EXPLORE FRR target model

Addendum to the report of 21 October 2016

27 July 2017

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Executive summary

The EXPLORE cooperation between the TSOs of Austria, Belgium, Germany and the Netherlands published a report on a consistent common FRR market design, respecting the EBGL[1] and limiting the impact on the European wholesale markets. This report was consulted upon with stakeholders until 21 November 2016.

This addendum provides a response to the questions and comments from stakeholders. It includes a summary of the stakeholder feedback in Chapter 2, shortened as necessary for reasons of confidentiality.

EXPLORE TSOs have investigated several topics in more detail, mainly in response to feedback received from stakeholders during the consultation process:

- TSO-BSP settlement for aFRR
- Interactions between intraday and balancing markets
- Interactions between aFRR and mFRR

TSO-BSP settlement for aFRR

Activation of aFRR depends on the imbalances after the previous control actions. This remaining imbalance can change heavily within one ISP. Activation of aFRR, as the fastest product for balancing energy, follows these changes.

This might lead to situations in which the highest price of an activated bid within an ISP does not reflect the demand for the whole ISP but only for a short part of the ISP. This becomes more relevant in case of short activation peaks. This is linked to the granularity at which scarcity is being metered.

EXPLORE TSOs have described several options of defining the marginal price for aFRR, including the option of taking the marginal price of the ISP of activation, and the marginal price at each activation cycle.

Interactions between Intraday and balancing markets

Based on stakeholder input, several market design options to avoid or minimise the impact of overlapping intraday and balancing energy markets were elaborated and analysed. EXPLORE TSOs concluded the option of releasing the most expensive balancing energy bids above a capped volume to be the best.

[1] Electricity Balancing Guideline, in this addendum the final text as voted on positively in comitology on 16 March 2017, https://ec.europa.eu/energy/sites/ener/files/documents/informal_service_level_ebgl_16-03-2017_final.pdf

The analysis of gate closure times for aFRR and mFRR markets showed that there are pros and cons to all sequences of gate closure times. Sequential gate closure times specifically offer advantages when combined with a market design including a limitation of the volume of balancing energy bids sent to the European platforms.

An illustration with a timeline example showed that the basic market design of releasing only non-activated bids does not allow designing a process with sequential and non-overlapping intraday and balancing energy markets. When applying the market design option of limiting the volume of balancing energy bids sent to the European platforms this becomes feasible, even with a very short local intraday gate closure time. This would however require a very short aFRR gate closure time, which might not be technically feasible.

Another option might be to accept the overlap between some markets. There would be more arbitrage needed for the concerned market parties but less intervention from the TSOs would be required. This would further emphasise the need to publish relevant information with a short delay to facilitate the arbitrage.

Interactions between aFRR and mFRR

EXPLORE TSOs have concluded that full access to the aFRR CMOL would be preferable both from technical and economical point of view, especially because of the added value in using aFRR in a reactive balancing market design in comparison to mFRR. However, cross-border activations may influence the amount of aFRR dimensioned by participating TSOs.

The ratio between aFRR and mFRR is determined with a mind to respect the FRCE target parameters. As a consequence, without specific agreements, TSOs could alter their ratios of aFRR versus mFRR when given full access to the CMOL for reasons of lower mFRR procurement costs. This could lower the overall amount of aFRR available within the system to unwanted levels. Appropriate neutralisation is therefore needed.

Next steps

EXPLORE TSOs are now extending their discussions to other TSOs in order to prepare and facilitate the implementation of the platforms to exchange balancing energy, which are as prescribed by EBGL to be implemented at European level.

The learnings of this project and the input from the stakeholders will be valued in these discussions.

Table of Contents

1. Introduction

The EXPLORE cooperation between the TSOs of Austria, Belgium, Germany and the Netherlands is investigating possibilities to create a consistent common FRR market design, respecting the EBGL[2] and limiting the impact on the European wholesale markets.

On 21 October 2016 the EXPLORE TSOs published a report on a target model for the exchange of frequency restoration reserves. This report was consulted upon with stakeholders until 21 November 2016.

This addendum to the report provides a response to the questions and comments provided by stakeholders during the consultation. Furthermore, it addresses in more detail some topics that were identified both on the basis of the received responses and on discussions between the EXPLORE partners.

The structure of the addendum is as follows. Chapter 2 provides an overview of the specific questions that were asked by stakeholders during the consultation together with the responses, shortened as necessary for reasons of confidentiality. It includes a summary of the feedback received from stakeholders and a response by the EXPLORE TSOs to stakeholder questions and comments. It also includes a summary of the general feedback received (not linked to specific questions).

Chapters 3 through 5 address in more detail the following selected topics:

- TSO-BSP settlement of aFRR (Chapter 3):
    - Marginal pricing for aFRR
- Interactions between intraday and balancing market (Chapter 4)
    - Streamlining interactions between balancing and intraday markets
    - Equality of aFRR and mFRR GCTs
    - Relation between market design options and gate closure times
- Interactions between aFRR and mFRR (Chapter 5)
    - Full access to the aFRR CMOL

For these topics design options for the target model are presented and analysed afterwards. As these topics are treated separately from the stakeholder consultation feedback, a reference to the relevant section will be provided in Chapter 2 in case they are addressed in stakeholder comments.

[2] Electricity Balancing Guideline, final text as voted on positively in comitology on 16 March 2017, https://ec.europa.eu/energy/sites/ener/files/documents/informal_service_level_ebgl_16-03-2017_final.pdf

2. Stakeholder consultation

This chapter provides a tabled overview of the questions posed to stakeholders, and the summary by EXPLORE TSOs of the responses received by stakeholders including both questions and comments, and the reaction of EXPLORE TSOs.

