Explanatory Document to all TSOs' proposal for the implementation framework for a European platform for the exchange of balancing energy from frequency restoration reserves with manual activation in accordance with Article 20 of Commission Regulation (EU) 2017/2195 establishing a guideline on electricity balancing

Date of the approval

DISCLAIMER

This document is released on behalf of the all transmission system operators ("TSOs") only for the purposes of the public consultation on the All TSOs' proposal for the implementation framework for the exchange of balancing energy from frequency restoration reserves with manual activation ("mFRRIF") in accordance with Article 20 of Commission Regulation (EU) 2017/2195 establishing a guideline on electricity balancing. This explanatory document does not in any case represent a firm, binding or definitive TSOs' position on the content.

Content

1. Introduction

This Explanatory Document provides background information and the rationale for choices made in the all TSOs proposal for the implementation framework for a European platform for the exchange of balancing energy from frequency restoration reserves with manual activation (hereafter referred to as "**mFRRIF**"), being developed pursuant to Article 20 of Commission Regulation (EU) 2017/2195 establishing a guideline on electricity balancing (hereafter referred to as "**EBGL**").

The Explanatory Document has been prepared to support the all TSOs' provision of the mFRRIF taking in to account the feedback received from the stakeholders during the MARI stakeholder workshops and voluntary consultation, which were held during the last 12 months. This consultation is being organized according to the provisions of EBGL, and aims at providing the stakeholders details on the topics covered by the mFRR implementation framework (mFRRIF), focusing on the choices made by the TSOs during the design phase.

1.1. Content of this document

Chapter 1 gives a general introduction to EBGL and the mFRR-Platform process. Chapter 2 provides a detailed explanation of the mFRR standard product and process timing. Chapter 3 presents details concerning the algorithm optimization function and creation of the common merit order list, covered in Article 9 and 10 of the mFRRIF.

Chapter 4 provides details on the approach to congestion management, part of Article 9 and 10 of the mFRRIF.

Chapter 5 addresses the mFRRIF approach to harmonization of the aspects, which fall under national responsibility but could have a significant impact on the liquidity of the mFRR-Platform.

Finally, in Chapter 6 of the document you can find a list of abbreviations. Annex I: briefly describes the possible approach to settlement. However, given the fact that this topic is being discussed and no decisions have yet been made, the details on settlement will be presented as part of the consultation on pricing and settlement according to Article 30 and 50 of EBGL.

1.2. EBGL and the mFRR process

The main purpose of EBGL is to integrate the markets for balancing services, and by doing so enhance the efficiency of the European balancing system. The integration should be done so that it avoids undue market distortion. In other words, it is important to focus on establishing a level playing field. This requires a certain level of harmonization in both technical requirements and market rules. To provide this level of harmonization, the EBGL sets out certain requirements for the integration of the mFRR markets. Figure 1 gives an overview of the requirements of the EBGL, their interconnection with each other and their interconnections with topics out of scope of the EBGL.

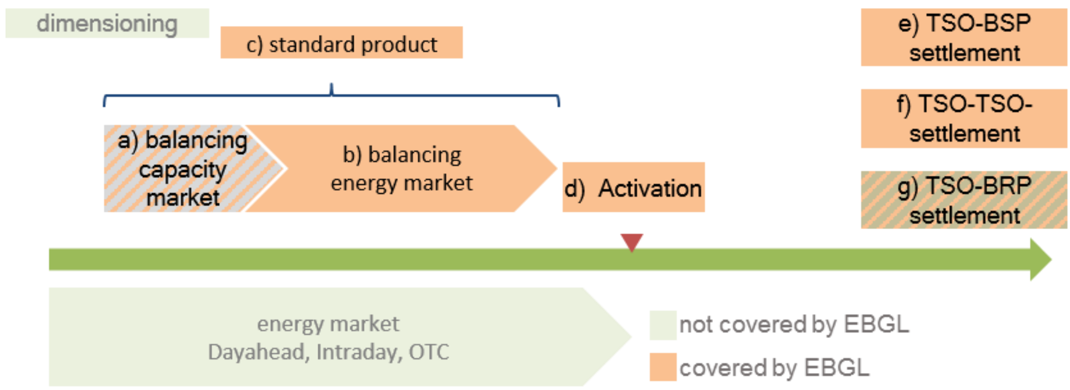

Figure 1: Scope of EBGL

1.3. Platform Background Introduction

The development of the mFRR-Platform is organised via the implementation project MARI (see Figure 2 for the overview of the involved countries), where technical details, common governance principles, and business processes are developed by the involved TSOs. Furthermore, MARI shall implement and make operational the European platform, where all standard mFRR balancing energy product bids shall be submitted and the exchange of balancing energy from mFRR shall be performed.

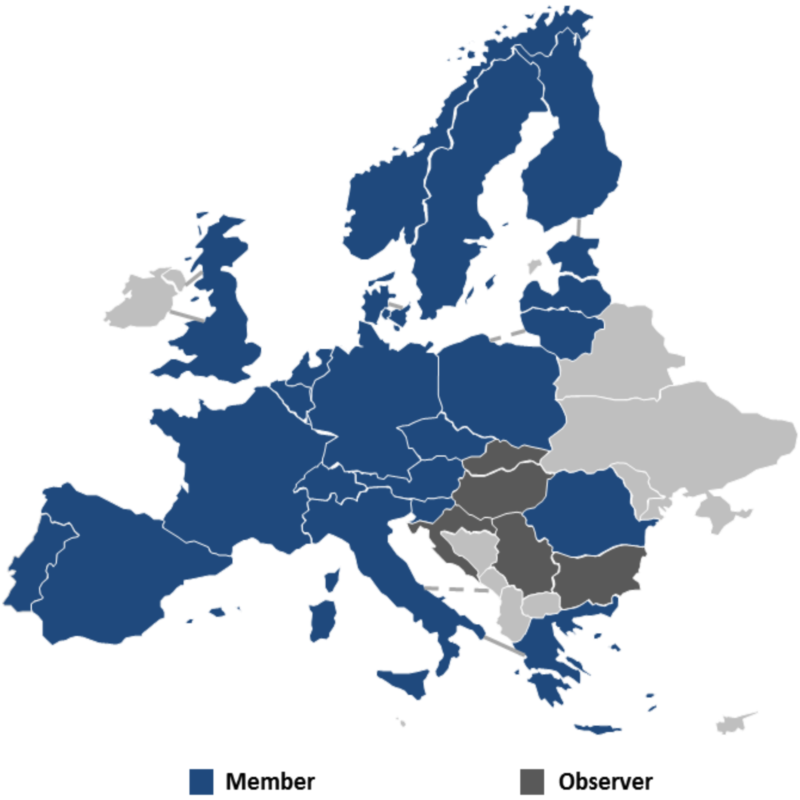

Figure 2: Overview of members and observers as of 29.03.2018

All TSOs developed through ENTSO-E and in close coordination with MARI the proposal for the mFRRIF. Analysis and discussions within the MARI project as well as stakeholders' input gathered by the project served as inputs to ENTSO-E. Topics with relevance for other implementation projects such as TERRE (RR), PICASSO (aFRR) and IGCC (IN) are coordinated by ENTSO-E via dedicated working groups.

The timeline for implementation is mostly described by the requirements in EBGL Article 20 (4), (5) and (6). These indicate that full operation of the platform is expected 30 months after the approval of the mFRRIF. To achieve this target six months after the approval of the mFRRIF the entity or entities that will operate the platform shall be designated. As experience during implementation of the mFRR-Platform may necessitate change, EBGL governs the process for any future amendments of the mFRRIF.

In case approval of the mFRRIF is given without a request for amendments and without escalation to Agency for the Cooperation of Energy Regulators (ACER), this approval is due 6 months after the delivery of the mFRRIF to the NRAs. The whole timeline then runs until December 2021, by which time the current project planning aims to have the mFRR-Platform operational and all members TSOs using the platform.

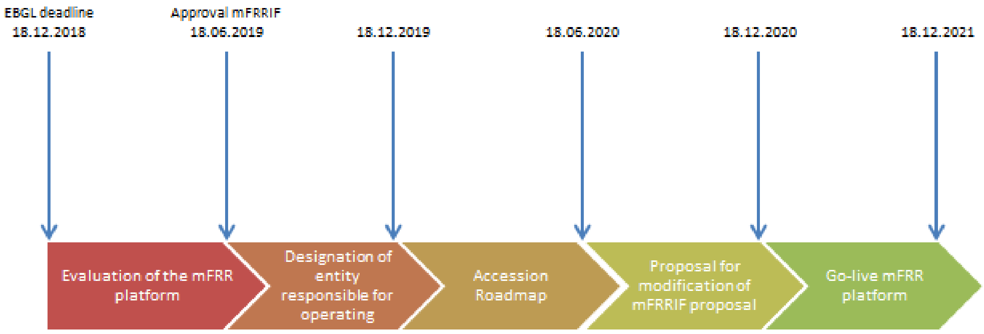

Figure 3: High-level implementation of the mFRR-platform according to EBGL

1.4. mFRR Process in the context of TSOs balancing strategy

European TSOs use different processes to restore their frequency:

1. automatic frequency restoration reserves (aFRR);
2. manual frequency restoration reserves (mFRR).

aFRR is activated automatically and in a continuous manner. It is by its nature more deeply integrated with the TSO systems. mFRR is activated manually in both a discrete and "close to" continuous manner by TSOs. For this reason, it is foreseen to allow direct and scheduled activations in the mFRR-Platform. Further details and reasons why both direct and scheduled activations are needed are given in Chapter 0.

In theory TSOs can be categorized as proactive and reactive based on the extent to which they forecast the imbalance. As a consequence, the TSOs use the different processes to either solve a forecasted imbalance or solve imbalances in real-time. This impacts how mFRR (including the use of direct and scheduled activations) and aFRR reserves are used.

1.5. General mFRR Process

Figure 4 below explains the general process as foreseen for the mFRR-Platform:

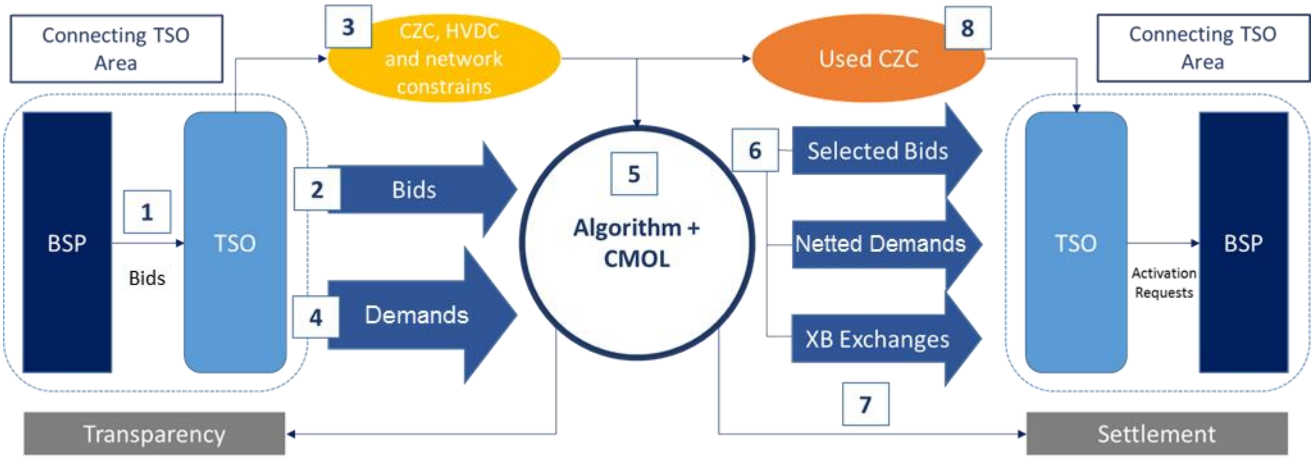

Figure 4: General Process of mFRR Activation

Legend:

1. TSOs receive bids from BSPs in their imbalance area
2. TSOs forward standard mFRR balancing energy product bids to the mFRR-Platform
3. TSOs communicate the available cross-zonal capacities (CZC) and any other relevant network constraints as well HVDC constraints
4. TSOs communicate their mFRR balancing energy demands
5. Optimization of the clearing of mFRR balancing energy demands against BSPs' bids
6. Communication of the accepted bids, satisfied demands and prices to the local TSOs as well as the resulting XB schedules
7. Calculation of the commercial flows between imbalance areas and settlement of the expenditure and revenues between TSOs
8. Remaining CZC are sent to the TSOs

2. Product and Process

2.1. Standard Product

The standard product of the mFRR-Platform is defined by the standard bid characteristics and variable bid characteristics as defined in Article 6 of the mFRRIF.

