aFRR product design note

Market Development

31/10/2018

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Purposes of the document:

The automatic Frequency Restoration Reserve (aFRR, former “Secondary Reserves”) is and will be the most complex balancing product for Elia in the near future. The aFRR product has a high activation frequency with a large amount of activated energy and requires that a continuous automatic signal via a SCADA-to-SCADA connection is followed.

In this study, several modifications are proposed amongst the implementation of a merit order activation, rules enabling portfolio bidding and other new features which facilitate the opening of the aFRR market to all technologies, independent on the voltage level and the type of aFRR provider (BRP/BSP).

The study is composed out of two parts. The first part describes the future product design of the aFRR product, i.e. the procedures for the submission of the bids, the selection of the bids, the activation procedure, the checks and financial settlement of the aFRR service. Part 2 of the design study describes the incremental design elements that would be necessary in case a ToE mechanism is implemented for the aFRR market.

In a following phase, an addendum of the aFRR design study, i.e. the roadmap study, will be drafted and consulted upon. The goal of this roadmap study is to:

- Propose an implementation road map with respect to the proposed aFRR design as outlined in Part 1 of the design note. This includes also the evolution covered in the study on “separated procurement of FCR and aFRR products”.
- With respect to the implementation of a ToE mechanism for the aFRR market as outlined in Part 2 of the design note:
    1. Propose a technical implementation description and roadmap for ToE;
    2. Propose an economic opportunity study.

    Based on the insights from point 1 and 2 above, and in line with the prescriptions of Section 5 of the ToE rules, propose a recommendation with respect to the opportunity to extend the ToE mechanism to the aFRR market and if so, according to which roadmap/timing.

* http://www.elia.be/en/about-elia/publications/Public-Consultation/Archives/Formal-public-consultation-regarding-a-study-on-Separate-procurement-of-FCR-and-aFRR-products

1 Terminology

Access point	Point of injection or off-take on the TSO or (C)DSO net.
aFRR	automatic Frequency Restoration Reserve
aFRRmax per delivery point per direction	The maximum individual aFRR contribution (upwards and/or downwards) of each delivery point. This value takes into account the results from the NFS-study for delivery points connected to the DSO-grid.
aFRRmax prequalified volume	Amount of aFRR volume for which a delivery point or an aFRR providing group is eligible. This value is determined during the simulation test of the prequalification process. It should be equal or lower than the sum of the aFRRmax per delivery point per direction and, as far as DSO delivery points are concerned, respect any limitations set by the NFS-study. The aFRRmax prequalified volume value is only relevant in the framework of reserved aFRR.
BSP	Balancing Service Provider
BRP_{Source}	The BRP that holds the end user's Access point in its portfolio
CRI	Congestion Risk Indicator
DSO	Distribution System Operator
Delivery point	A point on an electricity grid or within the electrical facilities of a grid user where a balancing service or strategic demand reserve is delivered – this point is associated with measurement system(s) that enables Elia to control on and assess the delivery of the service;
Point of injection	The physical location and voltage level of each point from which power is injected into the Elia grid and for which access to the Elia grid is granted to the access holder in accordance with the access contract;
Point of offtake	The physical location and the voltage level of each point where power is taken off from the Elia grid and for which access to the Elia grid is granted to the access holder in accordance with the access contract;
TSO	Transmission System Operator

2 Introduction

2.1 Context and objective of the present design note

The specifications set out in this design note take into account the long term vision of Elia to create harmonized and technology neutral rules for each balancing service (FCR, aFRR and mFRR) with as objective to open it to all technologies independent of the voltage level they are connected and independent of the type of aFRR provider (independent BSP/BSP integrated with a BRP).

The goal of this design note is to provide all stakeholders with a detailed description of a new proposed aFRR design answering aforementioned objectives. Compared to the current aFRR product approach, the new approach includes following important changes:

- Contractual opening of the aFRR product to all technologies;
- A proposal to move from a weekly to a daily procurement procedure;
- A proposal to have a separated procurement for FCR and aFRR
- Bidding obligations to incentivize asymmetrical bids in the capacity procurement tender.
- A balancing energy gate closure time for submission of aFRR energy bids close to real time
- A merit order selection & activation

Currently aFRR is the only balancing process for which the balancing capacity and balancing energy can only be delivered by assets which are coordinated via the CIPU-contract[1]. The CIPU-contract describes the rights and obligations of large production units mostly connected to the Elia grid. Therefore, the aFRR reserves can only be delivered by large power plants which are managed by BRPs.

[1] Contract for the Coordination of the Injection of the Production Units

Balancing processes	Current terminology	Description	Procurement	Market access
Imbalance netting process	IGCC	Technical netting of opposed imbalances between TSOs of different balancing areas	N/A	N/A
Frequency Containment Process (FCR)	Primary reserves (R1)	Very fast reserves to stabilize the European frequency in case of deviations after an incident.	Contracted reserves	CIPU/Non-CIPU
Automatic Frequency Restoration Process (aFRR)	Secondary reserves (R2)	Fast reserves activated automatically and on a continuous basis to handle sudden disruptions in the area managed by Elia	Contracted & non-contracted reserves	Only CIPU
Manual Frequency Restoration Process (mFRR)	Tertiary reserves (R3)	Activated manually at request of Elia to address a major imbalance in the LFC Block	Contracted & non-contracted reserves	CIPU/Non-CIPU

Table 1 – Schematic overview of the different balancing processes

It is important to open the aFRR product to other technologies, and more specifically to non-CIPU flexibility for following reasons:

- Foster competition by opening the product to new aFRR providers and new technologies like decentralised production and demand response.
- Make the sourcing of aFRR balancing capacity less dependent of one specific technology (CCGT) and hence make the sourcing cost of balancing capacity more independent from one specific market driver (clean spark spread).
- Fulfil legal requirements as imposed by Article 3 of the Guideline on Electricity Balancing (see below).

GL Electricity Balancing

Article 3

Objectives and regulatory aspects

- ensuring that the **procurement of balancing services** is **fair, objective, transparent and market-based**, avoids undue barriers to entry for new entrants, fosters the **liquidity** of balancing markets while preventing undue distortions within the internal market in electricity;
- **facilitating the participation of demand response** including aggregation facilities and energy storage while ensuring they compete with other balancing services at a level playing field and, where necessary, act independently when serving a single demand facility;
- **facilitating the participation of renewable energy sources** and support the achievement of the European Union target for the penetration of renewable generation.
- When applying this Regulation, Member States, relevant regulatory authorities, and system operators shall:
  a) apply the principles of proportionality and non-discrimination;
  b) ensure transparency;
  c) apply the principle of optimisation between the highest overall efficiency and lowest total costs for all parties involved;
  d) ensure that TSOs make use of market-based mechanisms, as far as possible, in order to ensure network security and stability;
  e) ensure that the development of the forward, day-ahead and intraday markets is not compromised;
  f) respect the responsibility assigned to the relevant TSO in order to ensure system security, including as required by national legislation;
  g) consult with relevant DSOs and take account of potential impacts on their system;
  h) take into consideration agreed European standards and technical specifications.

Although changes to the proposed design may be necessary at a later stage as a result of the requirements of the European PICASSO[2] project that aims at integrating the different national aFRR markets, the proposed design takes already into account all known or anticipated requirements of the PICASSO project in order to minimise the likelihood of any future (substantial) changes (if any) to the proposed design.

2.2 Scope and structure of the present design note

The present design note is structured in two large parts. In the first part (Part I) the aFRR design is described without considering the additional particularities needed in case of transfer of energy (“ToE” called hereafter). The second part describes the extra layer that is required for the ToE mechanism for aFRR.

[2] https://www.entsoe.eu/network_codes/eb/picasso/

The first part is structured according to the operational processes impacted by the new aFRR design:

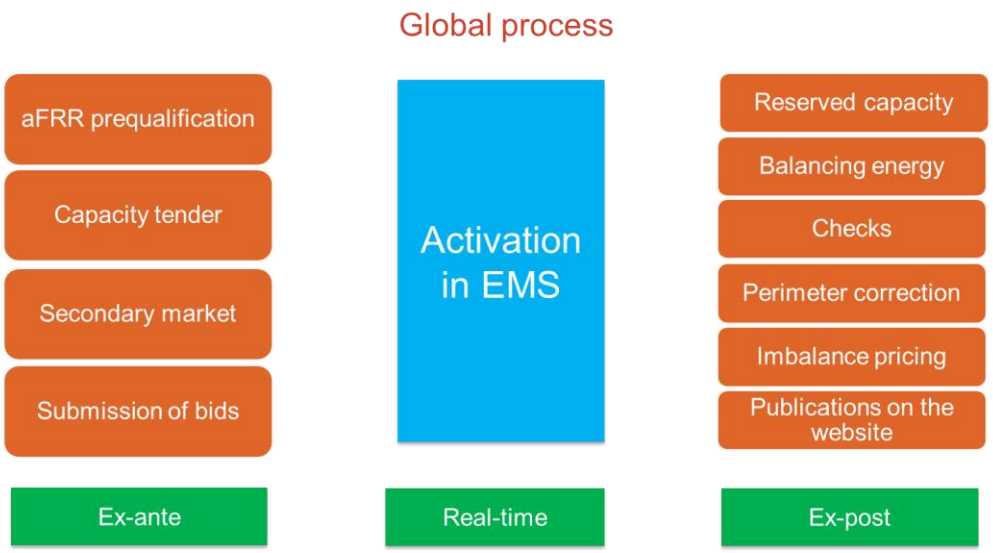


Figure 1 – Overview business processes for aFRR

1. **aFRR qualification[3]:** which steps have to be followed by the aFRR provider to prequalify one or several delivery points or aFRR providing groups;
2. **Balancing capacity tender:** how is the procurement of the aFRR capacity performed;
3. **Secondary market:** how can aFRR capacity obligations be transferred between aFRR providers;
4. **Submission of bids:** how shall aFRR energy bids be submitted by the BSPs to Elia on the bidding platform;
5. **Activation in EMS:** how are the bids activated by Elia;
6. **Reserved capacity:** how is the aFRR capacity settled and controlled;
7. **Balancing energy:** how are the aFRR energy bids settled and controlled;
8. **Checks:** which additional checks (baseline check, consistency check and availability check) are performed by Elia;
9. **Perimeter correction:** how is the perimeter of the corresponding BRP corrected in market situations without ToE, also referred to as imbalance adjustment in EBGL;

[3] Formally and according to SOGL, the prequalification process applies to providing units and providing groups. In this document, when we refer to the prequalification of an aFRR provider, the prequalification of the providing units or providing groups of this provider is meant.

10. **Imbalance pricing:** how is the imbalance price calculated;
11. **Publications on the website:** how are the publications on the website updated in the framework of the new design.

This first part of the design note is applicable for those market situations with an explicit or implicit[4] opt-out construction as described in the scheme hereunder:

Elements	Transfer of energy	Implicit opt-out	Explicit opt-out
Relation between market actors	1. BRP is different from Supplier and/or 2. BRPfsp is different from at least one BRPsource on delivery point	BSP = Supplier = BRPbsp = BRPsource	Agreement between FSP, Supplier and their respective BRP's (BRPbsp and BRPsource) to discard a market situation with ToE.

Part 2 of the design note deals with additional complexity and changes to the generic design for those market situations with ToE and is structured according to the different operational processes impacted by ToE. Next to this, a description of the legal framework and a detailed case-study of an activation with ToE is provided.

Elements	Transfer of Energy	Implicit opt-out	Explicit opt-out
Relation between market actors	1. BRP is different from Supplier and/or 2. BRPfsp is different from at least one BRPsource on delivery point	BSP = Supplier = BRPbsp = BRPsource	Agreement between FSP, Supplier and their respective BRP's (BRPbsp and BRPsource) to discard a market situation with ToE.

[4] In case of an explicit opt-out agreement, proof needs to be provided from the BSP to Elia via the mutual agreement between BSP, Supplier, BRPbsp and BRPsource(s).

3 High level overview

Figure 2 gives an overview of the global approach of the new aFRR design. It is required to make a distinction between assets coordinated via the CIPU-contract and those that are not (non-CIPU).

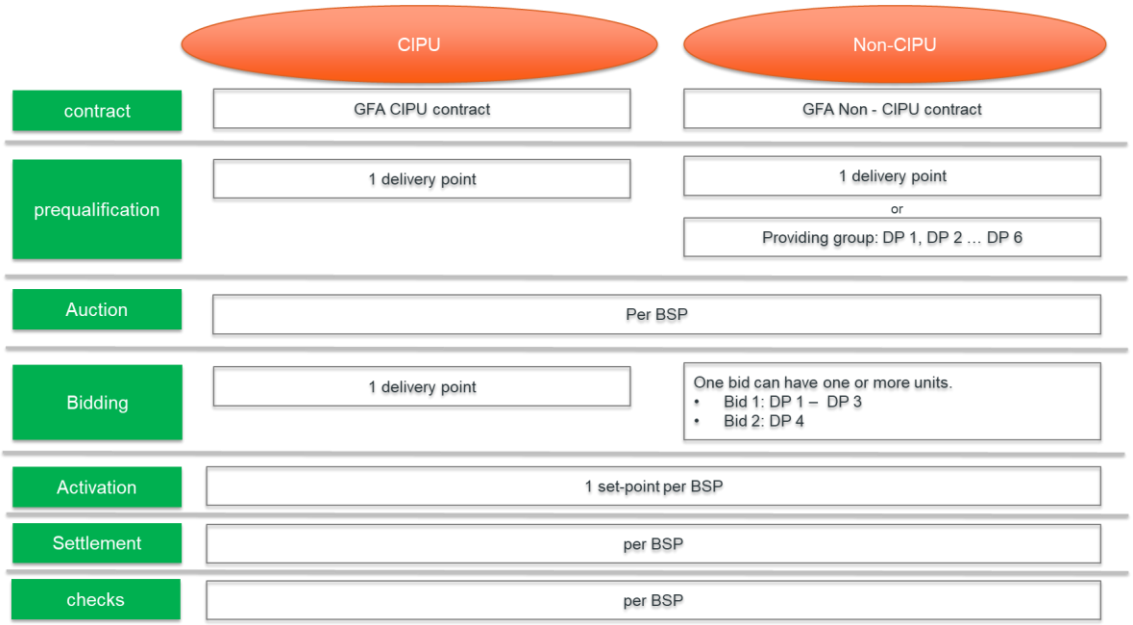


Figure 2– global approach for aFRR design

1. **Key characteristics of the aFRR product provided by CIPU assets**
    a. Dedicated GFA aFRR (CIPU) contract ;
    b. Prequalification done per aFRR providing unit;
    c. Balancing capacity procurement done on BSP level;
    d. Balancing energy bids to be submitted per delivery point. It is not possible to put more than one delivery point in a bid;
    e. During the activation, one set-point for both categories (i.e. CIPU and non-CIPU together) is sent to the BSP;
    f. Settlement is performed per BSP and no distinction is made between CIPU and non-CIPU assets;
    g. Baseline, availability, consistency checks are performed on BSP level and no distinction is made between CIPU and non-CIPU assets.

