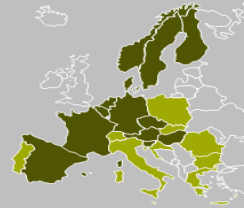
Centralized solution AOF result	Centralized solution „filtered“ AOF based on min. requirement	Centralized solution „filtered“ AOF based on simulated aFRR activation	Decentralized solution Based on FAP volumes
			
– TSO-TSO settlement volume based on AOF result in centralized way – Rectangle demands are exchanged as standard aFRR exchange – Disregard of upward and downward ramps in aFRR activation (symmetric assumption). – Netted volumes are directly included settled at the same XB-MP	– TSO-TSO settlement volume based on simulated aFRR activation performed in centralized way by the platform – Minimum requirements for aFRR activation are exchanged between TSOs as standard aFRR exchange (same for all LFC areas) – Similar to mFRR XB-Profile: symmetric ramps assumption – Netted volumes could be separately defined (ex-post calculation)	– TSO-TSO settlement volume based on simulated aFRR activation performed in centralized way by the platform – Effective aFRR activation is estimated a priori and used to be exchanged between TSOs (estimation of aFRR delivery different for all LFC area) – Up- and downward ramps for activation and deactivation based on estimation of local BSP behaviour. – Netted volumes could be separately defined (ex-post calculation)	– TSO-TSO settlement volume based on local TSO-BSP settlement volumes from the FAP-results – Real aFRR activation is assumed to be exchanged between TSOs – Up and downward ramps for activation and deactivation based on local BSP behaviour. – Netted volumes could be separately defined (ex-post calculation probably based on FAP estimation)



- **In a general way, there are further three ways to use TSO-TSO settlement volumes for TSO-TSO settlement:**
  - **Option 1: Explicitly calculate a congestion (in line with cost-based approach for TSO-TSO settlement):**
    - Congestion rent (for whole PICASSO area) is equal to individual TSO`s difference between actual and target costs
    - Problem: Definition of congestion rent per border hardly feasible
  - **Option 2: Look at net-position (calculated as for TSO-TSO settlement of each TSO (net importer / net exporter) and applicable XB-MP for pricing area**
    - Based on price spread between neighboring TSOs and net position determine congestion rent per border
    - Implication: Only applicable with TSO-TSO settlement based on TSO-TSO settlement volumes (volume-based approach)
  - **Option 3: Look at flow per direction per border and applicable price spread across this border**
    - Price spread and TSO-TSO volume per border separate for down and up determine congestion rent per border
    - Implication:
      - Only applicable with TSO-TSO settlement based on TSO-TSO settlement volumes (volume- based approach)
      - Volume per border is used for TSO-TSO settlement and congestion rent calculation

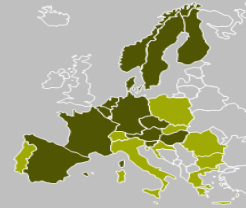


TOP 2. BEPP



- Discussion on BEPP are ongoing within PICASSO, with the following new considerations and topics:
  - The BEPP and effects of BEPP choice affect the consequences of open discussion points in regards to XB marginal price setting as presented today
  - Several mitigation measures to combat unnecessarily high imbalance prices are being investigated
- The following slides give an overview of the main two BEPP options and the mitigation measures being investigated
- A decision on BEPP will be taken as part of a choice of a consistent set of settlement options and will be presented in the consultation on the Article 30 proposal

Note
Previous and current evaluations on BEPP assume single imbalance pricing. In some countries dual imbalance pricing may still apply upon implementation of the aFRR platform



Situation
• TSOs are responsible for maintaining the frequency and ACE within given parameters. • Market participants carry financial responsibility for their energy imbalances. • Within an ISP the energy and power fluctuations are strongly linked. aFRR is activated continuously and follows power fluctuations within a delivery period (henceforth ISP).