The details of those characteristics are described in Chapter 0. Given the variety of local markets, some of these characteristics cannot easily be harmonized across Europe at this moment and will therefore be left at the discretion of the national markets.

However, regardless of the BSP bid characteristics accepted locally, the product exchanged between the TSOs through the mFRR-Platform will always have the same characteristics and is referred to as the 'TSO-TSO exchanged shape'.

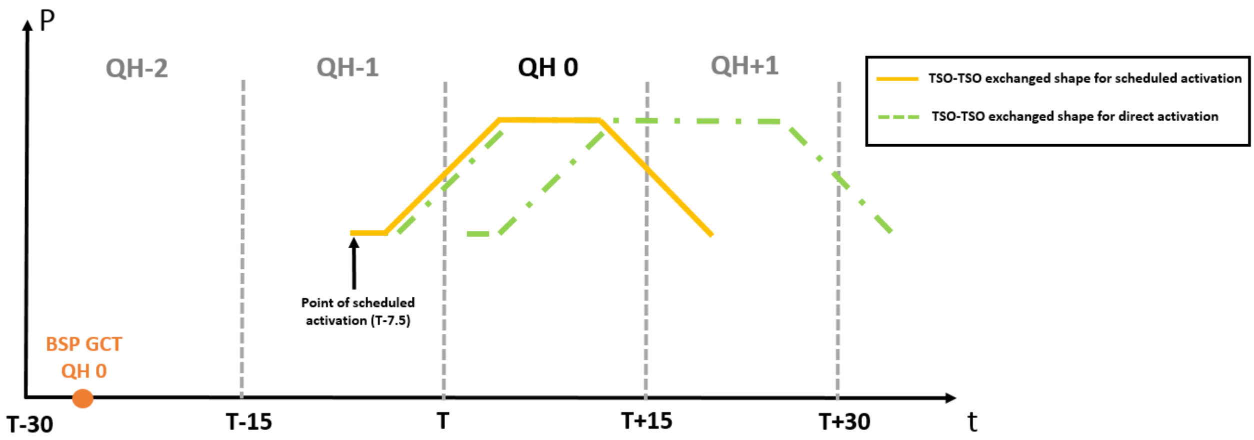

Figure 5: Illustration of the shape of the cross border exchange for a schedule activation and various direct activations

The TSO-TSO exchanged shape refers to how the changes in physical flows resulting from activations of the platform are realized. The TSO-TSO exchanged shape is defined according to the standard product characteristics.

Currently, the TSOs foresee using a linear ramp of 10 minutes for the cross-border exchange. A 10-minute ramp equals the ramp which is already in use for scheduled programs of exchange across Continental Europe. An infinite ramp would not be possible, as there are limits to how quickly the flow can be changed between synchronous areas without risking reduced operational security and voltage problems. It is assumed that following a 10-minute ramp is more realistic for most BSPs.

The 'BSP-TSO delivered shape' refers to the actual delivery/withdrawal of certain units. Deviations between the TSO-TSO exchanged shape and BSP-TSO delivered shape will lead to imbalances in the connecting TSOs imbalance area. Each TSO has the opportunity to define certain product characteristics nationally (e.g. the preparation period, the ramping period, deactivation period, maximum duration of delivery period) in order to incentivize BSPs to follow the TSO-TSO exchanged shape or to incentivize BSPs to react faster.

2.2. Standard Bid Characteristics

The key characteristics of standard mFRR balancing energy product, which set the BSP-TSO delivered shape described in the Article 6 of the mFRRIF, list the bid characteristics which have to be provided in each mFRR bid[1] by the BSP. With the exception of the full activation time and minimum duration of the delivery period, the boundaries and specific values for those characteristics are to be set on a local level.

- Preparation period – (element 1 in Figure 6 and Figure 7)

  'preparation period' means the period between the activation request by the connecting TSO in case of TSO-TSO model or by the contracting TSO in case of TSO-BSP model and the start of the ramping period;

- Ramping period – (element 2 in Figure 6 and Figure 7)

  'ramping period' means a period of time defined by a fixed starting point and a length of time during which the input and/or output of active power will be increased or decreased;

- Full activation time – (element 3 in Figure 6 and Figure 7)

  'full activation time' means the period between the activation request by the connecting TSO in case of TSO-TSO model or by the contracting TSO in case of TSO-BSP model and the corresponding full delivery of requested MW power of the concerned balancing energy bid;

- Minimum and maximum quantity

Quantity refers to the change of power output (in MW) which is offered in a bid by the BSP and which will be reached by the end of the full activation time.

For the standard mFRR balancing energy product TSOs propose a minimum quantity for balancing energy bids of 1 MW. This is a result of consensus between TSOs, who want the minimum quantity to be large enough to carry out their work in good conditions, and BSPs, who want the minimum quantity to be small enough to facilitate their participation.

TSOs propose a maximum quantity for standard mFRR balancing energy product bids of 9999 MW. That ceiling is mainly justified by IT factors.

[1] TSO applying a central dispatching model will convert the integrated scheduling process bids received from BSPs, pursuant to Article 27 of EBGL, into standard mFRR balancing energy product bids and then submit the standard mFRR balancing energy product bids to the mFRR Platform, taking into account operational security of the power system.

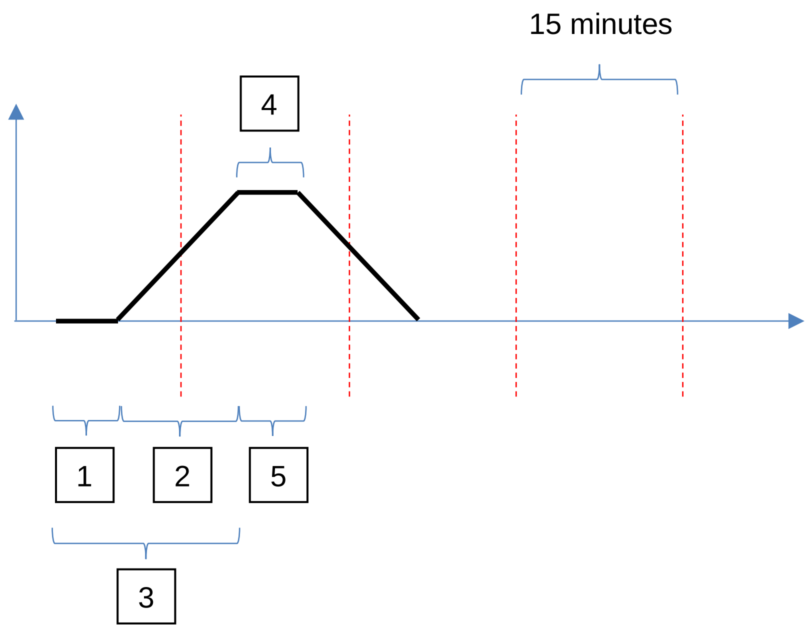

Figure 6: Example of a possible shape of the mFRR Scheduled Product

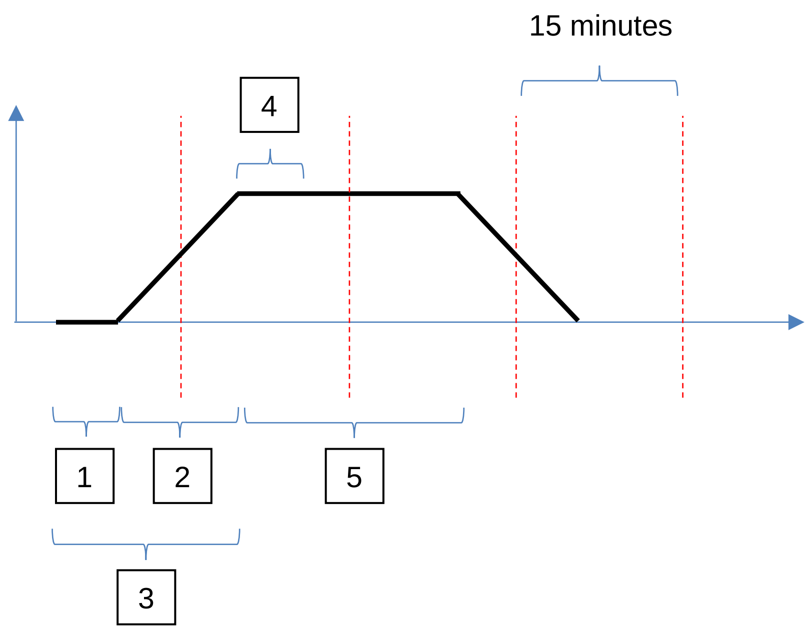

Figure 7: Example of a possible shape of the longest direct activation of mFRR

- Deactivation period

  'deactivation period' means the period for ramping from full delivery to a set point, or from full withdrawal back to a set point;

The deactivation period will start after notification of the scheduled auction results for the next quarter-hour (QH+1) to the activated BSP taking place at T+7.5. This will allow the BSPs not to deactivate if they are selected again for delivery in the next quarter.

In the TSO-TSO exchange for the direct activation, the deactivation will occur around the end of QH+1regardless of when the activation was initiated. Where T is the start of QH0; the QH for which the bid was placed.

- Minimum and maximum duration of delivery period – (element 4 and 5 in Figure 6 and Figure 7)

  'delivery period' means the period of time during which the BSP delivers the full requested change of power in-feed to/withdrawal from the system.

The proposal for the mFRRIF defines the minimum duration of delivery period. There are no conditions set for the maximum duration of the delivery period in the proposal for mFRRIF. The maximum duration of the delivery period depends on the tolerated deviation between the TSO-TSO exchanged shape and TSO-BSP delivered shape, which is defined individually by each TSO in accordance with their local terms and conditions.