Table 1: EXPLORE questions and stakeholder answers

Question	EXPLORE summary/conclusion
Do you feel interactions between balancing energy and wholesale markets have been sufficiently taken into account in the EXPLORE project? If not, what is missing?	Stakeholders wish to limit balancing market interference with intraday markets.
Do you agree with the considerations in regards to marginal pricing? If not, could you elaborate?	A number of stakeholders are not convinced by our argumentation for keeping pay-as-bid. If we wish to keep the option they want further argumentation. Some stakeholders support our considerations to keep the pay-as-bid option. Some stakeholders commented on the EXPLORE remarks in regards to marginal pricing for aFRR. This topic is described further in chapter 3.
Do you support the EXPLORE conclusions in regards to the gate closure times?	Some stakeholders thought we wanted exactly 30 minutes: this is a misinterpretation and is not the case. Making aFRR and mFRR gate closure times equal is being questioned; what is our argumentation? The gate closure times of aFRR and mFRR are discussed further in Chapter 4.
Do you have any further suggestions on how to better streamline intraday and balancing markets?	Some stakeholders do not wish to have a separate balancing energy market. Some stakeholders want to reduce the size of the MOL to the prequalified volume at gate closure. Some stakeholders wish for the possibility to remove their free bids after gate closure in case an intraday opportunity presents itself. Options are investigated in Chapter 4.
Do you miss anything in the analysis on pricing and settlement in the EXPLORE report? If so, what do you miss?	Some stakeholders asked what happened if an aFRR bid is activated more than once by several TSOs in one ISP. Some stakeholders stated that we should present solutions rather than problems, specifically in regards to marginal pricing.

Do you agree with the EXPLORE criteria used to decide between local and cross-border imbalance pricing? In case your answer is no, could you elaborate on why? Do you agree with the EXPLORE conclusion of local imbalance pricing? In case your answer is no, could you elaborate on why?	Stakeholders agree that prices should reflect the local situation. They question the argumentation on cross-border optimisation of portfolios. They feel methodologies should be more harmonised, especially in regards to additional components. Some stakeholders confirm that this is also related to other settlement schemes and local differences. Some stakeholders want local flexibility (coupling to intraday market prices) Some stakeholders proposed a marginal imbalance price based on bids activated for local needs.
Which of the remaining TSO-BSP settlement options has your preference and why?	Stakeholders do not agree on whether or not balancing energy price should be local or cross-border. Differences occurring from balancing energy needs being based on all bids, and imbalance only on bids for local need should be settled through TSO-TSO settlement. EXPLORE TSOs have investigated this option previously for the situation of local imbalance pricing, but it led to several issues on costs.
Do you agree with the elimination of options that allocate different (marginal) prices to BSPs in one area for the same product? Could you elaborate your answer?	Stakeholders are in agreement that we should eliminate options allocating different prices to BSPs in the same bidding zone.
Do you agree with the decision of per-product pricing (assuming one product for aFRR and one for mFRR)? Could you elaborate your answer?	Stakeholders differed of opinion. Argumentation for per-product pricing pointed out different technical requirements. Arguments for cross-product stated products were either sufficiently similar, or the energy was the product, and having the same price avoided arbitrage.
Regarding the requirements for the aFRR products, what is your preferred product (FAT product or setpoint product) and why?	Stakeholders had mixed opinions, based partly on what is currently available. A statement was made that requested settlement is more difficult with FAT product.
Could you provide your views on the advantages and drawbacks of the 2 control concepts (control demand and control request) if you evaluate that this choice impacts the BSPs?	Progress of ongoing discussion is not sufficient for stakeholders to derive a final opinion on the control concepts. However the interaction between the product and the control exchange was pointed out as important.

To which extent does the choice of the FAT affect the liquidity you are able to offer? Please precise for which type of technology your answer applies.	Liquidity will be reduced, in some places significantly, by reducing FAT. Some stakeholders say FAT should be as long as possible while still allowing TSOs to respect the frequency targets, others prefer existing faster FATs. New players are faster and can deliver short FATs.
Do you support the criteria used to evaluate the mFRR product options? If not, could you elaborate why?	mFRR criteria were supported. There was a difference of opinion between some stakeholders on whether bids should allow both scheduled and direct activation.
Which criterion do you feel is the most important?	Interactions with other markets pointed out as most important.
Which of the three remaining mFRR product options has your preference, and why?	The first option with longer time between the ISP of delivery and first possibility of direct activation was discarded by stakeholders due to interactions with intraday markets.
What are your thoughts on the priority for usage of cross-border capacities between the different (close-to-)real-time processes (ID; aFRR, mFRR exchange/sharing?)?	Stakeholders agreed that reservation of cross-zonal capacity for balancing should not occur. Some stakeholders mentioned that aFRR should be prioritised over mFRR.

Table 2: General remarks by stakeholders

Stakeholder comment	EXPLORE reaction
A French stakeholder indicated that proactive and reactive systems should both be taken into account in the target model.	This was out of scope of EXPLORE. Discussions will naturally take place in the implementation of European-wide platforms
Some stakeholders stated that the choice to have a balancing energy market should be left to the member states if it cannot be designed without interference with intraday markets	From other discussions, we assume this statement relates to the introduction of uncontracted bids. To limit the impact on interference of this on the liquidity of intraday markets, some options were investigated in Chapter 4, including those proposed by stakeholders. EXPLORE TSOs support shortening of ID gate closure time.
Some stakeholders oppose additional, ex-post components to imbalance price	The necessary level of harmonisation of imbalance price methodologies will be further discussed as part of the implementation of the EBGL, specifically harmonising the main features of imbalance settlement in accordance with Article 52(2).

3. TSO-BSP settlement for aFRR

This chapter gives more detail on topics related to TSO-BSP settlement for aFRR: determination of a marginal price for aFRR, determination of volume for the TSO-BSP settlement of aFRR and the determination of the imbalance adjustment. EB GL already defines a coupling between the balancing energy price and the imbalance settlement price - see Article 55 (4,5). Hence the determination of the marginal price for aFRR impacts also the imbalance settlement price. Furthermore the determination of the volume for TSO-BSP settlement in combination with the imbalance adjustment can give different incentives for BSP and BRPs depending on the chosen option.

Balancing Energy Pricing Period

In EXPLORE the mechanism of how to set the marginal price (MP) for one ISP was discussed. Activation of aFRR depends on the imbalances after the previous control actions. This remaining imbalance can change heavily within one ISP. Activation of aFRR, as the fastest product for balancing energy, follows these changes.