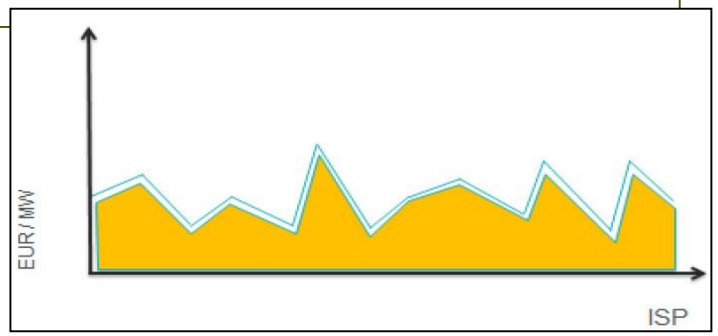
Complication
In some cases, fluctuating power demand can cause activation peaks and resulting price peaks that may not reflect the energy scarcity in the system when it is settled on the basis of a full ISP: • affecting the TSO-BSP settlement price • affecting the TSO-BRP settlement price The choice of BEPP influences the occurrence of price divergence, henceforth a decline in cross-border competition, and may lead in some cases to a negative congestion rent

- For more information please refer to the PICASSO consultation document (link) of 21 November 2017

- In principle two extreme options are possible for the balancing energy pricing period:

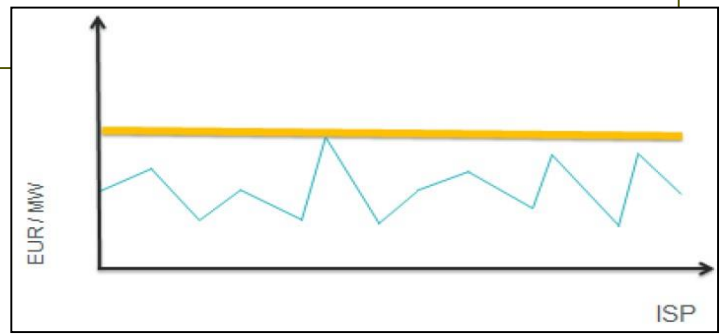
„Control-cycle BEPP“

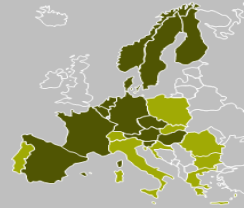
- The BSP settlement is settled on a control-cycle basis (each 4 seconds)
- The BRP settlement is done on a volume weighted average



„15-min BEPP“

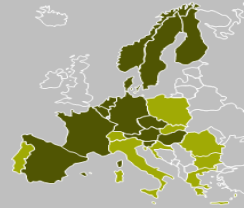
- The BSP settlement is done on an ISP basis (each 15 minutes)
- The BRP settlement results from the market clearing price of the BSP settlement





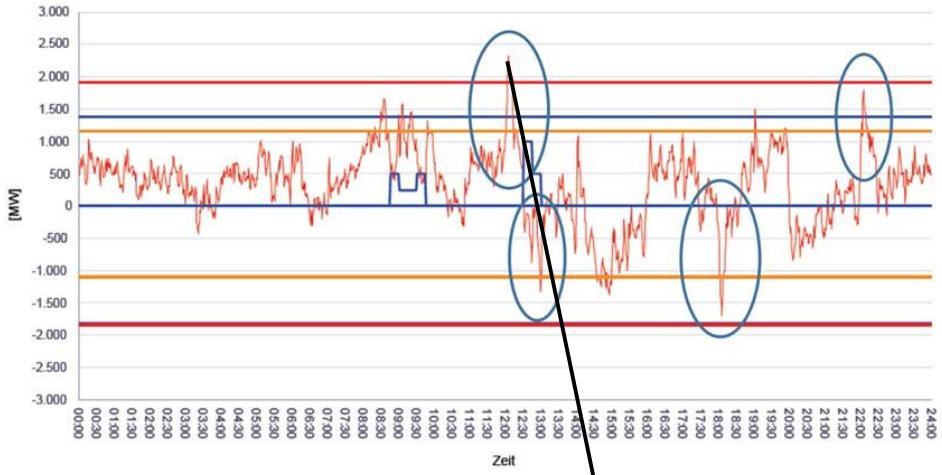
- The period of application of marginal pricing for aFRR is a pure market design & redistributive question.
- The aFRR activations are unchanged.
- Main effects resulting from the two options:

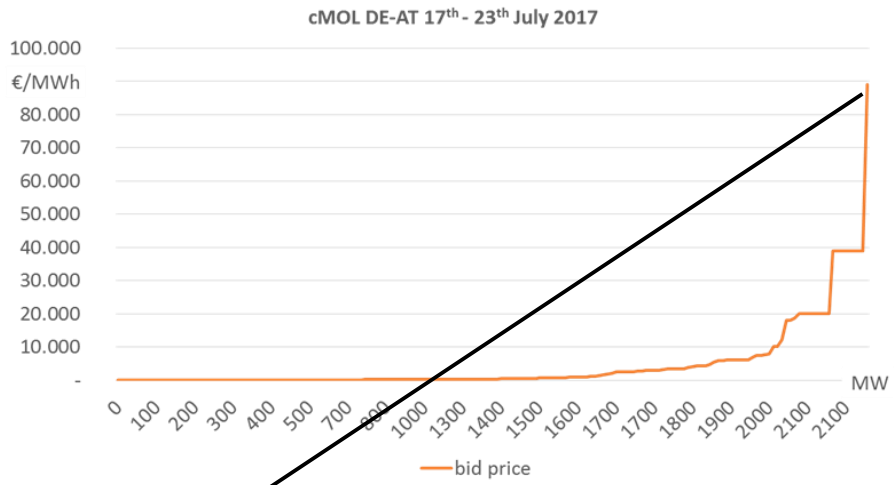
	Control cycle BEPP	Quarter-hour BEPP
BSP income	Lower	Higher
BRP cost of imbalances	Lower	Higher
Congestion rent	Lower	Higher in general (can also be negative)
Occurrence of price convergence	Higher	Lower



- Due to fluctuating aFRR demand, different borders could be congested at different moments within the same ISP
- Control-cycle BEPP determines prices for TSO-BSP settlement and TSO-TSO settlement, including the congestion rent, on cycle basis
- The ratio of price divergence is the same as the ratio of cycles in which a congestion occurs for activation cycle marginal pricing
- In case of 15-min BEPP, the occurrence of a congestion somewhere within the ISP will lead to price divergence over the whole ISP
- Due to the differences in price convergence, there is an impact on congestion rent
- Congestion rent for 15-min BEPP > Congestion rent for control-cycle BEPP
- Note that only the pricing and settlement are impacted - in both cases the same bids are activated

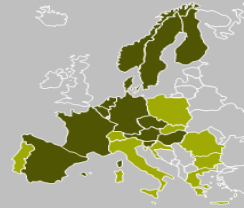
Risk for price spikes without mitigation in quarter-hour BEPP





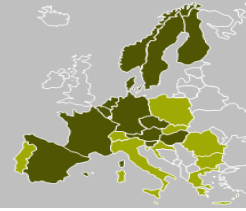
High prices triggered by demand spikes could affect longer periods

Quarter hour BEPP with mitigation measures



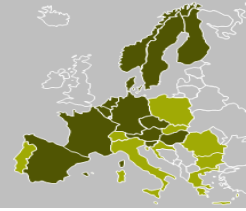
- A quarter hour BEPP combined with mitigation measures has been proposed in order to mitigate negative aspects
- The mitigation measures would mainly address the possibility of very short activation spikes to lead to high prices for a full ISP. Effects on price divergence are also taken into account
- Mitigation measures can be divided into three subcategories:
  - Selection rules (further elaborated on the next slide)
  - Price caps
- Mitigation measures can be applied locally or globally, in a harmonised or non-harmonised way, consistent with other settlement decisions

Note
Prices in current isolated aFRR markets are not necessarily representative of prices in an integrated European market. This is taken into account in evaluating the final options and mitigation measures.



- One option for mitigation measures are selection rules that define when a bid would become price setting. The following suboptions have been identified:
  - i. Requiring a minimum duration of activation before a bid becomes price setting
    - This would prevent activation peaks of short duration to lead to price spikes.
    - Open questions are:
      - Whether the duration would need to be harmonised, linked to whether the price is based on AOF or local selection
      - How long the duration would need to be
  - ii. Requiring a minimum volume to be delivered before a bid becomes price setting
    - This option seems suboptimal partially due to the non-harmonisation of volume determination
  - iii. Requiring a certain percentile of control cycles of activation of a bid before it becomes price setting
    - This is similar to the minimum duration of activation, except in this case all activations in a quarter hour are taken into account and the minimum duration does not have to be a single activation spike but could be several summed up
  - iv. Adjusting the AOF result, for instance in a proportional-integral way, and choose price-setting bids on the basis of the filter output. This suboption should be combined with centralised (AOF) price setting.

