REPORT

Study on potential evolutions of the BRP Perimeter adjustments in case of the activation of mFRR or redispatch energy bids

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Content

Executive summary

Context

In case Elia activates an mFRR or redispatch energy bid, and Elia hence explicitly requests a change of the offtake/injection of certain assets, **Elia also adjusts the Balancing Perimeter of the BRP**. Currently, Elia adjusts the Balancing Perimeter of the BRP **during the quarter hour(s) of the activation with the energy volume requested (i.e., the so-called block approach)**.

In the context of different evolutions, questions are raised regarding the BRP perimeter adjustments currently applied. **First**, there is the **question of how to ensure that the perimeter adjustments (and the imbalance price) do not result in financial incentives for not (fully) delivering the requested energy**. Indeed, in case an adjustment with the requested energy volume is applied, the exposure to the imbalance price could in a certain moment provide an incentive to not change the injection/offtake in the direction requested by the activation (e.g., when the imbalance price is low when an upward activation is requested or when the imbalance price would be high when a downward activation is requested).

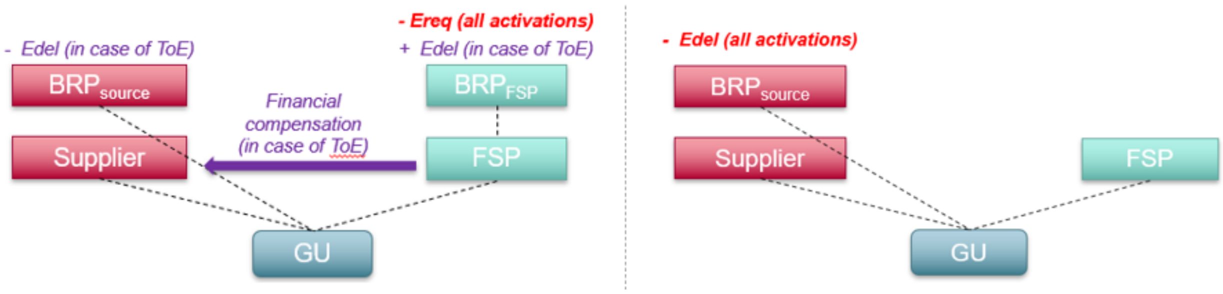
Second, it is foreseen that in the future, **different parties will be able to take up the roles of SA (and/or BSP) on the one hand, and BRP_{source} on the other hand**. In absence of a framework/model for splitting the roles, this would imply that an activation of a delivery point by the SA (or BSP) could have an impact on the Balancing Perimeter of the BRP_{source} (i.e., the BRP responsible of the offtakes/injections at the activated delivery point). To neutralize the impact on the Balancing Perimeter of the BRP_{source}, the original iCAROS design notes presented in 2017 foresaw an evolution towards adjusting the perimeter of the BRP_{source} with the actually delivered volume of energy (instead of a correction with the requested energy volume). However, there are important open questions related to the originally proposed design that carefully need to be addressed. These questions among others relate to the balance responsibility and cost recovery related to imbalances caused in case of over- or underdelivery of the requested service.

Third, the **activation profiles for the activation of mFRR and Redispatch energy bids will be adapted and are formalized** in the context of the MARI project and also adopted for iCAROS (redispatching). In that context, there is a **question of whether or not the block approach for the perimeter adjustments that is currently applied would need to be adapted** (and if yes, in which way).

Objectives and scope

Considering the different contextual elements described above, **the objective of this study is to determine the most suitable design for the adjustments of the Balancing Perimeter of the BRP in case of activations of mFRR or redispatch energy bids**.

To this end, **different possibilities for the BRP perimeter adjustments** have been considered and described. Specifically, **two fundamentally different options/models** have been considered. In **Option 1**, the perimeter of the BRP taking up the role of the BRP_{FSP} is **adjusted with the requested energy volume** (as is the case today) while in **Option 2**, there is no BRP_{FSP} role and the perimeter of the BRP_{source} is **adjusted with the effectively delivered volume**.



Schematic overview of the two main options for the BRP perimeter adjustments in case of activation of mFRR and Redispatch energy bids: Option 1 (adjustment with the requested energy volume; left-hand side) or Option 2 (adjustment with the delivered energy volume; right-hand side)

For each of these two options, different variants have been analyzed depending on the link made between the assumed activation profile and the perimeter adjustments (e.g., block approach for the perimeter adjustments or alternative adjustments resembling more closely the assumed activation profile).

The **benefits and drawbacks of the two main options for the perimeter adjustments** are first analyzed (Sections 3 to 5). **Subsequently, the different variants of these options are analyzed** in depth (Section 6). In the overall analysis, **specific attention is given to**:

- The **impact on the financial incentives for correct delivery of the activated bids**;
- The **impact** of the approach for the perimeter adjustment **on the allocation of the balance responsibility** (in case of imbalances resulting from under or overdelivery of the activated bids) and the implications for the recovery of the balancing costs;
- The **possibilities to enable different parties to take up the role of BRP_{source}/Supplier and SA/BSP (and $BRP_{BSP/SA}$)**.

Conclusions on the possibilities and needs for evolutions of the BRP Perimeter adjustments in case of the activation of mFRR or redispatch energy bids

A first main conclusion of the study is that **incentives for not delivering the requested energy can be avoided by applying well-dimensioned penalties** for underdelivery, and this **for all considered options for the perimeter adjustments** (the penalty scheme for underdelivery would however need to be different for the two options of perimeter adjustments considered).

A second main conclusion is that a model based on adjusting the perimeter of the BRP_{FSP} based on the requested energy volume[1] (Option 1) has significant benefits compared to a model in which there is no BRP_{FSP} role and in which the BRP_{source} is by default adjusted with the effectively delivered energy volume (Option 2), namely:

- In Option 1 (adjustment of the perimeter with the requested volume), the BRP_{FSP} takes up the balance responsibility for all imbalances introduced by under- or overdelivery of the requested energy, and therefore balancing costs related to the introduced imbalances are recovered via this BRP. In contrast, in Option 2 (adjustment with the delivered energy volume), no BRP would be responsible for the imbalances introduced in case less energy is delivered compared to what has been requested. This introduces a risk for socialization of balancing costs (as balancing costs would need to be recovered in another way).
- Option 2 has drawbacks related to enabling a split of roles. Notably, in Option 2, the BRP_{source} (and Supplier) would be financially impacted in case the FSP delivers more than the requested volume and valorization of flexibility that is available on top of the requested volume would only be possible via the party taking up the role of BRP_{source}, potentially making it more complex to valorize all available flexibility. These drawbacks are not present in Option 1.
- The complexity of implementing of Option 2 is significantly higher and the transition to such a model would require significant changes to the current processes.
- Option 2 does not seem compliant with the requirements stipulated in the Clean Energy package, which requires any market party to be responsible for the imbalances they introduce and to that end requires any market party to either be a BRP or appoint a BRP to take up this balance responsibility.

[1] Where applicable complemented by additional perimeter adjustments that would be performed if a correction model (such as Transfer of Energy) is applicable in case different parties would take up the roles of FSP/BRP_{FSP} on the one hand and BRP_{source}/Supplier on the other hand.

A third key conclusion is that there is no (strong) motivation for adapting the block approach for the perimeter adjustments applied in case of the activation of mFRR or Redispatch energy bids. The main attention point related to the block approach is that it would introduce small imbalances in the perimeter of the BRP_{FSP} in case the activation profile adopted in the context of MARI would be exactly followed by the FSP (at least on a quarter-hourly basis). Such imbalances could potentially introduce costs for the BRP_{FSP} that could in turn impact the pricing of energy bids (as the costs of such imbalances could be internalized in the bid). However, this study shows that such potential impacts would be highly limited and cannot be avoided for all technologies/deliver points (i.e., potential imbalances for the BRP_{FSP} can also not be avoided for all technologies/delivery points when applying more complex perimeter adjustments). This because:

- Independent of the profile taken for adjusting the perimeter of the BRP_{FSP}, potential imbalances for the BRP_{FSP} cannot be fully avoided. Indeed, any difference between the profile of the perimeter adjustment and the actual activation profile will result in an imbalance for the BRP_{FSP}. In practice, the different delivery points/technologies that participate to mFRR (or redispatching), while being fully compliant with the activation requirements, present in practice slightly different ramping characteristics (e.g., not all technologies follow exactly the theoretical profile described in the context of MARI). As a consequence, different activation profiles will be observed in practice and hence potential imbalances for the BRP_{FSP} cannot be fully avoided.
- The potential average financial impact on the BRP_{FSP} that would result from imbalances that would be introduced in case the assumed activation profile is exactly followed while the block approach for the perimeter adjustments is applied is considered to be highly limited. This because i) the imbalances that would be introduced represent highly limited energy volumes, ii) the imbalances that would be introduced are in opposite directions and would hence partially cancel out on average; iii) the financial impact on the BRP_{FSP} depends on the correlation between imbalance prices and the moment of mFRR/redispatch activations. This correlation is found to be close to zero for redispatching and uncertain for mFRR after connection to MARI (but rather expected to decrease than to increase).

Aside from the impact of the block approach on the Balancing Perimeter of the BRP_{FSP}:

- The block approach does not impact the financial incentives for delivering the requested energy once a bid has been activated. As such, the right financial incentives are ensured via a combination of the activation control (and applicable penalties) and the exposure to the imbalance price.
- The block approach enables the split of roles of FSP/BRP_{FSP} and BRP_{source}/Supplier without introducing additional complexity.

Proposed target design for the BRP Perimeter adjustments

Based on the above conclusions, **Elia recommends maintaining the current approach for the perimeter adjustments (i.e., the so-called block approach or the Option 1a)**.

1. Introduction

1.1 Context

In general, Balance Responsible Parties (BRPs) are incentivized to balance their Balancing Perimeter on a quarter-hourly basis or to intentionally deviate from a balanced Balancing Perimeter in order to contribute to the overall objective of maintaining the balance of the Belgian control area.[2] The incentives follow from the imbalance settlement process. In the imbalance settlement process, the imbalances of each BRP are settled based on the imbalance price. As such, BRPs receive the incentives provided via the imbalance price and at the same time take financial responsibility for the imbalances in their Balancing Perimeter.

In case Elia activates an mFRR or redispatch energy bid, and Elia hence explicitly requests a change of the offtake/injection of certain assets, **Elia also adjusts the Balancing Perimeter of the BRP**. Currently, the Balancing Perimeter of the BRP is adjusted **with the energy volume requested during the activation**.

In the context of different evolutions, questions are raised regarding the BRP perimeter adjustments currently applied. **First**, there is the **question of how to ensure that the perimeter adjustments (and the imbalance price) do not result in financial incentives for not (fully) delivering the requested energy**. Indeed, for Redispatching, the direction of an activation is dependent on the congestion to be resolved/prevented and independent of the imbalance price. Similarly, for mFRR and after the connection to the European balancing platforms, the direction of an activation is determined by the total imbalance in the uncongested area while the imbalance price could be dependent on the imbalance in the Belgian zone. As a result, the imbalance price could in certain moments provide an incentive to not change the injection/offtake in the direction requested by the activation. To avoid incentives for the incorrect delivery of mFRR and redispatching, Elia has recently proposed to apply financial penalties that are dependent on the imbalance price in the T&C SA/ T&C BSP mFRR. As such, any potential incentive for underdelivery provided to the BRP in the form of the exposure to the imbalance price would be compensated by the incentives provided to the SA/BSP in the form of the additional penalty component. Although a solution to this issue has been recently proposed in the form of applying financial penalties that are dependent on the imbalance price, different solutions could be envisaged. For instance, in case the perimeter adjustment would be based on the actually delivered volume of energy, any under- or overdelivery would not impact the perimeter of the BRP, and hence would not result in an incentive for not providing the service.

[2] Note that BRPs are only allowed to intentionally deviate from a balanced Balancing Perimeter under certain conditions.

Second, it is foreseen that in the future, **different parties will be able to take up the roles of SA (and/or BSP) on the one hand, and BRP on the other hand**.[3] If no clear framework is put in place, this would imply that an activation performed by the SA (or BSP) could have an impact on the Balancing Perimeter of the BRP responsible of the offtakes/injections at the Delivery Point concerned (i.e., the BRP_{source}). To neutralize the impact on the Balancing Perimeter of the BRP_{source}, the design in the original iCAROS design notes[4] foresaw an evolution towards adjusting the perimeter of the BRP with the actually delivered volume of energy (instead of a correction with the requested energy volume). However, there are important open questions related to the in 2017 proposed design that carefully need to be addressed. These questions among others address the balance responsibility and cost recovery related to imbalances caused in case of over- or underdelivery of the requested service. In addition, there are questions on whether a correction of the perimeter of the BRP with the delivered volume is sufficient to neutralize the financial impact on the involved market parties.

Third, the **activation profiles for the activation of mFRR and Redispatch energy bids will be adapted** in the context of the MARI and iCAROS projects. Specifically, the mFRR full activation time (equal to the default full activation time for redispatch energy bids) will be reduced from 15 minutes to 12,5 minutes. Moreover, scheduled activations will be requested in the middle of the quarter hour before the quarter hour for which the bid has been submitted. In the context of the changed activation profile, there is a **question of whether or not the so-called block approach for the perimeter adjustments currently applied would need to be adapted** (and if yes, in which way). Indeed, currently, the adjustment of the Balancing Perimeter of the BRP is restricted to the quarter hour(s) for which an energy bid has been activated and does not consider the ramping in the quarter hour(s) before or after this quarter hour.