This might lead to situations in which the highest price of an activated bid within an ISP does not reflect the demand for the whole ISP but only for a short part of the ISP. This becomes more relevant in case of short activation peaks, e.g. due to the very fast up- or down-ramping of pump storage hydro plants. There is no scarcity at quarter hour level to be settled (penalized) with BRPs – just a spike in the aFRR demand because of natural differences between trading products and the physical reality.

Furthermore, the fast changing demand for aFRR can lead to situations within one ISP in which different congested and non-congested areas are formed. This complicates the possibility of cross-border marginal pricing for balancing energy. A solution for this has not yet been identified. Based on these concerns several alternative options for application of marginal pricing to aFRR were assessed.

Option 1

If every activation can set the marginal price, the TSO-BSP settlement in an ISP could look as follows (where the yellow line reflects the MP and the blue line the price of the most expensive activated aFRR bid per control cycle):

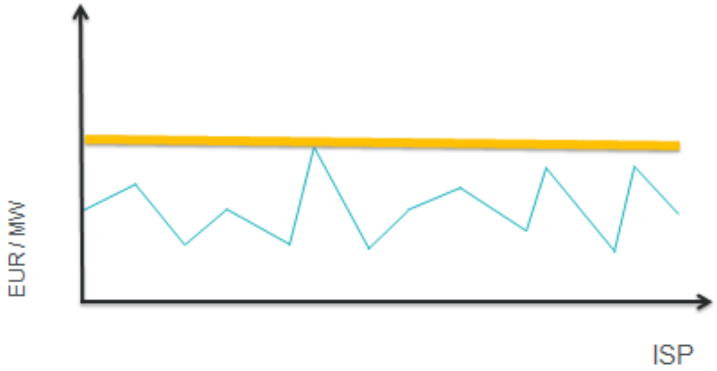

Figure 1 - highest activated bid is price-setting

Each activation of a bid, including those of very short duration, leads to an increase of the marginal price. Depending on the shape of the MOL and the scarcity in the system, this effect could be large

or small. The duration of the activation does not match the period for which the balancing energy is settled.

An advantage of this option is that the determination of the reference price for energy (real-time value of energy) through the balancing energy price is straightforward, and the imbalance price can be made equal to the balancing energy price. A mismatch between the imbalance price and the balancing energy price indirectly affects the incentive on BSPs to deliver on their bids. Another advantage is the simplicity of the methodology.

The disadvantage of this method is that it does not provide a solution for the concerns presented above. As is the case for the imbalance price, the TSO-BSP settlement price does not reflect inter-ISP differences in demand. In order to apply cross-border marginal pricing for balancing energy, an approach needs to be identified for handling variable congestions. The area between the yellow and the blue line is an inframarginal rent ("windfall profit") of BSPs to be paid by BRPs.

The alternative options assessed are the following:

2a) set the MP not for the whole ISP, but divide the ISP into several parts (e.g. three parts, each five minutes in an ISP of 15 minutes)

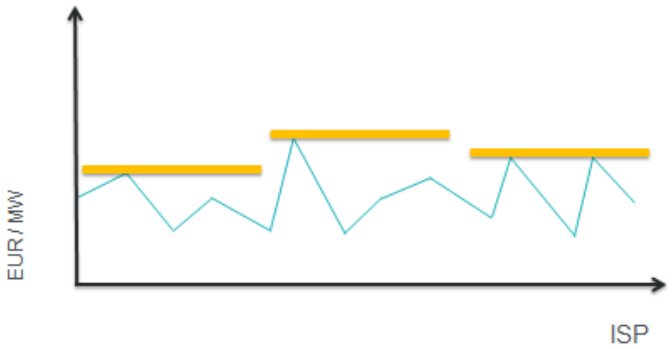

Figure 2a - several MP within one ISP

This option can be seen as an intermediate step between option 1 and option 2b. The advantage of this option is that it reflects demand changes within the ISP better than option 1, while being simpler than option 2b, providing a scarcity signal at a smaller granularity. The settlement period for balancing energy is not equal to the period for which the bid prices are established. It does not address the concern around the application of cross-border marginal pricing for balancing energy. Another disadvantage is that it does not allow the imbalance price and the balancing energy price to be the same.

2b) set a MP for each calculation step of the algorithm

Figure 2b – MP for smallest duration

This option considers each activation step on control cycle basis to be price setting. It is deemed to on the one hand reflect the demand, and on the other hand prevent price peaks at BRP settlement not reflecting the ISP demand.

It measures scarcity through TSO-BSP pricing on the cycle of several seconds. It allows for straightforward application of cross-border pricing (though technically challenging in the cycle of several seconds). This will increase the ratio of uncongested cases where an identical cross-border pricing is established across several areas, maximising therefore the cross-border competition.

The period for which the BSPs set their bid prices differs from the period for which the balancing energy settlement price is determined. This inconsistency in auction design is seen as less relevant, because marginal pricing should incentivize to bid at marginal costs that will not change within an ISP. Even if opportunities are taken into account, like intraday trading, the opportunity price is set for at least one quarter hour.

3) minimum duration of activation to be price setting

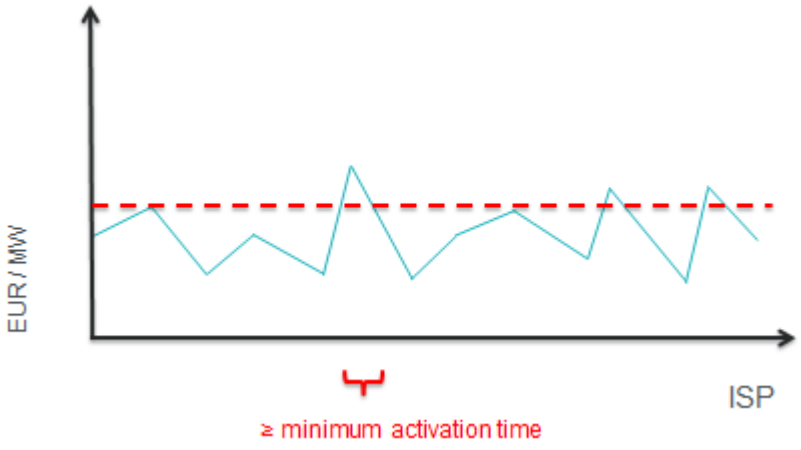

Figure 3 - minimum duration of activation to set MP

In this option activations of a shorter duration are neglected when determining the marginal price. The advantage of this method is that price peaks related to noise do not affect market prices. The

disadvantages are that the highest priced bids are either not settled at least their bid price, or are settled at a different price than other bids. It would be difficult to determine the duration of peaks that would be neglected in the determination of the marginal price. It does not provide a solution for the concern on cross-border marginal pricing.

