23 DECEMBER 2021

Informative document in support of the public consultation on the proposal for modification of the Rules for the compensation of the quarter-hourly imbalances (Balancing Rules)

Content

Practical information

Elia has launched a public consultation regarding the Balancing Rules. The document submitted for consultation is published on the Elia website.

The purpose of this public consultation is to receive comments and suggestions from involved market parties in the context of the official approval procedure of the document pursuant to article 200 of the Royal Decree with respect to the grid code for the management of the transmission grid of electricity and the access to this grid of 22 April 2019 (hereafter referred to as "Federal Grid Code"). The market parties can submit their responses via the online form on the Elia website, from 23rd December 2021 to 2nd of February 2022.

Following the consultation Elia will submit all stakeholders' responses to the CREG together with the document proposed for regulatory approval, the consultation report, and this supporting document. Elia will publish all these documents on the Elia website except for the responses of stakeholders that requested their feedback to be treated as confidential.

Questions relative to this consultation can be sent to the following email address: **consultations@elia.be**.

Introduction

Pursuant to article 200 of the Federal Grid Code, Elia submits market functioning rules for the compensation of quarter-hour imbalances (hereafter referred to as "Balancing Rules") and amendments thereof to the CREG for approval.

The current Balancing Rules entered into force on September the 30th, 2020. As Elia is preparing the next evolution of the aFRR energy and capacity designs, Elia must submit new proposals for related documents:

- Terms and Conditions for Balancing Service Providers for automatic Frequency Restoration Reserve (**T&C BSP aFRR**), which will be publicly consulted between the 8th of December 2021 and the 18th of January 2022.
- Balancing Rules, which will be publicly consulted between the 23rd of December 2021 and the 2nd February 2022.

As mentioned in the Proposal for Amendment of the T&C BSP aFRR, the implementation plan of the new designs is divided into 2 steps. The modification of the Balancing Rules is required for the 2nd step of the go-live, corresponding to the connection to the aFRR-Platform (known as the "PICASSO project)", the switch from paid-as-bid to marginal price remuneration of aFRR Energy bids and the change of the price limits for aFRR Energy bids.

1. Main changes compared to the current version of the Balancing Rules

The main changes brought to the Balancing Rules are the consequence of the connection to the aFRR-Platform. In addition, changes are brought to ensure compliancy with ISH[1] and references and terminology are updated consistently with the evolutions of the T&C BSP aFRR, the LFC BOA and the T&C SA.

This supportive document focuses on 2 particular changes in the Balancing Rules:

- The calculation of the System Imbalance
- The calculation of the aFRR component of the imbalance price

[1] Methodology for the harmonisation of the main features of imbalance settlement, ACER decision 18-2020

2. Calculation of the System Imbalance

2.1 Calculation before connection to the aFRR-Platform

The System Imbalance (SI) is currently calculated as the difference between the Area Control Error ("ACE") and the Net Regulation Volume ("NRV"):

$$SI = ACE - NRV$$

The ACE is equal to ($\Delta P + k\Delta f$ - Pcorr), where:

- ΔP represents the difference between the measured and scheduled flows on the borders. The principle behind is the following: if Elia import / exports as much as scheduled, it means that Elia is balanced.
  Important note: the scheduled flows do not include the Pcorr signals from the EU Platforms.
- $k\Delta f$ is the Frequency Control Error. This corresponds to the reaction that is expected from the FCR delivering units in Elia's LFC Block. If Elia is exporting more than expected because it's activating FCR in reaction to a frequency deviation (i.e. a deviation from 50 Hz), this should not impact the ACE. The term $k\Delta f$ allows to neutralize the effect of these FCR activations on the ACE.
- Pcorr is the correction signal received from the IN-Platform. It is used as input of the aFRR controller to prevent activation of aFRR in Elia's LFC block. Therefore, when an imbalance is compensated by the IN-Platform, the ΔP is maintained and it's necessary to correct the ACE with the correction signal from the IN-Platform.

The NRV is the sum of the contribution of the IN-Platform and the aFRR requested and mFRR requested to the BSPs. It represents the volume of reserves activated for the needs of the LFC block of Elia.