1.2 Objective and scope

Considering the different contextual elements described above, **the objective of this study is to determine the most suitable design for the adjustments of the Balancing Perimeter in case of activations of mFRR or redispatch energy bids**.[5] To this end, the different possibilities for the BRP perimeter adjustments and their impact on different design elements is analyzed. Specific attention is given to:

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[3] Note that for DP_{PG}, the BSP can be a different entity than the BRP_{source} (i.e., the BRP that takes the injections/offtakes at the Delivery Point in his Balancing Perimeter). However, for DP_{SU}, the roles of SA, BSP and BRP are currently taken up by the same party.
[4] The original iCAROS design note can be found on the **Elia website**.
[5] Note that the scope is restricted to the perimeter adjustments related to mFRR or redispatch activations.

- The impact on the allocation of the balance responsibility (in case of imbalances resulting from under or overdelivery of the activated bids) and the implications for the recovery of the balancing costs;
- The impact on the financial incentives for correct delivery of the activated bids;
- The possibilities to enable different parties to take up the role of BRP and SA/BSP.

1.3 Remainder of the study

The remainder of this document is structured as follows:

- **Section 2** first provides an overview of the perimeter adjustments that are currently applied and the different options for the perimeter adjustments that will be considered in the remainder of the study.
- **Section 3** describes the implications of the two main options of the perimeter adjustments on the balance responsibility in case of under- or overdelivery of the requested energy;
- **Section 4** analyzes for the considered options for the perimeter adjustments how to avoid incentives for not delivering the requested service;
- **Section 5** looks at the implication of the perimeter adjustments on the possibilities for enabling different parties to take up the role of BRP and SA/BSP;
- **Section 6** addresses the link between the perimeter adjustments applied and the assumed activation profile;
- **Section 7** finally presents Elia's recommendation for the BRP perimeter adjustments in case of the activation of mFRR and/or redispatch energy bids.

The present document is the first version of a report that will be submitted to the CREG by October 31, 2023. As such, the present public consultation is an opportunity to **collect stakeholders' views** on the conclusions and recommendations of the study. The stakeholders' feedback will be considered for the finalization of the study.

2. Overview of the different options for the perimeter adjustments in case of the activation of an mFRR or Redispatch Energy Bids

This section aims to provide an overview of the different options of the perimeter adjustments that will be further analyzed in the subsequent sections. Section 2.1 will first describe the model with perimeter adjustments based on the requested energy volume. Subsequently, Section 2.2 describes an alternative model relying on perimeter adjustments based on the actually delivered energy volume. Finally, Section 2.3 presents different variants for both types of perimeter adjustments related to how the assumed activation profile is transformed into the perimeter adjustments.

2.1 Option 1: Perimeter adjustments based on the requested energy volume

Before describing the perimeter adjustments, it is important to describe the distinct roles that are involved in or impacted by the activation of an mFRR or redispatch energy bid would be activated in the model of Option 1:

- The Balancing Service Provider (BSP) or the Scheduling Agent (SA): the BSP or SA (more generally referred to in the remainder of the study as the flexibility service provider or FSP) is responsible for the submission and the correct activation of energy bids. To this end, the BSP/SA delivers flexibility at one or more Delivery Points;
- The $BRP_{BSP/SA}$ (or more generally BRP_{FSP}): the BRP_{FSP} is a BRP that is appointed by the FSP to take in its balancing perimeter the responsibility for the energy volumes requested by Elia in case of an activation.[6]
- The Grid User: the party owning the installations that are physically injecting/consuming electricity from the grid;
- The BRP_{source}: the BRP_{source} is the BRP that takes the measured injection/consumption of electricity at the Delivery Point in his Balancing Perimeter;
- The Supplier: the Supplier invoices the Grid User for the consumed electricity (or pays the Grid User for the injected electricity).

In the model of Option 1, the Balancing Perimeter of the BRP_{FSP} is adjusted by subtracting the energy volume requested by the system operator. In practice, such a perimeter adjustment is applied each time an aFRR, mFRR or redispatch energy bid is activated. For example, in case Elia would activate an upward mFRR or Redispatch Energy

[6] Note that the role of the BRP_{BSP} is well defined (e.g., in the T&C BSP mFRR/aFRR). However, the role of the BRP_{SA} currently does not officially exist. However, implicitly, the role of BRP_{SA} is allocated to the BRP_{source}. Indeed, in iCAROS phase 1, the Balancing Perimeter of the BRP_{source} (i.e., the BRP responsible for the Injection at the Access Point where a Technical Facility is located for which redispatch energy bids have been submitted by the SA) is adjusted in case a redispatch energy bid is activated.

bid of 40 MW for the quarter hours Qh1 and Qh2, Elia would adjust the Balancing Perimeter of the BRP_{FSP} in the quarter hours Qh1 and Qh2 with -10 MWh (= - 40 MW * (1/4)h). The perimeter adjustment with the requested energy volume is thus i) independent of the energy volume that is actually delivered at one or more Delivery Points, and ii) independent of whether the role of the FSP is taken up by a different party than the BRP_{source}/Supplier.

In the context of enabling different parties to take up the role of FSP and BRP_{source}/Supplier, the model of Option 1 foresees the possibility to have additional adjustments of the Balancing Perimeters of both the BRP_{source} and the BRP_{FSP}. More specifically in case the role of the BRP_{source} is taken up by a different party than the FSP or BRP_{FSP}, and in case a correction model for splitting the roles such as Transfer of Energy is applied, the Balancing Perimeter of the BRP_{source} is adjusted to subtract the actually delivered volume of energy from his Balancing Perimeter and the Balancing Perimeter of the BRP_{FSP} is adjusted to add the actually delivered energy volume. As such, the actually delivered volume of energy is transferred from the Balancing Perimeter of the BRP_{source} to the Balancing Perimeter of the BRP_{FSP}. For example, in case an FSP would, in response to an activation request, reduce the consumption of a Delivery Point for which Transfer of Energy is applicable by 5 MWh, the Balancing Perimeter of the BRP_{source} is adjusted with - 5 MWh (thereby neutralizing the impact of the reduction of the consumption) and the Balancing Perimeter of the BRP_{FSP} is adjusted with + 5 MWh. In addition, the correction model for splitting the roles foresees in a mechanism to avoid financial impacts on the Supplier (e.g., to neutralize the lost revenues in case the consumption is reduced as a result of the activation). This compensation can be organized in different ways. In the Transfer of Energy framework, the FSP needs to compensate the Supplier in case of a reduction of consumption/increase of injection and vice versa. In the individual correction model proposed by Elia, this compensation could happen implicitly by adjusting the meter values such that the Supplier would invoice the energy that would have been consumed/injected in case no activation would have taken place.

The distinct roles and perimeter adjustments in this model are schematically represented in Figure 1. Given that in this model, any activation of an energy bid will always result in a net adjustment (across the possibly different BRPs involved) with the requested energy volume, we refer to this option as the option with a perimeter adjustment based on the requested energy volume.

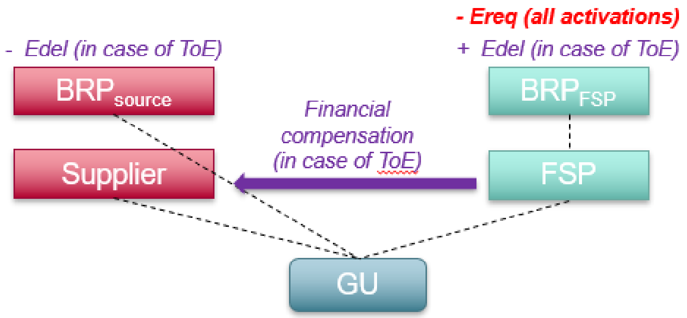

Figure 1: Schematic overview of the roles and perimeter adjustments in the model corresponding to option 1 for the perimeter adjustments (adjustment with the requested energy volume)

2.2 Option 2: Perimeter adjustments based on the delivered energy volume

The model corresponding to Option 2 for the perimeter adjustments is currently not applied in Belgium. However, this model was proposed in the original design notes related to the iCAROS project with the goal of enabling a split between the role of the SA and the BRP. It must be noted that Transfer of Energy is currently not applicable for redispatching actions.[7] In the absence of a legal framework for a correction model, the idea behind the model is that the impact of an activation on the BRP_{source} would always be neutralized by performing an adjustment of the Balancing Perimeter of the BRP_{source} that consists in subtracting the delivered volume. In this model, this is the only perimeter adjustment that would be applied. This means that in this model, there is no BRP_{FSP} involved.

The distinct roles and the perimeter adjustment in this model are schematically represented in Figure 2. Given that in this model, any activation of an energy bid will always result in a net adjustment with the actually delivered energy volume, we refer to this option as the option with a perimeter adjustment based on the delivered energy volume.

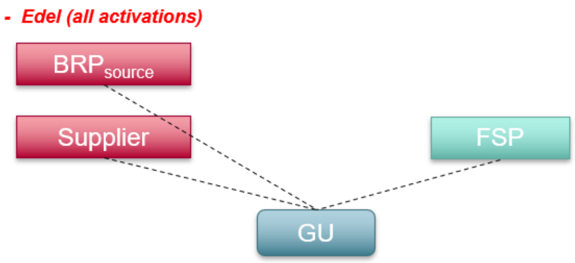

Figure 2: Schematic overview of the roles and perimeter adjustments in the model corresponding to option 2 for the perimeter adjustments (adjustment with the delivered energy volume)

Aside from splitting the roles, adjusting the Balancing perimeter of the BRP with the delivered energy volume could potentially also form an alternative approach to avoid incentives not to perform the requested activation. Indeed, in case the Balancing perimeter would be adjusted with the actually delivered volume of energy, any under- or overdelivery would not impact the Balancing perimeter of the BRP. Therefore, the imbalance price could not provide incentives to not (fully) perform the requested activation.

2.3 Variants of the two main options for the perimeter adjustments related to the assumed activation profile

[7] Art. 19bis of the current Electricity law restricts the scope of Transfer of Energy to mFRR, aFRR and DA/ID markets.

As described in Section 1.1, an activation profile needed to be formalized for mFRR in the context of the integration of the European balancing energy markets, i.e., assumptions needed to be made on the activation profile in order to account for the impact of the exchange of balancing energy on the observed deviations between scheduled and measured cross-border flows (and hence the FRCE). This activation profile has been taken over for Redispatching (at least for Redispatch bids with the default full activation time of 12,5 minutes).

The formalization of the activation profile for mFRR and Redispatching introduces questions on how the Balancing Perimeter of the BRP would ideally be adapted.

For Option 1 (perimeter adjustments based on the requested energy volume), three different variants will be considered for the perimeter adjustments performed in case of an activation of an mFRR or a redispatch energy bid:

- In **Option 1a**), the full requested energy volume is adjusted in the quarter hour for which the activated bid was submitted. This approach is better known as the “block approach”, is currently applied and also foreseen to be applied for iCAROS/MARI go-live.
- In **Option 1b**), the Balancing perimeter would also only be adjusted in the quarter hour for which the activated bid was submitted. However, the energy volume adjusted would correspond to the energy volume under the assumed activation profile within that quarter hour.
- In **Option 1c**), the perimeter adjustments would be fully aligned with the assumed activation profile, in the sense that an activation for one quarter hour would not only result in a perimeter adjustment in the quarter hour for which the activated bid was submitted, but also result in perimeter adjustments in the quarter hour in which the ramp of the assumed activation profile was initiated and the quarter hour in which the ramp of the assumed activation profile would be terminated.

Table 1 presents an illustration of the perimeter adjustments that would be performed in these three options in case a scheduled activation is requested (for one quarter hour) of an upward bid of 40 MW submitted for QH(t_0).

		QH(t_{-1})	QH(t_0)	QH(t_1)
Perimeter adjustment	Option 1a)	/	- 10 MWh (=-40 MW * (1/4)h)	/
	Option 1b)	/	- 8.33 MWh (= 0.833 * -40 MW * (1/4)h)	/
	Option 1c)	- 0.83 MWh (= 0.083 * -40 MW * (1/4)h)	- 8.33 MWh (= 0.833 * -40 MW * (1/4)h)	- 0.83 MWh (= 0.083 * -40 MW * (1/4)h)

Table 1: Illustration of the perimeter adjustments applied for the three variants of Option 1

For option 2 (perimeter adjustment with the delivered volume), two different options could be considered:

- In **Option 2a**), the delivered volume is only determined in the quarter hour for which the activated bid was submitted.
- In **Option 2b**), the delivered volume would be calculated for the quarter hour for which the activated bid was submitted, but also for the quarter hour in which the ramp of the assumed activation profile was initiated and the quarter hour in which the ramp of the assumed activation profile would be terminated. In all these quarter hours, the perimeter would be adjusted with the delivered volume as calculated for that quarter hour.

A schematic overview of all considered options for the perimeter adjustments is presented in Figure 3.