2. **Key characteristics of the aFRR product provided by Non-CIPU assets**
    a. Dedicated GFA (non-CIPU) contract ;
    b. Prequalification done per aFRR providing group and a providing group can contain more than one delivery point;
    c. Balancing capacity procurement done on BSP level;
    d. Balancing energy bids have to contain at least one delivery point, but can also contain several delivery points;

e. During the activation, one set-point for both categories (i.e. CIPU and non-CIPU together) is sent to the BSP;
f. Settlement is performed per BSP and no distinction is made between CIPU and non-CIPU assets;
g. Baseline, availability, consistency checks are performed on BSP level and no distinction is made between CIPU and non-CIPU assets.

Once the design of the iCAROS project[5] is implemented, the categorisation between CIPU and non-CIPU assets will be replaced by assets having the obligation to submit individual power schedules and assets with no individual power schedule. The key characteristics (such as the form of the bids, prequalification procedure …) for CIPU assets will become applicable for assets (production units, storage and demand) with an individual power schedule (i.e. MW per quarter-hour) and the key characteristic for non-CIPU assets will be applicable for assets without an individual power schedule (i.e. on-off schedule or no schedule).

As proposed in the iCAROS project framework, this concretely means that:

- PGM and storage C & D are obliged to deliver a power schedule
- PGM and storage B have the choice between a MW and an on-off schedule
- PGM and storage A have no scheduling obligation
- Demand facilities would default have no power scheduling obligation if not offering ancillary services. Voluntary offering flexibility for redispatching on a demand unit would however require the delivery of a power schedule as well."

[5] *http://www.elia.be/en/users-group/Working-Group_Balancing/Task-Force-CIPU-Redesign*

PART 1: Generic aFRR design

4 Key changes in the aFRR design

Before describing the proposed aFRR design in detail, first some key design features will be explained. A good understanding of them is required before entering into the details of each aFRR process step.

Following design features will be dealt with in this chapter:

- Portfolio approach/organisation;
- Baseline methodology;
- Metering configuration and accuracy
- Data exchange
- Configuration of the measurement and communication chain

4.1 Portfolio organisation

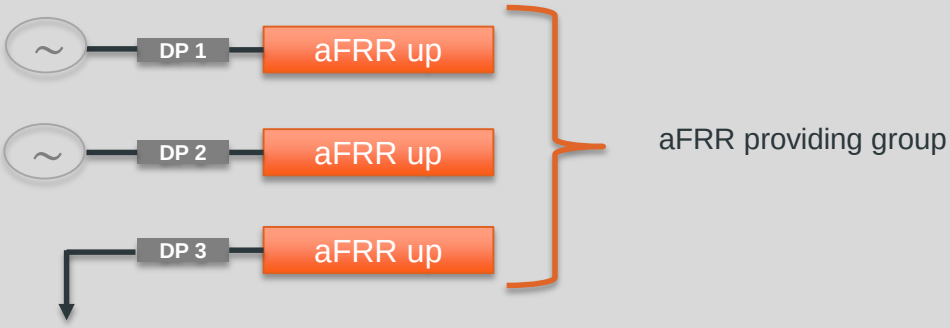
4.1.1 Definitions of the System Operation Guideline

The definitions of an aFRR reserve providing unit and an aFRR reserve providing group are given in the System Operation Guideline (SO GL).

- *'reserve providing unit' means a single or an aggregation of power generating modules and/or demand units connected to a common connection point fulfilling the requirements to provide FCR, FRR or RR;*
- *'reserve providing group' means an aggregation of power generating modules, demand units and/or reserve providing units connected to more than one connection point fulfilling the requirements to provide FCR, FRR or RR;*

EXAMPLE

An aFRR provider decides to combine 2 production units (DP1 and DP2) with one demand unit (DP 3) into one aFRR reserve providing group to offer to Elia aFRR up.



4.1.2 The need of providing groups during the prequalification test

Only during the qualification process, the concept of providing groups will be used, as further explained in Section 5.4. The concept of providing groups is relevant during the prequalification process for the following reasons:

- Sizing of the providing groups:
  BSP wants to add a new delivery point (DP) A to its existing pool but would like to test the DP A with a DP B that is already in the pool:
  - The BSP does a new prequalification test with the providing group where DP B do belongs; or
  - The BSP does the prequalification test only for DP A and the prequalified volume of DP A is added to the aFRRmax prequalified volume of the providing group.
- The prequalification of FRR providing units or FRR providing groups shall be re-assessed (Article 159 (4) of the SO GL):
  - at least once every five years; and
  - where the technical or availability requirements or the equipment have changed
- re-assessment of prequalification test in case of failure of following checks:
  - baseline check
  - consistency check
  - availability check

The situations explained above point out that the re-assessment of the prequalification test could occur on a regular basis. Therefore, it is decided to put a maximum limit of 100MW per providing group in case a providing group consists of one or more delivery points. This is described in principle 6 in Section 5.4. In that way, the impact of the simulation test during the prequalification process is reduced for both Elia and the aFRR provider.

4.2 Baseline methodology

Baselining (reference power) is a key aspect of the aFRR design and in particular when it comes to the calculation of the activated aFRR energy. Indeed, as illustrated in **Figure 3**, the delivered aFRR energy is determined as the difference between the baseline and the measured power. The delivered energy is an important metric in a series of processes such as the activation check and the availability test.

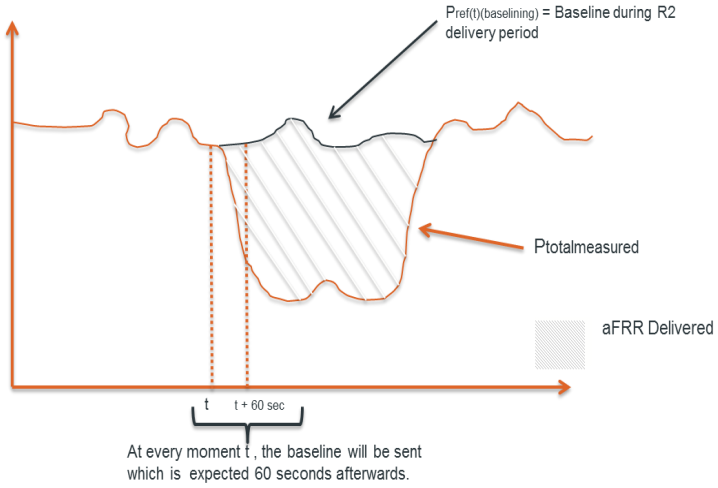


Figure 3 – Baseline methodology

The baseline for aFRR is determined by the aFRR provider. The aFRR provider sends the baseline which is expected one minute later each 4 seconds. This baseline, sent by the BSP, should already take into account the mFRR activations. Since the baseline is a crucial element for the good delivery of the aFRR service, the quality of the baseline will be verified during the prequalification process and ex-post (see Section 5 and 14). During the prequalification process, the quality check will be performed on providing group level. The quality of the aFRR service delivery will be checked on BSP level ex-post.

The risk of gaming with the baseline during an activation is considered low since the direction and variability of the activation is not known one minute in advance and since the set-point is sent every 4 seconds, this direction can rapidly change. In order to apply gaming, the aFRR provider has to correctly forecast the direction of the aFRR request at least one minute in advance.

Since the baseline test is a complete new process, Elia will re-evaluate the methodology one year after the go-live once sufficient data for doing the analysis is available. Elia will discuss the results of this analysis with relevant stakeholders.

4.3 Metering configuration and accuracy

Elia requires power measurements with a maximum resolution of 2” to verify the offered service.

The measurement equipment needs to have the highest precision of either 1% or better for the whole measurement chain (current and voltage transformers, measurement equipment), or 100kW.

In case of delivery points using private measuring devices, Elia will evaluate during the delivery point acceptance procedure the precision class of the aFRR provider’s measuring chain by considering the worst precision class value amongst the measuring chain components (current and voltage transformers, measurement equipment).

In case the measuring equipment for one or more delivery points within a providing group does not correspond to the requested precision, Elia will calculate an Emax factor for the providing group by taking into consideration the worst precision amongst all delivery points

within the providing group. The Emax factor is calculated as the difference between the worst measuring precision amongst all delivery points and 1% (requirement by Elia).

Elia will reduce the aFRRmax prequalified volume of the aFRR provider for the providing groups concerned with the Emax value. A minimal measurement availability of 95% is required.

In order to prove compliance, the aFRR provider must provide Elia with the following information before performing any prequalification test:

- An electrical scheme indicating the measurement equipment's precise position;
- A statement from the manufacturer certifying the measurement precision of the measurement equipment.

Elia has the right to perform an audit.

4.4 Data exchange

For the aFRR services, it is required to exchange data ex-ante, in real-time and for ex-post settlement. The required data-exchange is explained in detail in this section.

4.4.1 Ex-ante

It is required to submit the bids on the bidding platform before the balancing energy gate closure time (QH-25min). For aFRR providers with a reserve obligation, the reserved volume must be submitted to the bidding platform before D-1 at 15h00. For this bidding information, the following parameters need to be exchanged:

- Volume [MW] in up and down direction
- Activation price [€/MWh] in up and down direction
- Reserved and non-reserved volume [MW]
- Delivery point(s)
- ...

More details on this topic are given in Section 8.

4.4.2 Real-time

The following parameters should be communicated between Elia and the aFRR provider in real-time on a 4 seconds basis. The level of aggregation for the parameters is described in **Table 2**.

- **ΔPsec_tot (control request per BSP):**
  This is the control request (MW) that Elia will ask to each of its BSPs individually. The sum of these control requests per BSP is the global control request.
- **Return signal of ΔPsec_tot:**
  The aFRR provider sends the signal back to Elia (mirror of the received signal) in order to check if the signal is received correctly.

- **Avail_sec:**
  logical signal (0 or 1) that indicates whether the delivery point is actually delivering the service. (0: the delivery point/BSP does not participate to the aFRR services at that moment. 1: the delivery point/BSP is available and deliver the aFRR services at that moment).
- **Pmeasured (Pmeas):**
  The measurement (MW) of the net (gross if the net value cannot be measured) power produced per delivery point or aggregated.
- **Pref/ Pbaseline:**
  The power (in MW) that the delivery point or aggregation would have injected/consumed without the activation of aFRR services. The baseline is to be sent 60 seconds in advance.
- **Psec:**
  The number of MW of ΔPsec_tot that are attributed to a delivery point or an aggregation of delivery points.
- **Test request:**
  The signal that is sent as starting point of the prequalification test and the signal that is sent for starting an availability test.
- **Feedback test request:**
  The aFRR provider sends the signal back to Elia (mirror of the received signal) in order to check if the signal is received correctly.

Elia will send one set point to the /BSP for CIPU and non-CIPU assets (assets with and without an individual power schedule) together. A return signal of the set-point has to be sent by the BSP to Elia. Elia requests aggregated real-time data per BSP. The aggregation will take place at three levels (see also **Figure 4**):

- Aggregation per BSP of all delivery points (CIPU and non-CIPU assets/assets with and without an individual power schedule) attributed to bids on the bidding platform.
- Aggregation per BSP of all participating delivery points to the aFRR service during the concerned 4 seconds, i.e. avail_sec parameter is 1 during the 4 seconds timestamp.
- Aggregation per BSP of all non-participating delivery points to the aFRR service during the concerned 4 seconds, i.e. avail_sec parameter is 0 during the 4 seconds timestamp.

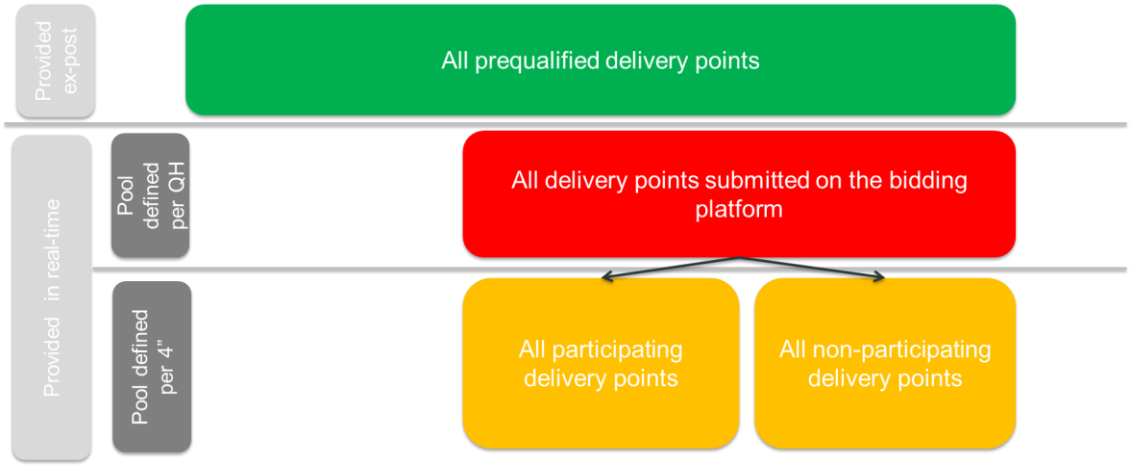


Figure 4 – Level of aggregation in real-time for CIPU and non-CIPU assets (assets with and without an individual power schedule).