The sign convention is positive for exports and for activation of FRR in the positive direction (negative for imports and activation of FRR in the negative direction).

The table below shows an example where:

- The System Imbalance is 0MW until T0. At that time, no activations take place
- At T0, a SI of -150MW occurs (Elia has a short position)
- The SI will be covered by local aFRR activations (100MW) and the IN-Platform (50MW)
- Assumptions: mFRR and $k\Delta f$ = 0MW

Time	System Imbalance	P measured	P scheduled	Pcorr	aFRR requested	ACE	NRV (aFRR req)	Calculated SI
T0 – 1 cycle	0	500	500	0	0	0	0	0
T0	-150	350	500	0	0	-150	0	-150
T0 + 1 cycle	-150	350	500	-50	0	-100	50	-150
T0 + FAT/2	-150	400	500	-50	50	-50	100	-150
T0 + FAT	-150	450	500	-50	100	0	150	-150

The example shows in particular:

- How the imbalance translates in a difference in the measured values on the borders (ΔP)

- How the activation of aFRR (locally) reduces the ∆P
- How the volumes netted via the IN-Platform impacts the ACE, but not the ∆P. Unintended flows become intended flows, but the physically, the flows remain unchanged
- That the SI calculated as ACE – NRV gives the correct result

2.2 Impact of the connection to the aFRR-Platform

The connection to the aFRR-Platform brings some modifications to the components used in the calculation of the SI:

- If the notion of NRV were to be used, aFRR requested would have to be replaced by aFRR Satisfied Demand
  - This is necessary as the aFRR requested includes the activations of bids in Elia's LFC Block for other TSOs and excludes the activations of other TSOs to cover the needs of Elia's LFC Block
  - The aFRR Satisfied Demand received from the aFRR-Platform is unramped, meaning it does not take into account the activation dynamics of the BSPs. In other words, in case a 150MW imbalance appears and that the aFRR-Platform has sufficient bids (or netting potential) to cover that new aFRR demand, the aFRR Satisfied Demand will change to 150MW as of the next Optimization Cycle (4 seconds later). In practice however, BSPs in Elia's LFC Block as well as in other LFC Blocks will need some time to activate the volumes requested.
- The ACE is calculated by the FRCE Adjustement Process (FAP) of the aFRR-Platform.
  - Objective: consider the aFRR activation dynamics in the ACE of each TSO. This is necessary to avoid that an exporting TSO receives ACE because of the mismatch between the unramped correction signal and the activation of aFRR by BSPs.
  - As a result, the ACE is not anymore measured by Elia, but sent by the aFRR-Platform.

The examples below show concretely what would be the consequence if SI were still calculated as ACE – NRV. For all examples, we assume mFRR, IN-Platform contribution and k∆f = 0MW.

Example 1: no imbalance, activation of 150MW in the positive direction for other TSOs

Time	System Imbalance	P measured	P scheduled	Pcorr	aFRR Satisfied Demand	aFRR requested (locally)	ACE (wo FAP)	ACE (with FAP)	NRV (aFRR SD)	Calculated SI
T0 – 1 cycle	0	500	500	0	0	0	0	0	0	0
T0	0	500	500	150	0	0	-150	0	0	0
T0 + 1 cycle	0	500	500	150	0	0	-150	0	0	0
T0 + FAT/2	0	575	500	150	0	75	-75	0	0	0
T0 + FAT	0	650	500	150	0	150	0	0	0	0

In this example, the calculated SI is correct, as long as the ACE considered takes into account the correction of the FAP. The example also illustrates why the FAP is needed, as otherwise Elia would have an ACE for exporting aFRR.