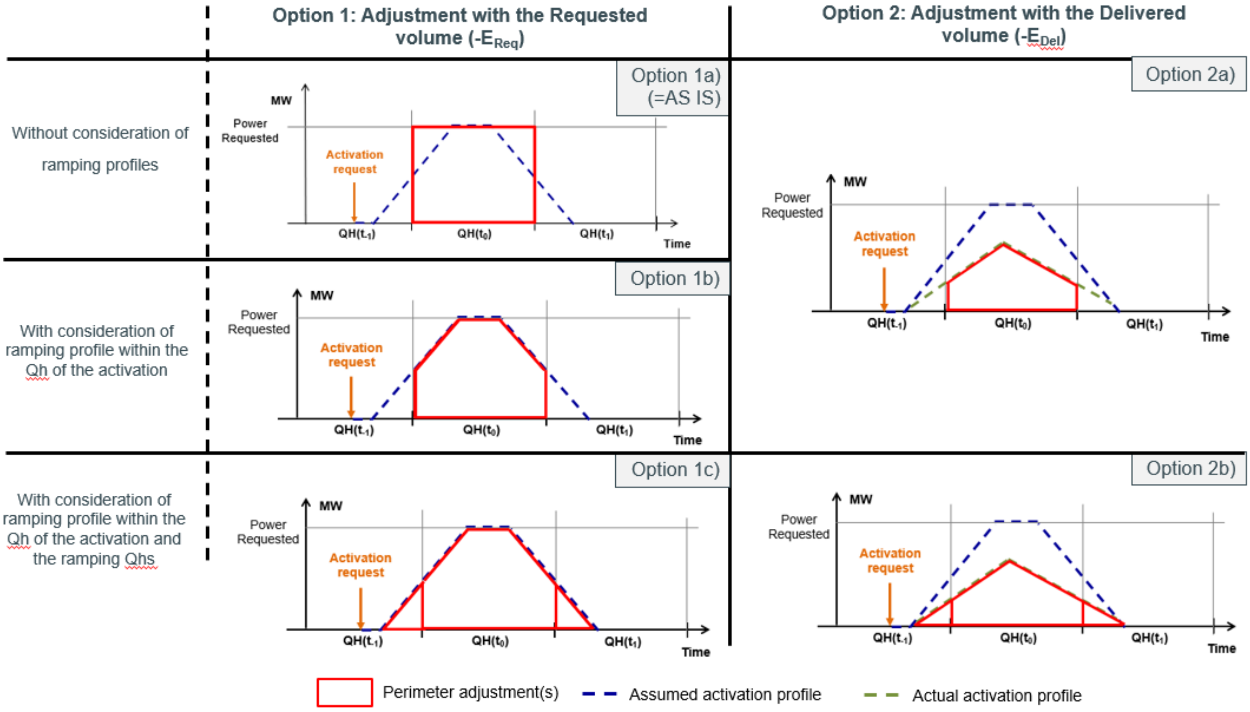

Figure 3: Schematic overview of all considered options for adjusting the Balancing perimeter of a BRP in case of an mFRR or a redispatch bid. This figure represents the adjustments that would take place for a scheduled activation for one quarter hour.[8]

[8] An actual activation profile is drawn in Figure 3 for the Options 2a) and 2b) (the green dashed lines). However, it must be noted that mFRR and Redispatch are quarter-hourly products relying on quarter-hourly measurement and baseline data, the delivered energy volume would be calculated on a quarter-hourly level.

3. Balance Responsibility and cost recovery

The starting point of this section is that under- or overdelivery impacts the balance in the system. An illustration is given in Figure 4 below where an upward redispatch or mFRR bid of 200 MW is activated but not delivered.

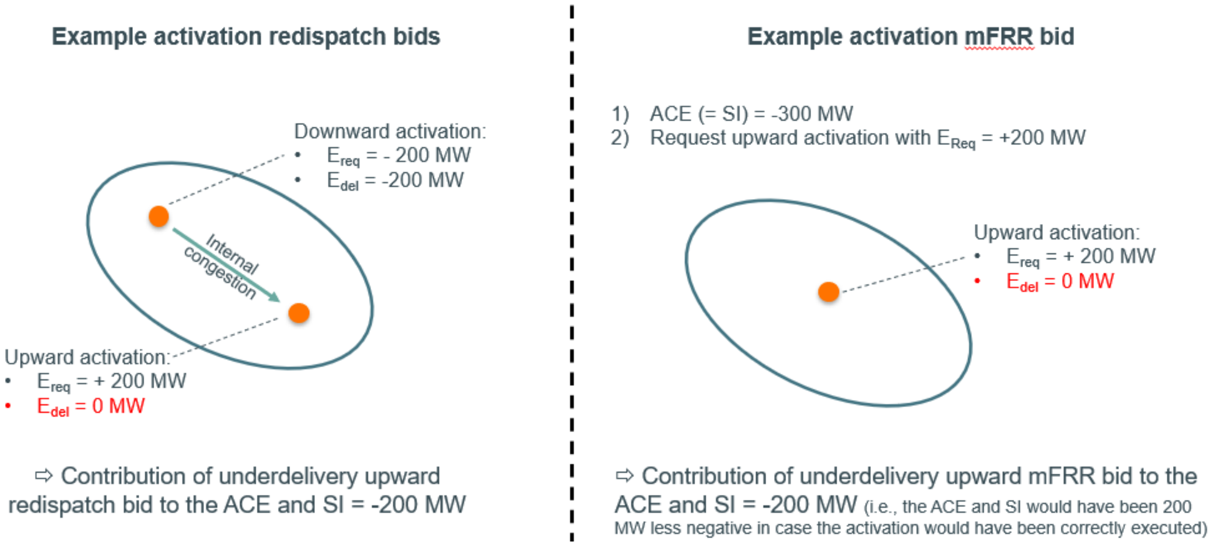

Figure 4: illustration of the impact of an underdelivery of an upward bid on the ACE/FRCE and the SI

One of the **fundamental differences between perimeter adjustments with the requested volume (Option 1) and perimeter adjustments with the delivered volume (Option 2) relates to who takes up the responsibility for the introduced imbalances in case of under- or overdelivery**.

In **Option 1, the difference between the requested energy volume and the delivered energy volumes comes in the Balancing Perimeter of the BRP_{FSP}**. As such, the BRP_{FSP} is responsible for any imbalance resulting from under- or overdelivery. It must be noted that this is the case regardless of whether the roles of FSP (and BRP_{FSP}) are taken up by a different party than the BRP_{source} (and Supplier) or not, as illustrated in Figure 5.

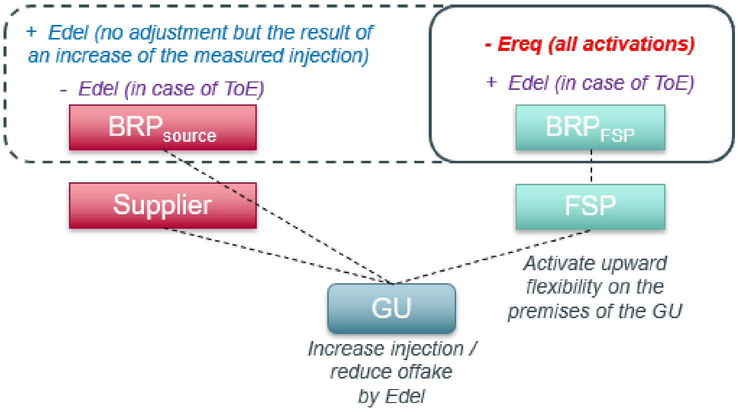

Figure 5: Illustration of balance responsibility in case of an adjustment with the requested energy volume (Option 1)

Indeed, in case all roles are taken up by the same party, there is one BRP that takes up the role of BRP_{source} as well as the role of BRP_{FSP}. As a result of the change of the offtake/injection at the Delivery Point, the Balancing Perimeter of the BRP (in its role of BRP_{source}) will be impacted, i.e., the delivered volume comes in the Balancing Perimeter of the BRP as a result of the change of the offtake/injection). In addition, Elia will adjust the Balancing Perimeter of the BRP (in its role of BRP_{FSP}) by subtracting the requested energy volume. As a result of these two impacts, the BRP will be responsible for the difference between the requested and the delivered energy volume (in this case, Transfer of Energy and the corresponding perimeter adjustments are not applicable).

In the case where one party would take up the role of FSP and BRP_{FSP} and another party would take up the role of BRP_{source}, and a correction model such as Transfer of Energy is applied, the impact of an activation on the two involved BRPs is as follows. The BRP taking up the role of BRP_{source} his Balancing Perimeter is impacted by the changed offtake/injection at the Delivery Point, but this impact is neutralized by the perimeter adjustment applied in the context of Transfer of Energy. Two adjustments apply to the Balancing Perimeter of the BRP_{FSP}: the adjustment consisting of subtracting the requested volume (that is applied to the BRP_{FSP} for all activations) and the adjustment consisting of adding the delivered volume of flexibility (that is only applied in case a correction model such as Transfer of Energy is applied). The consequence is that, also when the roles are split, the BRP taking up the role of BRP_{FSP} is responsible for the imbalances introduced by under-or overdelivering the requested energy volume.

In Option 2, no BRP is responsible for imbalances resulting from underdelivery. Indeed, in this option, the impact of an activation on the Balancing Perimeter consists of two elements: the direct impact following from the change of the offtake/injection (the delivered volume comes in the Balancing Perimeter of the BRP_{source}) and the perimeter adjustment for the BRP_{source} consisting of withdrawing the Delivered volume from the Balancing Perimeter of the BRP_{source}. As such, the BRP_{source} is neutralized and this regardless of whether the delivered volume corresponds to the requested volume or not. This is illustrated in Figure 6.

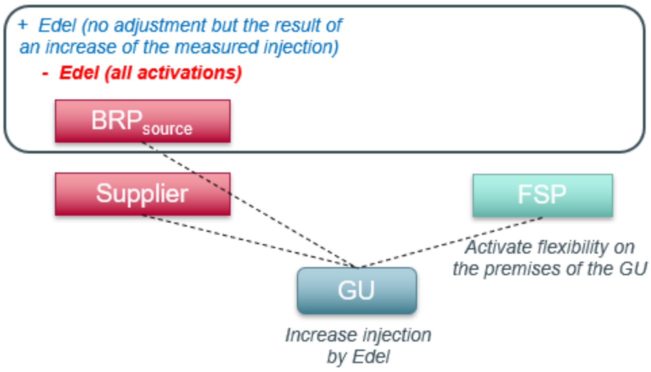

Figure 6: Illustration of the lack of balance responsibility in case of an adjustment with the delivered energy volume (Option 2)

The remainder of this section will investigate the impact of the lack of balance responsibility in Option 2 (adjustment with the delivered energy volume). Specifically, the remainder of this section will look at whether this would be compliant with the regulatory framework, what the impact would be on the recovery of balancing costs and the need for applying a cap and floor when calculating the delivered volume of energy that would be used for the perimeter adjustment.

3.1 Compliance with the regulatory framework

The Clean Energy Package requires all market participants to be responsible for the imbalances they cause in the system. The relevant article of the Clean Energy package is provided below.

(EU) 2019/943 Art. 5(1):

"All market participants shall be responsible for the imbalances they cause in the system ('balance responsibility'). To that end, market participants shall either be balance responsible parties or shall contractually delegate their responsibility to a balance responsible party of their choice. Each balance responsible party shall be financially responsible for its imbalances and shall strive to be balanced or shall help the electricity system to be balanced."

Considering that in Option 2 (net adjustment with the delivered volume), no BRP would be responsible for imbalances introduced in the system in case of underdelivery of the requested service, Elia considers this option not to be compliant with the Clean Energy Package.

3.2 Potential impact of absence of balance responsibility on the recovery of balancing costs

As discussed above, in Option 1, the BRP_{FSP} will be responsible for the imbalances created in case of under- or over-delivering. In this regard, the costs related to restoring the imbalances will be recovered via a BRP (as is the case for all other imbalances introduced in the system).

In contrast, when applying the perimeter adjustments of Option 2 (adjustment with the delivered volume), no BRP would take up the responsibility in case of underdelivery. This means that the resulting balancing costs would not be recovered by a BRP. As a result, there is a risk that part of these balancing costs would be socialized or would need to be recovered in another way (e.g., via sufficiently high penalties applied to the FSP). However, even in that case, it might lead to a (partial) socialization of costs and would imply that different sources of imbalances (related to under-delivery of energy requested by Elia or others) would be treated differently.

3.3 Need for a cap and floor when applying a perimeter adjustment based on the Requested energy volume

In Option 2 (adjustment with the delivered volume), a cap and floor need to be introduced on the calculation of the delivered volume (i.e., the delivered energy volume used for the perimeter adjustment in Option 2 should not exceed the requested energy volume).[9] This for a number of reasons.

First, a cap is needed to avoid that potentially large imbalances following from overdelivery would be socialized. An example of a case would be where a forced outage of a generation unit would occur at the moment a (small) downward bid is activated. In such a case, the downward volume delivered could largely exceed the requested volume. In absence of a cap on the calculation of the delivered volume, a large imbalance would be socialized. This is illustrated in Figure 7.

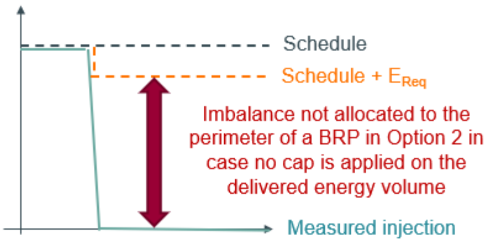

Figure 7: Illustration of the need for a cap on the calculation of the delivered volume in Option 2 (adjustment with the delivered volume)

[9] Note that this is not the case for the adjustments with +/- the delivered volume that are applied in Option 1 in case a correction model such as Transfer of Energy is applicable.

Second, in absence of a cap, distortions could be introduced in the form of incentives for large overdelivery. An example of a case would be where a downward bid is activated on a generation unit. In absence of a cap on the delivered volume, the FSP could decide to completely shut down the unit (e.g., to save fuel costs), without getting an imbalance in the Balancing perimeter. This is illustrated in Figure 7.

Third, the absence of a cap on the calculation of the delivered volume in Option 2 would take away all opportunities for valorizing flexibility that might be available on top of the requested volume. As an example, imagine a case where an upward redispatch bid is activated on a generation unit. This redispatch bid might be activated some time in advance. Assuming the unit has some remaining upward margin available, there would be no possibility to valorize this margin (e.g., by selling energy on the ID markets or by contributing to balancing the system in real time). Indeed, if no cap would be applied, any further increase of the injection would be neutralized and not arrive in the Balancing Perimeter of a BRP. Such a situation is illustrated in Figure 8.