In real-time, the aggregated values of all delivery points submitted on the bidding platform (CIPU and non-CIPU/assets with and without an individual power schedule, together) have to be sent to Elia. This pool is defined per quarter-hour and can therefore not change within a quarter-hour. This pool is divided in two sub-pools: the first sub-pool contains all the aggregated parameters of the delivery points that are, during a specific timestamp of 4 seconds, delivering the aFRR service (avail_sec equal to 1), the second sub-pool consists of all delivery points that are not delivering during that 4 seconds timestamp the aFRR service, meaning that the avail_sec value is zero. The two sub-pools are complementary, meaning that the delivery points that are nominated on the bidding platform are in one of two sub-pools and can also only be in one of the sub-pools. If the control request for a BSP is equal to zero, the avail_sec for all delivery points is per definition zero and all delivery points should be attributed to the sub-pool of the non-participating delivery points. The level of aggregation is required to avoid gaming possibilities without asking all the data on delivery point level in real-time. For each level of aggregation, the parameters defined above need to be exchanged in real-time.

On top of that, it is required to exchange all parameters per delivery point in real-time for CIPU (assets with an individual power schedule).

In **Table 2**, an overview is given of all the exchanged parameters and the level of aggregation. The baseline has to be sent one minute in advance to Elia for CIPU assets (assets with an individual power schedule) on an individually basis and for all nominated delivery points on aggregated basis. For the participating and non-participating sub-pool, it is not possible to know one minute in advance to which sub-pool a delivery point will be attributed (depending whether it will deliver or not deliver the aFRR services), as the BSP is free to change and optimise its activated delivery points in real-time for the delivery of the aFRR service. Therefore the baseline determined in advance and sent one minute in advance has to be resent in real-time separately for the participating and for the non-participating sub-pool in an aggregated way. However, Elia will perform consistency checks (Section 15), to verify that the sum of the baseline of the participating and non-participating sub-pool (sent in real-time) is equal to the baseline of the nominated delivery points (sent one minute in advance).

process	Parameter		From	To	Level of aggregation	Sending of data	Calculated/ measured
aFRR services	**ΔPsec_tot**		Elia	BSP	BSP	Real-time	Real-time
	Return signal of ΔPsec_tot		BSP	Elia	BSP	Real-time	Real-time
Prequalification	**Prequalification test**		Elia	BSP	BSP	Real-time	Real-time
Availability test	**Test request**		Elia	BSP	BSP	Real-time	Real-time
	Feedback Test request		BSP	Elia	BSP	Real-time	Real-time
aFRR services	**Avail_sec**		BSP	Elia	Per delivery point	Real-time	Real-time
	Pmeasured		BSP	Elia	Per delivery point	Real-time	Real-time
	Pbaseline		BSP	Elia	Per delivery point	One minute in advance	One minute in advance
	Psec		BSP	Elia	Per delivery point	Real-time	Real-time
	NOMINATED	**Pmeasured**	BSP	Elia	BSP	Real-time	Real-time
		Pbaseline	BSP	Elia	BSP	One minute in advance	One minute in advance
		Psec	BSP	Elia	BSP	Real-time	Real-time
	PARTICIPATING	**Pmeasured**	BSP	Elia	BSP	Real-time	Real-time
		Pbaseline	BSP	Elia	BSP	Real-time	One minute in advance
	NON-PARTICIPATING	**Pmeasured**	BSP	Elia	BSP	Real-time	Real-time
		Pbaseline	BSP	Elia	BSP	Real-time	One minute in advance

Table 2 – overview of the exchanged parameters and the level of aggregation

In addition, Elia will also exchange some parameters on an ad-hoc basis for the prequalification process and the availability test. For the simulation test which is part of the prequalification process, a start signal will be exchanged from the SCADA of Elia to the

SCADA of the BSP. This start signal indicates that the simulation test should start within 30 seconds. The test profile will not be sent in real-time but will be contractually fixed and known in ex-ante. The availability test will also be requested by sending a signal from the SCADA of Elia to the SCADA of the BSP. A feedback signal is required for the good reception of the test request for the availability test.

4.4.3 IT solutions for real-time communication

The IT requirements that are currently in place for real-time communication will not change. In terms of a technical solution Elia recommends conducting the real-time exchanges using the Tase2/ICCP protocol between SCADA BSP and SCADA Elia. The real-time communication system over a private IP network (between SCADA Elia and SCADA BSP) and its processes must be redundant and must continue in case of power supply interruption. Ensuring the reliability of the communication with Elia in order to avoid loss of data in both directions is the BSPs responsibility.

4.4.4 For ex-post settlement

For ex-post settlement purposes, all parameters that are exchanged in real-time as specified in Section 4.4.2, must be sent per delivery point for all prequalified delivery points. For the ex-post settlement, Pmeasured, Pbaseline, avail_sec and Psec per delivery point for all prequalified delivery points should be provided to Elia.

4.5 Configuration of the measurement and communication chain

Today, aFRR is only delivered by CIPU units. These CIPU units have a Remote Terminal Unit (“RTU”) which is installed and owned by Elia. By opening the market, all technologies (small biogas units, cogeneration…) can participate. Elia expects an increasing amount of resources participating in the aFRR market and will allow the usage of privately owned measurement devices for these units. At any time, Elia holds the right to check private-RTU infrastructure on site (on-site audit) and can suspend an aFRR provider in case of manipulation. Section 4.4 describes which data needs to be exchanged in real-time, ex-ante and for ex-post settlement purposes. This section focusses on how this data needs to be exchanged. The details on the data collection, transmission and authenticity are described in this section for all delivery points participating at the aFRR services.

4.5.1 Real-time data exchange

This section describes the data-exchange in real-time. For CIPU assets (assets with an individual power schedule), the real-time communication is presented in **Figure 5**. The exact parameters to be exchanged are described in Section 4.4.2. For CIPU assets (assets with an individual power schedule) two options will be allowed:

1. With Elia RTU: an Elia RTU is installed on the level of the delivery point. This RTU measures the power and communicates it directly to the SCADA of Elia. The private device is used for the steering of the asset.
2. Without Elia RTU: a private device installed on the asset shall be used for both steering and acquisition of power measurements. This private device, located at the

delivery point will provide the measured power via the SCADA of the BSP to the SCADA of Elia in real-time.

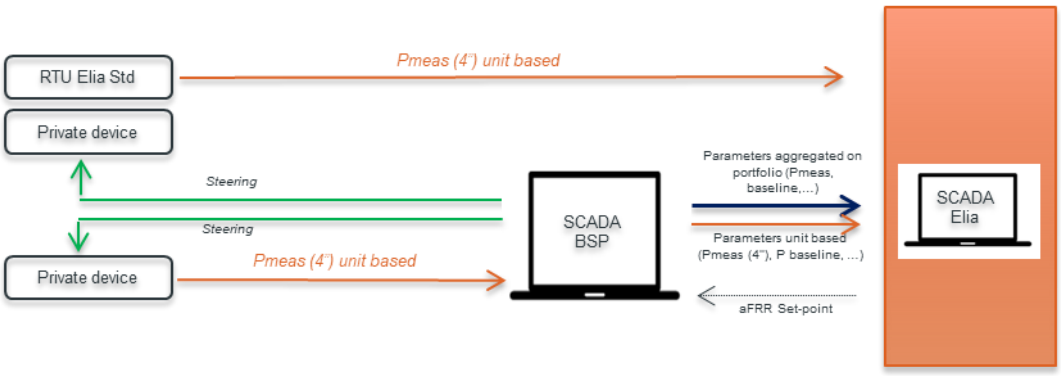


Figure 5 – Configuration for real-time data-exchange for CIPU assets (assets with an individual power schedule).

The other parameters (Pbaseline, avail_sec ...) are communicated via the SCADA of the BSP to the SCADA of Elia for both situations (situation with Elia RTU and situations without).

For non-CIPU assets (assets without an individual power schedule), the configuration for the real-time data exchange is given in **Figure 6**.

The communication of the parameters occurs in all cases via the SCADA of the BSP to the SCADA of Elia. As far as the power measurements are concerned, two options are allowed:

1. A single private device is installed on the level of the delivery point which sends power measurements via the SCADA of the BSP to the SCADA of Elia. The private device is both used for the steering in real-time and acquisition of power measurements by the BSP.

2. (C)DSO measurements can also be used for the acquisition of power measurements, next to private devices (or other) which are used for the active steering in real-time. (C)DSO measurements are acquired via the SCADA of the (C)DSO and sent via the SCADA of the BSP to the SCADA of Elia.

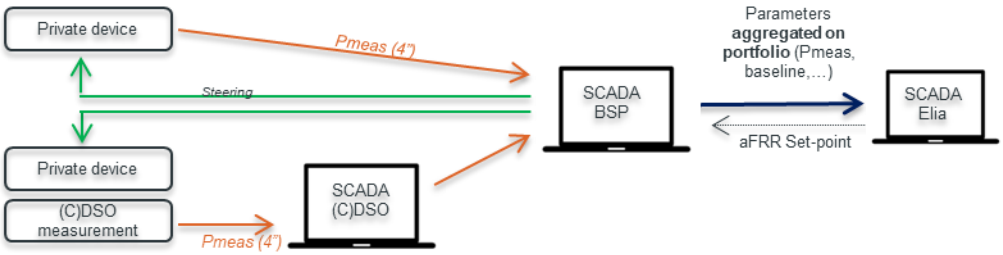


Figure 6 – Configuration for real-time data-exchange for non-CIPU assets (assets without an individual power schedule).

The other parameters (Pbaseline, avail_sec ...) are communicated via the SCADA of the BSP to the SCADA of Elia for both situations.

In all cases, the BSP sends the data for delivery points linked to CIPU and non-CIPU assets (assets with and without an individual power schedule) together in an aggregated way via its SCADA to the SCADA of Elia. No individual data is exchanged in real-time in this case.

The BSP is at all times contractually responsible towards Elia for the real-time communication via the BSP towards Elia in both directions. This responsibility to provide Elia the necessary aFRR parameters for the execution of the aFRR service is independent from the RTU configuration (Elia of private device). Elia is responsible for the real-time communication between the RTU owned by Elia and the SCADA of Elia. If the BSP opts to use (C)DSO owned RTU's and problems arise in the real-time communication towards Elia (due to problems in the link "RTU (C)DSO - SCADA (C)DSO" or "SCADA (C)DSO - SCADA BSP), the BSP is responsible towards Elia for the quality loss, absence or any other malfunction of the aFRR parameters (Pmeas, Pbaseline, Pmax,…) which needs to be delivered to Elia in real-time on an aggregated basis. Since only aggregated data is required for non-CIPU assets (assets without an individual power schedule), the sending in real-time of the (C)DSO measurements is not possible.

4.5.2 Data exchange for ex-post settlement

The parameters (see Section 4.4.2) of each prequalified delivery point for non-CIPU assets need to be delivered to Elia for the ex-post settlement of the aFRR service. Elia allows the use of private devices by the BSP for the measurement and acquisition of the concerned data. Allowing the use of private devices requires careful consideration with respect to the need for any additional measures in order to guarantee, amongst others, the authenticity and the integrity of the data used for the settlement of the aFRR service.

These considerations should however also take due account of the economic and technical impact of any additional measure and should avoid to hamper the entrance of new technologies or market players.

In this respect, several options are being weighted and investigated by Elia and (where applicable) the DSOs. The following design principles were identified for the set-up of the data exchange:

- **Scalability**: the number of participating assets to the aFRR market is expected to significantly increase. Therefore Elia believes that set-up of the data exchange for the ex-post settlement should be scalable and henceforth future proof;
- **Data-integrity**: guarantee the accuracy and completeness of the parameters per delivery point necessary for the settlement of the aFRR service;
- **Data-authenticity**: guarantee that the data is authentic and has not been manipulated by any market actor;
- **Market entry barrier**: minimize the market entry barriers by focusing on a solution that has limited technical and business complexity;
- **Cost/complexity:** trade-off between benefits and costs, considering the relatively small asset size.

These business principles are essential prerequisites to ensure an accurate settlement of the aFRR service while minimizing costs and entry barriers for market actors.

Several options have been identified so far:

1) **Asset-level signing**: To ensure the authenticity of the data a signing procedure at the level of the delivery point is put in place. The system operator will receive all parameters on an encrypted basis via the BSP on a daily basis. This is realized by having the BSP to buffer the individual asset level data for a day and send the 4 seconds data in a single batch towards the system operator, through an encrypted line. All parameters from the asset, BSP and Elia need to be signed at the level of the delivery point to ensure that these have not been changed by an unauthorized party.
2) **Installation of a data logger at the level of the delivery point**: the mandatory installation of a DSO-owned data-logger for DSO delivery points at the level of the delivery point. This centralized architecture provides ex-post (or possibly close to real-time) all 4 second data directly from the delivery point. This is realized by having a data logger that captures and logs all relevant parameters, which then can be directly consulted by the system operator.
3) **Real-time connection to a cloud-based communication platform:** each non-CIPU delivery point is required to be directly connected in real-time to a cloud-based communication platform via a gateway for which minimal technical requirements will be identified. The delivery point sends every 4 seconds all required parameters to the communication platform, which then can be directly be consulted by the system operator. The architecture is
    a. **Secure,** relying on widely accepted security practices
    b. **Easy to interface** for clients. It uses standard connection methods and protocols, lowering the entry barriers for the aFRR market.

A thorough analysis of the abovementioned options is being performed by Elia and the DSOs for non-CIPU delivery points. Elia will elaborate upon in the implementation plan on the real-time connection to a cloud-based communication platform. The exact modalities will be publicly consulted with the market parties by means of the implementation plan.

4.6 Interaction with other ancillary services contracts (FCR and mFRR)

Elia determines in this section the possible interactions with the other reserves (FCR and mFRR). It is reminded that the rules described in this section concern both the capacity reservation and the delivery of aFRR energy.

1) There can only be one BSP per delivery point;
2) Metering configurations that imply overlap of the metered energy are not allowed. As consequence, a combination between a headmeter and a submeter behind (as illustrated in **Figure 7**) or with 2 submeters with hierarchy is not possible.