Example 2: imbalance of -150MW, covered by local activations

Time	System Imbalance	P measured	P scheduled	Pcorr	aFRR Satisfied Demand	aFRR requested (locally)	ACE (wo FAP)	ACE (with FAP)	NRV (aFRR SD)	Calculated SI
T0 – 1 cycle	0	500	500	0	0	0	0	0	0	0
T0	-150	350	500	0	0	0	-150	-150	0	-150
T0 + 1 cycle	-150	350	500	0	150	0	-150	-150	150	**-300**
T0 + FAT/2	-150	425	500	0	150	75	-75	-75	150	**-225**
T0 + FAT	-150	500	500	0	150	150	0	0	150	-150

This example illustrates that calculating the SI based on the ACE and on the NRV (based on the aFRR Satisfied Demand) leads to errors. The reason is that ∆P is based on measures, which takes into account the activation dynamics of aFRR, while the aFRR Satisfied Demand does not.

Example 3: imbalance of -150MW, covered by activations abroad

Time	System Imbalance	P measured	P scheduled	Pcorr	aFRR Satisfied Demand	aFRR requested (locally)	ACE (wo FAP)	ACE (with FAP)	NRV (aFRR SD)	Calculated SI
T0 – 1 cycle	0	500	500	0	0	0	0	0	0	0
T0	-150	350	500	0	0	0	0	-150	0	-150
T0 + 1 cycle	-150	350	500	-150	150	0	0	-150	150	**-300**
T0 + FAT/2	-150	350	500	-150	150	0	0	-75	150	**-225**
T0 + FAT	-150	350	500	-150	150	0	0	0	150	-150

This example leads also leads to errors in the calculated SI.

As a conclusion, once we are connected to the aFRR-Platform, as soon as aFRR activations take place to solve an imbalance, calculating the SI based on the ACE and on the NRV is not correct anymore.

2.3 Proposal

The following approach to calculate the SI is proposed in the Balancing Rules:

$$SI = \Delta P + k\Delta f - (\text{aFRR Requested} + \text{mFRR Requested})$$

The use of this formula is justified as follows:

- It reflects the **physical balance of the system**
- FRR activations should not impact the SI
    - Impact of **local FRR activation** are reflected in the flow measured on the borders and compensated by the term "aFRR Requested + mFRR Requested"
    - **Imported FRR activations** do not impact the cross-border flows. Unintented flows become intended flows, but ∆P and SI remain unchanged

The tables below illustrate the result of this formula with the same examples as in §2.2. Here also, it's assumed that mFRR, IN-Platform contribution and k∆f = 0MW.

Example 1: no imbalance, activation of 150MW in the positive direction for other TSOs

Time	System Imbalance	P measured	P scheduled	Pcorr	aFRR Satisfied Demand	aFRR requested (locally)	ACE (wo FAP)	ACE (with FAP)	NRV (aFRR SD)	Calculated SI
T0 – 1 cycle	0	500	500	0	0	0	0	0	0	**0**
T0	0	500	500	150	0	0	-150	0	0	**0**
T0 + 1 cycle	0	500	500	150	0	0	-150	0	0	**0**
T0 + FAT/2	0	575	500	150	0	75	-75	0	0	**0**
T0 + FAT	0	650	500	150	0	150	0	0	0	**0**

The example illustrates how the aFRR requested (locally) compensates the change in ∆P (via Pmeasured) occurring as a result of the activation requested by the aFRR-Platform.

Example 2: imbalance of -150MW, covered by local activations

Time	System Imbalance	P measured	P scheduled	Pcorr	aFRR Satisfied Demand	aFRR requested (locally)	ACE (wo FAP)	ACE (with FAP)	NRV (aFRR SD)	Calculated SI
T0 – 1 cycle	0	500	500	0	0	0	0	0	0	**0**
T0	-150	350	500	0	0	0	-150	-150	0	**-150**
T0 + 1 cycle	-150	350	500	0	150	0	-150	-150	150	**-150**
T0 + FAT/2	-150	425	500	0	150	75	-75	-75	150	**-150**
T0 + FAT	-150	500	500	0	150	150	0	0	150	**-150**

The same conclusion can be drawn from this example: ∆P is progressively reduced to 0 thanks to local aFRR activations. The SI remains equal to -150MW, which is the correct result.