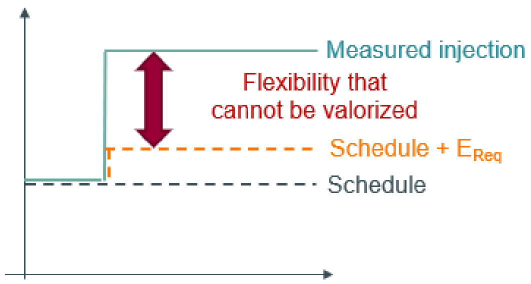

Figure 8: Illustration of the need for a cap on the calculation of the delivered volume in Option 2 (adjustment with the delivered volume)

Applying a cap (and floor) on the calculation of the delivered energy has certain implications. First, it introduced additional complexity on implementation. Particularly in the case where multiple Delivery Points are being activated to deliver the requested energy, an algorithm would need to be developed to determine how to adapt the Delivered volumes corresponding to the different Delivery Points involved. This is needed as the different Delivery Points could be in the Balancing Perimeters of different $BRP_{sources}$. Second, it also introduced an arbitrary factor in the neutralization of the Balancing perimeters of the different involved BRP_{source}(s).

This is illustrated in below for a situation where two Delivery Points, located in the Balancing perimeters of two different $BRP_{sources}$ are used for a bid and together delivery more than what has been requested.

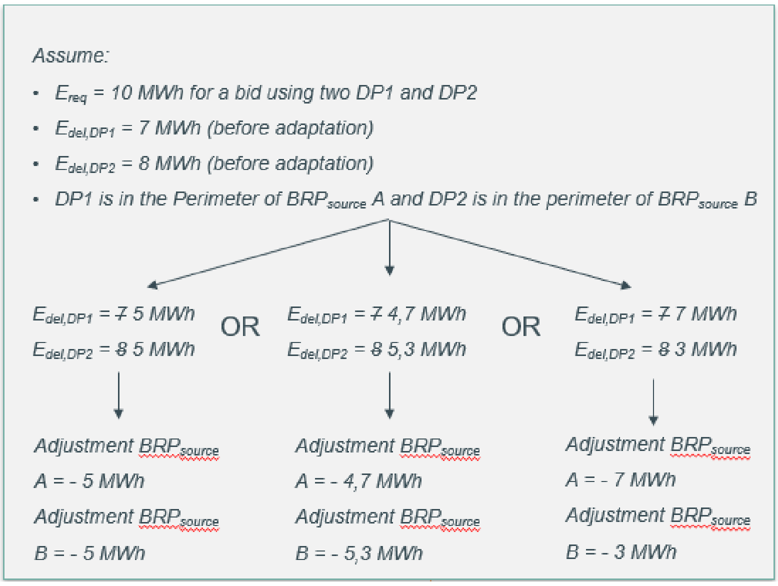

Figure 9: Illustration of the fact that there are different possibilities to cap the delivered energy volumes when multiple delivery points are involved

3.4 Summary and conclusion

The starting point of this section is that an under- or overdelivery of the requested energy volume introduces an imbalance in the system. This section showed that in Option 1 (adjustment of the perimeter with the requested volume), the BRP_{FSP} takes up the balance responsibility for such imbalances, and therefore balancing costs are recovered via this BRP. This is also compliant with the Clean Energy Package's requirements on balance responsibility. In contrast, this section has shown that in Option 2 (adjustment with the delivered energy volume), no BRP would be responsible for the imbalances introduced in case less energy is delivered compared to what has been requested. This introduces a risk for socialization of balancing costs (as balancing costs would need to be recovered in another way) and does not seem to be compliant with the requirements in the Clean Energy Package. Moreover, Option 2 would also introduce additional implementation complexities as a cap (and floor) would need to be introduced on the calculation of the delivered energy volume.

4. Incentives for correct delivery of the requested service

As discussed in Section 1.1, in case an adjustment with the requested energy volume is applied, the exposure to the imbalance price could in a certain moment provide an incentive to not change the injection/offtake in the direction requested by the activation (e.g., when the imbalance price is low when an upward activation is requested or when the imbalance price would be high when a downward activation is requested). Such situations can occur for redispatching but could also occur for mFRR after connection to the European balancing platforms,

This section analyzes in detail how incentives for not performing the requested energy volume could be avoided, and this both in case perimeter adjustments with the requested or the delivered energy volume would be applied.

4.1 Methodology

The financial incentives for delivering energy when an activation is requested are analyzed. When looking at the incentives for delivering energy, the approach adopted in the study consists of two steps:

1) In a first step, the profits that would be realized in case a bid is activated are written as a function of the volume that is effectively delivered (E_{Del}). Indeed, when determining whether or not to deliver the requested energy volume, the actually delivered volume of energy forms the decision variable.

$$Profit(E_{Del}) = \sum Revenues(E_{Del}) - \sum costs(E_{Del})$$

2) In a second step, the incentive to deliver are mathematically derived by taking the derivative of the profits with respect to the energy volume actually delivered. Indeed, there is an incentive to increase the energy volume delivered as long as this derivative is positive. In contrast, there is a financial incentive to deliver less energy if this derivative is negative

$$Incentive\ to\ increase\ E_{Del}\ if\ \frac{\partial\ Profit}{\partial\ E_{Del}} > 0$$

$$Incentive\ to\ decrease\ E_{Del}\ if\ \frac{\partial\ Profit}{\partial\ E_{Del}} < 0$$

For step 1 (determination of the profits related to an activation as a function of the energy volume actually delivered), two key assumptions are taken:

a) The revenues and costs from all roles taking up responsibilities or being involved in the delivery of the requested service are considered. Specifically, in Option 1, this means that we will look at the financial impacts on the roles of the GU, the FSP and the BRP taking up the role of BRP_{FSP}. As there is no BRP_{FSP} in Option 2, for this option only the financial impacts on the GU and the FSP are considered.

b) The analysis looks at the joint profits that can be realized by (the possibly multiple) parties taking up the distinct roles involved in the delivery of the service and does not look at incentives for individual parties/roles. This for two reasons. First, in principle the incentives would remain to maximize the total profits. Also, in case different parties would be involved, maximizing the total profits could lead to benefits for all involved parties. Second, the revenues/costs of individual parties depend on the arrangements made between the different involved parties. Such arrangements could differ from situation to situation and in any case are not known to Elia.

4.2 Possibilities for avoiding incentives to not deliver the requested energy volume

This section looks at the incentives for delivering the requested energy and the possibilities to avoid that there is an incentive to not deliver the requested energy. For simplicity, the remainder of this section is elaborated assuming an upward activation (positive energy volume requested). However, identical conclusions would be achieved for downward activation.

4.2.1 Option 1: adjustment with the requested energy volume

The total profits (or loss) that can be realized in case an energy bid is activated can be represented as follows:

$$Profit = E_{Req} \times P^{energy\ bid} - E_{Del} \times P^{Operational\ cost} - \left(E_{to\ be\ supplied} - E_{Del}\right)_{E_{Del} < E_{to\ be\ spplied}} \times P^{penalty} - \left(E_{Req} - E_{Del}\right) \times P^{imb}$$

As can be seen, the total profit (or loss) consists of 4 components:

- The energy remuneration received by the FSP for the activated bid ($= E_{Req} \times P^{energy\ bid}$)
  - The energy remuneration is based on the requested energy volume (E_{Req}) and is independent of the volume actually delivered
- The operational costs or opportunity costs faced by the GU related to delivering the energy ($= -E_{Del} \times P^{Operational\ cost}$)
  - The operational costs (e.g., fuel costs) are assumed to be liner with the energy volume effectively delivered
- The penalty applicable to the FSP in case of underdelivery ($= -\left(E_{to\ be\ supplied} - E_{Del}\right)_{if\ E_{Del} < E_{to\ be\ supplied}} \times P^{penalty}$)

    - This term only applies in case the actually delivered volume is lower than the volume to be supplied[10].
- The cost for the BRP_{FSP} related to the imbalance created in his Balancing Perimeter in case more/less energy is delivered compared to what has been requested ($= -(E_{Req} - E_{Del}) \times P^{imb}$)

When takin the derivative of the total profits with respect to the volume actually delivered ($\frac{\partial Profit}{\partial E_{Del}}$), it can be considered that there is an incentive to increase the delivered volume of flexibility if $\frac{\partial Profit}{\partial E_{Del}} > 0$, or thus if:

$$\begin{cases} P^{penalty} + P^{imb} > P^{Operational\ cost} \ (if\ E_{Del} < E_{to\ be\ supplied}) \\ P^{imb} > P^{Operational\ cost} \ (if\ E_{Del} \geq E_{to\ be\ supplied}) \end{cases}$$

In other words, when a perimeter adjustment with the requested energy volume is applied, there is an incentive to deliver the service (avoid underdelivering) if the penalty to which the underdelivered volume would be exposed and the imbalance price to which the BRP_{FSP} is exposed are higher than the cost of actually delivering the energy. It can further be noted that this holds independent of the actual volume of the perimeter adjustment (i.e., whether Option 1a, 1b) or 1c) would be taken.

From this, it can also be observed that there is indeed a risk that in case the imbalance price would be low (or possibly even negative) at the moment an upward activation is requested, this could result in an incentive to not deliver the requested energy. However, such incentives can be avoided by applying well-dimensioned penalties. Specifically, incentives for not delivering the requested energy are avoided in case:

$$P^{penalty} \geq P^{Operational\ cost} - P^{imb} \quad (1)$$

As can be seen from Equation (1), the penalty that would minimally be needed to avoid incentives to not deliver the requested energy is thus dependent on the imbalance price. Moreover, the operational costs are not necessarily known to Elia (e.g., for mFRR) but it can be considered that the price of the activated energy bid is equal or higher than the operational costs. Elia has proposed a penalty scheme in the new mFRR design as well as in the iCAROS design, in which two penalty terms can be applied depending on the imbalance price:

1) A minimum penalty that is always applied. This minimum penalty corresponds to 25% of the price of the energy bid.

[10] Note that the term energy volume to be supplied ($E_{to\ be\ supplied}$) is used to reflect that the energy volume used in the activation control. Depending on the approach taken for the perimeter adjustments (i.e., Option 1a), Option 1b) or Option 1c)), this term could be the same or (slightly) differ from the requested energy volume (i.e., the energy volume used for the perimeter adjustment).

2) An additional penalty (= $P^{energy\ bid} - P^{imb}$) that is only applied in case the imbalance price exceeds the price of the energy bid.

It can be derived that the penalty scheme proposed by Elia indeed avoids incentives for not delivering the requested energy at all moments.[11]

4.2.2 Option 2: adjustment with the delivered energy volume

In case an adjustment with the delivered energy volume would be applied, the total profits (or loss) that would be realized in case an energy bid is activated can be represented as follows:

$$Profit = E_{Req} \times P^{energy\ bid} - E_{Del} \times P^{Operational\ cost} - \left(E_{to\ be\ supplied} - E_{Del}\right)_{E_{Del} < E_{to\ be\ spplied}} \times P^{penalty}$$

Again, the profits consists of the remuneration for the activated energy bid $(= E_{Req} \times P^{energy\ bid})$, the operational costs or opportunity related to delivering the energy $(= -E_{Del} \times P^{Operational\ cost})$ and the penalty applicable in case of underdelivery $\left(= -\left(E_{to\ be\ supplied} - E_{Del}\right)_{if\ E_{Del} < E_{to\ be\ supplied}} \times P^{penalty}\right)$. The only difference with Section 4.2.1 is that there is no term related to an imbalance faced by the BRP_{FSP}, as there is not BRP_{FSP} involved in this case (and the BRP_{source} is neutralized).

When takin the derivative of the total profits with respect to the volume actually delivered $(\frac{\partial Profit}{\partial E_{Del}})$, it can be considered that there is an incentive to increase the delivered volume of flexibility if $\frac{\partial Profit}{\partial E_{Del}} > 0$, or thus if:

$$\begin{cases} P^{penalty} > P^{Operational\ cost}\ (if\ E_{Del} < E_{to\ be\ supplied}) \\ P^{Operational\ cost} < 0\ \ (if\ E_{Del} \geq E_{to\ be\ supplied}) \end{cases}$$[12]

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[11] Indeed, in case in case $P^{imb} \geq P^{energy\ bid}$, the term on the right-hand side of Equation (1) will always be smaller or equal to 0 (as we can safely assume that the price of the energy bid would be minimally equal to the operational costs) and there is no need to apply an additional penalty component. In contrast, in case $P^{imb} < P^{energy\ bid}$, an additional penalty component might be needed. By considering that the additional penalty component equals $P^{penalty} = P^{energy\ bid} - P^{imb}$, replacing this in Equation (1) yields $P^{energy\ bid} - P^{imb} \geq P^{Operational\ cost} - P^{imb}$ or thus $P^{energy\ bid} \geq P^{Operational\ cost}$. Considering that there is no reason to bid below the operational cost, it can thus be shown that the proposed penalty scheme avoids incentives to not deliver the requested energy in all situations.

[12] In case the FSP does not take up the role of BRP_{source}. If the FSP would be the BRP_{source} and considering that a cap would be applied to the calculation of the delivered volume, the BRP_{source} any volume overdelivered would be exposed to the imbalance price.

In other words, when a perimeter adjustment with the delivered energy volume is applied, there is an incentive to deliver the service (avoid underdelivering) if the penalty to which the underdelivered volume would be exposed is higher than the cost of actually delivering the energy, or thus:

$$P^{penalty} \geq P^{Operational\ cost} \tag{2}$$

It can be seen that when a perimeter adjustment with the delivered volume would be applied, the financial penalty that is by default applicable in case of underdelivery would need to be significantly higher compared to a situation where a perimeter adjustment with the requested energy volume would be applied. Considering that the operational cost can be considered lower/equal to the price of the energy bid, and that a certain margin is needed to avoid that bids for which $P^{operational\ cost} = P^{energy\ bid}$ would still get a sufficient incentive for actually delivering the service, a penalty such as 125% of the price of the energy bid would realize this goal. It must be noted that the penalty term applied in case a perimeter adjustment with the delivered energy volume would be applied could be independent of the imbalance price.