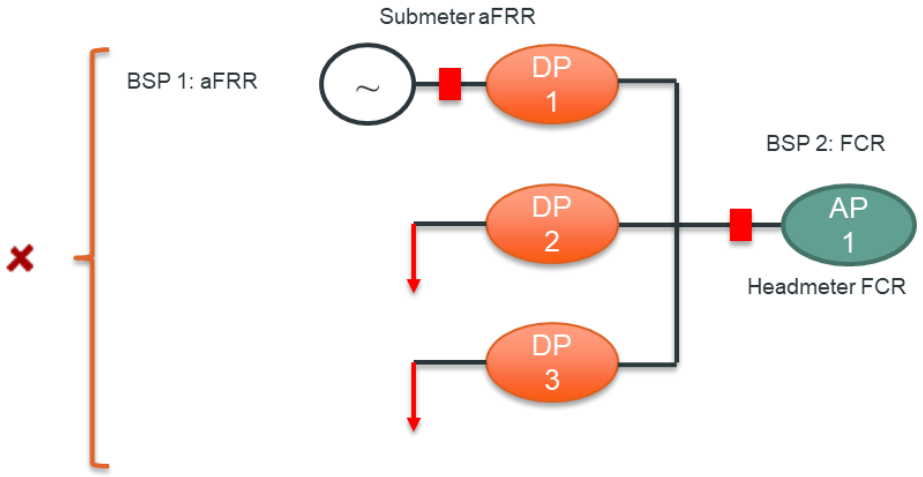


Figure 7 – No combination between headmeter and submeter behind or with 2 submeter with hierarchy.

3) 2 different BSPs can deliver distinct ancillary services behind an access point only if it concerns 2 independent Delivery points (proven by an electrical scheme)

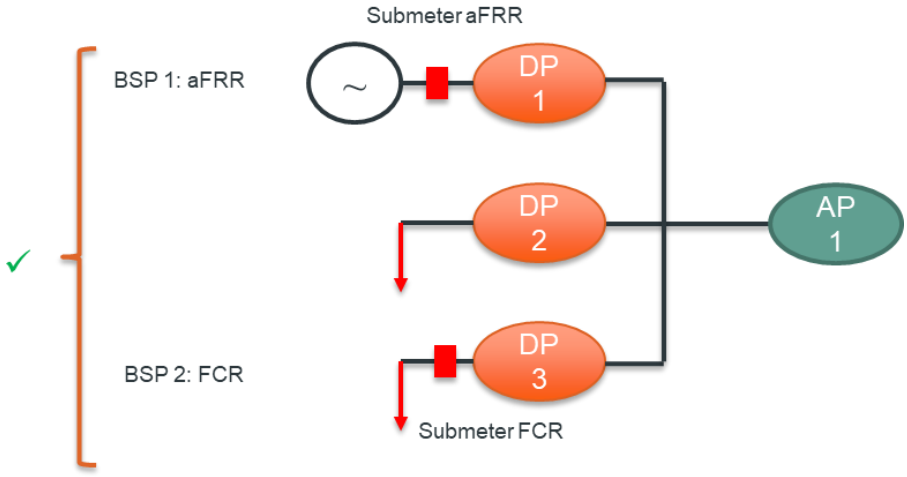


Figure 8 – Possible combinations in case of 2 independent delivery points.

4) a separate prequalification process need to performed for FCR, aFRR and mFRR

5) As explained in Section 8.2, a delivery point can only be offered to one energy bid during a given validity period (quarter-hour). For bids which are offered in an aggregated way, this exclusivity is also applicable between the products aFRR and mFRR. In other words a delivery point offered in aggregated way via aFRR bids cannot be offered via another energy bid during the same quarter hour, whether this is aFRR or mFRR.

   In case the same delivery point can be activated for aFRR and mFRR on the same moment, additional settlement rules need to be develop and implemented which are

very complex. This will affect in a significant way the project timing and cost. Before adding such complexity, Elia proposes to first wait how the participation of smaller delivery points in the aFRR market will evolve and then assess based on relevant experience the added value of such an implementation.

5 Qualification process

A qualification process has several objectives:

- Check compliancy with **technical, organizational** and **administrative requirement**;
- Check **availability requirements**;
- Determine and test maximal **aFRRmax prequalified volume** (upwards and/or downwards) for each aFRR reserve providing group by doing a simulation test.

5.1 Relevant articles in the System Operation guidelines.

Article 159 of the System Operation Guideline describes the prequalification process. The provider of aFRR services shall demonstrate during the prequalification process that he complies with the minimal technical requirements, the aFRR availability requirements, the ramping requirements and the connection requirements, as described in Article 158 of the System Operation Guideline. The maximum timings to be respected for the prequalification process are described in Article 159.3 and 159.4. Article 159.6 indicates the frequency of the prequalification tests.

SO GL

Article 159 FRR prequalification process

1. **By 12 months after entry into force** of this Regulation each TSO shall **develop a FRR prequalification process** and shall clarify and make publicly available its details.
2. A potential FRR provider shall demonstrate to the reserve connecting TSO or the TSO designated by the reserve connecting TSO in the FRR exchange agreement that it **complies with the FRR minimum technical requirements** in Article 158(1), **the FRR availability requirements** in Article 158(2), **the ramping rate requirements in Article** 158(1) and the **connection requirements** in Article 158(3) by completing successfully the prequalification process of potential FRR providing units or FRR providing groups, described in paragraphs 3 to 6 of this Article.
3. A potential FRR provider shall submit a **formal application** to the relevant reserve connecting TSO or the designated TSO together with the **required information of potential FRR providing units or FRR providing groups**. Within **8 weeks** from receipt of the application, the reserve connecting TSO or the designated TSO shall **confirm** whether the **application is complete**. Where the reserve connecting TSO or the designated TSO considers that the **request is incomplete** they shall **request additional information** and the potential FRR provider shall **submit** that additional information **within 4 weeks** from the receipt of the request. Where the potential FRR provider does not supply the requested information within that deadline, the application shall be deemed to be withdrawn.
4. **Not later than 3 months** after the reserve connecting TSO or the designated TSO confirms that the application is complete, the reserve connecting TSO or the designated TSO shall **evaluate the information provided** and **decide whether the potential FRR providing units or FRR providing groups meet the criteria** for a FRR prequalification. The reserve connecting TSO or the designated TSO shall notify their decision to the potential FRR provider.
5. The qualification of FRR units or FRR providing groups by the reserve connecting TSO or the designated TSO shall be valid for the entire LFC Block.
6. The qualification of FRR providing units or FRR providing groups shall be re-assessed:
    a) at least once **every five years**; and
    b) where the **technical or availability requirements or the equipment have changed**.
    c) To ensure operational security, the reserve connecting TSO shall have the **right to reject the provision of FRR by FRR providing groups on the basis of technical arguments** such as the geographical distribution of the power

The aFRR minimum technical requirements are described in Article 158 of the System Operation Guideline.

SO GL

Article 158

FRR minimum technical requirements

1. The FRR minimum technical requirements shall be the following:
   a) each FRR providing unit and each FRR providing group shall be **connected to only one reserve connecting TSO**;
   b) a FRR providing unit or FRR providing group shall activate FRR in accordance with the **setpoint received from the reserve instructing TSO;**
   c) the reserve instructing TSO shall be the reserve connecting TSO or a TSO designated by the reserve connecting TSO in an FRR exchange agreement pursuant to Article 165(3) or Article 171(4);
   d) a FRR providing unit or FRR providing group for automatic FRR shall have an **automatic FRR activation delay not exceeding 30 seconds**;
   e) a FRR provider shall ensure that the FRR activation of the FRR providing units within a reserve providing group can be monitored. For that purpose, the **FRR provider shall be capable of supplying** to the reserve connecting TSO and the reserve instructing TSO **real-time measurements of the connection point or another point of interaction agreed** with the reserve connecting TSO concerning:
      i. **time-stamped scheduled active power output**;
      ii. **time-stamped instantaneous active power** for:
         – each FRR providing **unit**;
         – each FRR providing **group**; and
         – **each power generating module or demand unit of a FRR providing group with a maximum active power output larger than or equal to 1.5 MW**;
   f) a FRR providing unit or FRR providing group for automatic FRR shall be capable of activating its complete automatic reserve capacity on FRR within the **automatic FRR full activation time**;
   g) a FRR providing unit or FRR providing group for manual FRR shall be capable of activating its complete manual reserve capacity on FRR within the manual FRR full activation time;
   h) a FRR provider shall fulfil the **FRR availability requirements** ; and
   i) a FRR providing unit or FRR providing group shall fulfil the **ramping rate requirements of the LFC block**.
2. All TSOs of a LFC block shall specify FRR availability requirements and requirements on the control quality of FRR providing units and FRR providing groups for their LFC block in the LFC block operational agreement pursuant to Article 118.
3. The reserve connecting TSO shall adopt the technical requirements for the connection of FRR providing units and FRR providing groups to ensure the safe and secure delivery of FRR.
4. Each FRR provider shall:
   a) **ensure that its FRR providing units and FRR providing groups fulfil the FRR technical minimum requirements, the FRR availability requirements and the ramping rate requirements referred to in paragraphs 1 to 3**; and
   b) **inform its reserve instructing TSO about a reduction of the actual availability of its FRR providing unit or its FRR providing group or a part of its FRR providing group as soon as possible.**
   c) Each reserve instructing **TSO shall ensure the monitoring** of the compliance with the FRR minimum technical requirements in paragraph 1, the FRR availability requirements in paragraph 2, the ramping rate requirements in paragraph 1 and the connection requirements in paragraph 3 by its FRR providing units and FRR providing groups.

The cooperation between TSO and (C)DSOs and the modalities for reserve providing units connected to the (C)DSO grid are described in article 182 of the System Operation Guideline.

SO GL

Article 182

Reserve providing units connected to the DSO grid

1. TSOs and DSOs shall cooperate in order to facilitate and enable the delivery of active power reserves by reserve providing groups or reserve providing units located in the distribution systems.
2. For the purposes of the prequalification processes for FCR in Article 155, FRR in Article 159 and RR in Article 162, each TSO shall develop and specify, in an agreement with its reserve connecting DSOs and intermediate DSOs, the terms of the exchange of information required for these prequalification processes for reserve providing units or groups located in the distribution systems and for the delivery of active power reserves. The prequalification processes for FCR in Article 155, FRR in Article 159 and RR in Article 162 shall specify the information to be provided by the potential reserve providing units or groups, which shall include:
    a) voltage levels and connection points of the reserve providing units or groups;
    b) the type of active power reserves;
    c) the maximum reserve capacity provided by the reserve providing units or groups at each connection point; and
    d) the maximum rate of change of active power for the reserve providing units or groups.
3. The prequalification process shall rely on the agreed timeline and rules concerning information exchanges and the delivery of active power reserves between the TSO, the reserve connecting DSO and the intermediate DSOs. The prequalification process shall have a maximum duration of three months from the submission of a complete formal application by the reserve providing unit or group.
4. During the prequalification of a reserve providing unit or group connected to its distribution system, each reserve connecting DSO and each intermediate DSO, in cooperation with the TSO, shall have the right to set limits to or exclude the delivery of active power reserves located in its distribution system, based on technical reasons such as the geographical location of the reserve providing units and reserve providing groups.
5. Each reserve connecting DSO and each intermediate DSO shall have the right, in cooperation with the TSO, to set temporary limits to the delivery of active power reserves located in its distribution system before the activation of reserves. The respective TSOs shall agree with their reserve connecting DSOs and intermediate DSOs on the applicable procedures.

5.2 Availability requirement

Each prequalified delivery point or providing group should be able to deliver 4 hours continuously aFRR. This availability requirement is only applicable for the reserved volume that is offered during the bidding process.

The availability requirement does not have to be checked during the prequalification phase. The proposed prequalification process (Section 5) can be maintained. As a simulation test of 4 hours would represent an important cost for the aFRR provider, it would constitute an entry barrier. Henceforth, it will not be requested. Instead, the aFRR provider has to explain how the delivery of 4 hours can be ensured for the aFRRmax prequalified volume by providing qualitative information on how he will satisfy the energy requirements. Valid line of explanations can be:

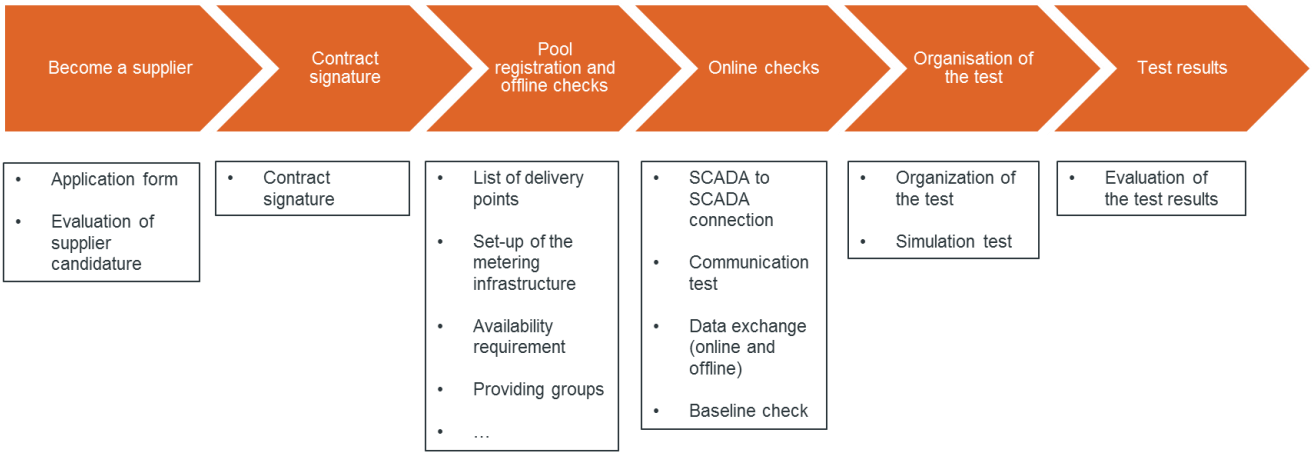
- The aFRR provider will offer aFRR with a portfolio of delivery points;
- The aFRR provider has no providing group but only one delivery point which is energy limited but will take measures to ensure energy requirements are always met (i.e. in case of pump storage he will make sure to have always enough water in the reservoir to deliver all energy required in case of activation).

It is important for Elia to have a thorough understanding of the process behind the supply of aFRR in order to consider a simulation test shorter than 4 hours.