Example 3: imbalance of -150MW, covered by activations abroad

Time	System Imbalance	P measured	P scheduled	Pcorr	aFRR Satisfied Demand	aFRR requested (locally)	ACE (wo FAP)	ACE (with FAP)	NRV (aFRR SD)	Calculated SI
T0 – 1 cycle	0	500	500	0	0	0	0	0	0	**0**
T0	-150	350	500	0	0	0	0	-150	0	**-150**
T0 + 1 cycle	-150	350	500	-150	150	0	0	-150	150	**-150**
T0 + FAT/2	-150	350	500	-150	150	0	0	-75	150	**-150**
T0 + FAT	-150	350	500	-150	150	0	0	0	150	**-150**

Finally, this last example shows that the result of the calculation also provides the expected result when aFRR Demand is satisfied by activations by other TSOs.

3. Calculation of the aFRR component of the imbalance price

3.1 Calculation when Elia is connected to the aFRR-Platform

The new formula proposed in the Balancing Rules is reminded below. Example is taken for the MIP, applicable in case of a short position of Elia's LFC Block, leading to a need of positive balancing energy on average over the quarter-hour).

$$\frac{\sum_{OC\ where\ aFRR\ SD_{OC,j}>0_{j=qh}} \left(df_{OC,j} * \ aFRR\ SD_{OC,j} * CBMP_{OC,pos,j} + \left(1 - \ df_{OC,j}\right) * \ aFRR\ SD_{OC,j} * VoAA_{pos,j}\right)}{\sum_{OC\ where\ aFRR\ SD_{OC,j}>0_{j=qh}} \left(aFRR\ SD_{OC,j}\right)}$$

with:

- *OC*: the Optimisation Cycle of the Activation Optimisation Function of the aFRR-Platform
- $df_{OC,j}$: the direction factor of the Optimisation cycle OC during the concerned quarter-hour j. The direction factor is equal to 1 when the aFRR-Platform selects at least one aFRR Energy bid in the direction requested by Elia and 0 otherwise.
- $aFRR\ SD_{OC,j}$: the aFRR Satisfied Demand of the Optimisation Cycle OC during the concerned quarter-hour j, expressed in MW.
- $CBMP_{OC,pos,j}$: the CBMP of the Optimisation Cycle OC during the concerned quarter-hour j, in the positive direction, expressed in €/MWh.
- $VoAA_{pos,j}$: the Value of Avoided Activation in the positive direction of the concerned the quarter-hour j, expressed in €/MWh. The $VoAA_{pos}$ corresponds to the first aFRR Energy Bid in the LMOL available for regulation in the positive direction.

Use of the aFRR Satisfied Demand

The use of the aFRR Satisfied demand for the volume considered in the volume weighted average is consistent with ISH Article 9(5)(c). In addition, it is consistent with volumes considered in the settlement between TSOs for cross-border activations via the aFRR-Platform.

Use of the CBMP

The use of the CBMP is consistent with ISH 9(3)(c). In addition, it is consistent with prices considered in the settlement between TSOs for cross-border activations via the aFRR-Platform, as well as with the prices used for the settlement of BSPs (except for activated bids which have a bid price above the CBMP, see T&C BSP aFRR Article II.16.7).

Use of the direction factor

The notion of direction factor is needed because it can occur that the average demand in the uncongested area of the aFRR-Platform is in the opposite direction of Elia's demand. For example, Elia has a demand of 100MW in the positive direction (Elia is short) and the aFRR-Platform selects bids in the downward direction (as a result of a larger demand of other TSOs in the negative direction). In this case, the CBMP calculated by the aFRR-Platform corresponds to a price for activations in the negative direction, while Elia's need is in the positive direction.
Therefore, the CBMP is only considered in the imbalance price when its direction corresponds to Elia's need. In this way, the signal given to the BRPs in Elia's LFC Block via the imbalance price provides the right incentive to balance the Elia LFC Block.

Use of the VoAA when direction factor is equal to 0

However, if Optimisation Cycles where the direction factor is equal to 0 were not considered at all, the resulting imbalance price would in some cases lead to unjustified values, as illustrated in the extreme example below.