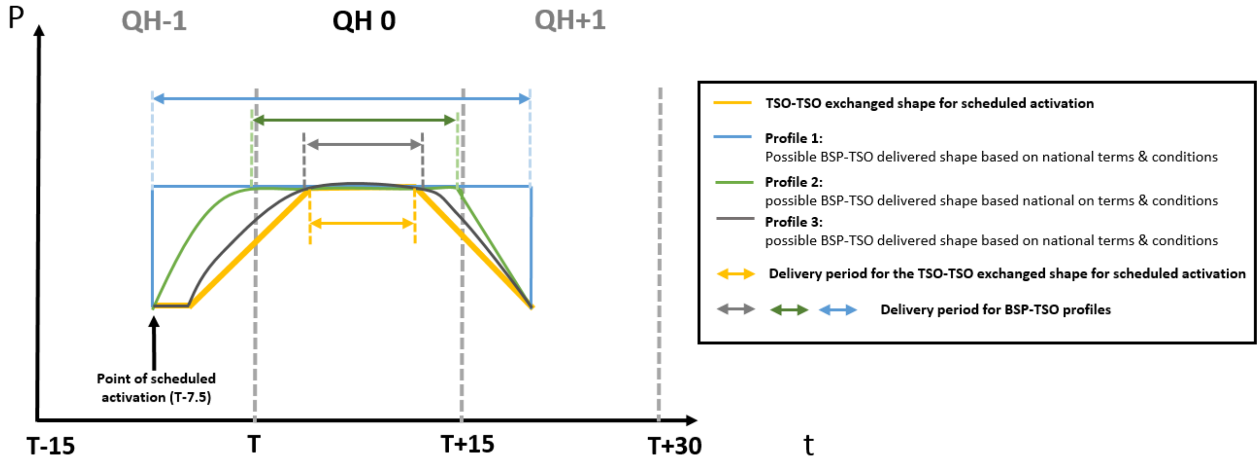

Figure 8: Illustration of different BSP-TSO delivered shapes and their influence on the duration of the delivery period in the case of a schedule activation. Since the BSP-TSO delivered shape can be defined by each TSO individually, it is not possible to define a global maximum delivery period

- Validity period

  'validity period' means the period when the balancing energy bid offered by the BSP can be activated, where all the characteristics of the product are respected. The validity period is defined by a start time and an end time;

More precisely, it means the time period for which a balancing energy bid submitted by a balancing service provider can be activated:

- for a schedule activation this is a single fixed point in time for each quarter-hour as is known as the 'point of schedule activation';
- for a direct activation this is a period of time between two points of schedule activation.

Stakeholders should be aware that it is possible for a direct activatable bid submitted for a specific quarter-hour to deliver outside of that quarter-hour (i.e. the subsequent quarter-hour). A probable consequence is that BSPs will have to carefully consider in which quarter-hours they can safely bid (see also technical linking in subchapter 2.6.2).

For a directly activatable bid submitted for QH0, where T is the start of QH0:

- the earliest point of direct activation is T-7.5;
- the latest point of direct activation is T+7.5.

- Mode of activation.

  'Mode of activation' means the implementation of activation of balancing energy bids, manual or automatic, depending on whether balancing energy is triggered manually by an operator or automatically in a closed-loop manner.

This Explanatory Document refers only to the manually activated product.

2.3. TSO Balancing Energy Demand Characteristics

The balancing energy demands that the TSOs submit to the platform will include at least the following characteristics:

1. Quantity [MW];
2. Direction: Positive (system short) or Negative (system long);
3. TSO demand price [€/MWh] with a price resolution of 0.01€/MWh (optional demand characteristic for the scheduled activations only);

   This characteristic will enable the TSOs to deal with uncertainties about costs when they have alternative measures to solve their imbalances. It may increase the demand to the platform as it removes the incentive for the TSO not to send a demand to the platform when it has alternative measures with more certain costs. A demand can then be submitted with a price reflecting the cost of the alternative measures. A TSO can also declare a price inelastic demand.
4. Location of demand: bidding zone or LFC area;

   TSOs will provide demand depending on the applied frequency restoration process and topology of the LFC areas and bidding zones. If the LFC area consists of several bidding zones – demand may be provided per bidding zone or total demand for the LFC area. If a bidding zone consists of several LFC areas – demand shall be provided for each LFC areas.
5. Purpose: balancing purposes or other purposes.

   TSOs foresee that the platform can be used for other purposes than balancing with other rules for activation and settlement.

All balancing energy demands are assumed to be divisible. An example of a balancing energy demand is presented in *Table 1*.

TSO	Direction	Quantity (MW)	TSO Demand Price (€/MWh)	Elastic/Inelastic	Location
TSO 1	Positive	100	10	Elastic	Bidding zone A
TSO 2	Positive	100	--	Inelastic	Bidding zone B
TSO 2	Negative	-50	-20	Elastic	Bidding zone C

Table 1: Demand example

In Table 1: Demand example, the TSO 1 has an elastic positive demand of 100 MW with a price of 10 €/MWh. This implies that this TSO is willing to pay a maximum of 10 €/MWh to satisfy its demand. TSO 2 has an inelastic positive demand of 100 MW which is located in the bidding zone B and an elastic negative demand of 50 MW located in the bidding zone C with a price of -20 €/MWh. That is, TSO 2 accepts that its demand of 100 MW in the bidding zone B will be met irrespective of (high or low) marginal prices, while also satisfying negative demand in the bidding zone C by selling 50 MW for a minimum of 20 €/MWh.

2.4. Direct and Scheduled Activation

For a direct activatable bid, the activation request from the TSO can be issued to the BSP at any point in time after the scheduled auction for each quarter hour. Such a bid can be activated and exchanged between TSOs shortly after an incident happens as it doesn't involve the potential waiting time associated with the process for scheduled activation.

Direct activation (DA) is needed for the TSOs using mFRR to resolve large imbalances within the Time To Restore Frequency (see System Operation Guideline) to have the ability to activate mFRR bids at any point in time when a large imbalance occurs. Typically, this could be N-1 incidents.

For a scheduled activatable bid, the activation request from the TSO is issued to the BSP at a specific point in time (point of scheduled activation)

Scheduled activation (SA) is typically used to replace previously activated aFRR bids or alternatively to handle forecasted imbalances proactively depending on the TSO's balancing strategy. For the TSOs, this allows the gathering of several demands and realizing benefits from the netting demands in opposite directions. For the BSPs, it gives certainty on the timing of any activation which would be useful when the capacity is subsequently offered in different markets (for instance: used in ID and then offered as mFRR).

2.5. Timing of the mFRR Process

In this section we focus on the various aspects of the timing during the process, starting with the TSO submitting their demands to the platform and continuing until full activation of bids is reached.

The duration of this process is dependent on the following elements:

- Computation time of algorithm;
- Time to change flow on HVDC cables;
- Communication times between platform, TSOs and BSPs;
- Full activation time of the balancing product;
- Potential delay from the moment when a demand is submitted to the platform until the algorithm starts to process it, i.e.:
  - Waiting time until a scheduled process starts;
  - Waiting time if algorithm is already running due to earlier activation.

The time needed for all listed elements is uncertain. Figure 9 illustrates the different elements of the scheduled process with some assumptions on their respective timings that yield 15 minutes total time from TSO energy bid submission Gate Closure Time (TSO_GCT) for submitting needs until full activation of balancing bids. Based on the knowledge we have today, both the assumption of 3 minutes for changing the flow on HVDC cables and 1 minute for the processing time of the algorithm may be challenging to realize.

From the chart, we can see that from the time the results of the platform are communicated to the TSOs the process of (i) changing the flow on HVDC cables and (ii) the communication process TSO-BSP can start in parallel.

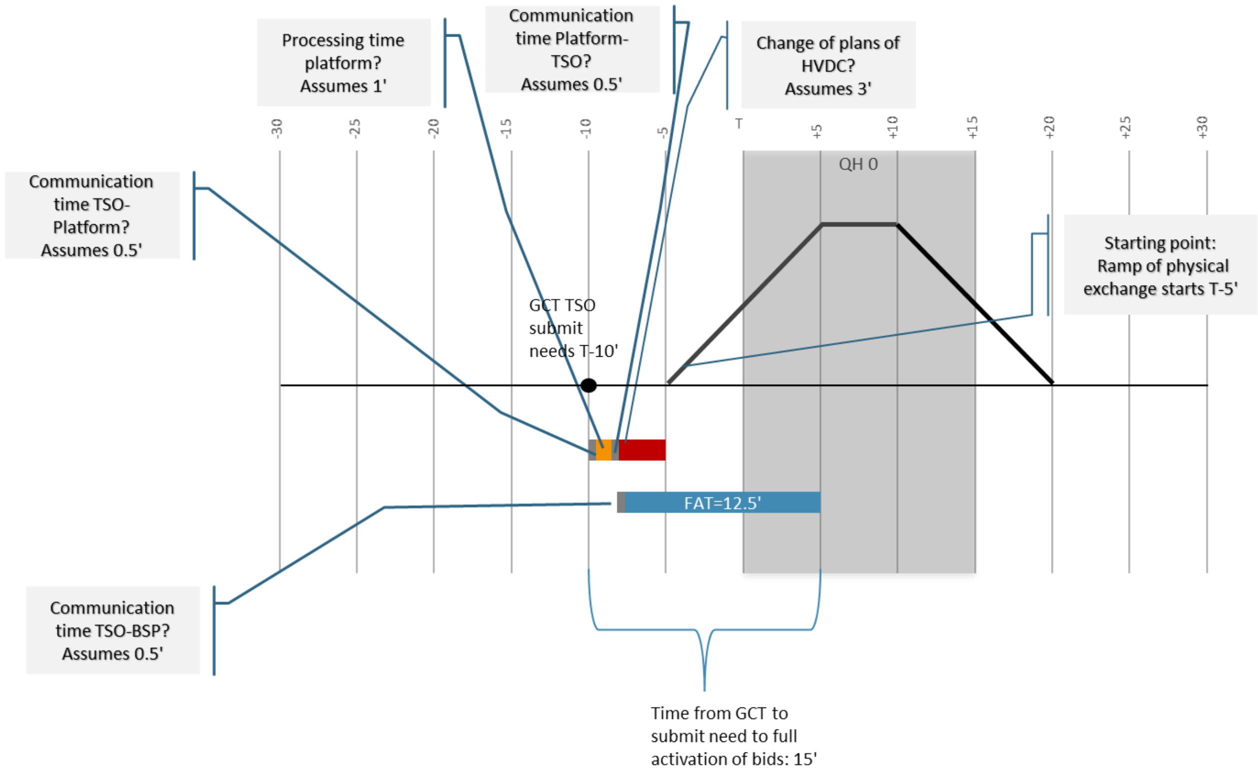

Figure 9: Timing of the Scheduled Process

Today, the total time needed for changing the physical flow of HVDC cables varies between cables and depends on several features:

- Electronic interfaces between market management systems, energy management systems/SCADA and controllers;
- Physical properties and functionalities of the cable;
- Resolutions of HVDC plans (typically 1 or 5 minutes).

It is uncertain how much time can possibly be gained and when this improvement can be realized. However, it is clear that improved IT systems, automation and development of more efficient procedures adapted to the platform will be necessary. Several critical elements are involved in the process of changing the flow on HVDC cables and currently we need to account for minimum 2-3 minutes[2]. Parts of this process will have to be fully completed before the cable is ready for making new HVDC plans, which determines how frequently direct activations can impact the flow across HVDC interconnections.

[2] Taking into account new investments in IT systems and processes, technical experts in Statnett and National Grid have assessed the time needed from the point where a TSO receives a request until the flow of a cable can start to change. The estimated time of 2-3 minutes is uncertain and the functionality of older HVDC cables may not allow this flexibility.

2.5.1. The Process of Direct Activations

It is intended that the DA process minimizes the time between TSO demand being submitted to the platform and the full activation of bids being reached. This time should not be longer than 15 minutes. In the same way as SA, the total time needed for DA will have to include time for communication between the TSOs, the platform and BSPs and the computation time of the algorithm in addition to the full activation time according to the product definition. The selection of bids and update of CZCs between bidding zones must be completed before the algorithm can start to process another TSO demand (i.e. runs of the computation algorithm must run sequentially in series and not in parallel).

2.5.2. The Interaction between the Direct and the Scheduled Process

All bids submitted for a certain quarter-hour (QH) can first be used for SA and then the remaining direct activatable bids will be available for DA. The alternative sequence of using the bids for DA first and then allowing the remaining bids to be available for SA afterwards has also been investigated.

The two options have been evaluated according to a number of criteria and there are advantages and disadvantages to both. The main reasons for having SA before DA is that it allows more time for TSO to assess CZCs and the availability of bids according to grid constraints, before sending them to the platform. It also allows balancing energy gate closure time (BSP GCT) to move closer to real time giving BSPs more time to update the bids. For TSOs it is also possible to ensure that enough direct activatable bids are available for tackling an incident without limiting liquidity. The alternative of having DA before SA has the main advantage that most of the energy delivered as a result of a DA is in the quarter-hour for which the bid is submitted.