This availability requirement is important for the aFRR services. A daily procurement with blocks of 4 hours will be put in place (Section 6). In order to have sufficient reserved capacity, it is required that the aFRR providers are capable to offer for at least blocks of 4 hours. Therefore, it is important for Elia to be able to check this availability requirement, in a qualitative way, during the prequalification test.

5.3 The steps during the qualification process

The prequalification process consists of several steps which are represented below.



There is a need to go through the prequalification process in the following cases:

- New aFRR delivery points (linked to CIPU and non-CIPU assets, assets with and without individual power schedule) wishing to participate to the aFRR services;
- Existing aFRR delivery points linked to CIPU assets have to do the prequalification test for the new aFRR design, the simulation test however has to be done within 2 years after go-live of the new aFRR design.

The prequalification test has to be re-assessed (Article 159 (4) of the SO GL):

- at least once every five years; and
- Where the technical or availability requirements or the equipment have changed.

5.3.1 Become an aFRR provider

A candidate aFRR provider can apply by submitting a completed application form and the required documents to Elia.

5.3.2 Contract signature

In this phase all the formalities concerning contract completion and signature have to be fulfilled:

- aFRR contract (signature of the GFA).
- Per delivery point, submission of a:
    - Grid user declaration;
    - FSP/DSO contract if delivery points are connected to DSO grid. The participation of a DSO connected delivery point to the aFRR service is preconditioned by a positive outcome of the NFS study. The modalities of this NFS study as well as this condition for eligibility for participation of DSO connected delivery points will be described in the FSP-DSO contract;
    - CDSO declaration, if applicable;
    - CDSO Collaboration Agreement, if applicable.

In case of an explicit opt-out agreement, as explained under Section 2.2, the BSP needs to provide proof to Elia of an existing mutual agreement between BSP, Supplier, BRPsource and BRPbsp to discard a market situation with ToE.

5.3.3 Pool registration and offline checks

Article 159 of the System Operation Guideline provides clear guidance for the registration of an aFRR providing group or unit:

“A (potential) supplier of aFRR services shall submit a formal application to Elia with the required information of the potential aFRR providing groups and/or delivery points;

- *Within 8 weeks from receipt of the application, Elia will confirm whether the application is complete.*
    - *In case the application is incomplete, Elia will request additional information*
    - *The potential supplier shall submit the additional information within 4 weeks from the receipt of the request. In case the requested information is not provided within that deadline, the application shall be deemed to be withdrawn.*
- *No later than 3 months after the confirmation by Elia that the application is complete, Elia shall evaluate the provided information and decide whether the potential aFRR providing groups and/or delivery points meet the criteria for an aFRR prequalification. Elia will notify its decision to the potential aFRR provider“.*

The formal application to Elia consists of several parts. The first part is the registration of aFRR providing units and/or aFRR providing groups. For the registration, at least the following information is required. If the information is available from the EAN code, Elia will take this information, otherwise, this information should be provided to Elia.

- List of delivery points
- Name of the delivery point
- EAN of the delivery point
- Grid User
- (C)DSO if applicable
- Location of the assets (behind which access point, TSO or (C)DSO connected, …)
- Voltage levels and connection points
- Type of active power reserves
- The technical characteristics of each delivery point (maximum and minimum offtake …).
- Declaration of aFRRmax per delivery point: potential individual contribution (upwards & downwards) of each delivery point to the aFRRmax prequalified volume of the aFRR providing group.
- All related information to aFRR providing group (see Section 5.4)
- The required documentation on availability requirement (see Section 5.2).
- Entry/exit procedure if applicable (see Section 5.4.2)
- Information on combinability with other productsRequired contracts:
    - Grid user declaration
    - FSP/DSO contract if delivery points are connected to the DSO grid.
    - CDSO declaration if delivery points are connected to a CDS grid.
- Validity period

The second part contains the general compliancy for the measurement chain which is required for each delivery point. The accuracy of the measurement chain that will be used for the settlement as well as relevant documentation and certificates will be checked (see Section 4.3 for more information). It will contain at least following information:

- Type of measurement device that will be used;
- Location on the electrical grid of the measurement device, meter's certification;
- RTU: technical info check list and commissioning test if applicable;
- IT protocols;
- The accuracy of the measurement chain.

In a third part of the formal application form, the ex-ante and data exchange for ex-post settlement will be verified. This data exchange is explained in Section 4.4.

5.3.4 Online check

Elia will do a communication test. In this test, Elia will test the SCADA to SCADA connection and make sure that:

- The requested real-time data can be exchanged by Elia and the aFRR provider for delivering aFRR services (see Section 4.4.2);

- The requested data can be exchanged for the availability test (see Section 13);
- The requested data can be exchanged for the prequalification test (see Section 5.3.5).

An overview of the signals that an aFRR provider should be capable to send and receive is described in Section 4.4.2. During the online test, Elia will verify that all parameters are received in real-time and that no interruption or invalid data is received.

5.3.5 Organization of the test

The test itself consists of two parts, i.e. the baseline test and the simulation test. As previously explained the test will be done per providing group or per delivery point during the prequalification process. The baseline test is required for all delivery points which are used to offer aFRR services. The simulation test however is only applicable for delivery points or providing groups which are used to set the aFRRmax prequalified volume. Always the same providing group should be used for simulation and baseline tests. All costs of the tests (assumed to be very limited in the absence of an activation) are borne by the BSP.

During the **baseline test**, Elia will check whether the baseline is equal to the measured power in case of no activations. The test will take some days. During this time period, Elia will check whether the quality targets are reached. Relative Root Mean Square Error with respect to the average daily baseline should be lower than 5% on average on a daily basis. 2% of the outliers are excluded. The verification and the quality targets for the baseline during the prequalification phase is exactly the same as done ex-post and is described in Section 14.1.

During the **simulation test**, the aim is to test the aFRRmax prequalified volume (upwards and/or downwards) of the aFRR reserve providing group. On top of that, it is also checked whether the BSP can follow the simulation profile with a 4 seconds granularity. The exact knowledge of the starting point is an important information for the evaluation of the simulation test. For this test, Elia will use its SCADA to SCADA connection with the aFRR provider to start the simulation test. Elia will send to the aFRR provider, via the SCADA connection, the start signal for the simulation test. The additional information concerning the test (e.g., date, timing, test profile, providing group ...) will be exchanged by email. The test profiles are known ex-ante as described in this section. The configuration and the identification of the test signals are occurring during the communication tests as described in 5.3.4.

The following steps have to be followed for the organization of a simulation test.

- The aFRR provider contacts the (C)DSO (if (C)DSO connected) and Elia to inform about the organization of the simulation test;
- The aFRR provider, the (C)DSO (if applicable) and Elia agree on a timing;
- Within the agreed timing, Elia contacts the aFRR provider with respect to the announcement of the start of the prequalification test via the SCADA to SCADA connection;
- Elia reserves the right to abort the prequalification tests at any moment if it jeopardizes Elia grid or any distribution grid security when requested by (C)DSOs to Elia.

The test profiles are contractually fixed. Three test profiles for aFRR are foreseen:

a. Symmetrical test signal (**Figure 9**)
b. Asymmetrical test signal down (**Figure 10**)
c. Asymmetrical test signal up (inverse of **Figure 10)**

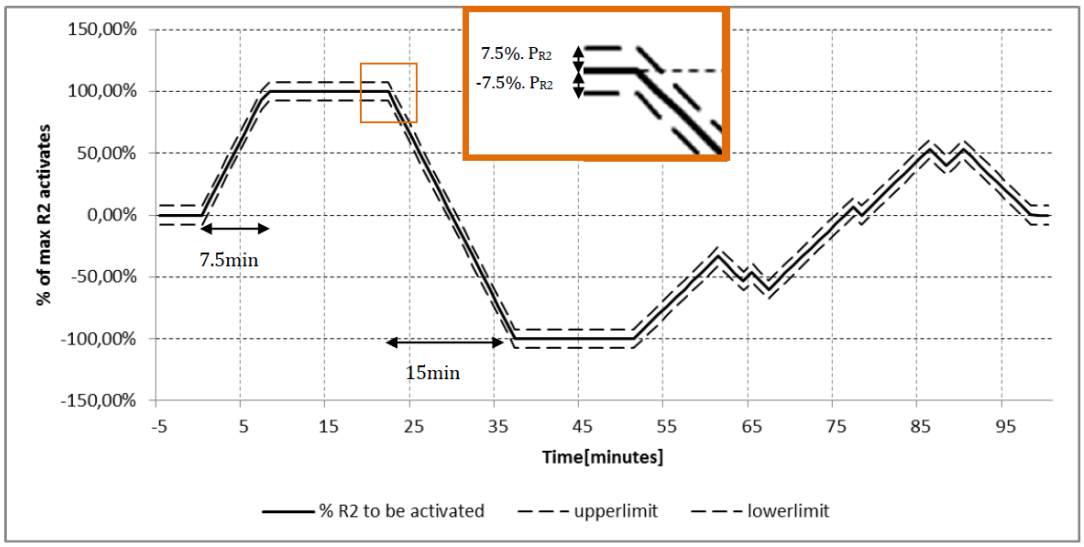


Figure 9 – Symmetrical test signal

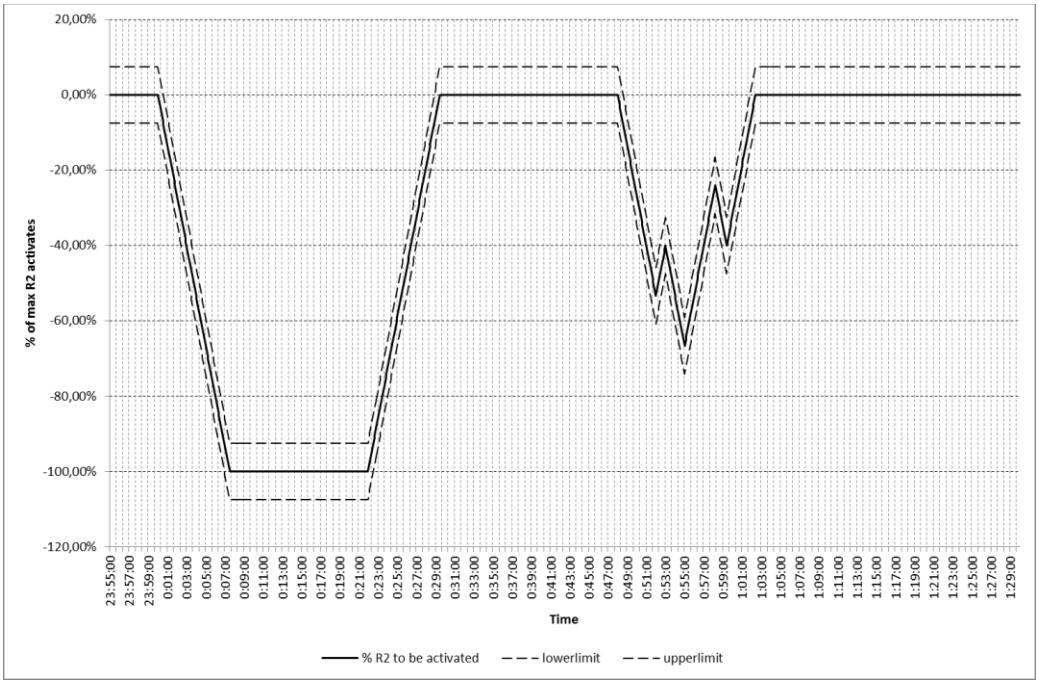


Figure 10 – Asymmetrical test signal (for down)

The above simulation profiles are for a full activation time (FAT) of 7,5 minutes. The aFRR provider can also choose to do a simulation test with a FAT of 5 minutes. Doing already a simulation test with a FAT of 5 minutes avoids that the aFRR provider has to redo the simulation test when the FAT requirement changes from 7,5 minutes to 5 minutes. This

change is expected within the coming years (end 2025) once standard products for balancing energy need to be implemented in the framework of the Guideline on Electricity Balancing.

In PICASSO, there is a commitment by all TSOs to develop market rules that incentivises faster reaction by end 2021. In this context, Elia will take steps in the future to allow a variable ramping rate corresponding to a FAT smaller than 7.5 minutes (and 5 minutes in the future). In a first step, this variable ramping rate should be confirmed during the simulation test of the prequalification process. Afterwards, this ramping rate, should be submitted during the bidding process for the balancing energy bids, taking into account the maximum ramping rate determined during the prequalification process.

5.3.6 Test results

Elia will verify the results of the simulation test. With this simulation test, Elia will verify whether the aFRR provider can activate the aFRR services and if he is able to follow a variable signal with a deviation smaller than 7.5% of the maximum value. This signal must be between the upper and lower limit (band of 15%) as indicated in **Figure 9** and **Figure 10**. Elia will check the aFRRmax that is reached during the test. For this test a sample will be taken every 4 seconds. This signal must be between the upper and lower limit (band of 15%). 4 deviations of 4 seconds are allowed.

The consistency check, as described in Section 15, will also be verified during the simulation test to check whether the data is exchanged in a correct way.

During the prequalification, once the aFRRmax prequalified volume has been fixed during the simulation test, the provider needs to demonstrate that he can provide this amount of aFRRmax prequalified volume continuously at least during 4 hours. It is not foreseen to physically check this availability requirement during the prequalification phase. A simulation test of 4 hours would represent an important cost for the aFRR provider and would be complex to organise. Valid qualitative explanations can be:

- The aFRR provider will offer aFRR with a portfolio of delivery points which are capable in delivering the aFRR max during 4 hours.
- The aFRR provider has no providing group but only one delivery point which has no energy limitations.

As, for the reasons explained before, the simulation test will be shorter than the 4 hours during which an aFRR provider could have to deliver continuously once in operation, it is important for Elia to gain a thorough understanding of the process the aFRR provider intends to implement to guarantee that if required, he would be able to comply with the 4 hours continuous delivery.

5.3.7 Auction and bidding

After a successful prequalification, the aFRR provider is allowed to offer capacity bids for the procurement of reserves for a maximum volume equal to the sum of the aFRRmax prequalified volume of the aFRR reserve providing groups. For the aFRR energy bids (on the bidding platform), the volume up or down can be larger than the aFRRmax prequalified up or down volume as long as it does not exceed the sum of the aFRRmax per delivery point respectively in the up or down direction.