4.3 Summary and conclusion

In this section, the incentives for delivering the requested energy are analyzed, and this both in case a perimeter adjustment with the requested energy volume would be applied, and in case a perimeter adjustment with the delivered energy volume would be applied.

The main conclusion of the analysis is that in both main options for the perimeter adjustments, incentives for not delivering the requested energy can be avoided by applying well-dimensioned penalties. In case a perimeter adjustment with the requested energy volume (Option 1) is applied, it is shown that penalty applied for underdelivery would need to be dependent on the imbalance price (at least in certain moments) and hence is more complex. The penalty scheme proposed by Elia for the new mFRR and iCAROS design realize the objective of avoiding incentives to not deliver the requested energy in all moments; In case an adjustment with the delivered energy volume would be applied, significantly higher penalties would need to be applied in case of underdelivery in order to avoid incentives for not delivering the requested energy. However, the applied penalty does not need to be dependent on the imbalance price and hence could be simpler.

5. Implications of the perimeter adjustments for the possibilities to enable different parties to take up the role of BRP and SA/BSP

As introduced in Section 1.1, there are questions on how to adjust the perimeters in case different parties take up the role of BSP/SA and the roles of BRP_{source}/Supplier. In Section 2.1 and 2.2, the model based on a perimeter adjustment with the requested volume and the model based on a perimeter adjustment with the delivered volume have been presented. In this section, we will evaluate these two models in terms of the implications for enabling different parties to take up distinct roles.

Before the implications of the two models on the split of roles is analyzed in detail, two key principles are presented that are essential for any model enabling different parties to take up distinct roles:

1) An activation performed by an SA/BSP should not have an impact on the roles not involved in the delivery of the service (i.e., the BRP_{source} and the Supplier)[13];
2) Distortions impacting an efficient market functioning should be avoided.

5.1 Key differences between both models for the perimeter adjustment and their implications for enabling different parties to take up distinct roles

There are two key differences when comparing the two models presented in Section 2.1 and 2.2. This is illustrated in Figure 10 and discussed in detail below.

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[13] Note that an activation performed by the SA/BSP could have an impact on the $BRP_{SA/BSP}$ (if present in the model). However, this impact is not considered to be an issue as the SA/BSP and the $BRP_{SA/BSP}$ are both taking up responsibilities related to the activation and are working together (in practice, it is observed that the party taking up the role of BRP_{BSP} is (almost) always the same party as the party taking up the role of BSP.

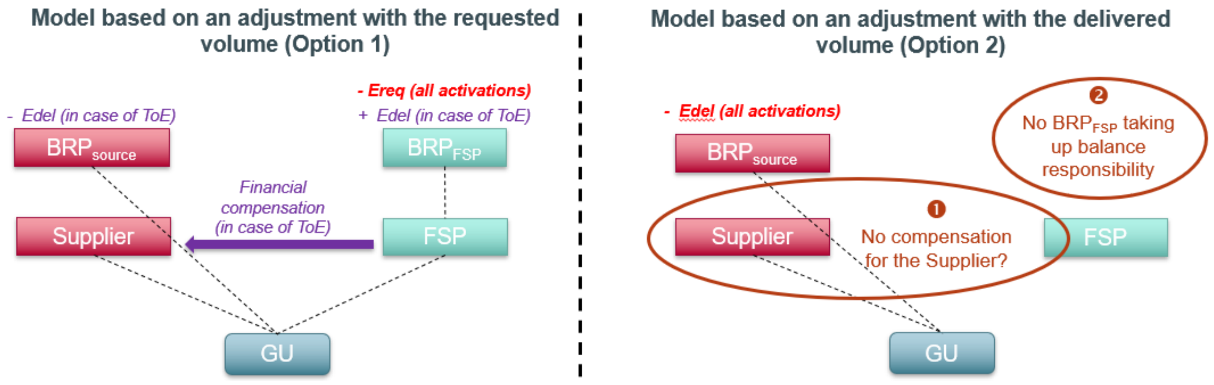

Figure 10: Overview of the two models and their key differences related to the split of roles

5.1.1 Need for compensation mechanism for the impact on the Supplier

A **first difference relates to the compensation of the Supplier**. In the Transfer of Energy model currently applied for splitting the roles between FSP/BRP_{FSP} and BRP_{source}/Supplier, there is a financial compensation foreseen between the FSP and the Supplier.[14] In contrast, in the original iCAROS design notes where the model based on adjusting the perimeter with the delivered volume has been proposed, there is no explicit mention of a compensation mechanism for the Supplier. While the compensation for the Supplier is a priori out of scope of this study, this aspect is nevertheless treated here as it has an important impact on the possibilities for enabling a split of roles.

A compensation for the Supplier is however needed on top of the adjustment of the perimeter of the BRP_{source}. This because in absence of a compensation for the Supplier:

1) An activation performed by an FSP would have a financial impact on the party taking up the role of Supplier
2) Distortions would be introduced that could have a significant impact on the price formation of energy bids (and hence the merit order)

These two effects are illustrated in the illustration below.

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[14] Note that the compensation can be organized in different ways in different correction models. In the Transfer of Energy, there is a direct compensation between the FSP and the Supplier. In the individual correction model Elia has proposed, the compensation of the Supplier would happen implicitly by adjusting the metering values such that the Supplier would invoice the energy that would have been consumed/injected in case no activation would have taken place.

Assume:

- a GU has a small CHP unit and has a contract with his Supplier (=BRP_{source}) to sell all injected energy at a fixed price of 150€/MWh;
- the GU takes up the role of BSP himself or appoints a third party different from his Supplier/BRP_{source} to take up the role of BSP;
- the operational costs (e.g., fuel and emission costs) related to this activation in the given quarter hour correspond to 150 €/MWh.

The impact of the activation of the different roles is described below and presented in the figure below:

1) Elia sends an activation request of a bid of 4 MW for a single quarter hour (corresponding to an energy requested of 1 MWh) and remunerates the BSP for the requested energy.
2) The injection of the CHP unit is effectively increased by 1 MWh during the quarter hour. As a result, the operational costs for the Grid User increase by 150€. At the same time, the GU can sell 1MWh more to his Supplier with a value of 150€. As a result, there is no net financial impact on the GU.
3) There is no net impact on the BRP_{source}. Indeed, the 1 MWh additional injection that enters in the Balancing Perimeter of the BRP_{source} is compensated by the perimeter adjustment with the delivered volume of 1 MWh.
4) The Supplier needs to buy an additional MWh from the GU for a cost of 150€ (and this without the energy ending up in the Balancing Perimeter of the BRP_{source}).

In absence of a compensation for the Supplier, the consequences are that:

- The Supplier(-BRP_{source}) is financially impacted as a result of the activation performed by the BSP
- The parties involved in valorizing the flexibility can make a positive profit when offering the energy bid at prices well below the operational costs. As such, there could be a significant impact on the price formation of energy bids. Indeed, in absence of a compensation for the Supplier, the same energy can be valorized twice (i.e., the 1 MWh is sold to Elia in the form of a balancing energy bid and is sold to the Supplier). As a result, in this example, the BSP and GU could already make profits when selling upward energy bids at any price above 0€/MWh.

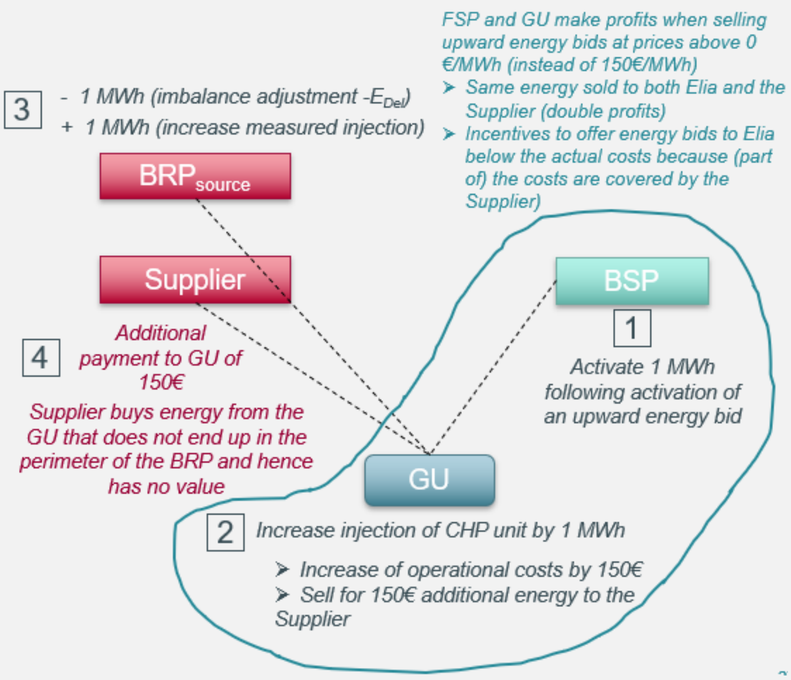

Figure 11: Illustration of the need for a compensation mechanism for the Supplier when splitting the roles

It can thus be concluded that neutralizing the impact of an activation on the BRP_{source} is not sufficient but that a compensation of the Supplier is also needed in order to enable different parties to take up distinct roles without introducing distortions. The implication is that in order to effectively enable a split the roles, **a compensation mechanism would need to be put in place**. As discussed above, this compensation can take different forms:

- The compensation can be agreed between the parties taking up the role of FSP/BRP_{FSP} and the parties taking up the roles of Supplier and BRP_{source} (similar to the "Opt-out agreement' applicable for delivery points of the type DP_{pg} participating to the aFRR, mFRR or DA/ID market segment via an FSP that is a different party than the BRP_{source}/Supplier)
- The compensation can be organized between the FSP and the Supplier. This is currently applied in the Transfer of Energy framework
- The compensation can be realized implicitly by correcting the meter values such that the Supplier invoices the energy component based on the corrected metering (i.e., the Supplier would invoice the energy component based on the offtake/injection that would have taken place in absence of an activation). This is currently not applied in Belgium but is being proposed by Elia.

The introduction of a compensation mechanism for the Supplier might also require changes to the regulatory framework (notable, the Transfer of Energy mechanism is currently restricted to specific market segments that do not include redispatching).

5.1.2 Impact of the absence of BRP_{FSP} taking up balance responsibility

A second key difference between both models is that in the model based on an adjustment with the delivered volume, there is no BRP_{FSP} role taking up balance responsibility. At first sight, the absence of a BRP_{FSP} does not impact the BRP_{source} and/or Supplier and hence seemingly does not impact the split of roles. However, as discussed in Section 3.3, a model based on the adjustment with the delivered volume requires to introduce a cap and floor when calculating the delivered volume. In addition to the complexity coming along with such a cap (and floor), there are important consequences for the split of roles:

1) The BRP_{source} and Supplier would still be financially impacted in case the FSP would deliver more than the requested volume. In addition, in case multiple delivery points are used for an activation with overdelivery, the capping of the delivered volume on the level of the delivery point further introduces an arbitrary element in the compensation of the BRP_{source}/Supplier.
2) Valorizing available flexibility on top of the requested volumes would only be possible in collaboration with the BRP_{source}.

Finally, a model where a BSP/SA could enter the market without being a BRP or assigning a BRP to take up balance responsibility does not seem compliant with the Clean Energy Package (relevant article shown below).

(EU) 2019/943 Art. 5(1):

"All market participants shall be responsible for the imbalances they cause in the system ('balance responsibility'). To that end, market participants shall either be balance responsible parties or shall contractually delegate their responsibility to a balance responsible party of their choice. Each balance responsible party shall be financially responsible for its imbalances and shall strive to be balanced or shall help the electricity system to be balanced."

5.2 Summary and conclusion

This section examined the impact of models described in Sections 2.1 and 2.2 on the split between the roles of FSP/ BRP_{FSP} and BRP_{sourc}/Supplier .

A first important conclusion is that to neutralize the impact of the activation performed by the SA/BSP on other market parties, it is not sufficient to only adjust the perimeter of the BRP_{source}. Indeed, a compensation mechanism for the Supplier also needs to be foreseen. A framework for neutralizing the BRP_{source} and the Supplier is currently being applied to the balancing market, in the form of different compensation mechanisms (as part of the model based on the requested volume). An extension of (a part of) this framework would be needed to enable a split between the SA and the BRP_{source}/Supplier for redispatching.

Second, this section has shown that the model based on the adjustment with the delivered volume (Option 2) has drawbacks related to the model based on an adjustment with the requested volume (Option 1). Notably, in the model based on an adjustment with the delivered volume:

- The BRP_{source} (and Supplier) would be financially impacted in case the FSP delivers more than the requested volume.
- Valorization of flexibility that is available on top of the requested volume would not be possible via the FSP, and is hence only possible via the BRP_{source}, making it more complex to valorize all available flexibility.
- The FSP could participate to the market without being a BRP or appointing a BRP, which seems does not seem compliant with the Clean Energy Package.

6. Consideration of the assumed activation profile

As discussed in more detail in Section 1.1, the activation profile for mFRR needed to be formalized and harmonized in the context of the connection to the MARI platform in order to have a clear way of accounting for the impact of the exchange of balancing energy on the FRCE. As a result, the assumed activation profile for mFRR has changed, and has also been adopted for redispatching (at least, in case the default full activation time of 12,5 minutes is applicable). Specifically:

- The mFRR full activation time (= default activation time for redispatch bids) is reduced from 15 to 12,5 minutes;
- Scheduled activations are requested in the middle of the quarter hour before the quarter hour for which the bid is activated;
- In the assumed activation profile, the ramping up (down) starts (terminates) in the quarter hour before (after) the quarter hour for which the bid has been activated.

In that context, this section addresses the question of **whether or not there is a need to adapt currently used block approach for the perimeter adjustments** (and if yes, in which way). To this end, Section 6.1 first gives an overview of the block approach for the perimeter adjustment and its impact. Next, Section 6.2 evaluates the benefits and drawbacks of the potential alternative approaches for the perimeter adjustments that have been introduced in Section 2.3.