The detailed timings of the chosen option (SA before DA) are illustrated and explained below. For the direct activation, a continuous process with close to zero computation time of the algorithm is assumed in these illustrations. As explained above, we need to take into account that there will also be a computation time for direct activations and it is uncertain how short we can keep this computation time. Direct activations have to be processed in sequence because the inputs to the algorithm (e.g. CZC values, activated bids etc) are dependent on the outputs of the previous algorithm run.

We have assumed that the communication times between the platform, the TSOs and BSPs are the same as for the scheduled process (1 minute assumed for clearing the scheduled auction).

We assume 1 minute for the algorithm to process the scheduled activation. Thus, if a TSO's demand is received by the platform just after the clearing of the scheduled auction starts, this demand has to wait for 1 minute before it can be processed.

The process of direct activation itself takes 14 minutes assuming close to zero computation time, but as a result of the above mentioned, the total time for a direct activation can take up to 15 minutes maximally if the 1 minute waiting time applies (with zero computation time).

SA Process before DA Process

The TSO can submit demands for direct activation just after the TSO GCT of the same specific quarter-hour until just before the TSO GCT of the next quarter-hour. This is between T-10' and T+5', referring to the quarter-hour starting at T (QH 0). Correspondingly, BSPs can receive the activation signal at T-7.5' for the scheduled activation and between T-7.5 and T+7.5' for the direct activation.

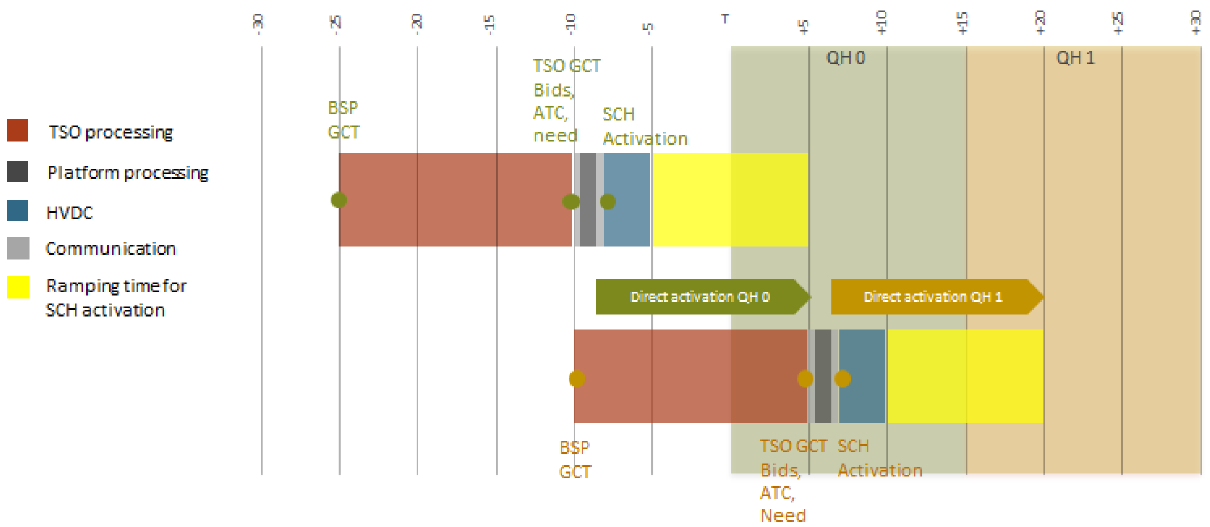

Figure 10: Alternative 2 - Scheduled before Direct Activation for Two Consecutive quarter-hours

It is sufficient for TSOs to submit bids and CZCs at the same time as the SA demand and thus a GCT of T-25' for BSPs is feasible. However, given that the results of the mFRR platform for QH 0 are published after the BSP GCT for QH 1, the BSPs that have submitted bids will not have the opportunity to update their bids for QH 1 after knowing the results for QH 0.

2.6. Other Bid Properties

2.6.1. Introduction to linked bids

It is of the utmost importance to distinguish between the linking of bids for economic reasons and for technical reasons:

- Technical linking: links between bids in consecutive quarter-hours needed to avoid the underlying asset of a bid being activated twice;
- Economical linking: links between bids with the purpose of economic optimization, allowing BSPs to offer more flexibility and to maximize the opportunity of being activated.

2.6.2. Technical Linking

Due to the nature of the direct activation process and the gate closure times, there is a need to "technically" link bids between quarter-hours. For example, due to the fact that the results of the mFRR platform for QH 0 are known only after the BSP GCT for QH+1, a technical link between bids submitted both for QH 0 and QH+1 will avoid that the underlying asset of a bid is activated twice, i.e. with overlapping delivery periods but activated in different quarter-hours. Moreover, for activations where the delivery period is between 5 and 20 minutes, this linking between bids will even have to extend over more than one quarter-hour. Such technical links between bids will be especially needed for a BSP with small portfolios or for countries with unit bidding.

The Activation Optimization Function (AOF) will need rules for avoiding unfeasible overlapping activations of the same bid submitted for consecutive quarter-hours. Hence, BSPs will be required to indicate if bids in consecutive quarter-hours are technically linked, i.e. to indicate if the underlying assets of a bid are the same as a bid offered in previous quarter-hour(s).

Below are listed the most relevant rules for technical linking between two consecutive quarter-hours (Figure 11):

1. A bid direct activated in QH-1 is not available in QH 0 for direct activation;
2. A bid direct activated in QH-1 is not available in QH 0 for scheduled activation;
3. A bid scheduled activated in QH-1 is not available in QH 0 for direct activation, unless the asset can perform ramping up during ramping down of a scheduled bid activated in QH-1 (see red dotted shape in Figure 11).

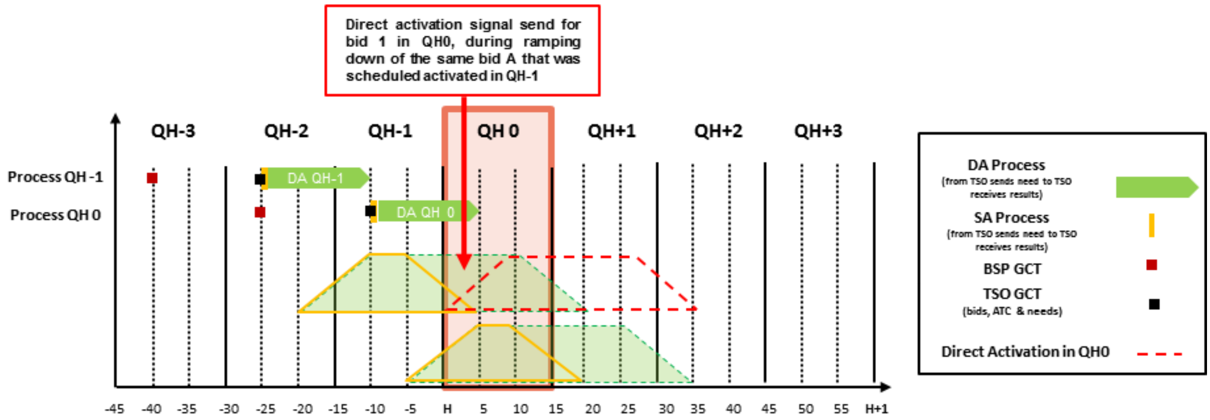

Figure 11 Graphic representation of two consecutive mFRR processes

Below is listed the rule for technical linking between consecutive quarter-hours i.e. more than two quarter-hours (Figure 12):

1. A bid direct activated in QH-1 is not available for direct activation in QH+1, unless the asset can perform ramping up during ramping down of a direct activated bid in QH-1 (see red dotted shape in Figure 12).

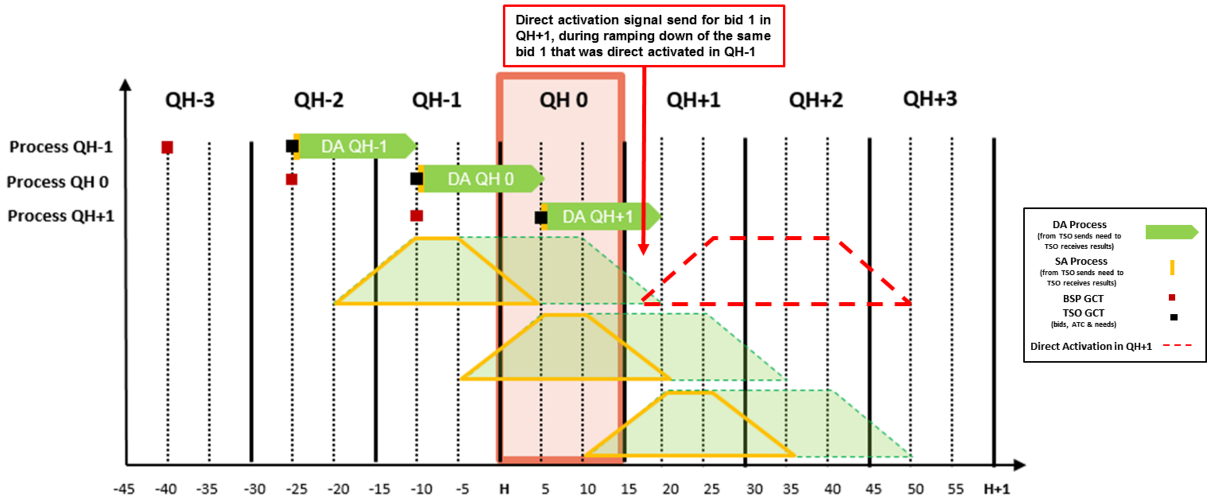

Figure 12 Graphic representation of three consecutive mFRR processes

Technical linking is necessary for avoiding unfeasible activations of the same bid and will rely on simple and pragmatic rules (as shown above). These rules, will modify the inputs given to the next CMOL based on the activations (direct or scheduled) made in the previous CMOL. The TSOs will investigate further, how this feature will be practically implemented.

However, it is of utmost importance that the BSPs give precise information about which bids are technically linked from one quarter-hour to the next. For example, an ID number could be assigned to the bids (an idea could be to efficiently adapt the Energy Identification Coding scheme (EIC) for this purpose). Bids with same ID are linked together and are subject to the above listed technical linking rules implemented in the AOF.

Below is an example (Figure 13) of why it is essential that BSPs provide themselves the correct ID and the correct technical linking between the bids.

Example: assuming that a BSP has only one asset which can deliver only 60 MW in the upward direction until maximum power is reached. This BSP, submits bids A, B, C for QH 0 and bids F and C for QH+1. In QH 0 there is a TSO's upward demand of 40 MW. Hence, bids A and B are activated in the CMOL for QH 0 as they are the cheapest bids. In QH+1 there is a new TSO's upward demand of 40 MW. Bid F in QH+1 is actually formed by bid A and B in volume (i.e. F=A+B) but if the BSP doesn't provide the correct linking to the AOF (i.e. doesn't specify that bid F= bid A+ bid B), there could be a risk of unfeasible activation.