In case a BSP has successfully performed an asymmetrical simulation test up (down) with a providing group or delivery point, he is only able to offer asymmetrical aFRR up (down) for capacity and energy bids. In case a BSP has done a symmetrical simulation test with an aFRR reserve providing group or delivery point, he may not only offer symmetrical aFRR but also offer asymmetrical up or down. In this case the bid volume for the aFRR capacity procurement may not be larger than the aFRRmax prequalified volume up and aFRRmax prequalified volume down.

5.4 Detailed information on providing groups

In this section, all the information concerning the providing groups is described in detail.

5.4.1 General principles for aFRR providing groups in the prequalification process

In this, the general principles for the aFRR reserve providing groups are described. These rules are only applicable for the prequalification process. For all other processes including bidding and activation these specific rules are not applicable.

- **Principle 1:**
  The aFRR provider decides how to compose an aFRR providing group.
- **Principle 2:**

  For delivery points linked to an asset with an individual power schedule (CIPU-assets), a providing group can only contain one delivery point. For delivery points not linked to an asset with an individual power schedule (i.e. non-CIPU assets); a providing group can contain more than one delivery point.
- **Principle 3:**
  A delivery point can only be part of one aFRR providing group.
- **Principle 4:**
  The individual aFRR contribution (upwards & downwards), i.e. the aFRRmax per delivery point per direction, will be given by the aFRR provider to Elia during the prequalification process as part of the documents needed for an aFRR providing group.
- **Principle 5:**
  The aFRRmax prequalified volume of the providing group per direction is determined during the simulation test of the prequalification process and should be equal or lower than the sum of the aFRRmax per delivery point per direction. The aFRRmax prequalified volume is only limiting the volume of balancing capacity which can be offered by the provider. In case sufficient flexibility is available, a provider is allowed to offer a volume of energy bids which is higher than the aFRRmax prequalified volume.
- **Principle 6:**
  The aFRRmax prequalified volume per providing group is limited and capped to 100MW per direction in case the providing group contains more than one delivery point. This limit is valid for the up and down direction separately. For a providing group

with one delivery point with an individual power schedule, there is no limit for the aFRRmax prequalified volume per providing group. The reasons for limiting the aFRRmax prequalified volume per providing group are explained in Section 4.1.2.

- **Principle 7:**
  The aFRR provider should be able to deliver 4 hours continuously the aFRRmax prequalified volume of a providing group. This is the availability requirement which is explained in Section 5.2. Additional volumes, which cannot guarantee the minimum delivery time of 4 hours, can be offered as non-reserved energy bids.

EXAMPLE

An aFRR provider has decided to create an aFRR providing group 1 (principle 1). The aFRRmax up and aFRRmax down prequalified volume of the aFRR providing group is limited to 100MW (principle 6). The individual aFRRmax per delivery point is given in the table (principle 4). The aFRRmax prequalified volume is given (principle 5). Since all delivery points of this providing group have an aFRRmax per delivery point in the up and down direction (i.e. symmetrical), it is possible to have an aFRRmax prequalified volume in the up and down direction (principle 8).

aFRR group 1	aFRR max up per DP	aFRR down per DP
Delivery point 1	2 MW	3 MW
Delivery point 2	20 MW	1 MW
Delivery point 3	1 MW	20 MW
Delivery point 4	1 MW	5 MW
Max aFRR prequalified volume	**20 MW**	**28 MW**

- **Principle 8:**

  In case all the delivery points of a providing group are symmetrical, this providing group can have an aFRRmax prequalified volume up AND down different from zero. The value in the up and down direction can be different. In all the other cases, the providing group can only have an aFRRmax prequalified volume up OR down.

5.4.2 Evolution of the aFRR providing group in the prequalification process

- **Principle 9:**
  An aFRR provider can increase the aFRRmax prequalified volume of an aFRR providing group in 2 different ways:

  1. A new prequalification test for the new aFRR providing group including the new delivery point(s) can be done. The availability requirement of the providing group has to be updated.
  2. The aFRR provider can only prequalify the additional delivery point(s) individually whose prequalified volume will be added to the existing aFRRmax

prequalified volume. The availability requirement of the additional delivery point(s) has to be provided.

- **Principle 10:**
  If the additional delivery point(s) cannot comply alone with the prequalification requirements, a simulation test must be done for the complete aFRR providing group in order to determine the aFRRmax prequalified volume of the new providing group.
- **Principle 11:**
  If the aFRR provider does not want to increase the aFRRmax prequalified volume of an aFRR providing group but only add extra flexibility to this aFRR providing group, the additional delivery point(s) can be included to the aFRR providing group without doing the simulation test. It is also not required to provide the availability requirement per delivery point for the additional delivery points or to update the availability requirement of the providing group. The aFRRmax per delivery points is required for those additional delivery points.

EXAMPLE

An aFRR provider wants to add DP 2 and DP 3. The aFRR provider can do an individual prequalification test for DP2 and DP3 or he can do a new prequalification test for aFRR providing group 2.

- **Principle 12:**
  The delivery points of a providing group that will participate to the simulation test cannot participate to the aFRR services during the period of the test. The initial reserve obligation of the BSP will remain valid.
- **Principle 13:**
  To remove a delivery point from an existing aFRR providing group, Elia will lower the aFRRmax prequalified volume by the aFRRmax per delivery point of the concerned delivery point. In case the contribution of the delivery point was less than the aFRRmax per delivery point, a new simulation test of the providing group is required to determine the new aFRRmax prequalified volume of the providing group.

- **Principle 14:**
  The qualification of aFRR providing units or aFRR providing groups shall be re-assessed conform Article 159 (4) of the SO GL:
  - *at least once every five years; and*
  - *where the technical or availability requirements or the equipment have changed*

  The re-assessment of the prequalification test will be done per providing group.

6 Capacity tender

For the opening of the aFRR capacity market, a daily procurement will be put in place. By going from a weekly to a daily procurement with a lead time of one day, aFRR providers should be able to better forecast available aFRR capacity and henceforth increase available volumes and lower entry barrier for new technologies. Today, BSPs offer mostly symmetrical volumes for aFRR. By opening of the aFRR market to non-CIPU, asymmetrical offers will become more regular.

Elia proposes to procure the reserved capacity with a combination of 4-hour blocks and 24-hour blocks. A BSP that makes an offer for a 24-hour block will also be obliged to split the offer in 4-hour blocks. The submission of only 4-hour blocks is also allowed. Bidding obligation for both directions, i.e. for aFRR up and aFRR are imposed. As a consequence, a BSP with a symmetrical bids, has to offer the same volume in asymmetrical bids. A total cost optimization will be performed on a daily basis.

Since this is a fundamental update of the methodology for the capacity tender, Elia will describe the methodology in the proposal for the implementation plan and will consult it in November 2018.

6.1 From a weekly to a daily procurement

An evolution from a weekly to a daily procurement with a lead time of one day is crucial for demand response, RES and decentralized production. This is also confirmed in the study "Delivery of downward aFRR by wind farms"[6] and the study on the R2 non-CIPU pilot project[7].

The advantages of moving from weekly to a daily procurement is clearly demonstrated in the study "Delivery of downward aFRR by wind farms". **Table 3** shows an overview of which share of the (simplified) theoretical downward aFRR capacity that can be offered for different aFRR product durations (month, week and day) and product resolution.

[6]http://www.elia.be/~/media/files/Elia/users-group/task-force-balancing/Downward_aFRR_windfarms_EN_2015.pdf

[7]http://www.elia.be/~/media/files/Elia/users-group/Working-Group-Balancing/20171221_R2-non-CIPU-Report.pdf

	Product duration / product resolution	Base delivery	Peak & long-off-peak	8h blocks	4h blocks
Onshore wind farm	Month	0%	0%	1%	1%
	Week	2%	4%	5%	8%
	Day	**25%**	**34%**	**50%**	**65%**
BE aggregated offshore production	Month	0%	1%	1%	1%
	Week	3%	6%	7%	11%
	Day	**36%**	**47%**	**65%**	**78%**

Table 3 – Impact of product duration on aFRR capacity potential for wind farms

From the table, it can clearly be derived that with the current weekly aFRR capacity product duration in Belgium there is almost no potential for stand-alone wind farm participation in the aFRR down capacity market. Only in case of daily procurement and short procurement lead times there is a high potential for wind farms to participate in an aFRR down capacity market.

The conclusion that shorter procurement lead times and shorter product duration have a positive impact on the available aFRR capacity potential is also confirmed by the the study on the R2 non-CIPU pilot project.

The evolution to a shorter procurement time is also confirmed by Article 32(b) of the GL EB stating *the procurement process shall be performed on a short-term basis to the extent possible and where economically efficient*.

6.2 Gate Closure Time & Selection

This topic is also closely linked to the study concerning the "separated procurement of FCR and aFRR products"[8]. Elia has taken the feedback on this study into account for the proposals described below. One of the important feedbacks of the stakeholders was that it is not desirable that there are many implementation steps which require at the stakeholders side significant changes. In addition and complementary to this, Elia believes that, for the sake of efficiency and clarity, any (significant) change in the procurement approach towards the identified target model should at least last for one year.

In addition, the aFRR design work has also brought new insights with respect to:

- ➔ Gate Closure Times
- ➔ Asymmetrical bidding obligation

These new elements are described in the sections below.

6.2.1 Timings FCR Cooperation

The timings of FCR Cooperation are set on regional level and have an important impact on the timings of the local FCR/aFRR procurement. They are therefore presented below. An

[8] http://www.elia.be/en/about-elia/publications/Public-Consultation/Archives/Formal-public-consultation-regarding-a-study-on-Separate-procurement-of-FCR-and-aFRR-products

important element to take into account is that the FCR volume of Elia to be sourced through the FCR Cooperation is dynamic. The rules of the FCR Cooperation impose that this volume has to be known 24 hours before the gate closure time of FCR Cooperation. As long as Belgium has a local FCR procurement and as long as the aFRR is procured in combination with FCR, the same timing restrictions of the FCR Cooperation will impact the procurement lead times for aFRR.

According to the official proposal of FCR Cooperation towards the concerned NRAs, from November 2018 on and pending regulatory approval, FCR Cooperation will have a daily procurement with daily products ranging from D-2 to D-4. The detailed timings for FCR Cooperation can be found in **Table 4**.

FCR cooperation: GCT 15:00	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Delivery D	Wednesday	Thursday	Friday	Saturday Sunday	Monday Tuesday
	D-2	D-2	D-2	D-2/**D-3**	**D-3/D-4**

Table 4 – Foreseen timings for FCR Cooperation between November 2018 and July 2020.

From July 2020 on, FCR Cooperation will have a daily procurement on D-1 with 4 hours products. The timings for FCR Cooperation can be found in **Table 5**.

FCR cooperation: GCT 08h00	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Delivery D	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
	D-1	D-1	D-1	D-1	D-1	D-1	D-1

Table 5 – Foreseen timings for FCR Cooperation from July 2020 onwards.

In case of combined procurement, aFRR needs to be procured according to the timings shown in the table below.

Delivery D	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
R1/R2 GCT **10:00**	Thursday **(D-4)**	Thursday **(D-5)**	Sunday (D-3)	Monday (D-3)	Tuesday (D-3)	Wednesday (D-3)	Wednesday **(D-4)**
RL: GCT 15:00	Friday **(D-3)**	Friday **(D-4)**	Monday (D-2)	Tuesday (D-2)	Wednesday (D-2)	Thursday (D-2)	Thursday **(D-3)**

Table 6 – Foreseen timings for combined FCR/aFRR procurement between go-live new aFRR design and July 2020.

Since the FCR procurement needs to take place at least 24 hours before the gate closure time of the FCR cooperation, the daily combined procurement of FCR/aFRR would take place

at D-3 and up to D-5 for the period before July 2020. The combined procurement of FCR/aFRR with the timings as proposed has limited added value for attracting additional flexibility with respect to the weekly procurement that is in place today. FCR Cooperation foresees a daily procurement on D-1 from July 2020 on. From that moment onward, the combined procurement could occur on D-2 06h00 or 07h00 or D-3 at 16h00. Daily tendering in such a context is also suboptimal as in the previous section, we have demonstrated that a crucial design element of the new aFRR design is an evolution to a daily aFRR procurement.

5.1.2. Asymmetric bidding

Today, BSPs offer mostly symmetrical volumes for aFRR. By opening up the aFRR market to non-CIPU assets, asymmetrical offers will become more regular. To ensure healthy market dynamics, it is important that assets who offer symmetrical bids are also offering asymmetrical bids. Today, for the combined FCR/aFRR procurement, there are no bidding obligations in place for asymmetrical flexibility and the bidding rules are only applicable for symmetrical aFRR bids with an equal upward and downward volume, combined with FCR bids. The opening of the aFRR market to non-CIPU assets requires an update of the bidding obligations in order to give the opportunity to BSPs offering asymmetric aFRR to match with a complementary product. It is assumed that by attracting bids from non-CIPU assets, it is desirable to have additional bidding instructions for aFRR up and down separately. Enforcing these additional bidding instructions would make it very impractical from an operational point of view[9]. The number of bids to be submitted increases exponentially with the number of linked products. For example, if the bidding obligation imposes to slice a large bid into at least 10 smaller bids, then imposing a bidding obligation over 3 linked products implies the submission of $>10^3 = 1000$ bids combinations. This qualitative analysis clearly shows the complexity of having a combined procurement for FCR and aFRR with bidding obligations for asymmetrical bids for aFRR.

In case of a separated procurement of FCR and aFRR, it is logical and reasonable to impose bidding obligations on the two aFRR directions, i.e. aFRR up and aFRR down to incentivize asymmetrical bids. The bidders would be obliged to split up large symmetrical bids into smaller symmetrical and asymmetrical bids. It is proposed that the maximum step size is also reduced from 24MW to 10MW in order to make sure that the capacity procurement is not dominated by large indivisible bids. A total cost optimization is applied for the two aFRR directions. A total cost optimization minimizes the reservation procurement cost, subject to:

1. Respecting the bid constraints (incl. “indivisibility” and “link across products”) and
2. Ensuring that selected volume must at least cover the minimum volume pursued for aFRR products in both directions.