6.1 The block approach for the BRP perimeter adjustments

6.1.1 Introduction to the block approach

Figure 12 schematically illustrates the block approach for the perimeter adjustments applicable today[15] in case of a scheduled mFRR/redispatch activation of two quarter hours (QH(t_0) and QH(t_1)).

[15] Before the new version of the T&C BSP mFRR for MARI and the new version of the T&C SA for iCAROS phase 1 have entered into force.

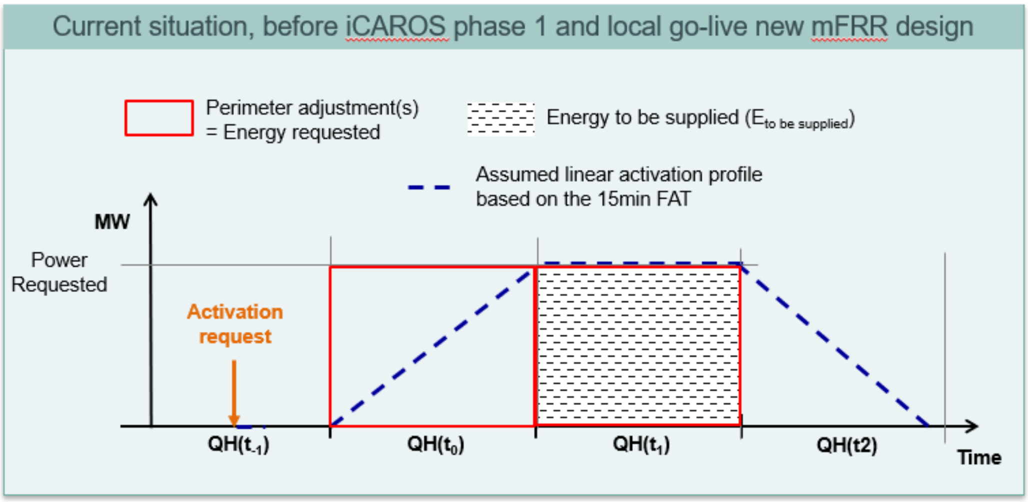

Figure 12: Illustration of the block approach for an upward mFRR/Redispatch activation lasting two quarter hours

As can be seen on the above figure, the current full activation time of 15 minutes is translated in an assumed linear activation profile (presented by the blue dashed line on Figure 12). Currently, no activation control is performed during the first quarter hour for which the bid is activated as this quarter hour spans the full activation time of 15 minutes. During the second quarter hour, the activation control is being performed by checking whether the energy delivered is equal to or larger than the energy to be supplied (indicated by the white surface with the black dashes on Figure 12). In contrast to the activation control, the remuneration of the activated energy bids and the perimeter adjustments are based on the full power requested from the start of the first quarter hour of the activation. Given that the resulting perimeter adjustments are blocks (red rectangles on Figure 12), this way of adjusting the Balancing Perimeter of the BRP is commonly referred to as the “block approach”.

With respect to the linear activation profile that is assumed, it is essential to note that mFRR/redispatching are quarter-hourly energy products (i.e., the BSP/SA has to provide a volume over the quarter hour) and not a profile product such as aFRR. This means that, although the current full activation time is translated in a linear minute-by-minute activation profile as drawn on Figure 12, the activation control is based on quarter-hourly values (i.e., quarter-hourly metering data and quarter-hourly schedules/baselines). The direct consequence of this is that different activation profiles can be (and in practice are being) followed by different delivery points/technologies that all respect the full activation time of 15 minutes and hence result in a successful activation control. In that sense, the combination of the activation control and the block approach currently applied results in a pragmatic solution that recognizes different activation profiles occurring in practice, while giving an indirect incentive to deliver as much as possible the energy requested already during the first quarter hour of the activation.

6.1.2 Impact of the block approach

This section looks at the (potential) impact of applying the block approach. The impact on three different aspects will be considered:

- The impact on the Balancing perimeter of the BRP_{FSP} and the potential impact on pricing of energy bids (Section 6.1.2.1);
- The impact on the incentives for delivering the requested energy (Section 6.1.2.2);
- The possibilities for splitting the roles (Section 6.1.2.3).

6.1.2.1 Potential impact on the Balancing perimeter of the BRP_{FSP}

<u>Current situation (before go-live of iCAROS phase 1 and the new mFRR design for the connection to MARI)</u>

Assuming that the assumed linear activation profile would be followed by the FSP, the impact on the Balancing Perimeter of the BRP_{FSP} of applying the block approach is represented in Figure 13. As can be seen on this figure, the impact would be the following:

- The BRP_{FSP} would have a short (long) position during the first quarter hour of delivery in case of an upward (downward) activation;
- The BRP_{FSP} would have a long (short) position during the quarter hour after delivery in case of an upward (downward) activation.

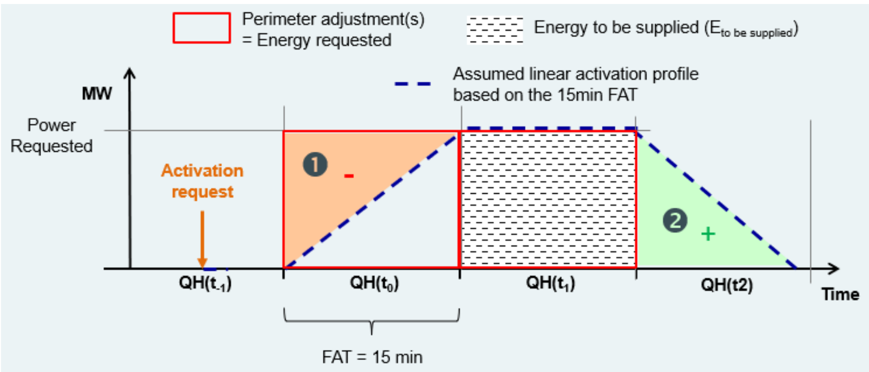

Figure 13: Illustration of the impact of the block approach on the balancing perimeter of the BRP_{FSP} in case the assumed linear activation profile is followed in reality (situation before go-live of iCAROS and the new mFRR design)

In case the linear activation profile would be followed, there would thus be both positive and negative imbalances for the BRP_{FSP}. These imbalances could have a financial impact on the BRP_{FSP} if the financial impact of the negative imbalance would not be fully compensated by the financial impact of the positive imbalance.

For mFRR, the imbalance price is currently correlated with the mFRR activations in the sense that the imbalance price in the first quarter hour of an upward (downward) mFRR activation (QH(t_0) in Figure 13) is on average higher (lower) than the imbalance price in the first quarter hour after the mFRR activation (QH(t_2) in Figure 13). As a result, the financial impact of the positive imbalance on average does not fully neutralize the financial impact of the negative imbalance, implying that, on average, a limited cost would be induced for the BRP_{BSP} in case of an activation.

For redispatching, it is observed that imbalance prices are not correlated with redispatch activations (as could be expected). As a result, the average financial impact of potential imbalances that would occur if the assumed linear activation profile would be exactly followed is expected to be close to zero.

However, it must be noted that the above holds under the assumption that the assumed linear activation profile would be followed (on a quarter-hourly level). As discussed in Section 6.1.1, in practice different activation profiles are being followed (e.g., depending on the technological characteristics) that could all respect the full activation time. Considering further that any difference (on a quarter-hourly level) between the actual activation profile and the profile applied for the perimeter adjustments would introduce an imbalance for the BRP_{FSP}, it can be concluded that potential imbalances introduced for the BRP_{FSP} cannot be fully avoided, and this regardless of the profile taken for the perimeter adjustments.

Situation following the go-live of iCAROS phase 1 and the new mFRR design for the connection to MARI

As discussed above, the assumed activation profile has been adapted and formalized in the context of the integration of the European balancing energy markets and this activation profile has also been adopted for redispatching However, it is important to note that, although the minute-by-minute activation profile has been formalized, mFRR and redispatching are foreseen to remain quarter-hourly energy products. As such, it cannot be excluded that the actual activation profiles will deviate from the new activation profile, particularly because certain technologies cannot exactly follow the MARI profile.

For technologies that would follow the profile of the block approach, no imbalances and potentially resulting costs are introduced. However, in case technologies/delivery points are used that would exactly follow the activation profile, the BRP_{BSP} would face certain imbalances. These imbalances would however be different with the new activation profile and are shown on Figure 14. Indeed, the imbalances that would result if the new activation profile would be followed represent significantly smaller energy volumes compared to the imbalances that would be found in case the linear activation profile based on todays' FAT would be followed.[16] In other words, the new activation profile more closely

[16] The volume of the negative and positive imbalances to which the BRP_{FSP} would be exposed in case the BSP/SA would exactly follow the activation profile is reduced by 67% when comparing the new activation profile to the linear

resembles the profile of the block approach compared to the current linear activation profile. This is due to two reasons: 1) in the new activation profile, the ramp is assumed to happen over 10 minutes compared to the 15 minutes with the current linear activation profile, 2) the ramps are assumed to be spread over two quarter hours.

The potential financial impact on the BRP_{FSP} not only depends on the energy volumes of the potential imbalances but also on the imbalance price spread between the quarter hours where the short and the long positions would be realized. In this regard, it can be noticed that, in contrast to the imbalances that can be further apart with the current activation profile that (as shown on Figure 13), the positive and negative imbalances that would materialize if the new activation profile would be followed happen in consecutive quarter hours (as shown on Figure 14). As a result, the imbalance price spread observed for mFRR also tend to be smaller compared to the current activation profile.

Based on data from April 2022-April 2023, the imbalance prices during the first quarter hour where upward mFRR was activated (QH(t_0) in Figure 14) was on average 90€/MWh higher than in the quarter hour before the activation (QH(t_{-1}) in Figure 14) . Similarly, the imbalance price during the last quarter hour where upward mFRR was activated (QH(t_1) in Figure 14) was on average 88€/MWh higher than in the quarter hour after the mFRR activation (QH(t_2) in Figure 14) . As a result, the imbalance price tends to be higher at the moment the BRP_{BSP} would have a short position (QH(t_0) and QH(t_1) in Figure 14) and lower during the quarter hours where the BRP_{BSP} would have a long position (QH(t_{-1}) and QH(t_2) in Figure 14). Therefore, the potential imbalances for the BRP_{BSP} when following the activation profile on a quarter-hourly basis would on average introduce a cost for the BRP_{BSP}.

For downward mFRR activations, a different observation is made. In general, the imbalance price during moments of downward mFRR activations is lower than outside periods of downward mFRR activations. However, when looking at the price spreads observed shortly before/after a downward mFRR activation, the situation is different. Specifically, in the first quarter hour after the downward mFRR activation, the imbalance price is on average 24€/MWh higher compared to the imbalance price in the last quarter hour of the downward mFRR activation. However, the average imbalance price observed in the quarter hour before the downward mFRR activation is on average 34€/MWh lower than during the first quarter hour of the mFRR activation. As can be seen, for downward activations, the observed price spreads are significantly smaller as for upward activations and would even result on average in a benefit rather than a cost for the $BRP_{BSP.}$

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activation profile based on today's full activation time. With the new activation profile, the volume of the short position during the first quarter hour of the activation (assuming an upward activation) would represent 8,3% of the energy volume that is remunerated for the first quarter hour. During the last quarter hour of the activation, there would be another short position reflecting another 8,3% of the remunerated energy volume of one quarter hour. In contrast, with the linear activation profile based on today's full activation time, the short position in the first quarter hour of delivery would represent 50% of the energy volume that is remunerated for the first quarter hour.

It must be noted that the connection to the European balancing platforms introduce uncertainty on the imbalance price spreads observed between the quarter hour before an mFRR activation and the first quarter hour of the activation, and between the last quarter hour of an mFRR activation and the first quarter hour after the activation. However, Elia would expect these price spreads to rather decrease than increase.[17]

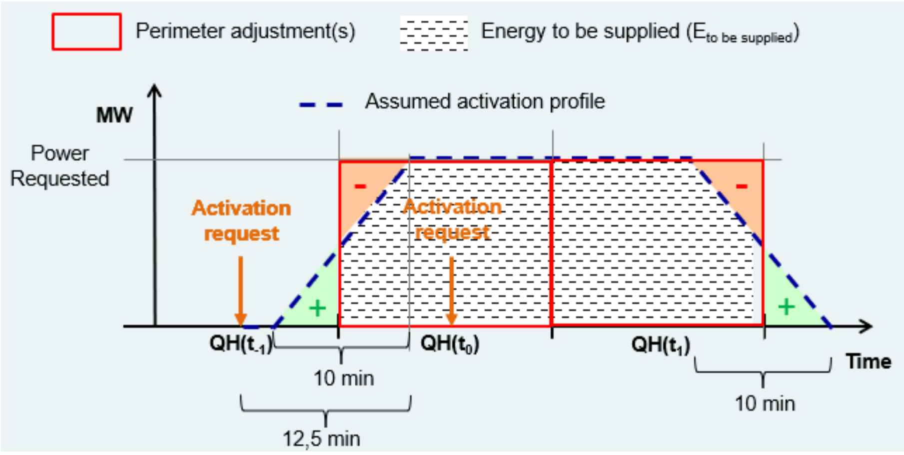


Figure 14: Illustration of the impact of the block approach on the balancing perimeter of the BRP_{FSP} in case the new activation profile would be followed (situation after go-live of iCAROS and the new mFRR design)

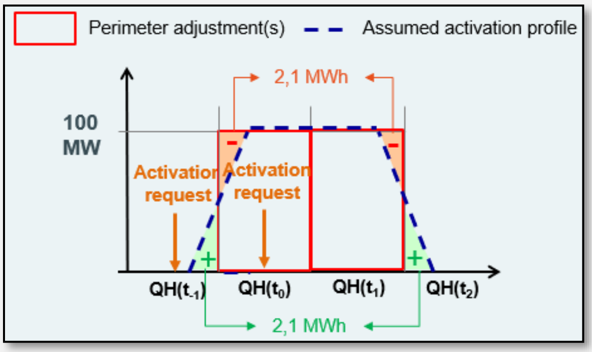
The potential financial impact on the BRP_{BSP} is relevant as any imbalance-related cost for the BRP_{BSP} would likely be considered in the pricing of the submitted energy bids. An illustration of the potential financial impact for an upward mFRR activation is provided below. It must be noted that the below illustration is intended to provide an indication of the order of magnitude of the average[18] financial impact of the imbalances that would be introduced for the BRP_{BSP} in case of an upward activation and under the assumption that the new activation profile would be exactly followed (on a quarter-hourly basis). As indicated above, the imbalance price spread and the resulting average financial impact for a downward activation is much lower (and on average even beneficial for the BRP_{BSP}).