- Elia's demand = 100 MW up during the full quarter-hour
- During the first 224 OCs of the quarter-hour: other TSOs demand = 400 MW down ➔ Direction factor = 0
- During the last OC of the quarter-hour: other TSOs demand = 200 MW up ➔ Direction factor = 1
- The Common Merit-order is the following

Position in CMOL	Positive aFRR	Negative aFRR
1	100MW @ 60 €/MWh	100MW @ 20 €/MWh
2	100MW @ 90 €/MWh	100MW @ 17 €/MWh
3	200MW @ 5.000 €/MWh	300MW @ 10 €/MWh

As a result:

- The imbalance price of that quarter-hour would be 5.000 €/MWh. This is explained by the fact that OCs with direction factor = 0 are not taken into account
- There is a discontinuity in the results of the imbalance price: the VoAA is used when the direction factor is = 0 for all OCs (see Article 16(2)(ii) of the Balancing Rules), and the CBMP is used as soon as just 1 OC has a direction factor = 1

For this reason, the proposal is to consider the VoAA when the direction factor is equal to 0. In the example above, the VoAA of 60 €/MWh would be used for the first 224 OCS, resulting in an imbalance price of that quarter-hour 82 €MW/h.

Use of the local VoAA

Elia proposes to define the VoAA as the first bid in the Local Merit-Order List. By doing so, it is ensured that the imbalance tariff will always be above (when the system is short) the price of the first aFRR bid available for activation in the LFC Block of Elia in the direction that would reduce the local system imbalance. This will allow to prevent a situation where the imbalance price provides an incentive to the BRPs in the Belgian LFC Block to aggravate the System Imbalance.[2]

3.2 Calculation when Elia is disconnected from the aFRR-Platform

When Elia is disconnected from the aFRR-Platform, the aFRR Satisfied Demand and the CBMP are not available anymore. Therefore, a different method needs to be defined for this case. The formula proposed in the Balancing Rules is reminded below. Here also, the example is taken for the MIP, applicable in case of a short position of Elia's LFC Block, leading to a need of positive balancing energy.

[2] The aFRR-Platform provides a VoAA to each TSO. However, this VoAA corresponds to the first available bid before any the optimization run of the aFRR-Platform. As the optimization makes use of ATCs between TSOs, there is no guarantee that the VoAA calculated by the aFRR-Platform would actually be available for Elia when needed.

$$\frac{\sum_{ts\ where\ Global\ CT>0_{j=qh}}\left(Global\ CT_{ts,j} * LMP_{ts,pos,j}\right)}{\sum_{ts\ where\ Global\ CT>0_{j=qh}}\left(Global\ CT_{ts,j}\right)}$$

with:

- Time Step or "*ts*": as defined in Article 3.
- $Global\ CT_{ts,j}$: the global control target for the Time Step "ts" during the concerned quarter-hour j, expressed in MW. The Global Control Target is to be understood as the output of the aFRR controller of Elia.
- $LMP_{ts,pos,j}$: the Local Marginal Price, as defined in Annex 14 of the T&C BSP aFRR, for the Time Step "ts" during the concerned quarter-hour j, in the positive direction, expressed in €/MWh.

Use of the local marginal price

The use of the LMP is consistent with prices used for the settlement of BSPs (except for activated bids which have a bid price above the LMP, see T&C BSP aFRR Article II.16.7 and Annex 14).

Use of the global control target

As the LMOL is limited to the contracted capacity in fallback mode, the use of the aFRR demand, capped at the contracted capacity, would be equivalent with the approach followed when Elia is connected to PICASSO. However:

- When Elia is not connected to PICASSO, there is a direct link between the aFRR demand and the Local Marginal Price. As the aFRR demand varies much faster than the global control target (the aFRR controller acts as a filter), this would lead to higher volumes allocated to Time Steps where the Local Marginal Price is high, thereby increasing the imbalance price.
- The volumes used for BSP remuneration are closer to the global control target than to the aFRR demand.
- The Local Marginal Price is based on the global control target and not on the aFRR demand. This would lead to additional complexity to solve inconsistencies between the direction of the price and of the volume considered in the imbalance price.

Therefore, it's proposed to use the global control target for the volume considered in the volume weighted average.

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