[9] More details are giving in Chapter 3.4.4 of “separated procurement of FCR and aFRR products”

6.2.2 Way forward proposed options

⇨ *Proposed way forward with respect to the joint procurement of FCR and aFRR*

Considering the elements regarding timing and requirements to have asymmetric bidding obligations for aFRR, **Elia proposes to have a separated procurement of FCR and aFRR once the new aFRR design goes live**. Looking at the latest developments in the FCR market, liquidity is expected to significantly increase by the foreseen go-live of the new aFRR design.

⇨ *Proposed way forward with respect to the procurement of FCR*

With respect to the FCR procurement two options can be identified, based on the moment in time at which the entire FCR procurement will be done through the regional platform.

The consequences of moving the entire FCR procurement to the regional and henceforth stopping the "local auction" are:

- Shorter FCR procurement lead times
- Simplified operations both at Elia as well as market participants side
- No more asymmetric products

Option 1: "one step" option

This option would consist in aligning the shift to full regional FCR procurement with the go-live timing of the new aFRR design (corresponding also to the moment in time at which the joint procurement of FCR/aFRR will be stopped as indicated above). This is illustrated in **Table 7** and **Table 8**.

Delivery D	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
FCR Cooperation: GCT 15:00	Friday (D-3)	Friday (D-4)	Monday (D-2)	Tuesday (D-2)	Wednesday (D-2)	Thursday (D-2)	Thursday (D-3)
aFRR: GCT **09:00**	Sunday (D-1)	Monday (D-1)	Tuesday (D-1)	Wednesday (D-1)	Thursday (D-1)	Friday (D-1)	Saturday (D-1)

Table 7 – Procurement scheme for FCR and aFRR between the go-live of the new aFRR design and July 2020 in the "one step" option.

Delivery D	Monday	Tuesday	Wednesday	Thursday	Friday	Saterday	Sunday
FCR Cooperation **08:00**	Sunday (D-1)	Monday (D-1)	Tuesday (D-1)	Wednesday (D-1)	Thursday (D-1)	Friday (D-1)	Saturday (D-1)
aFRR: GCT **09h00**	Sunday (D-1)	Monday (D-1)	Tuesday (D-1)	Wednesday (D-1)	Thursday (D-1)	Friday (D-1)	Saturday (D-1)

Table 8 – Procurement scheme FCR and aFRR from July 2020 onwards.

Option 2: "two step" option

This option would consist in splitting the joint procurement of FCR and aFRR when the new aFRR design goes live, and then to shift to full regional FCR procurement with the moment in time that the regional FCR cooperation will implement a daily procurement lead time and a product length of 4 hours (anticipated to be in July 2020). This is illustrated by the following **Table 9** and **Table 10**

Delivery D	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
FCR GCT 10:00	Thursday (W-1)	Thursday (W-1)	Friday (W-1)	Monday (W-1)	Tuesday (W-1)	Wednesday (W-1)	Wednesday (W-1)
FCR cooperation: GCT 15:00	Friday (D-3)	Friday (D-4)	Monday (D-2)	Tuesday (D-2)	Wednesday (D-2)	Thursday (D-2)	Thursday (D-3)
aFRR: GCT **09:00**	Sunday (D-1)	Monday (D-1)	Tuesday (D-1)	Wednesday (D-1)	Thursday (D-1)	Friday (D-1)	Saturday (D-1)

Table 9 – Procurement scheme for FCR and aFRR between the go-live of the new aFRR design and July 2020 in the "two step" option

Delivery D	Monday	Tuesday	Wednesday	Thursday	Friday	Saterday	Sunday
FCR Cooperation: GCT **08:00**	Sunday (D-1)	Monday (D-1)	Tuesday (D-1)	Wednesday (D-1)	Thursday (D-1)	Friday (D-1)	Saturday (D-1)
aFRR: GCT **09h00**	Sunday (D-1)	Monday (D-1)	Tuesday (D-1)	Wednesday (D-1)	Thursday (D-1)	Friday (D-1)	Saturday (D-1)

Table 10 – Procurement scheme FCR and aFRR from July 2020 onwards. The whole FCR volume is procured in the FCR cooperation.

The timings of the aFRR procurement will be independent of the timings of the local and regional (FCR Cooperation) FCR procurement.

Currently, Elia is analysing in detail the organization of the tenders for FCR, aFRR and mFRR and more specific the timings of these tenders. The timings of these tenders will be presented in the proposal for the implementation plan, which will be consulted in November.

As can be noticed, the only difference between the “one step” and the “two step” option is the moment in time at which the entire FCR procurement will be organised through the regional platform. It is furthermore assumed that, as from the moment in time that the regional FCR cooperation will shift towards a daily procurement lead time and a product length of 4 hours (anticipated to be in July 2020), the local procurement would anyhow be stopped because it is expected with some certainty that the development of liquidity and competition for FCR will allow suppressing the local design (local products, weekly procurement…) as indicated in the study on “separated procurement of FCR and aFRR products[10]”.

6.3 Conclusions

Taking into account the current estimate that the new design of the aFRR may go live in the beginning of 2020[11]:

- Considering the good development of the FCR market and the expectation that this will continue in the future
- Considering that the asymmetric FCR products are being used less and less and that this trend will likely continue
- Taking into account the insights and results of the study on “separated procurement of FCR and aFRR products”.

Elia believes that the advantages of the “one-step option” (quicker benefiting from shorter FCR procurement lead times and simplified operations both at Elia as well as market participants side) outweigh the advantages of the “two-step option” (longer availability of asymmetric FCR products). This scenario is confirmed by the feedback of stakeholders during the consultation.

[10] http://www.elia.be/en/about-elia/publications/Public-Consultation/Archives/Formal-public-consultation-regarding-a-study-on-Separate-procurement-of-FCR-and-aFRR-products

[11] This will be confirmed in the implementation study by the end of 2018.

7 Secondary market

The objective of the secondary market is to allow BSPs to bilaterally exchange reserve obligations between each other after closure of the primary market (i.e. capacity tender). The design of the rules for the secondary market for aFRR are aligned with rules for the secondary market for mFRR.

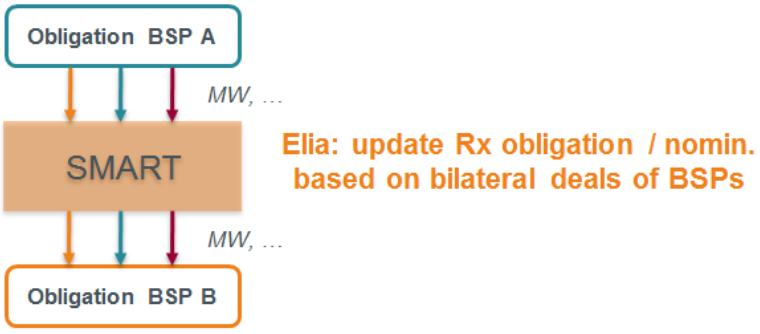


Figure 11 – Secondary market

7.1 Day-ahead before 13h30

In day-ahead, a BSP (the initiating aFRR provider) can transfer part or all his aFRR reserve obligations to another BSP (the counterpart aFRR provider), who is prequalified for aFRR service provision. The initiating aFRR provider can decrease the reserve obligations that he has contracted in the primary market irrespective whether these concern CIPU or non-CIPU assets. The counterpart aFRR provider is allowed to take over the reserve obligations both CIPU and non-CIPU assets as long as he has a valid contract for aFRR reserve. The sum of his existing reserve obligations and the amount taken over from a 3rd party through an exchange on the secondary market may not exceed the capacity that he has prequalified for the corresponding product (up, down and/or symmetric). All combinations of transfer (from CIPU to CIPU assets, from non-CIPU to non-CIPU assets, from CIPU to non-CIPU assets, and from non-CIPU to CIPU assets) are allowed.

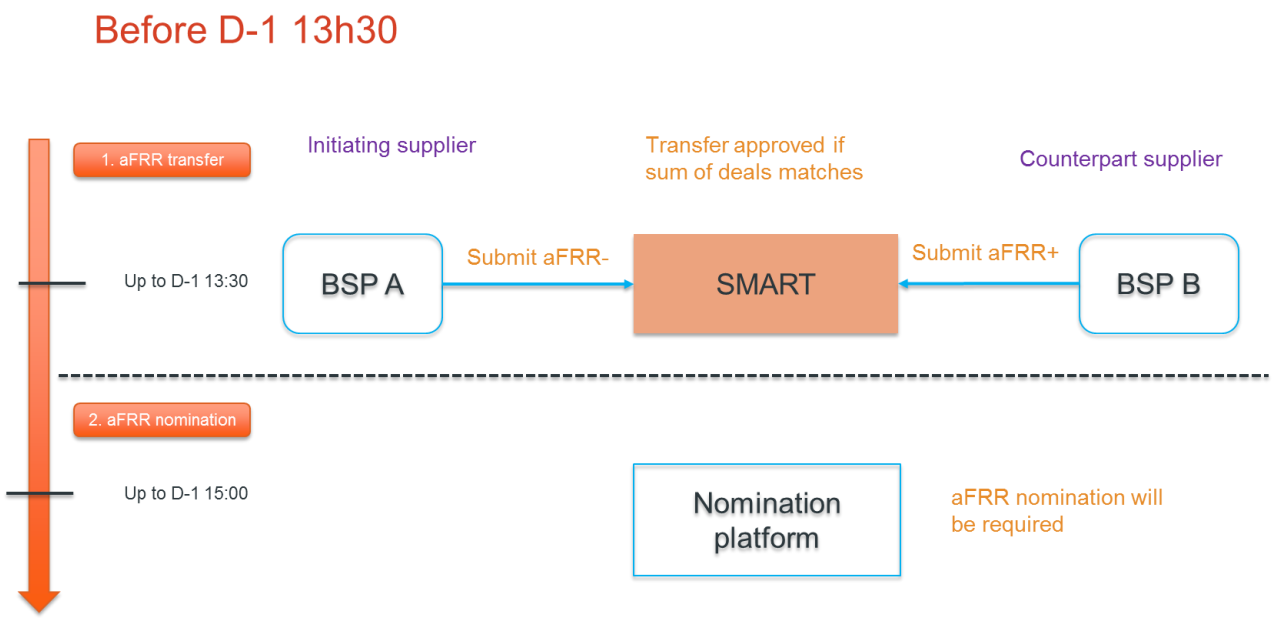


Figure 12 – Day-ahead secondary market

Both the initiating aFRR provider (the one decreasing his obligation) and the counterpart aFRR provider (the one increasing his obligation) nominate a “deal”, i.e. Obligation Reserve Transfer (ORT) on the SMART platform. Deals must be entered before 13:30 D-1. Both aFRR providers specify the delivery period, the type of reserve (in this case aFRR), the volume, the counterparty and, if applicable, the service type (up and/or down) and contract type (CIPU or non-CIPU). If both deals match each other, the transfer is approved automatically and Elia takes into account the new reserve obligations of both aFRR providers. They nominate in BMAP their new reserve obligations based on the transfers executed for both CIPU and non-CIPU.

7.2 Intraday (H-1)

The philosophy is the same as the one proposed for the day-ahead process. All combinations of transfer (from CIPU to CIPU assets, from non-CIPU to non-CIPU assets, from CIPU to non-CIPU assets, and from non-CIPU to CIPU assets) are all allowed.

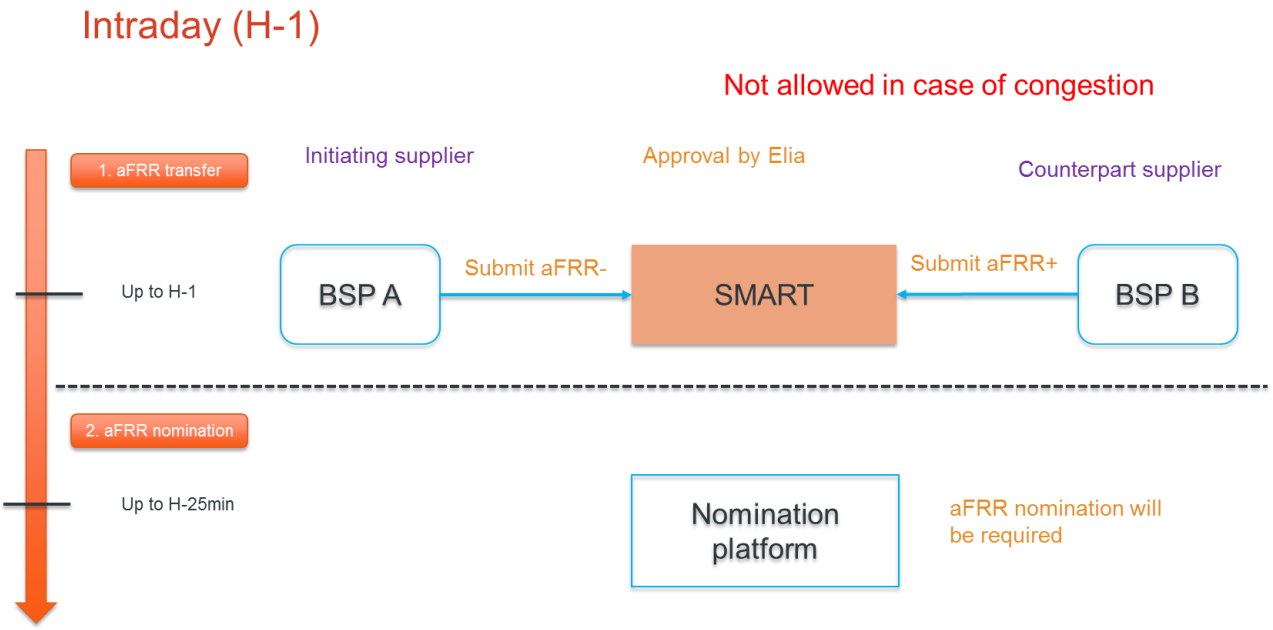


Figure 13 – Intraday secondary market.

The initiating aFRR provider (the one decreasing his obligation) creates a Nomination Reserve Transfer (NRT) on the SMART platform. The counterpart aFRR provider (the one increasing his obligation) has to approve this deal. The initiating aFRR provider specifies the volume, contract type (CIPU or non-CIPU), service type (up and/or down) and the type of reserve (in this case aFRR). Once approved by the counterpart aFRR provider, the transfer must be approved by Elia. Elia will check that the requested transfer does not endanger operational security of the grid. The transfer will not be approved in intraday if it generates congestion issues (see Section 8.5). Deals on the SMART platform must be approved no later than one hour before delivery. After the approval by Elia, the nominations in BMAP should be updated by the initiating and the counterpart BSP in conformity with the procedures.