4) Average of the highest activated bids define the MP

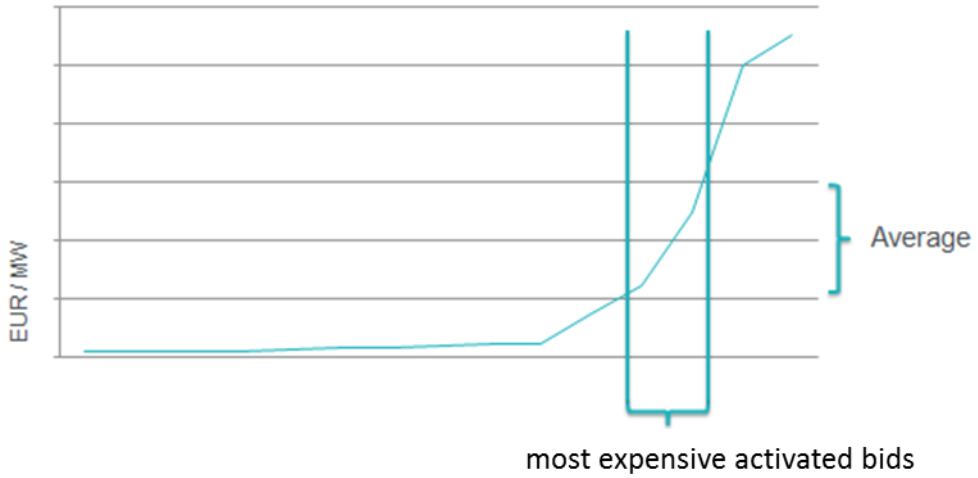

Figure 4 - average of most expensive bids sets MP

This option takes an average value of the highest priced activated bids. It has the disadvantage that higher priced bids are not settled at least the bid price. Another disadvantage is that scarcity pricing is reduced. Furthermore, it is unclear how to determine which bids would be used to calculate the average price. For these reasons, this option was discarded.

4. Interactions between intraday and balancing markets and the relation with GCT

This chapter goes into more detail on the topics related to the interactions between intraday and balancing markets. First question is how intraday and balancing markets could be better streamlined. Secondly, how do these interactions relate to gate closure times[3](GCT), especially for aFRR and mFRR. With respect to the latter, the equality of mFRR and aFRR gate closure times as assumed in the EXPLORE report will be examined first before making the link with intraday and balancing energy markets.

Streamlining interactions between balancing and intraday markets

Different market designs have the potential to lead to non-optimal utilisation of flexibility in the system for different reasons. The example of Figure 9 below illustrates how the sequence between intraday and balancing markets can influence the available flexibility in the system:

- Markets stopped early hinders real-time price signals
- Markets stopped late locally draws away liquidity from cross border markets
- (Cross border) balancing energy markets are caught in the middle.

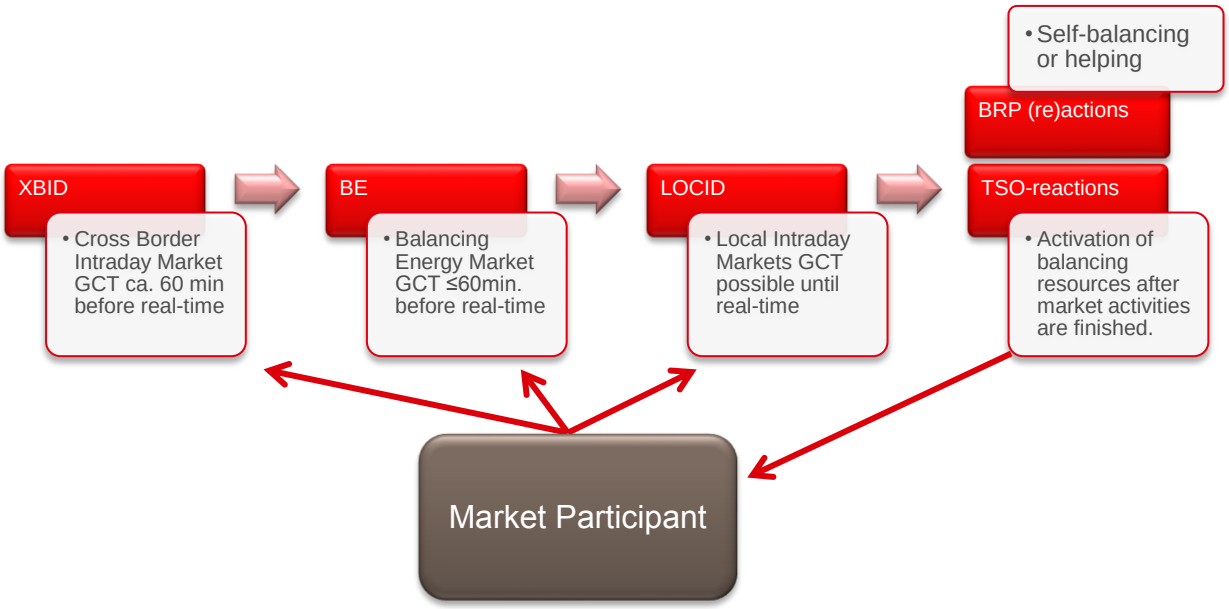

Figure 5: Illustration of a sequence of intraday and balancing energy markets

In their response to the consultation, stakeholders proposed different ideas on how interactions could be better streamlined. These ideas where elaborated by the EXPLORE TSOs into seven different market design options. Note that some of the proposed market design options are not allowed under EBGL. This will be indicated as a con in the comparative table.