CMOL QH 0			
BID CODE	Power	BSP	Price
A	20 MW	BSP 1	10 €/MWh
B	20 MW	BPS 1	15 €/MWh
C	20 MW	BSP 1	60 €/MWh

CMOL QH+1			
BID CODE	Power	BSP	Price
F	40 MW	BSP 1	12 €/MWh
C	20 MW	BSP 1	60 €/MWh

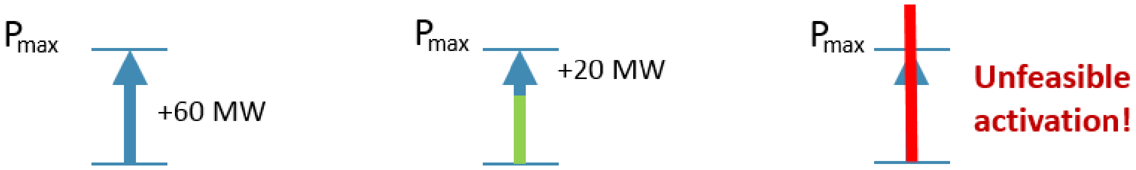

Figure 13: Example of how incorrect links can lead to unfeasible activations

2.6.3. Economical linking

Economical linking of bids is an important feature, allowing BSPs to offer more flexibility, maximize the opportunity to be activated, and by fitting with the TSOs' demands, reduce costs of balancing, and contribute to an efficient and competitive balancing market. Moreover, economical linking will help to maximize the liquidity of the mFRR Platform.

Nevertheless, economical linking over quarter-hours (linking forward in time) will not be allowed since the mFRR Activation Optimization Function does not perform optimized activations over more than one quarter-hour (Figure 14). This means that if a bid is selected in a quarter-hour, no link will guarantee that another bid in a subsequent quarter-hour will be activated as well. In fact, bids submitted for a quarter-hour, will be activated by the AOF only if economically efficient.

The following economical linking will be allowed in the mFRR Platform within the quarter-hour (Figure 14):

- **Parent-child linking**: a given bid (the child) can only be activated if another specific bid (the parent) is activated as well, not vice-versa. In other words, the acceptance of a subsequent bid can be made dependent on the acceptance of the preceding bid. Parent-child linking could reflect the start-up costs and power limits of their BSP's units more correctly.

  Example: bid 2 (child) can only be accepted if upward bid 1 (parent) is also accepted; i.e. the bid 2 (child) is linked to bid 1 (parent) and not vice-versa. Referring for example to start-up costs, this can be explained as follows: the price of bid 1 is 70 €/MWh and includes a starting cost of 1000 € while the price of bid 2 is only 50 €/MWh. There is no starting cost in bid 2 but only energy related costs. However, the use of this bid 2 is conditional to the preceding activation of bid 1;

- **Exclusive group orders**: only one bid can be accepted from a list of mutually exclusive bids. Example: only one of the following bids can be accepted (they can differ in size and price) A1, A2, A3…An.

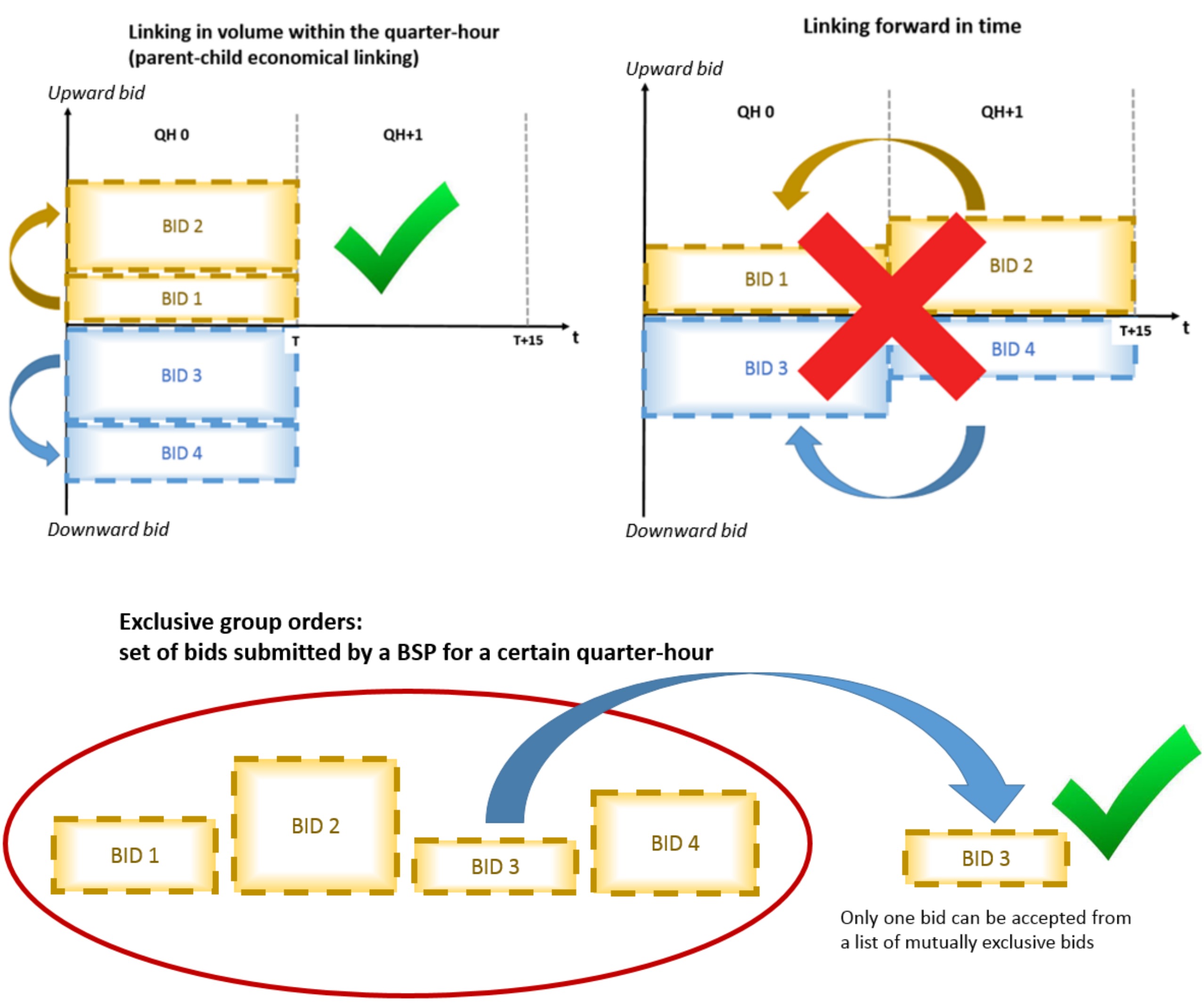

Figure 14: Graphic Representation of the type of economical linking that are allowed and not allowed

However, the above types of economical linking could generate complexity for the activation optimization function. Thus, all the above listed features will be implemented only if the impact they have on the time needed by the algorithm and the added value they generate (flexibility, lower costs, etc.) is acceptable.

It is interesting to note that the BSP GCTs do not allow BSPs to update themselves with the price and volume of a bid submitted for subsequent quarter-hours if a bid was activated in the previous quarter-hour (Figure 15). This could penalize some BSPs offering a bid with start-up cost in a quarter-hour, because they cannot update the price and volume of that bid in the subsequent quarter-hours if the first bid was activated.

Example:

- Bid 1 contains start-up cost (e.g. 70 €/MWh and includes a starting cost of 1000 €) and is placed by a BSP for QH-1, QH 0 and QH+1;
- This bid is activated (scheduled or direct), in the CMOL of QH-1 (between T-25 and T-10);
- Since the BSP GCT for QH 0 is at T-25, the BSP cannot update the price and volume of bid 1 for QH 0 (i.e. reduce the price of bid 1 for QH 0 - since start-up costs have been already covered by the activation in QH-1 - and possibly change volume);
- The same situation could occur even for QH+1. In fact, if bid 1 is direct activated for QH-1 just before T-10, the BSP will receive the activation signal just after the BSP GCT for QH+1 at T-10 (due to communication and computational time).

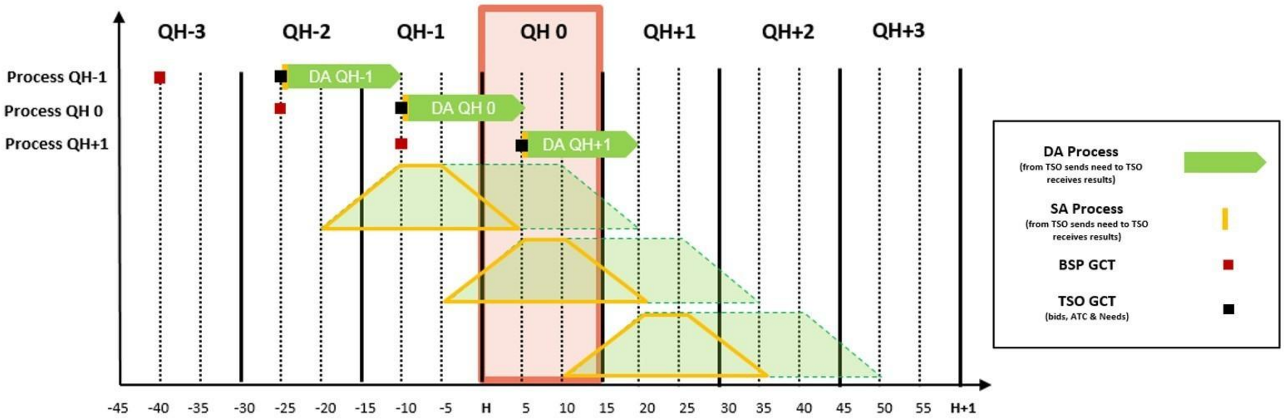

Figure 15: BSP GCT and activation process

The TSOs are investigating whether the introduction of an economical linking in time for start-up purposes (Conditional Bids - economical linking backward in time) is feasible and easily implementable in the algorithm. This feature will allow an automatic update of the bids submitted by a BSP in a subsequent quarter-hour, if a bid with start-up costs submitted in a preceding quarter-hour has already been activated.

If this feature is implemented, BSPs will need to provide conditional links between the bid with start-up costs submitted in a quarter-hour and the bids submitted in following quarter-hours (e.g. if bid 1 is activated in QH 0, then consider bid 2 in the next quarter-hour (Figure 16).

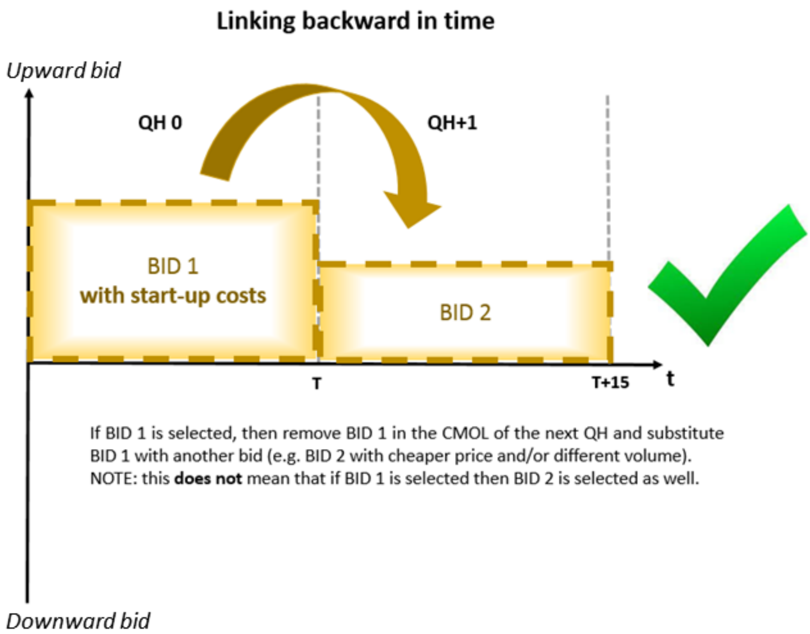

Figure 16: Linking backward in time - bids with start-up costs

Below are listed some rules for economical linking backward in time (only for start-up costs reasons):

- if bid 1 (e.g. 70 €/MWh and includes a starting cost of 1000 €) is activated in the **scheduled auction** of QH-1 (at T-25), the linked bid is available in the scheduled auction of QH 0 but at a lower price (e.g. 50€/MWh);
- if bid 1 (e.g. 70 €/MWh and includes a starting cost of 1000 €) is activated in a **direct auction** of QH-1 (between T-24 and T-10) the linked bid is available in the scheduled auction of QH+1 but at a lower price (e.g. 50€/MWh).