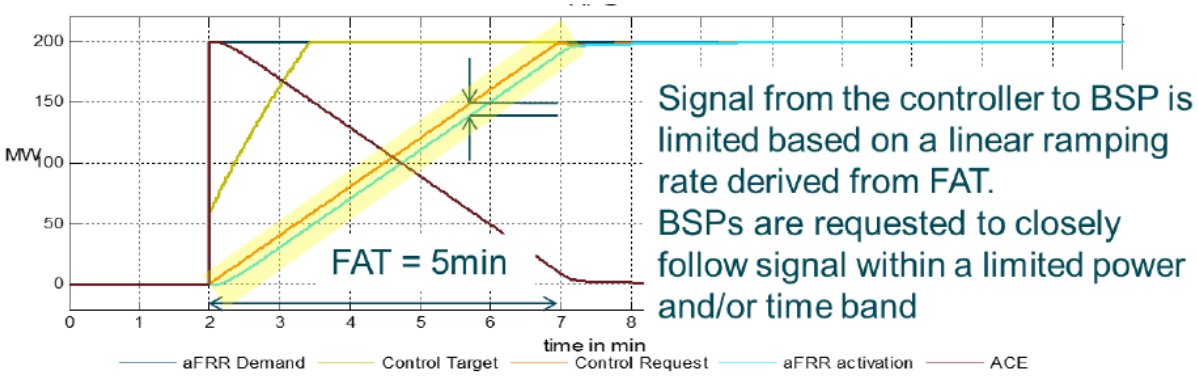
- Aside from these options that represent some level of harmonisation, allowing TSOs to apply locally defined selection rules in combination with decentralised cross-border marginal price setting is also possible.



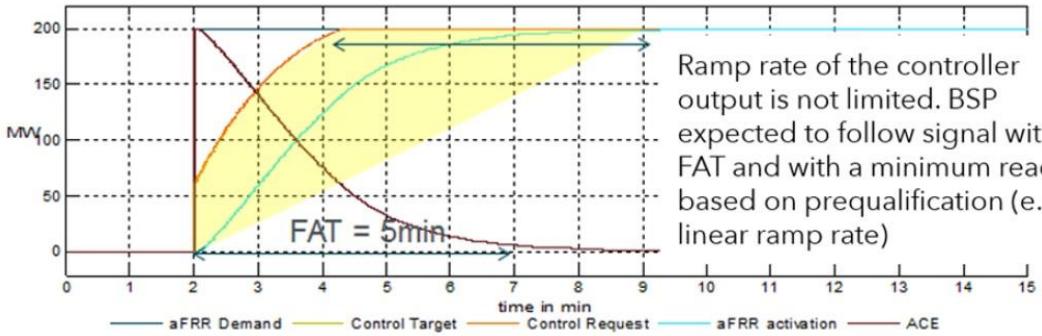
TOP 3. TSO-BSP Volume determination & Dummy Energy

Link between non harmonization of activation method and non harmonization of TSO-BSP volume determination

- PICASSO TSOs decided not to harmonize the activation method. The two main currently used approaches throughout Europe will coexist: "FAT approach" and "ramping approach"



Signal from the controller to BSP is limited based on a linear ramping rate derived from FAT.
BSPs are requested to closely follow signal within a limited power and/or time band



Ramp rate of the controller output is not limited. BSP expected to follow signal within FAT and with a minimum reaction based on prequalification (e.g. linear ramp rate)