[3] When referring to gate closure times, it is meant the gate closure times of markets organised by power exchanges or TSOs, but not the gate closure times of for example bilateral financial trades which in some countries can take place until after real time or their related schedule changes (eg. ex post notification).

Next to these seven options, there is one design feature which can either be seen as a basic design on its own or a complementary feature applicable to most of the seven other market design options: bids from balancing energy markets that were not activated (RR, mFRR) by the latest possible time of activation, are explicitly released and become available for subsequent markets such as local intraday markets (LOCID).

Arguments in favour of this design feature are the fact that short term local intraday markets can benefit from increased liquidity because bids from market participants do not remain locked in a CMOL, but can be used in LOCID. Arguments against are the technical complexity with respect to the very short timings, the fact that in case of mFRR it is only possible for very short GCT in LOCID (15 min or less) and that it is not applicable for aFRR markets as aFRR is activated in real time operation.

Note that this extra option considers release of non-activated bids only, which is not to be confused with release of free bids for voluntary relocation (option E in the table below), or limiting the amount of bids sent to the CMOL to capped volume(option D, in accordance with Article 29(11)). The table gives an overview of the seven different options, introducing the basic idea and some of arguments pro and contra.

Option		Idea	Pro	Con
A	No local ID markets	• Intraday trading should only be allowed on XB-level • All liquidity/flexibility not marketed before XBID GCT shall be made available to TSOs via a BE market (free bids)	• Consistent international market design • All flexibility in the system visible to the market and available to be used	• RES are exposed to large imbalances due to lack of real-time optimization. → Imbalance price must therefore be moderate (no scarcity signals). • Price setting for BE ca. 1h ahead of real-time. • Limits freedom of dispatch. Limits availability of flexibility to market participants for portfolio optimisation. No possibility for BRPs to react in real-time on system balance.
B	No balancing energy markets	• Balancing Energy price is set ex-ante (e.g. in Balancing Capacity Auction). • TSO only has contracted balancing resources at hand. • All remaining liquidity goes to Local Intraday Market.	• RES have possibility to react on volatile infeed close to real-time. • Local Intraday markets can establish value of energy close to real-time. • Market Participants have certainty about which resources are available.	• Non-compliant with EBGL • Flexibility / liquidity is concentrated in local markets and cannot be allocated XB close to real-time. • Flexibility not allocated in local intraday is lost for the market. • One of the main preconditions for marginal pricing of BE is missing • Lack of competition on the balancing energy prices
C	No ‘free bids’ in BE-market	• BE-price can be set close to real-time but only for contracted capacity. • TSO only has contracted balancing resources at hand. • All remaining liquidity is available for the local intraday market or own use by the BRP.	• RES have possibility to react on volatile infeed close to real-time. • Local intraday markets can establish value of energy close to real-time. • Market Participants have certainty about which resources are available.	• Non-compliant with EBGL • Flexibility / Liquidity is concentrated in local markets and cannot be allocated XB close to real-time. • Flexibility not allocated in local intraday is lost for the market. • Lack of competition on the balancing energy prices
D	Limitation of balancing energy bid volume sent to European platforms	• Free Bids are allowed to enable additional flexibility entering the BE-market in the short-term (esp. to allow RES). • The balancing energy bids sent to the European platforms are limited to a	• RES have possibility to react on volatile infeed close to real-time. • Local intraday markets can establish value of energy close to real-time. • Market participants have certainty about which resources are available.	• Potential limitation of cross-border markets if bids held back are cheaper than bids in other areas. • Flexibility not allocated in Local Intraday is lost for the market. • Only most expensive resources in

		certain volume[4]. • Most expensive BE bids above the volume limitation are released. → Free to participate in the LOCID, other BE markets or for own use.	• Flexibility is allocated to where it is most valued (XB-BE or LOCID)	LOCID for RES optimization
E	Free bids can be withdrawn until activation deadline	• Free bids are allowed to enable additional flexibility entering the BE-market in the short-term (esp. to allow RES). • Free Bids are not considered firm until the LOCID GCT. Free bids can be withdrawn from the (C)MOL until activation deadline.	• RES have possibility to react on volatile infeed close to real-time. • Local intraday markets can establish value of energy close to real-time. • Market participants have certainty about which resources are available. • Flexibility is allocated to where it is most valued (XB-BE or LOCID) • All flexibility in the system visible to the market and available to be used.	• Technical complexity • Might jeopardize system security • Interactions with TSO bid-submission gate closure (method of marking bids as unavailable after TSO bid-submission gate closure would be needed) • Firmness risk of non-delivery is moved from responsible market participant to TSO (as risk on system security).
F	Combined ID & BE markets (sequential)	• All flexibility is automatically forwarded into the next subsequent market timeframe, considering pre-qualification. E.g.: bids not excepted in the XB-ID are transferred into the BE-market for RR; after the clearing for RR they are transferred into the BE-markets for mFRR & aFRR if pre-qualified. • May be combined with other options (e.g. withdrawal of free bids, etc.)	• Market Participants have certainty about which resources are available. • Automated procedure for BSPs (“one stop market”)	• Technically complex while effect on markets may be limited
G	Combined ID & BE markets (linked)	• Bids are placed on the different platforms simultaneously and can be linked to each other.	• All flexibility is visible to the market (multiple times). • Market Participants can bid all	• Technical feasibility unclear. • Requires real-time communication between market platforms of all

[4] Article 29 (10) of EBGL foresees the option for each TSO applying a self-dispatching model and operating within a scheduling area with a local intraday gate closure time after the balancing energy gate closure time to develop a proposal to limit the amount of bids that is forwarded to the European platform. The bids forwarded to the European platform shall always be the cheapest bids. The proposal shall include the definition of the minimum volume to be forwarded and rules to release the bids that are not submitted to the platform.