This feature will reduce balancing costs and increase liquidity as BSPs will be more able to accurately reflect their actual costs in their bid prices. Moreover, the issue of start-up costs and not paying them more than once in several consecutive quarter-hours, can be tackled. A logic could be implemented to automatically adapt the bid price and/or volume of the same bid for the next consecutive quarter-hour based on information given by the BSP when the bids were submitted. This means for example that the price of a bid for consecutive activations after the first activation could be lower by the amount of the start-up cost. Consequently, it would increase the probability of the bid being selected again in the following activation period.

Linking of bids between different European Platforms (e.g. PICASSO and TERRE projects) is a particular challenge that is investigated and will not be facilitated at a first stage at the platforms. Nevertheless, there might be specific local arrangements that may facilitate this (see aFRR IF explanatory document).

2.6.4. Divisibility of Bids

It is foreseen to allow indivisible bids as most of the TSOs are allowing indivisible bids today and this is considered to have a positive impact on the volume of bids offered to the platform. An important consideration has been whether a maximum bid size for indivisible bids should be applied and if yes at which level.

The option of having no maximum bid size was chosen for the design of the mFRR platform in order to ensure that the maximum range of providers and technology types can participate. At the same time the TSOs foresee not allowing unforeseeably rejected divisible bids, which is incentivizing the BSPs to bid indivisible in small amount in order to decrease the chance to be rejected.

3. Activation Optimization Function

The Activation Optimization Function (AOF) that will be used in the mFRR Platform is based on the maximization of the social welfare (Articles 2, 3 and 10 of the proposal for mFRRIF), and the minimization of manual frequency restoration power exchange on borders (Article 10 of the mFRRIF) which is effective in case the maximization of the social welfare provides multiple optimal solutions. Usage of the term social welfare throughout this Explanatory Document should be considered in the context of the definition given to this term in article 2.2(l) of the mFRRIF.

A scheme of the optimization model is presented in Figure 17. As illustrated in this figure, the optimization model uses as input the common merit order lists (CMOL) with the balancing energy bids submitted by the BSPs, the balancing energy demands submitted by the TSOs, as well as network information, i.e. cross-zonal capacities (CZC) or HVDC constraints. The AOF creates a cost curve consisting of the TSO balancing energy demands and the CMOLs of all bids, and based on this curve as well as on all defined constraints, it provides the optimal social welfare, the satisfied demands, the accepted bids, the XB marginal prices and the XB commercial schedules.

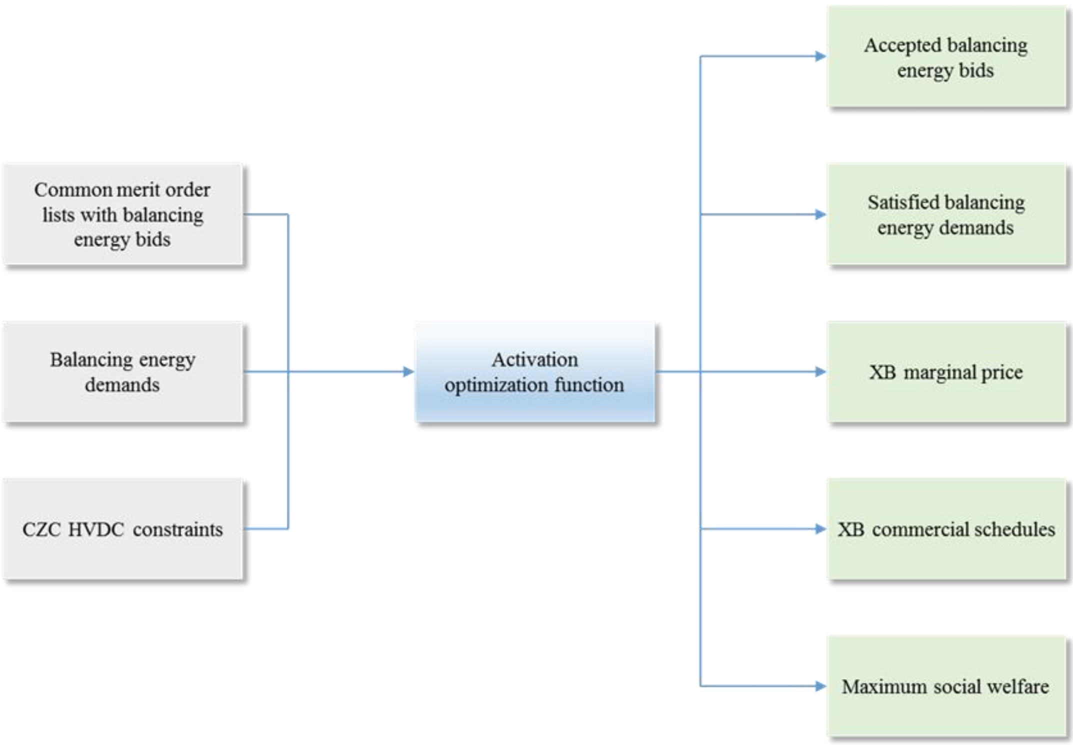

Figure 17: Scheme of the Activation Optimization Function

3.1. Inputs for the Merit Order List and Optimal Outputs

The following subchapter presents the structure of the CMOLs which are received as inputs by the AOF. **Regarding the sign convention used, we note that:**

- For positive needs (short TSOs), a positive price indicates that a TSO is willing to pay (maximum) this price in order for its demand to be satisfied. On the other hand, a negative price indicates that the TSO is willing to be paid (at least) the submitted price in order for its needs to be satisfied.
- For negative needs (long TSOs), a positive price indicates that the TSO is willing to be paid (at least) the submitted price in order for its needs to be satisfied. On the other hand, a negative price indicates that the TSO is willing to pay (maximum) the submitted price in order for its demand to be satisfied.

- For upward bids, a positive price indicates that the BSP wants to be paid (at least) the submitted price in order to be activated. On the other hand, a negative price indicates that the BSP is willing to pay (maximum) the submitted price in order to be activated.
- For downward bids, a positive price indicates that the BSP is willing to pay (maximum) the submitted price in order to be activated. On the other hand, a negative price indicates that the BSP wants to be paid (at least) the submitted price in order to be activated.

3.1.1. Details on elastic and inelastic TSO needs

The submission of TSO mFRR needs to the mFRR Platform happens 10 minutes before the beginning of the QH at the latest. Therefore, some TSOs and particularly those with a proactive balancing philosophy base their balancing process on forecasts that provide better vision on the upcoming minutes or even hours, i.e. on their expectation of the system situation and their ability to be able to balance their system at minimum costs. Using these forecasts, TSOs can elaborate different action plans depending on the expectation of the imbalance on their LFC area, and also the different solutions available. Other TSOs, particularly those with a reactive balancing philosophy, do not make imbalance forecasts.

If no other solution is available within their decision perimeter, or if the realisation of imbalance is certain (such as in the case of outages), then this is the typical case for an inelastic demand: a TSO has to pay that service, i.e. the activation of mFRR balancing energy at any price.

But if other solutions are available, or if there is uncertainty of the forecasted imbalance, a TSO may face a trade-off decision: a TSO that anticipates an forecasted imbalance will not be ready to pay any price for mFRR activation if BSPs are ready to provide the service at a lower price (for instance in case of specific products available locally). In a similar manner if the TSO is uncertain about the expected imbalance and there are other solutions in subsequent processes closer to real time, it will not be ready to pay any price, as they will then not balance the system at lowest cost. From an economic point of view, this simply means that some TSOs can have a limit on the price they are willing to pay to satisfy the proactively activated mFRR demand.

These situations have been taken into account through the concept of elastic needs for the scheduled activations. Any TSO can submit an elastic demand that reflects the price they are ready to pay on the platform, regarding the cost of the available alternative solutions and its expectation of the demand and therefore its risk exposure on the demand uncertainty. The elastic demand concept is expected to increase the mFRR needs volume submitted by TSOs to be satisfied through the mFRR Platform, since it will allow TSOs to better consider the uncertainty of the imbalance and the alternative solutions within their decision perimeter. We note that for direct activation, only inelastic needs are allowed, since direct activation is expected to be used in the case of outages, i.e. when the imbalances are certain and balancing energy is needed as soon as possible. There is no uncertainty of a direct demand.

3.1.2. CMOL

EBGL Article 37 paragraph 2 sets the requirements for the common merit order list:

> *Common merit order lists shall consist of balancing energy bids from standard products. All TSOs shall establish the necessary common merit order lists for the standard products. Upward and downward balancing energy bids shall be separated in different common merit order lists.*

This provision is reflected in the mFRRIF Article 9 [CMOL], which explains how the CMOL will be formed. In the mFRR Platform there will be two CMOL created for the scheduled activation and two for each direct activation:

- For the schedule activation:
    - all the available upward bids create the first CMOL (a)
    - all the available downward bids create the second CMOL (b)

- For the direct activation:
  - all the available direct upward bids create the first CMOL (c)
  - all the available downward bids create the second CMOL (d)

As a result, each CMOL- curve consists of the mFRR balancing energy bids. The input to the optimization algorithm for the schedule activation is the respective CMOL merged with the TSO balancing energy demands. The upward CMOL is merged with the downward needs, and the downward CMOL with the upward needs. An example of such an input is illustrated in Figure 18 and is based on the bids and needs for schedule activation provided in Table 2.

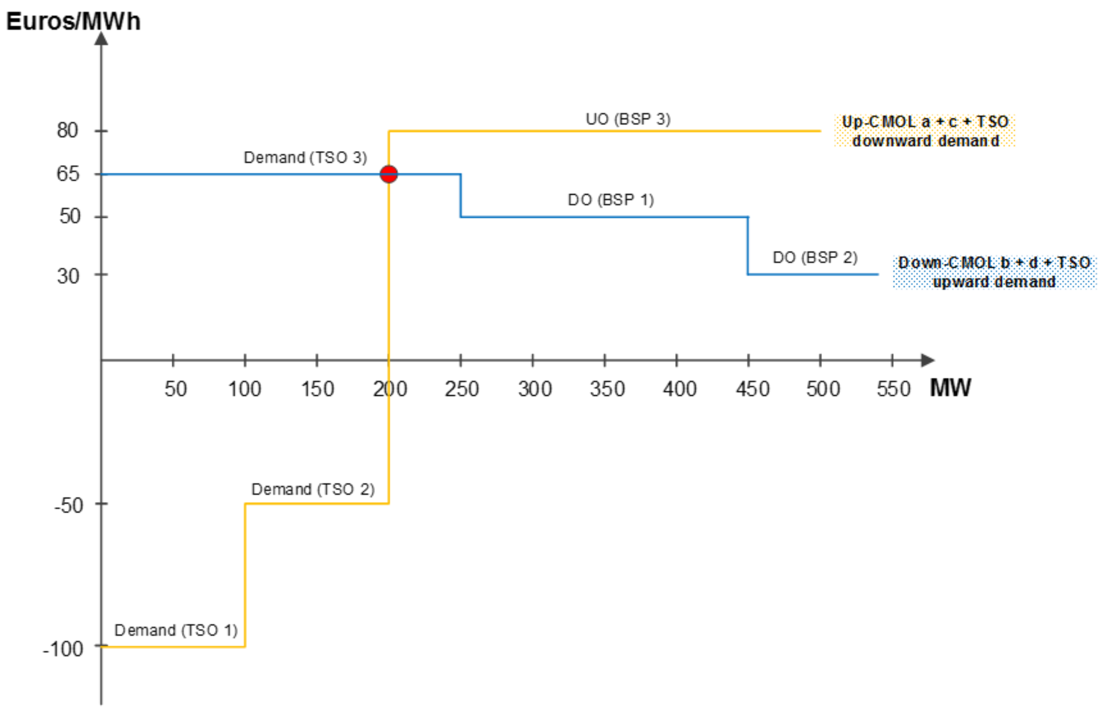

Figure 18: CMOLs merged with balancing energy demands

Type	Volume (MWh)	TSO demand price/Bid price (€/MWh)	Elasticity of Demand
Demand (TSO 1)	-100	-100	Elastic
Demand (TSO 2)	-100	-50	Elastic
Demand (TSO 3)	250	65	Elastic
Downward bid (DB BSP1)	200	50	--
Downward bid (DB BSP2)	100	30	--
Upward bid (UB BSP3)	300	80	--

Table 2: Inputs of the example

For the direct activation, as a first come first serve approach is followed, the AOF runs with the submitted balancing energy demand and the CMOL with the balancing energy bids of the same direction with the demand. Therefore, when the AOF runs to satisfy upward demand, the input to the AOF is the upward CMOL and the upward demand to be satisfied. On the other hand, when the AOF runs to satisfy downward demand, the input to the AOF is the downward CMOL and the downward demand to be satisfied.