[17] Indeed, today mFRR activations are performed in response to a system imbalance in the Belgian zone. The price of the mFRR activation is considered in the calculation of the imbalance price during the moment of the mFRR activation. As the mFRR component frequently sets the marginal incremental price and hence the imbalance price, the imbalance price tends to be higher during quarter hours with upward mFRR activations compared to the quarter hours just before/after the mFRR activation. However, after connection to the MARI platform, an mFRR energy bid could be activated on request of another TSO. In that case, there is no demand for mFRR by Elia and the clearing price of the activated mFRR energy bid would not be considered in the calculation of the imbalance price for the Belgian zone. As a result, in those cases there would be no reason to assume that the imbalance price during the mFRR activation would be higher than just before/after the activation.

[18] The average financial impact is analyzed as the average financial impact is assumed to be considered by the BSP/BRP_{BSP} when pricing mFRR energy bids.

Assume:

- an upward mFRR Energy Bid of 100 MW is activated for 2 consecutive quarter hours (QH(t_0) and QH(t_1))
- The price of the activated mFRR Energy bid equals 400 €/MWh (for both quarter hours)[19]
- The imbalance price in QH(t_0) and QH(t_1) is 400 €/MWh[20]
- The imbalance price in QH(t_{-1}) and QH(t_4) is 310 €/MWh[21]
- The BSP exactly follows the new activation profile



In this case:

- The energy remuneration received by the BSP corresponds to 20.000 € (= 100 MW * 400 €/MWh * ½ h)
- The cost for the BRP_{BSP} related to the imbalances corresponds to 378€ (= 2 * 2.1 MWh * (400-310) €/MWh)

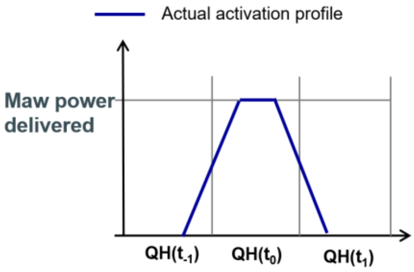
In other words, in this illustration, the imbalances that would be introduced if the BSP would exactly follow the activation profile would represent (on average) less than 2% of the remuneration corresponding to the activated energy bids. In case the BSP would follow the profile of the block approach on a quarter-hourly basis, the BRP_{BSP} would have no imbalances and related costs.

Figure 15: Illustration of the potential financial impact on the BRP_{BSP} in case the assumed activation profile is followed and the block approach for the perimeter adjustments is applied

[19] The price reflects the clearing price of the energy bid and can hence be higher than the price at which the bid has been offered (e.g., for bids lower in the merit order).
[20] In the period April 2022-April 2023, the average imbalance price during moments where upward mFRR has been activated corresponded to 406 €/MWh.
[21] It must be noted that the imbalance prices assumed in the different quarter hours do not directly influence the result of the illustration as long as the spread between imbalance prices remains the same. The imbalance price during the activation could in some moments for instance be higher than the price of the mFRR energy bid. However, this would not impact the results from the illustration as long as the imbalance price spread would remain unchanged. Based on

It must further be noted that the perimeter adjustments according to the block approach do not create a barrier for participation to mFRR. Indeed, perimeter adjustments according to the block approach would not result in a financial incentive for valorizing the flexibility implicitly instead of explicitly in the form of an mFRR energy bid, and hence would not negatively impact liquidity.

This can be clearly shown by looking at the total profits that can be obtained by the FSP/BSP and its BRP when delivering a certain energy volume. Assume an energy volume as illustrated below.



This energy could either be delivered as part of an implicit reaction to the system imbalance/imbalance price or could be delivered in response to an energy bid (assuming the BSP has submitted a corresponding energy bid). In case the energy is delivered as part of an implicit reaction, no perimeter adjustment is being applied. In contrast, in case the energy is delivered as part of an mFRR energy bid, it is assumed that a perimeter adjustment according to the block approach is applied.

In case the energy is delivered as part of an implicit reaction, the joint profit for the FSP/BRP_{FSP} is a direct result from the operational costs of delivering the energy and the imbalance prices in the three quarter hours in which the energy is delivered:

$$Profit = -\left(E_{Del,QH(t-1)} + E_{Del,QH(t0)} + (E_{Del,QH(t1)}\right) \times P^{Operational\ cost} + E_{Del,QH(t-1)} \times P^{imb}_{QH(t-1)} + E_{Del,QH(t0)} \times P^{imb}_{QH(t0)} + E_{Del,QH(t1)} \times P^{imb}_{QH(t1)}$$

In case the energy is delivered in response to the activation of an mFRR energy bid, there are two additional terms in the equation describing the profit for the BSP/BRP_{BSP}: a term related to the energy remuneration of the activated bid and a term related to the adjustment of the perimeter according to the block approach. The resulting joint profit for the BSP/BRP_{BSP} is in that case:

$$Profit = -\left(E_{Del,QH(t-1)} + E_{Del,QH(t0)} + (E_{Del,QH(t1)}\right) \times P^{Operational\ cost} + E_{Del,QH(t-1)} \times P^{imb}_{QH(t-1)} + E_{Del,QH(t0)} \times P^{imb}_{QH(t0)} + E_{Del,QH(t1)} \times P^{imb}_{QH(t1)} + E_{Req} \times P^{energy\ bid} - E_{Req} \times P^{imb}_{QH(t0)}$$

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actual imbalance price spreads observed between April 2022-April 2023, a spread of 90 €/MWh for upward activations is used as a representative value for the illustration.

As can be seen from these equations, the potential revenues that could be obtained by delivering a certain energy implicitly could only exceed the revenues from delivering the same energy in response to an activation of an mFRR energy bid in case the two additional terms form a negative contribution to the profit, i.e., in case

$$+ E_{Req} \times P^{energy\ bid} - E_{Req} \times P^{imb}_{QH(t0)} < 0$$

, or thus in case the imbalance price during the moment of the activation would exceed the clearing price of the energy bid (e.g., in case the imbalance price would be set by an aFRR energy bid). This incentive related to the different prices is general and regardless of the perimeter adjustments.[22]

It can hence be concluded that the perimeter adjustment with the block approach does not form an entry barrier for participation to mFRR compared to valorizing the flexibility implicitly. This result is general for both upward and downward activations and independent of any assumptions related to the imbalance price spreads between the quarter hour(s) for which the submitted bid has been activated and the quarter hours just before/after the activation.

6.1.2.2 Impact on incentives for delivering the requested energy

In Section 4, an in-depth analysis was performed on the financial incentives for delivering the requested energy and this for both the case where an adjustment of the Balancing Perimeter of the BRP would be performed with the requested energy volume and the case where an adjustment of the Balancing Perimeter of the BRP would be performed with the delivered energy volume. Here[23], it was concluded that, when an adjustment with the requested volume is applied, the financial incentives depend solely on the imbalance price, the penalty applied in case of underdelivery and the operational cost of effectively delivering the energy, and hence not on the volume of the perimeter adjustment. This result is valid when applying the block approach for the perimeter adjustments but would be equally valid in case a different profile would be taken for the perimeter adjustments. Indeed, although the adjustment of the perimeter of the BRP represents a certain financial value for the BRP_{FSP} (cost or revenue), this financial value represents a sunk cost/value after a bid has been activated (i.e., the value/cost related to the perimeter adjustment can no longer be influenced by delivering the requested energy). After the bid has been activated, the FSP still has the choice of whether or not to deliver the requested energy and the value of delivering that energy is determined by the imbalance price and the avoidance of financial penalties in case of underdelivery. As such, it can be concluded that **the block approach for the adjustment of the perimeter has no direct impact on the financial incentives for delivering the requested energy**.[24]

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[22] It must be noted that in practice, many different aspects could determine the choice of the FSP (e.g., uncertainty related to imbalance prices, ability to deliver mFRR, etc.).
[23] Section 4.2.1
[24] The perimeter adjustments could provide an indirect incentive to follow the profile of the perimeter adjustment (and avoid imbalances) where possible.

6.1.2.3 Impact on the possibilities for splitting the roles

The block approach does not have a direct impact on the BRP_{source}/Supplier and hence has no direct impact on the split of roles. Indeed, the block approach refers to the approach for adjusting the perimeter of the BRP_{FSP} for the energy sold to Elia in the form of an mFRR or redispatch energy bid. In case the party taking up the roles of FSP/BRP_{FSP} would be a different party than the party(ies) taking up the roles of BRP_{source}/Supplier, a compensation mechanism (e.g., Transfer of Energy or based on a bilateral agreement between the different parties) is applied and this independent of the adjustment of the perimeter of the BRP_{FSP}.

6.2 Potential alternatives for the block approach

This section analyzes the potential benefits and drawbacks of the alternative ways of adjusting the perimeter of the BRP. The different options for the perimeter adjustments that are considered have been presented in Section 2.3.

6.2.1 Option 1b) adjustment during the quarter hour of delivery based on the assumed activation profile

In this option, the perimeter of the BRP_{FSP} would be adjusted only during the quarter hour for which the activated energy bid has been submitted (as also the case for the block approach). However, the volume of the adjustment would correspond to the integral of the assumed activation profile within this quarter hour.

Figure 16 represents the impact on the BRP_{FSP} in case the FSP would exactly follow the activation profile. Notably:

- The BRP_{FSP} would be balanced during the quarter hours for which the energy bid has been activated
- The BRP_{FSP} would have a positive (negative) imbalance in the quarter hour in which the ramp up is initiated, and the quarter hour in which the ramp down is terminated in case of an upward (downward) activation.[25]

[25] Assuming the party taking up the role of BRP_{FSP} is the same party taking up the role of BRP_{source}.

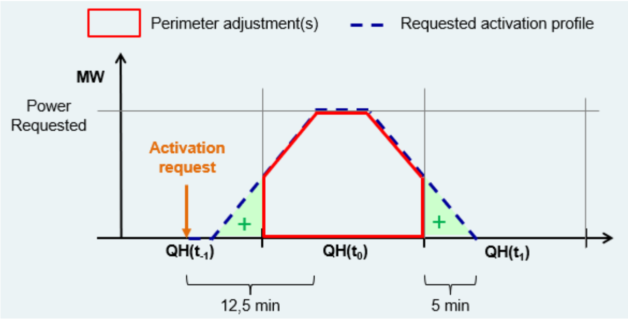

Figure 16: Illustration of the impact of the perimeter adjustments of Option 1b) on the perimeter of the BRP$_{FSP}$ in case the assumed activation profile would be followed

The result is thus that perimeter adjustments would represent a **significant hidden subsidy for the BRP$_{FSP}$ in case of upward activations and a significant hidden cost for the BRP$_{FSP}$ in case of downward activations**. This because, for an upward activation, the energy delivered in the quarter hour before the activation and the quarter hour after the activation is remunerated twice: it is remunerated by Elia as part of the energy bid remuneration and it is valorized via the imbalance price (that is positive on average).[26] For a downward activation, an opposite impact would be observed, i.e., the FSP and BRP$_{FSP}$ would need to pay twice for the downward energy delivered during the ramping periods (assuming positive energy bid and imbalance prices): once as part of the energy bid remuneration and once in the form of a negative impact on the imbalance. Note that **this subsidy/cost introduced via this way of adjusting the perimeter is i) applicable to all delivery points/technologies participating as it is independent of the actual profile followed, ii) can take significant proportions.[27]**

The hidden subsidies and costs could introduce significant distortions. In particular for mFRR, the subsidies/costs will significantly distort bid prices (assuming that the BSP would consider all subsidies/costs when pricing energy bids), which would **result in a strong distortion of the common merit order list of the MARI platform**. This will in turn lead to a **sub-optimal use of the available flexible resources** and hence higher system costs. In addition to this distortion of the common merit order list, the additional cost introduced via this type of perimeter adjustment **for downward flexibility could result in a barrier for participation to mFRR** and hence negatively impact liquidity for downward balancing energy.

[26] Note that it is assumed that the remuneration of the energy bid would not be changed when this option for the perimeter adjustments would be applied, i.e., the remunerated energy corresponds to the full energy volume of the assumed activation profile (equal to the volume of the perimeter adjustment according to the block approach).
[27] Taking the same illustration as in Section 6.1.2.1, but now applying the perimeter adjustments of Option 1b), the subsidy for the BRP$_{BSP}$ represents a value of 1302€ (= 2 * 2.1 MWh * 310 €/MWh) or more than 6% of the energy remuneration received over the two quarter hours. For downward activations, the additional cost for the BRP$_{BSP}$ is of a similar order of magnitude.

In addition to introducing undesirable subsidies/costs, **this approach for adjusting the perimeters would also introduce significant complexity**. This because the volume of the perimeter adjustment to be applied in the different quarter hours would need to be calculated separately considering whether or not the bid has been activated in the previous/next quarter hours, the volumes (and direction) related to those activations and the moment of activation (in case of direct activations).