		• If one bid on a platform is accepted / activated it becomes unavailable for the other market.	flexibility. • Flexibility is allocated to where it is most valued (XB-BE or LOCID)	timeframes. - Transparency may be problematical. • Not possible In case of a LOCID with GCT until real-time

Based on the qualitative analysis of pros and cons, EXPLORE TSOs conclude that aside from not taking any further action, design options D (‘Limitation of balancing energy bid volume sent to European platforms') and E (‘Free bids can be withdrawn until activation deadline’) are the two most promising ones. However, there are two more decisive arguments against the non-firmness of bids in option E which could not be fully covered in the table above:

- The problem of competing options for market parties is not limited to balancing and local intraday: market participants also have the ability to choose between other options like OTC trades or keeping flexibility for self-balancing. Arbitrage between these different options is a natural part of their optimisation and they should bear the full responsibility in this matter.
- Balancing markets will have short-term GCTs (1 hour or less) and TSOs will publish information to allow BSPs to evaluate the competitiveness of their bids offered in the balancing energy market. If the bids are not competitive and they are still offered to the TSOs, it should be considered as a BSP responsibility.

Therefore non-firmness of bids (option E) is not optimal from a market perspective and technically not realistic on the short term. Hence, option D (limitation of bid volume sent to CMOL) is preferred by EXPLORE TSOs over option E. It will be demonstrated further in this text how a market design without overlap between consecutive markets and enough time in between for re-allocation of bids could be feasible if applying the features of design option D.

It should be stressed that in its last version, EBGL foresees that the implementation of the release of bids above a given volume is a national choice. Another option might be to accept the overlap between some markets. There would be more arbitrage needed for the concerned market parties but less intervention from the TSOs would be required. This would further emphasise the need to publish relevant information with a short delay to facilitate the arbitrage.

For both design options D and E, the feature of releasing non-activated bids after the activation deadline can be applied. Its added value will strongly depend on the possibility to reallocate non-activated bids to subsequent markets or for the use of the BRP or BRPs affiliated with the BSP (self-balancing or helping the system). This possibility will mostly depend on the period left between release and the gate closure times of the subsequent markets. Gate closure times are further assessed in the next section.

Equality of aFRR and mFRR gate closure times

Before looking at the relation between gate closure times and interactions between balancing energy and intraday markets, the equality of gate closure times of aFRR and mFRR balancing energy bids is analysed again.

In Chapter 2 of the EXPLORE report it was concluded that the gate closure times of aFRR and mFRR balancing energy bids should be the same. However, in their answers to the consultation, stakeholders argued that this conclusion was drawn without clear arguments against simultaneous gate closure times. Therefore the possibility of different gate closure times for mFRR and aFRR is re-evaluated here. The analysis starts from minimum lead times arising from mFRR product design and then makes the link with aFRR gate closure time.

Starting from mFRR, three different options for combinations of direct activated (DA) and schedule activated (SA) bids remain on the table (see section 5.4 of the EXPLORE report):

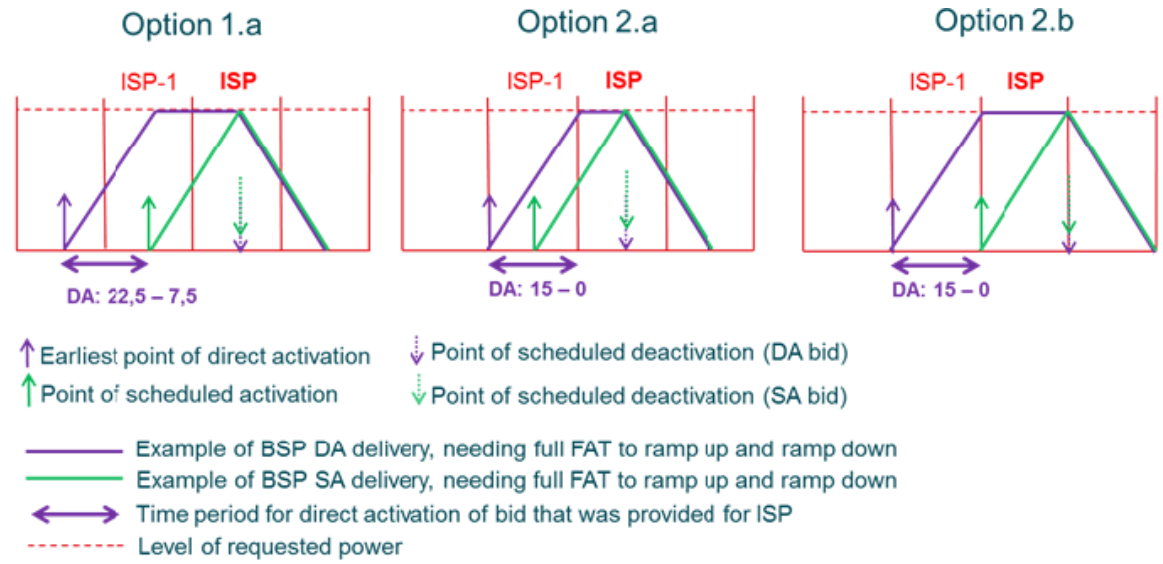

Figure 6: mFRR product options

For all three product options, the earliest point of direct activation determines how close the gate closure time can be to the start of the ISP, i.e. the minimum gate closure time.

- Option 1.a
  - Minimum mFRR GCT = start of the ISP – 22.5min – processing time
- Options 2.a and 2.b:
  - Minimum mFRR GCT = start of the ISP – 15min – processing time

Considering the conclusion for mFRR gate closure times, three options exist for aFRR gate closure times: aFRR can either be before (i.e. earlier in time or further away from the start of the ISP), equal to or after mFRR gate closure time. All three options are considered in the following table.