3.1.3. Other Inputs

The balancing energy demands are also inputs to the AOF and are described in detail in Chapter 2.3. Other inputs of the AOF include CZC limits, and HVDC loss factors.

3.2. Optimal Outputs

The optimal clearing algorithm outputs are as follows:

- Accepted bids per each area [MW]
- Satisfied demand per each LFC area or bidding zone [MW]
- XB Marginal Prices per the smallest of an LFC Area or bidding zone bidding zone [€/MWh];
- Optimal Social Welfare [€];
- Used CZC, including flows at each border between LFC areas or bidding zones.

Note that this is the high-level description of the inputs and outputs of the AOF. The TSOs will follow the transparency and publishing obligations of European and national regulations.

3.3. Criteria of the Clearing Algorithm

In this section, we elaborate on the criteria which will be considered in the AOF, i.e. the objective function which will be optimized and the constraints which will be respected. We assume that the optimization of scheduled bids and demands will be carried out within a single auction, and there will be only one independent auction per 15-minute period.

3.3.1. Objective Function: Maximizing Social Welfare

The objective of the AOF is to maximize the social welfare. In the context of the AOF, the social welfare is the total surplus of all TSOs participating in the mFRR Platform obtained from satisfying their mFRR demands and the total surplus of BSPs resulting from the activation of their associated mFRR bids, as illustrated in Figure 19. The curve consisting of positive TSO mFRR demands and downward BSP mFRR bids constitutes the consumer curve (based on economic theory), and therefore indicates what price consumers (TSOs and BSPs) are prepared to pay for consuming mFRR balancing energy, based on their expectations of private costs and benefits. On the other hand, the curve consisting of negative TSO mFRR demands and upward BSP mFRR bids constitutes the producer curve (based on economic theory), and therefore shows the price they are prepared to receive for supplying mFRR balancing energy. Social welfare, also known as economic welfare, is the total benefit available to society from an economic transaction, and therefore is made up of the red area in Figure 19 which is the sum of the consumer and the producer surplus.

For inelastic demand, the social welfare cannot be determined (in theory infinite value), as the demand must be satisfied at any cost. For implementation purposes, a price will always be assigned, but for inelastic demands, this price will be higher than any mFRR offer and will represent the technical limit of the mFRR Platform AOF.

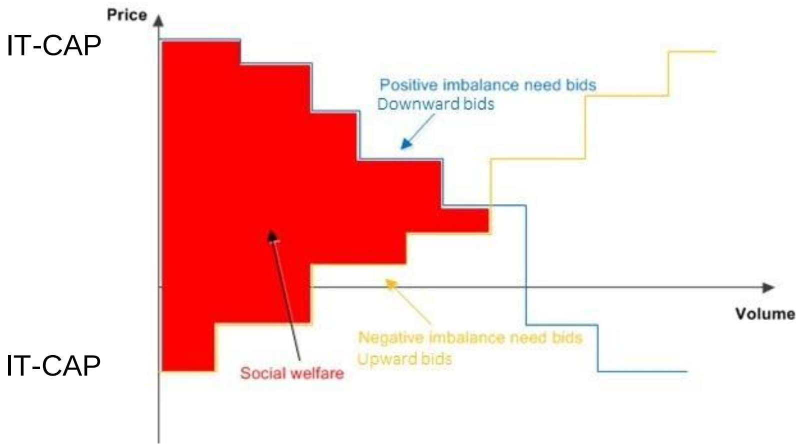

Figure 19: Social Welfare

The following example illustrates how the AOF maximizes the social welfare of a region consisting of two TSOs. The inputs of the example are presented in Table 3 and the outputs of the example are presented in Table 4.

Type	Volume (MWh)	TSO demand price/Bid price (€/MWh)	Divisibility of Bids
Positive demand (TSO 1)	+100	1000	--
Positive demand (TSO 2)	+100	1000	--
Upward bid (UB BSP1)	100	10	Divisible
Upward bid (UB BSP2)	100	20	Indivisible
Upward bid (UB BSP3)	200	5	Indivisible

Table 3: Inputs for Example - Activation of Bids with the Aim of Maximization of Social Welfare

Type	Activated volume/Satisfied demand (MWh)
Positive demand (TSO 1)	+100
Positive demand (TSO 2)	+100
Upward bid (UB BSP1)	0
Upward bid (UB BSP2)	0
Upward bid (UB BSP3)	200
Social Welfare (€)	Marginal Price (€/MWh)
100·1000 - 100·5 + 100·1000 - 100·5 + 200·5 - 200·5 = 199'000	5

Table 4: Output for Example

3.3.1. Schedule counteractivations

With the term scheduled counteractivations, we refer to the simultaneous activation of an upward and a downward bid by the AOF in order to satisfy the inelastic demand as much as possible and thus also increase social welfare. Due to the fact there may be some downward bids with higher prices than some upward bids, i.e. if some BSPs would be willing to pay higher prices to reduce their production than the prices that some other BSPs would be willing to receive to increase their production, schedule counteractivations could occur. Figure 20 presents two common merit order lists, i.e. if a downward bid had a higher price than an upward bid then these two bids would be simultaneously activated, as this would result in a higher social welfare.

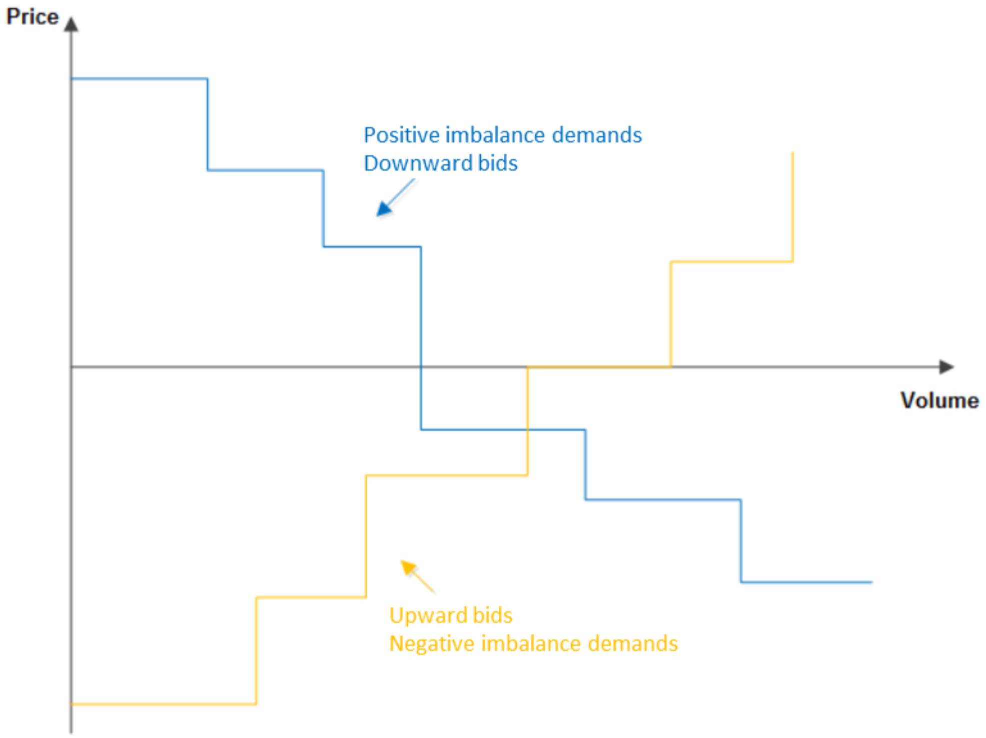

Figure 20: Interaction between two CMOLs – Downward & Upward bids

Here we note that allowing counteractivations will result in higher social welfare and simplify the complexity of the algorithm as no additional constraints are added in the optimization algorithm, which will result in lower computation time. Further it will increase the opportunity of BSPs to be activated and gives non-distorted price signals that will promote price convergence.

Further, the occurrence of a downward mFRR bid with a higher price than an upward mFRR bid is expected to be observed when the energy prices in the smallest LFC area or bidding zone of the downward mFRR bid is higher than the energy prices in the bidding zone or LFC area of the upward mFRR bid. Therefore, in order for having such price differences, we expect that the cross zonal capacity will already mostly have been used from the previous timeframes and therefore the probability of schedule counteractivations to occur is low and is expected to become even lower given the price convergence signal within a marginal pricing scheme and particular when allowing counteractivations.

Moreover, it have to be noted that schedule counteractivations can also be helpful in two further cases. The first one is to activate more cost-efficient indivisible bids, and the second case is to increase the satisfaction of demand by allowing activation of indivisible bid. This would be the case when only a part of the indivisible bid would be needed for the satisfaction of demand, and in the absence of counteractivations, because it would be skipped and a less cost-efficient would have to be activated in the first case, or in the second case the demand could remain unsatisfied. An example is shown in the figure below:

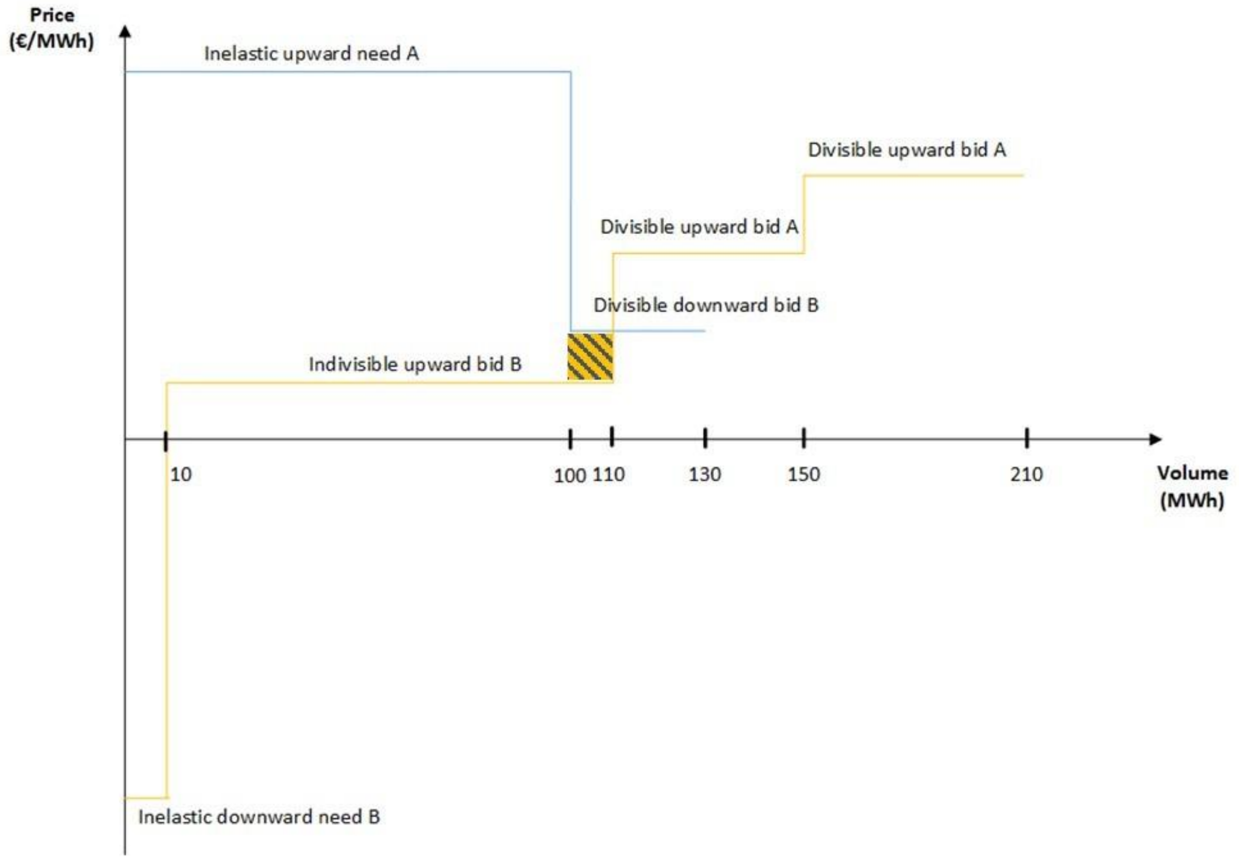

Figure 21: Interaction between two CMOLs – Downward & Upward bids

Due to schedule counteractivation, the indivisible upward bid B is selected together with a small part of the divisible downward bid B. In the absence of schedule counteractivations the indivisible upward bid B would be skipped and the two divisible upward bids A would have been activated instead resulting in a much higher price.

3.3.2. Constraints of the optimization algorithm

The power balance equation is a constraint that is formulated for each LFC area or bidding zone. The constraint ensures that the cross border mFRR exchanges (mFRR induced flows on the respective border), the mFRR balancing energy bid activated within the LFC area or bidding zone and the satisfied mFRR demand are summed up to zero.

The sum of all manual frequency restoration power interchanges is equal to zero means that in each time the algorithm is used, the resulted mFRR balancing energy exchanges are such that they sum up to zero.

The manual frequency restoration power exchange on a border shall not exceed the available cross-zonal capacity.

Losses in the HVDC lines

In the following example, the losses on the HVDC link are characterized by a percentage (4 %) of the circulating flow inside the interconnector. This percentage entirely determines the line's losses, and should be applied in both directions, whether A or B is the exporting area. Thus, when A wants to export 1000 MWh, only 960 MWh actually reaches market area B.

Figure 22: Example of Power Flow Losses on an HVDC Link

To take into account these physical losses, the algorithm should provide two specific features: some specific power flow constraints, and a specific output price computation. These two features are directly inspired by what has been done in the Euphemia algorithm for the Day-Ahead market coupling. They should also be completed with an appropriate settlement process regarding the congestion rent management, as in the example of the Euphemia algorithm.

4. Congestion Management

TSOs have a responsibility to make sure that bids that are activated in the mFRR Platform will not endanger the system's security. The TSOs shall design a mFRR process and a platform which guarantee that the system constraints are fully respected.

This chapter tackles the issues and questions concerning congestion management, building on the provisions of the EBGL on CZC calculation (Art. 37), i.e.:

1. *After the intraday-cross-zonal gate closure time, TSOs shall continuously update the availability of cross-zonal capacity for the exchange of balancing energy or for operating the imbalance netting process. Cross-zonal capacity shall be updated every time a portion of cross-zonal capacity has been used or when cross-zonal capacity has been recalculated.*
2. *Before the implementation of the capacity calculation methodology pursuant to paragraph 3, TSOs shall use the cross-zonal capacity remaining after the intraday cross-zonal gate closure time.*
3. *Five years after entry into force of this Regulation, all TSOs of a capacity calculation region shall develop a methodology for cross-zonal capacity calculation within the balancing timeframe for the exchange of balancing energy or for operating the imbalance netting process. Such methodology shall avoid market distortions and shall be consistent with the cross-zonal capacity calculation methodology applied in the intraday timeframe established under Commission Regulation (EU) 2015/1222.*

Since the methodology for CZC calculation within the balancing timeframe for the exchange of balancing energy or for operating the imbalance netting process will be available by 2022 at the earliest, the available CZC to be considered in the mFRR Platform is the capacity remaining after the intraday cross zonal GCT.

4.1. Proposed options to be used in the mFRR Platform[3]

To keep the transmission system within agreed security limits in the operational phase the TSOs have an opportunity to request additional limitations after the Intraday market.

The measure creates an opportunity for a TSO to update CZC in case new information regarding CZC is available. This measure is common practice and currently used before intraday, RR process and in the IGCC cooperation. Each TSO updates CZC and submits them to the platform before the TSO CZC gate closure time.

This approach is required due to the inherent imperfections of the capacity calculation leading to the ATC used by the platform. The TSOs acknowledge the impact such limitations have on the market outcome, and commit to transparently publish these requests.

Local congestion will be dealt with at local level, for instance with bid filtering according to Article 29(14) of EBGL.

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[3] The option Critical Network Element is seen as a measure for the future after introduction of a flow based model at Intraday. This was supported by several stakeholders in the consultation where they stated that Critical Network Elements should not be introduced in the balancing market before it is introduced in all Day-Ahead and Intraday markets.

This option is aligned with the goal of wholesale market Day-Ahead and Intraday.

Critical Network Elements is the target process, however an adequate methodology at a CCR level will most likely not be established before the go-live of the mFRR Platform and therefore it should currently be regarded as a future improvement.

5. Harmonization

Fragmented balancing market arrangements across Member States can distort the integration of European balancing markets. Therefore, the EBGL prescribes the implementation of a coherent set of terms and conditions related to balancing in each Member State. Article 15(1) of the Implementation Framework reiterates this national responsibility, and the need to respect the European framework to safeguard consistency in market arrangements.

Going forward, and concurrent with the development of the balancing platforms, it is essential that all TSOs involved harmonise the market design elements that are key to creating a level playing field for balancing market participants. For mFRR, this includes the balancing energy gate closure time, settlement price of balancing energy and the full activation time, which will be harmonised by the implementation date of the mFRR platform.

Further harmonisation of terms and conditions for balancing service providers, balancing the responsible parties and the methodologies of TSOs can contribute to further improving the level-playing field. Therefore, the TSOs involved in the mFRR-Platform will continuously consider harmonisation of such terms and conditions in coordination with the development of other European balancing platforms. On this basis, and at defined terms during the implementation phase and the operational phase of the mFRR platform, all TSOs will review their national terms and conditions related to balancing with the aim of harmonisation.

The first harmonisation proposal shall be submitted to NRAs no later than 12 months after the mFRR-Platform becomes operational for all TSOs. The next proposal shall be submitted not later than three years after the previous proposal.

6. List of Abbreviations

aFRR	Automatic Frequency Restoration Reserves
AOF	Activation Optimization Function
ATC	Available Transmission Capacity
BRP	Balance Responsible Party
BSP	Balancing Service Provider
CCR	Capacity Calculation Region
CMOL	Common Merit Order List
CZC	Cross-Zonal Capacity
DA	Direct Activation, directly activated, directly activatable
DB	Downward bid
EBGL	Guideline on electricity balancing
GCT	Gate Closure Time
HVDC	High Voltage Direct Current
IGCC	International Grid Control Cooperation
LFC	Load-Frequency Control(ler)
MARI	Manually Activated Reserves Initiative
mFRR	Manual Frequency Restoration Reserves
MOL	Merit Order List
NRAs	National Regulatory Authorities
QH	Quarter Hour
RR	Replacement Reserves
SA	Scheduled Activation, scheduled activated, scheduled activatable
SCADA	Supervisory Control and Data Acquisition
TERRE	Trans-European Replacement Reserves Exchange

TSO	Transmission System Operator
UB	Upward bid
XB	Cross-Border
XBMP	Cross-Border Marginal Pricing

Annex I: Settlement

In the course of the past conceptual design phases for a common mFRR platform, the issues of settlement between TSOs have been dealt with by the MARI initiative alongside the main deliverables required for the all TSOs' proposal for the European mFRR platform according to EBGL Art. 20. Although Settlement is not an integral part of the corresponding Implementation Framework of this Explanatory Document, but will be addressed in separate Implementation Frameworks in accordance with the respective Articles of the EBGL, i.e. Art. 30 (Pricing), Art. 50 (Settlement), Art. 29 (3) (Activation Purpose), this chapter is intended to provide a brief overview on which Settlement issues have been dealt with so far and to what degree they have been developed towards a common agreement or proposal.

TSO-TSO Settlement model

It is proposed to use cross-border marginal price (XBMP) between TSOs in the mFRR Platform according to the following definition: *"The cross border marginal price is the price of the last bid of the mFRR standard product which has been activated to cover the energy demand for balancing purposes within an uncongested area".*

On the issue of how to share congestion rents which occur due to price differences between congested areas, several sharing options have been identified. The majority of MARI members expressed their preference for sharing methodologies currently applied in congestion income distribution used in the Day-a-head timeframe.

Volumes and Pricing

Volumes

As far as TSO-TSO settlement is concerned, the majority of TSOs and Stakeholders prefers to settle blocks, i.e. to minimize quarter hours and thus complexity for settlement. A related topic which has been taken up by the implementation project MARI, although EBGL does not explicitly require a proposal, concerns the interrelationship with TSO-BRP settlement, in terms of imbalance adjustment volumes, and what could be harmonized in this regard. The current approach is to align incentives that should be given to BRPs, without limiting or dictating the options on how to provide these incentives.

Pricing

Several pricing options have been elaborated and assessed based on an agreed set of weighted criteria. A shortlist of options has been made which corresponds to the options which are preferred by stakeholders according to feedback received in the course of the first consultation. One of the most decisive questions remaining is whether to apply separate prices (i.e. the clearing price for SA can be higher or lower as the highest activated DA bid price) or to make prices for scheduled activations (SA) and prices of direct activations (DA) dependent on each other (e.g. apply the same price for both, set by the most expensive activated SA- and DA-bid). The latter option would not be possible in the case of elastic demands.

Counter Activations

Due to the nature of direct activations the activation of bids of opposite direction for the same quarter hour is possible in subsequent algorithm runs (i.e. direct activation which is opposed to a scheduled activation or another direct activation). Two options for the pricing of such "counter-direct activations" have been identified. Option1: Separate prices for up- and downward activations (restricted by preceding prices of activations from the same QH-MOL(cap/floor)). Option 2: One marginal price determined at the end of the QH. The decision as to which of these options will be proposed depends on whether netting will be applied for DA and how netted volumes will be settled.

Price Indeterminacy

Price indeterminacy is a special situation where identical bid and demand selection leads to multiple optimal clearing price solutions. In this situation all solutions have an identical social welfare. It can occur either due to the presence of elastic demands or due to scheduled counter-activations. Several options for a settlement rule which leads to a single price between the set of optimal prices have been identified. A decision has not yet been taken, however, there is a preference towards taking the mid-point between the lowest and the highest price, as this would be consistent with the current practice in other markets (Day–Ahead, Intraday, TERRE).

Settlement of netted volumes

Since opposing demands of upward and downward mFRR will be netted in in the mFRR Platform, the question of how to settle these volumes needs to be answered. The current working assumption suggests applying the XBMP provided by the algorithm, however, the alternative option of applying opportunity options has been discussed. The latter is particularly considered as an option for the case of perfect netting of inelastic demands (i.e. no activation).