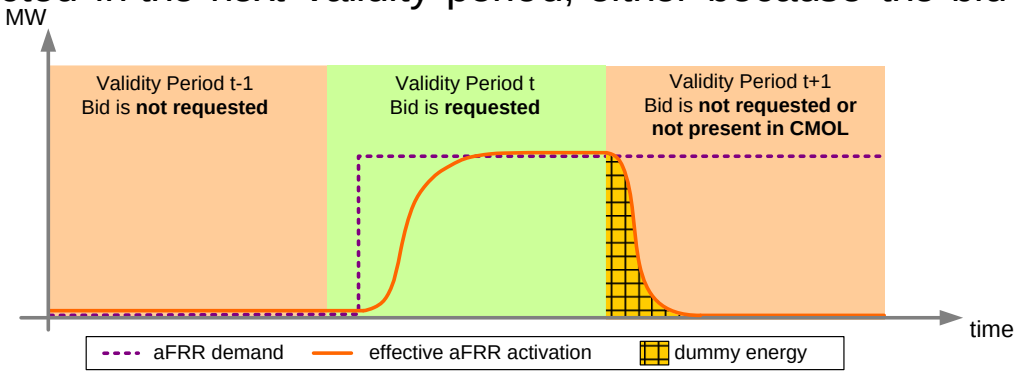
- A consequence of not harmonizing the activation method is that TSO-BSP volume determination will not be harmonized as well at the launch of the platform. However, TSOs are convinced that both designs of activation methods and TSO-BSP volume determination (based on requested value or based on measurement) provide a good estimation of the actually delivered aFRR volume.

- A specific harmonization topic impacting TSO-BSP volume determination currently under discussion in PICASSO is the settlement of dummy energy

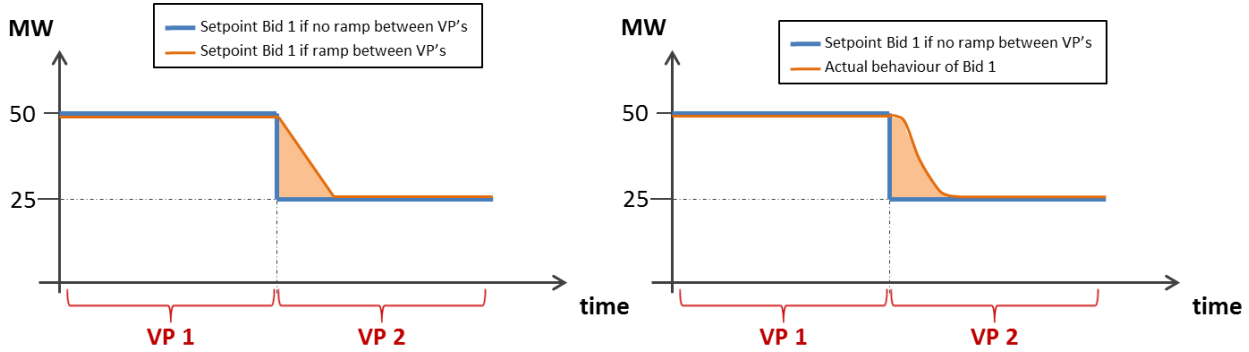
What is dummy energy?

- Dummy energy as defined by PICASSO TSOs refers to energy still delivered by BSPs although not directly requested from the TSO due to:

1. **A change in the bid validity <u>between two consecutive bid validity periods</u>** (either because the bid is not selected in the next validity period, either because the bid is not submitted in the next validity period)



2. **A reduction of the bid volume between two consecutive validity periods**



Validity period n° 1

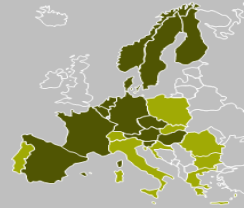
	Volume (MW)	Price (€/MWh)
Bid 1	50	15

Validity period n° 2

	Volume (MW)	Price (€/MWh)
Bid 1	25	10

Bid 1 is fully activated at during VP1 and has to be fully activated at the begin of VP2

Settlement of dummy energy



- Currently, some TSOs include dummy energy in TSO-BSP settlement while others (the majority) don't
- At this stage, PICASSO TSOs see two possible options for the settlement of dummy energy:
  - No harmonization
  - Harmonization towards no settlement (less implementation effort, better incentive for fast deactivation and incentive for stability of bidding behaviour on several validity periods)

Q&A

It's time for your questions.