aFRR GCT vs. mFRR GCT	Evaluation
aFRR GCT before mFRR GCT  	• Capped aFRR bids could be released to BSPs to be reallocated to mFRR or other subsequent markets or for portfolio balancing in case such a design option is chosen. • In this case limiting aFRR volume in favour of the mFRR volume is contrary to the knowledge that cross-border markets are more important for aFRR for EXPLORE countries (see also chapter 5). • From technical point of view, the aFRR GCT could be closer to real time. This means that updated price information could be available for availabilities within BSP portfolios, potentially leading to unnecessary mark-ups in the more important balancing energy market.
aFRR GCT equal to mFRR GCT  	• Minimum aFRR GCT is imposed by the minimum mFRR GCT as analysed above • BSPs need to choose between offering a bid for aFRR or mFRR, which is a natural part of their optimisation and responsibility • Keeping GCTs equal avoids possible gaming in bidding strategies that may adversely affect prices in both mFRR and aFRR markets. • Released mFRR bids could only be recycled for aFRR - or vice versa-by using a complex bidding and clearing system communicating between aFRR and mFRR platforms, platforms which could have different ownerships…
aFRR GCT after mFRR GCT  	• Limit for aFRR GCT is processing time because there is no such concept as schedule activated bids for aFRR. Therefore GCT can be closer to the start of the ISP than for mFRR. • Non-activated or capped mFRR bids could be released to BSPs to be reallocated to aFRR or other subsequent markets or for portfolio balancing in case such a design option is chosen.

Next to these three options, following general principles for aFRR gate closure times are important to consider:

- If gate closures times for aFRR and mFRR would be different, the minimum duration between both should be defined by the time BSPs need to process the released bids and reallocate them to other markets in order to value this different timing.
- Technically, the minimum gate closure time for aFRR is defined by the processing time the TSO needs between GCT and the first point of activation, but enough time should be foreseen for back-up solutions to assure the correct functioning of this essential balancing process in case something would go wrong.

Based on this evaluation, EXPLORE TSOs have reviewed their initial conclusion of equal gate closure times for mFRR and aFRR. Different gate closure times have some advantages, especially when combined with a limitation of the volume sent to the European platform. All possible sequences - a gate closure time of aFRR followed by mFRR or vice versa, or equal gate closure times - have their pros and cons and no final choice for any of the three options could be made at this moment.

Relation between market design options and gate closure times

In this section it is demonstrated with a time line example that by combining the market design option of limiting the volume of balancing energy bids to the European platforms with sequential gate closure times for aFRR and mFRR, a feasible solution without overlap between Local intraday and balancing energy markets can be designed dependent on the exact point in time of the local intraday gate closure times.

It should be noted that this only avoids overlap between organised intraday markets and balancing energy markets. With e.g. ex-post notification, market participants' portfolio optimisation, support of the system by BRPs, and OTC trading there will always be different competing options for market participants to utilise their flexibility.
The example is created based on mFRR product option 2.b (see Figure 6) and following starting assumptions apply:

1) 5,0' time required between GCT and first activation
2) 2,5' processing time, i.e. time between GCT and moment the BSP knows if a bids is listed or released
3) 2,5' time a BSPs needs between release of a bid from one market and GCT of the next market to offer his bid again in the 2nd market
4) 0,0' time needed between last point of activation and release of non-listed bids

Note: the durations assumed represent minimum durations and must be seen as extremely optimistic. This position was taken on purpose to identify if a market design without overlap would be possible. Feasibility has not been assessed and cannot be guaranteed. They leave little to no buffer time. E.g. an assumed gate closure time of 5 minutes for aFRR is so close to the start of the ISP, that in case of an error in the process, there might not be enough time left for a rerun of the process. At least solid back-up procedures are required to assure correct operation of this essential process.

The starting point is the basic market design where only non-activated bids are released and the gate closure time of the local intraday market is at 30 minutes before the ISP in question. The illustration (see Figure 7) shows that a sequence of local intraday, mFRR and aFRR markets is not possible without overlap between mFRR and aFRR processes, even for the smallest possible aFRR gate closure time assumed (5 minutes). Bringing the local intraday gate closure time closer to the start of the ISP, as is already the case today in several countries, will only make the issue worse: a local intraday gate closure time of less than 25 minutes would no longer allow unmatched local intraday bids to be offered again in the mFRR market.

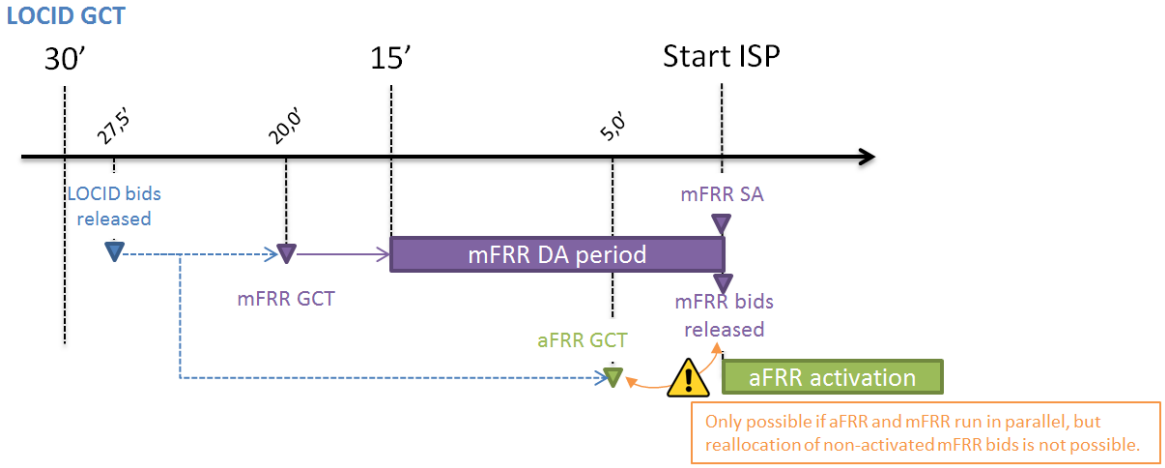

Figure 7: Illustration of sequential LOCID and BE markets for a LOCID GCT of 30 minutes and a basic market design where only non-activated bids are released.

Now the same time line illustration is made applying market design option D (limitation of the volume of balancing energy bids sent to the European platforms). Figure 8 shows that by introducing the features of option D, a sequence without overlapping markets is possible, even with a very short local intraday gate closure time (5 minutes in this example) and an aFRR GCT of 10 minutes.