Elia hence considers that Option 1b) does not form an appropriate approach for adjusting the Balancing Perimeter of the BRP.

6.2.2 Option 1c) adjustment during all quarter hours based on the assumed activation profile

In this option, the perimeter of the BRP_{FSP} would be adjusted during the quarter hour for which the activated energy bid has been submitted as well as during the quarter hours where the ramp-up is initiated and the ramp-down is terminated. The volume of the adjustment in each of those quarter hours would correspond to the integral of the activation profile within that quarter hour. This is represented in Figure 17.

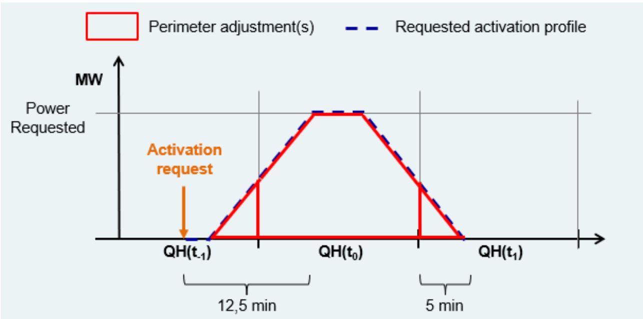

Figure 17: Illustration of the impact of the perimeter adjustments of Option 1c) on the perimeter of the BRP_{FSP} in case the assumed activation profile would be followed

Intuitively, this option of adjusting the perimeter of the BRP_{FSP} has the **benefit that the BRP_{FSP} would not have imbalances in case the FSP would exactly follow the assumed activation profile** (on a quarter-hourly basis).[28] **However, in practice, imbalances would still be introduced for technologies that are not able (e.g., technologies with an on/off behavior) or would not follow the assumed activation profile (e.g., possible for technolo-**

[28] Assuming the party taking up the role of BRP_{FSP} also takes up the role of BRP_{source}.

gies that are capable of responding significantly faster than the full activation time) while still realizing compliant activations). As such, a cost/benefit for the BRP_{FSP} will still be introduced for certain technologies/delivery points.

Moreover, this approach of adjusting the perimeter of the BRP_{FSP} would come with fundamental challenges. First, this approach comes with **a high level of complexity** because:

- The calculation of the volume to adjust in the different quarter hours becomes significantly more complex. This because the volume of the perimeter adjustment to be applied in the different quarter hours would need to be calculated separately considering whether or not the bid has been activated in the previous/next quarter hours, the volumes (and direction) related to those activations and the moment of activation (in case of direct activations).
- The correction models for splitting the roles (e.g., Transfer of Energy) would logically also need to be extended to the quarter hours before and after the quarter hour for which the submitted bid has been activated.

The need to extend correction models, such as Transfer of Energy, to the quarter hours where the ramp is initiated/terminated comes with **fundamental inaccuracies for calculating the delivered volume during those quarter hours**. This because mFRR and redispatching are quarter-hourly products relying on quarter-hourly metering and schedule/baseline values. Accurately quantifying the small energy volumes delivered during only a fraction of a quarter hour while using quarter hourly metering and baseline values is not considered feasible.[29] The below example illustrates this fundamental inaccuracy The deviations on the calculated volume of energy delivered during the ramping quarter hours could i) introduce a significant risk for the BRP_{FSP} that could potentially form a barrier for participation, and ii) introduces a random character in the adjustments performed for the BRP_{source}.

[29] In case of a scheduled activation, and assuming the BSP follows the activation profile, energy is being delivered in only 5 minutes during the quarter hours just before and just after the activation. In case of a direct activation, energy could be delivered in even a smaller part of the quarter hour just before the activation.

Assume:

- An upward mFRR Energy Bid of 10 MW is activated on an industrial site.
- In case no activation would have taken place, the industrial site would have consumed 20 MW (i.e., a perfect baseline would be 20 MW).
- The industrial site exactly follows the assumed activation profile (relative to the perfect baseline).
- In practice, the baseline is not always fully accurate. The calculated baseline is assumed to be distributed around the value of 20 MW with a normal distribution resulting in a mean absolute error of 2 MW.

Under these assumptions, the average absolute deviation of the calculated energy volume within a quarter hour represents 0.5 MWh (either in positive or negative direction). This while the energy volume that would be effectively delivered (using a perfect baseline) during the ramping quarter hours represent an energy volume of merely 0,2 MWh (= 8,3% * 10 MW * (1/4)h). In other words, the noise introduced by an imperfect baseline would represent energy volumes that are significantly larger than the energy volume effectively delivered. This is illustrated in the figure below that shows the probability distribution of the calculated volume of energy delivered in comparison to the volume that is supposed to be delivered during the ramping quarter hours.

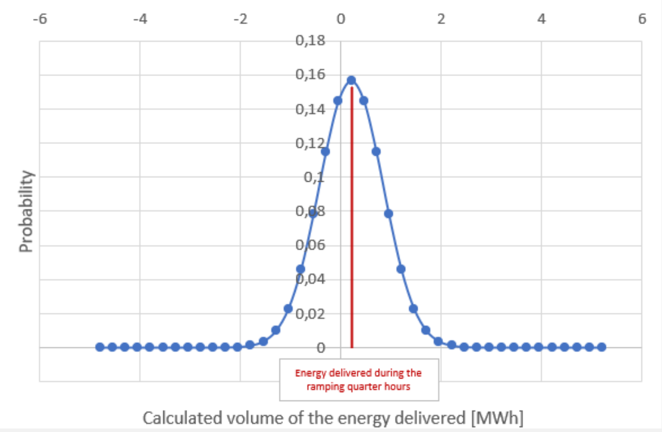

Figure 18: Illustration of the challenge of accurately calculating the energy volume delivered during the ramping quarter hours. The noise introduced by the baseline in unavoidable as Elia already adopts the best performing baseline methodologies for mFRR (cfr. The conclusions from the ***2021 study on baseline methodologies****)..*

6.2.3 Option 2a) adjustment during the quarter hour of delivery based on the delivered energy

In this option, the perimeter of the BRP_{source} would be adjusted during the quarter hour for which the activated energy bid has been submitted. The volume of the adjustment would correspond to the energy delivered during the quarter hour of the activation (calculated based on the quarter-hourly metering values and the quarter-hourly schedules/baseline. This is represented in Figure 19.

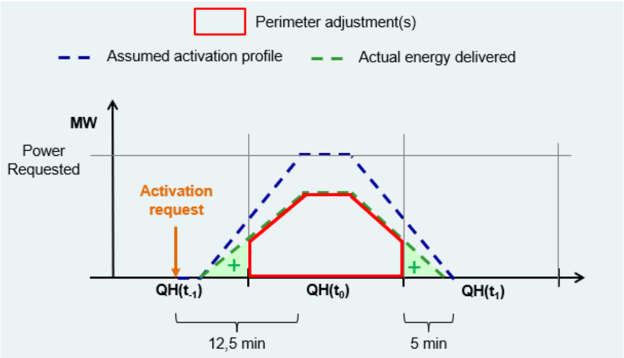

Figure 19: Illustration of the impact of the perimeter adjustments of Option 2a) on the perimeter of the BRP

As this option is based on adjusting the perimeter of the BRP_{source} with the delivered volume, **this option comes with the fundamental drawbacks of using the delivered volume to adjust the perimeter of the BRP,** as identified in Sections 3 and 5.

In addition, when this approach to the perimeter adjustments would be taken, and assuming the FSP would exactly follow the activation profile (at least on a quarter-hourly basis):

- The BRP_{source} would be balanced during the quarter hours for which the energy bid has been activated
- The BRP_{source} would have a positive (negative) imbalance in the quarter hour in which the ramp up is initiated, and the quarter hour in which the ramp down is terminated in case of an upward (downward) activation.

The result is that the volume of the perimeter adjustment is by default smaller than the remunerated energy volume, and hence would result in a hidden subsidy for upward energy bids and a hidden cost for downward energy bids (as in Option 1b).

In addition, this option would come with a very high complexity as it reflects a fundamental change compared to the perimeter adjustments based on the requested volume that are applied today and the models for splitting the roles applied today.

Elia hence considers that Option 2a) does not form an appropriate approach for adjusting the Balancing Perimeter of the BRP.

6.2.4 Option 2b) adjustment during all quarter hours based on the delivered energy

In this option, the perimeter of the BRP_{source} would be adjusted during the quarter hour for which the activated energy bid has been submitted as well as during the quarter hours where the ramp-up is initiated and the ramp-down is terminated. The volume of the adjustment in each of those quarter hours would correspond to energy delivered during each of those quarter hours (calculated based on the quarter-hourly metering values and the quarter-hourly schedules/baseline). This is shown in Figure 20.

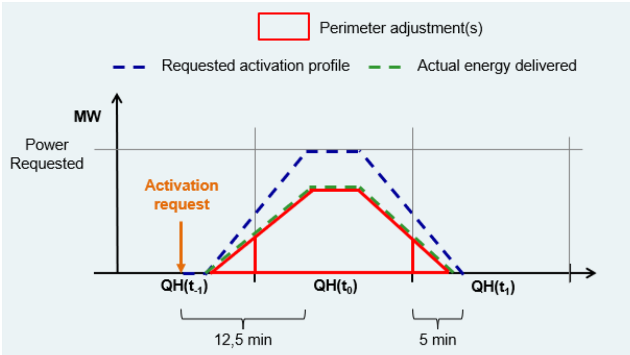

Figure 20: Illustration of the impact of the perimeter adjustments of Option 2a) on the perimeter of the BRP

As this option is based on adjusting the perimeter of the BRP_{source} with the delivered volume, **this option comes with the fundamental drawbacks of using the delivered volume to adjust the perimeter of the BRP, as identified in Sections 3 and 5.**

In addition, this approach would come with a **very high complexity** as it reflects a fundamental change to the perimeter adjustments with the requested energy volume that are applied today and the models for splitting the roles that are applied today. Moreover, this approach comes with the **fundamental difficulty of calculating the delivered volume during the quarter hours where the ramp is initiated/terminated**. This because mFRR and redispatching are quarter-hourly products relying on quarter-hourly metering and schedule/baseline values. Accurately quantifying the small energy volumes delivered during only a fraction of a quarter hour while using quarter hourly metering and baseline values is not considered feasible.

Elia hence considers that Option 2b) does not form an appropriate approach for adjusting the Balancing Perimeter of the BRP.

6.3 Summary and conclusion

Based on the analysis of the impact of the block approach presented in Section 6.1, **Elia considers that there currently is no motivation for adapting the block approach for the perimeter adjustments** applied in case of the activation of mFRR or Redispatch energy bids. This because:

- The **block approach does not impact the financial incentives for delivering the requested energy** once a bid has been activated (cfr. Section 6.1.2.2);
- The **block approach does not directly impact the possibilities for splitting the roles** of FSP/BRP_{FSP} and BRP_{source}/Supplier (cfr. Section 6.1.2.3);
- The **block approach could potentially introduce imbalances in the perimeter of the BRP_{FSP}**. This in case the FSP would exactly follow the activation profile. Such potential imbalances could slightly impact the costs perceived by the FSP/BRP_{FSP} related to the activation of an energy bid and could hence impact the pricing of mFRR energy bids (as the costs could be internalized in the bid). However, it must be noted that:
    - **any potential financial impact for the BRP_{FSP} in case the BSP would exactly follow the activation profile is currently observed to be highly limited on average.** This because i) the imbalances that would be introduced represent highly limited energy volumes, ii) the imbalances that would be introduced are in opposite directions and would hence partially cancel out on average; iii) the financial impact on the BRP_{FSP} depends on the correlation between imbalance prices and the moment of mFRR/redispatch activations, which is expected to be close to zero for redispatching and uncertain and rather expected to decrease for mFRR after connection to MARI.
    - **independent of the profile taken for adjusting the perimeter of the BRP_{FSP}** (i.e., Option 1a), 1b) or 1c)), **potential imbalances for the BRP_{FSP} cannot be fully avoided for all technologies/deliver points as the actual activation profiles will differ from the profile used for the perimeter adjustment.**

7. Recommended target design for the BRP perimeter adjustments

Section 2 has presented the different options for adjusting the perimeter of the BRP in case of the activation of an mFRR or redispatch bid. Sections 3 to 6 subsequently presented the result of an in-depth analysis of these different options. A global overview of the benefits and drawbacks of the different options is presented in Figure 21.

	Option 1: Adjustment with the Requested volume ($-E_{Req}$)			Option 2: Adjustment with the Delivered volume ($-E_{Del}$)	
	1a) Block approach	1b) Req. profile during Qh of delivery	1c) Req. profile all Qhs	2a) Del. during Qh of delivery	2b) Del. during Qh of delivery and ramping Qhs
Balance responsibility	✓	✓	✓	✗	✗
Possibility to avoid incentives for not performing the activation	✓	✓	✓	✓	✓
Possibilities to split the roles BRP – SA/BSP	✓	✓	✓ / ✗	✓ / ✗	✓ / ✗
Impact of potential imbalances for the BRP_{FSP}	✓ / ✗	✗	✓ / ✗	✗	✓
Implementation complexity	++	-	--	--	---
Compliancy with the regulatory framework	✓	✓	✓	✗	✗
	Proposed option				

Figure 21: Overview of the benefits and drawbacks of the considered options for the perimeter adjustments in case of the activation of an mFRR or redispatch energy bid.

Based on this, **<u>Elia recommends maintaining the current approach for the perimeter adjustments (i.e., the so-called block approach or the Option 1a)</u>**. This mainly because:

- Perimeter **adjustments based on the requested volume have fundamental benefits compared to perimeter adjustments with the delivered volume** (cfr. the conclusions of sections 3 and 5)
- From the different variants of the perimeter adjustments based on the requested volume, Elia is convinced that the **current approach for the perimeter adjustments provides the right incentives for delivering the requested service, enables a split of roles and forms the most pragmatic option**.