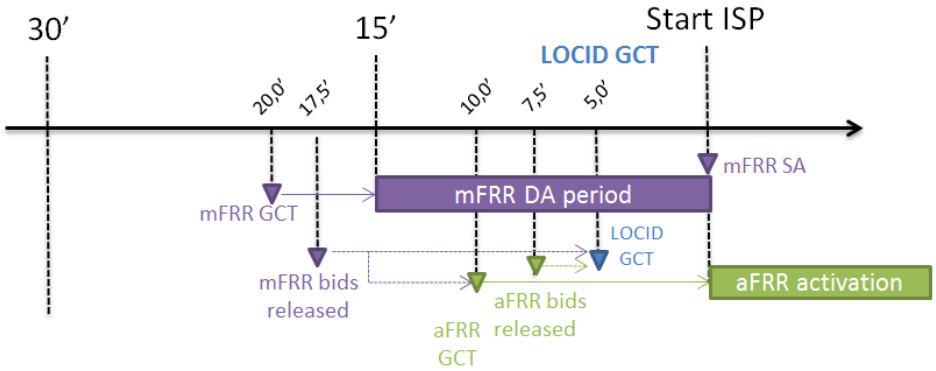

Figure 8: Illustration of sequential LOCID and BE markets for a LOCID GCT of 5 minutes and a market design where the most expensive bids above a capped volume are released. Only the mFRR bids that can be DA cannot be re-used.

Conclusion

Based on stakeholder input, several market design options to avoid or minimise the impact of overlapping intraday and balancing energy markets were elaborated and analysed. EXPLORE TSOs concluded the option of releasing the most expensive balancing energy bids above a capped volume to be the best.

The analysis of gate closure times for aFRR and mFRR markets showed that there are pros and cons to all sequences of gate closure times. Sequential gate closure times specifically offer advantages when combined with a market design including a limitation of the volume of balancing energy bids sent to the European platforms.

An illustration with a time line example showed that the basic market design of releasing only non-activated bids does not allow designing a process with sequential and non-overlapping intraday and balancing energy markets. When applying the market design option of limiting the volume of balancing energy bids sent to the European platforms this becomes feasible, even with a very short local intraday gate closure time. This would however require a very short aFRR gate closure time, which might not be technically feasible.

The sequence of the different markets will be further analysed in the European discussions together with other TSOs. The basic assumptions given at the beginning of this section about the required time will need to be reviewed to confirm their feasibility.

5. Interactions between aFRR and mFRR

This chapter addresses the interactions between the aFRR and mFRR balancing markets. They focus on the usage of cross-zonal capacity for the different processes, also including imbalance netting, and discuss the possible impact of allowing full access to the complete CMOL for aFRR balancing energy on local dimensioning of aFRR and mFRR.

Full access to the aFRR CMOL

EBGL states that each requesting TSO may request the activation of balancing energy bids from the aFRR common merit order lists up to the total volume of balancing energy. The total volume of balancing energy that can be activated by the requesting TSO from balancing energy bids from the aFRR common merit order lists is calculated as a sum of volumes of:

- balancing energy bids submitted by the requesting TSO not resulting from sharing of reserves or exchange of balancing capacity (= exclude “exported” capacity)
- balancing energy bids submitted by other TSOs as a result of balancing capacity procured on behalf of the requesting TSO (= include “imported” capacity)
- balancing energy bids resulting from the sharing of reserves under the condition that the other TSOs participating in the sharing of reserves have not already requested the activation of those shared volumes (= include not used “shared” capacity)

EBGL further states that all TSOs may propose the conditions or situations in which the above-mentioned limits shall not apply and that in case a TSO requests aFRR balancing energy bids beyond the limit, all other TSOs shall be informed in a timely manner.

The situations mentioned here are not further detailed by EBGL, but it is understood that this situation is not considered to occur frequently. The idea is to use the full potential of the CMOL in times when it is beneficial from a technical point of view (for instance: large remaining ACE in the requesting country). The obligation to inform other TSOs about a usage of this assistance suggests that EBGL does not consider assistance as a process to be used frequently.

Limiting the volume of bids to be activated to the CMOL has the consequence of limiting the technical potential of an aFRR-Cooperation, as well as limiting benefits for each.

The main reason for not giving a full access to CMOL would be to have a clearer cut regarding the responsibility of each TSO, in particular in relation with possible undue reduction of the dimensioning of aFRR. Full access to the CMOL creates indeed a concern on whether the amount of FRR, both aFRR and/or mFRR procured locally could be reduced due to an unwarranted and/or uncoordinated usage of the CMOL. Several relevant articles are presented below to illustrate the possible issue.

- SOGL article 157(2)(h,i)
  The determining factors for the required reserve capacity are either the 99%-rule or the dimensioning incident. SOGL states that all TSOs of a LFC block not using RR shall ensure that the reserve capacity on FRR (mFRR and aFRR) is sufficient to cover the LFC block imbalances for at least 99 % of the time, based on historical records. This part of the FRR dimensioning rules leads to a volume requirement that is determined only by the

imbalances and therefore independent from local or cross-border activation or FRCE target parameters. The dimensioning incident is also unrelated to activations of balancing energy. As such for the determination of the total FRR volume, at least for those countries not using RR, there is no possibility to legally misuse the CMOL to reduce the amount of required reserve capacity.

- SOGL Article 157(2)(b,c)
  Any cross-border influences are implicitly taken into account when determining the amount of reserve capacity sufficient to respect the FRCE target parameters of the LFC block. The ratio between aFRR and mFRR is determined with a mind to respect the FRCE target parameters. As a consequence, without specific agreements, TSOs could alter their ratios of aFRR versus mFRR when given full access to the CMOL for reasons of lower mFRR procurement costs. This could lower the overall amount of aFRR available within the system to unwanted levels.

A possible solution to ensure TSOs do not reduce their dimensioned aFRR to unwanted levels would be if the TSOs of the participating LFC Blocks agree to take the effect of the cross-border activation into account for their Level 1 and Level 2 FRCE target parameters before they are allowed to have full access to the aFRR-CMOL.

EXPLORE TSOs believe this possible solution should be analysed while aiming at an efficient aFRR process with a fair distribution of the full sharing of the CMOL.