Note for both CIPU and non-CIPU assets, the BSP can never nominate a volume that exceeds the capacity he has prequalified for the corresponding product.

7.3 Forced outage

Immediately after the occurrence of a forced outage that impacts the aFRR provider's contractual obligation, the aFRR provider quantifies the loss of reserve obligation and communicates it to Elia. In parallel, the aFRR provider adapts its intraday nomination for the first possible quarter-hour, considering the nomination process neutralization time. This nomination update is essential for Elia as it will be used as input to trigger an availability test.

Elia authorize a reconstitution time of 4 hours – starting from the occurrence of a forced outage which is notified to Elia via email – to give the aFRR provider time to find a back-up solution (using the intraday secondary market facility offered by Elia or within its own portfolio). Once the solution is found and before the end of the 4 hours reconstitution time, the BSP updates its nominations. If, by the end of these 4 hours, no solution has been found and part of the obligation cannot be fulfilled by the aFRR provider, Elia will automatically apply a penalty on the missing volumes.

Remark: Occurrence of forced outage is rare. The use of this 4 hours reconstitution time must therefore remain exceptional. If Elia observes the occurrence of several forced outages on same delivery points over a limited period of time or if the BSP fails to explain their reason, Elia will exclude these delivery points from the aFRR provider's prequalified pool until the aFRR provider proves that a durable solution has been found and implemented to avoid such event to reoccur in future (by re-prequalifying the delivery point).

8 Bidding process for balancing bids

8.1 Relevant articles in the guidelines

Article 24 of the Guideline on Electricity Balancing gives more information on the balancing energy gate closure time. This will be harmonized on European level. Article 25 of the same Guideline defines the characteristics of a standard product bid.

Guideline on Electricity balancing

Article 24

Balancing energy gate closure time

1. As part of the proposals pursuant to Articles 19, 20 and 21, all TSOs shall harmonise the balancing energy gate closure time for standard products at the Union level, at least for each of the following processes:
    a) replacement reserves;
    b) frequency restoration reserves with manual activation;
    c) frequency restoration reserves with automatic activation.
2. Balancing energy gate closure times shall:
    a) be as close as possible to real time;
    b) not be before the intraday cross-zonal gate closure time;
    c) ensure sufficient time for the necessary balancing processes.
3. After the balancing energy gate closure time, the balancing service providers shall no longer be permitted to submit or update their balancing energy bids.
4. After the balancing energy gate closure time, balancing service providers shall report to the connecting TSO any unavailable volumes of balancing energy bids without undue delay in accordance to 158(4)(b) and 161(4)(b) of Regulation (EU) 2017/1485. If the balancing service provider has a connection point to a DSO, and if required by the DSO, the balancing service provider shall also report any unavailable volumes of balancing energy bids to the DSO without undue delay.
5. ...

Guideline on Electricity balancing

Article 25

Requirements for standard products

6. The list of standard products for balancing energy and balancing capacity **may set out** at least the following characteristics of a standard product bid:
    a) preparation period;
    b) ramping period;
    c) full activation time;
    d) minimum and maximum quantity;
    e) deactivation period;
    f) minimum and maximum duration of delivery period;
    g) validity period;
    h) mode of activation.

7. The list of standard products for balancing energy and balancing capacity **shall set out** at least the following variable characteristics of a standard product to be determined by the balancing service providers during the prequalification or when submitting the standard product bid:
    a) price of the bid;
    b) divisibility;
    c) location;
    d) minimum duration between the end of deactivation period and the following activation.

According to Article 25 of the Guideline on Electricity balancing, there are **required** characteristics of a bid and **possible** characteristics of a bid. **Table 11** gives an overview on how each of the characteristics of this article is defined. The content of the implementation framework for the aFRR platform, pursuant to Article 21 of EBGL and as consulted in May and June 2018, has been considered even if not yet final. The national specificities are also included in the table. More details are given in Section 8.2.

Possible characteristics	Information
Preparation period;	30 seconds
Ramping period;	Not applied for aFRR
Full activation time;	Currently, a full activation time of 7,5 minutes is applied. This will be 5 minutes by the 18th of December 2025.
Minimum and maximum quantity;	In principle, there is no maximum bid size for balancing energy bids. However, reserved balancing energy bids with non-CIPU asset(s) (assets without an individual power schedule) should fulfil the requirements of the reserve obligations, i.e. maximum bid size of 50MW. The reasons for the maximum bids size are explained in principle 9 of Section 8.2.
Deactivation period;	See Section 10.2
Minimum and maximum duration of delivery period;	Not applicable
Validity period;	The validity period is 15 minutes. The validity period will be consecutive and not overlapping.
Mode of activation.	A merit order activation will be applied with a pro-rata activation as fall-back procedure. Bids with the same price in the merit order list will be activated on a pro rata basis. The activation will be done automatically.
Required characteristics	**Information**
Price of the bid;	The activation price is in €/MWh. The application of a price cap and its level is under discussion (see Section 8.6).
Divisibility;	Bids are divisible without a minimum granularity which means the activation request can be lower than the minimum quantity.
Location;	The delivery points are identified per bid.

Minimum duration between the end of deactivation period and the following activation.	The bid can be activated and deactivated at any moment within the validity period. No minimum duration time shall be permitted.

Table 11 – Possible and required characteristics of a balancing energy bids.

Table 12 shows additional characteristics which are also defined for a balancing energy bid within Elia.

Additional characteristics	Information
Granularity of a bid	1 MW
Congestion management	Will be applied for aFRR bids (see Section 8.5)

Table 12 – Additional characteristics of a balancing energy bids

8.2 General principles of a bid

In this section the general principles of a bid are explained. Those general principles are in line with the relevant articles of the guidelines as explained in the section above.

- **Principle 1: Unit based versus pool based bidding**

  The balancing energy bids should be per delivery point for delivery points with an individual power schedule (CIPU assets). For delivery points without individual power schedule (non-CIPU assets) portfolio bids are allowed.

- **Principle 2: Exclusivity of the delivery points**

  A delivery point can only belong to one bid. The aFRR provider can also only select the delivery points that belong to his portfolio.

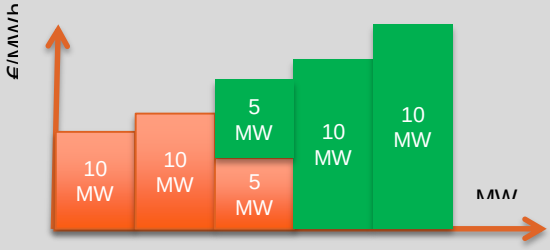
- **Principle 3: reserved and non-reserved**

  One bid per aFRR provider can have a reserved and non-reserved volume. The reserved and non-reserved volume should be separately indicated in the bid.

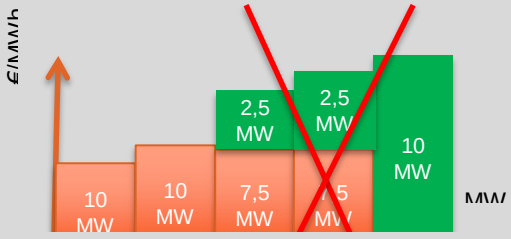
EXAMPLE

Below a bid with 5 MW reserved and 5 MW non-reserved capacity is presented.

An aFRR provider has 25 MW reserved capacity and he offers 5 times a balancing energy bid of 10 MW. In that case, he can only offer 3 bids with reserved capacity. Only one bid can have a reserved and non-reserved volume, i.e. the third bid in this example. It is not required that the bids with lowest activation price are labelled as reserved.



The following set-up is not allowed.



- **Principle 4: Numbers of bids is predefined in the bidding platform**

  The configuration of bids on the bidding platform is fixed and predefined. As a consequence, the number of bids per BSP is also fixed. However, BSPs could request an increase of the number of bids. For each delivery point which requires unit based bidding, a bid will be foreseen. For the remaining flexibility, where pool based bidding is allowed, there will be a bid foreseen per volume of 5 MW. Additional bids will not be created automatically. The BSP has to submit a request to Elia in order to increase the number of bids he can submit.

- **Principle 5: Continuous bids**

  Even though a bid is formally submitted for a given validity period, the practical implementation with the fixed number of bids is that a bid has a continuous duration

(thus not limited to a specific validity period). This has also as consequence that the EMS considers this bid as continuous and that the previous control request of the bid will be the starting point for the next quarter-hour if the bid volume did not change over the quarter-hours. More information is given in Section 10.2.

- **Principle 6: Main variables of the bids**
  - The up and down volume of a predefined bid can change each quarter-hour in the future.
  - The up and down price of a predefined bid can change each quarter-hour in the future.
  - Only one set of delivery points for the future quarter-hours can be submitted. An example of a bid is given in Section 8.3.

- **Principle 7: maximum activation price for reserved bids.**

  It is possible to foresee a price cap for reserved bids, meaning that the activation price of a bid with flag “reserved” cannot be larger than this price cap (i.e. it will not be possible to submit an activation price larger than this price cap). More information on the price cap is given in Section 8.6.

- **Principle 8: minimum bid size and granularity**

  The minimum bid size is 1 MW and a bid has a granularity of minimum 1 MW.

- **Principle 9: maximum bid size**

  Maximum quantity of a portfolio bid containing assets with no individual power schedule is 50 MW for the reserved volume of the bid. A bid, containing a delivery point with an individual power schedule (CIPU asset), does not have a maximum bid quantity. In that case, there is only one bid per unit and therefore, the maximum bid size cannot be limited. In that situation, the bid volume cannot be larger than the aFRRmax per delivery point.

  There are three reasons for limiting the bid size:

  - The first reason for limiting the bid size for non-CIPU assets (assets without an individual power schedule) is linked to potential congestion issues (the current so called “red zones” mechanism or Congestion Risk Indicator (CRI) in the framework of the iCAROS project) . If one of the delivery points of a bid is in a red zone, the entire bid could be put on unavailable. If the aFRR provider put all his flexibility in one bid (in case of no maximum bid size), a large amount of flexibility could be lost due to unavailability of a few delivery points. Thanks to the limit of 50 MW, only 50 MW per bid can be lost. In principle this is no limitation for the aFRR provider. Offering one bid of 100 MW or two bids of 50 MW with the same activation price will be treated in the same way for activation. For bids containing a delivery point with an individual power schedule (CIPU assets), it is not needed and possible to limit a bid since it is unit based bidding. More information on the red zones and CRI can be found in Section 8.5;

- The second reason for the limited bid volume is in case a bid becomes (temporarily) unavailable (e.g. forced outage). In that case, the impact on the aFRR activation is limited to a loss of maximum 50 MW;

  The third reason is the availability test. In an availability test, only the reserved volume of a bid will be tested. In order to limit the volume to be tested, a maximum volume is introduced for the reserved volume, i.e. 50 MW. More information on the availability test can be found in Section 13.

- **Principle 10: CRI/red zones**

  Before the go-live of the of the iCAROS project, the aFRR provider is not able to submit a bid with a CIPU unit or a bid with a non-CIPU unit with an aFRRmax per delivery point larger than 25 MW in a red zone after the publications of the red zones. The possibility exists to update a bid in a red zone (delivery points, activation price, volume decrease), but no volume increase is possible. More information on the red zones can be found in Section 8.5.

  After the go-live of the iCAROS project, the Congestion Risk Indicator will be applied to all delivery points, i.e. delivery points with and without an individual power schedule.

8.3 Example of a bid

In this section two examples of a bid are represented. The table below shows the information that a portfolio bid will contain. This is in case there is no individual power schedule (i.e. there are only non-CIPU assets).

Bid 1		Qh 1	Qh 2	Qh 3	…
Volume [MW]	Volume up				
	Volume down				
Activation price [€/MWh]	Act. price up				
	Act. price down				
Reserved/Non-reserved [MW]	Reserved volume				
	Non – reserved volume				
Delivery points	DP 1				
	DP 2				
	…				
	DP i				

Table 13 – Example of a portfolio bid

The table below shows the information for a bid with an asset with an individual power schedule (CIPU asset). In that case, unit based bids are required.

Bid 2		Qh 1	Qh 2	Qh 3	…
Volume [MW]	Volume up				
	Volume down				
Activation price [€/MWh]	Act. price up				
	Act. price down				
Reserved/Non-reserved [MW]	Reserved volume				
	Non – reserved volume				
Unit	Select one unit				

Table 14 – Example of a unit based bid

8.4 Timings for submission of the balancing energy bids

8.4.1 Pre-offering for reserved bids: D-1 @ 15h00

Each aFRR provider from whom Elia has procured aFRR capacity (or who took over a reserve obligation from another BSP following a transaction on the SMART platform) must offer at least the quantity for which he has an obligation to bid. The gate closure time for reserved balancing energy bids is D-1 at 15h00. The gate opening time is after the procurement procedure for the capacity bids is finalized and the results are published.

8.4.2 Balancing energy gate closure time for all bids: QH-25min

The aFRR provider can make more aFRR volumes available to Elia than his aFRR obligations (i.e. non-reserved volumes) until 25 minutes before delivery. Until this balancing energy gate closure time, it is also possible to do a transfer between reserved and non-reserved bids within a portfolio. The reserved bids can still be updated until this balancing energy gate closure time. This means that an update of volume (increase or decrease) and activation price is still possible. The update of the volumes will only be possible in case it is allowed by the red zones/CRIs (Section 8.5).

8.5 Bids with delivery points located in congested areas.

In the long term (i.e. after the go-live of the iCAROS project), the congestion risk indicator (CRI), which is a concept that has been developed in the framework of iCAROS project, will be applied to all delivery points. It will not be allowed for a BSP to offer flexibility in the congested direction.

In the short-term, the following rules apply for the submission of the energy bids (these rules are in line with the rules applicable to non-reserved mFRR energy from non-CIPU assets offered on the Bid Ladder):

- If the congested areas have not yet been identified and communicated to the BSPs:
  - There are no restrictions for the submission of bids.
- If the congested areas have been identified and communicated to the BSPs:

- It will not be allowed to offer a bid with a CIPU asset and it will not be allowed to submit a portfolio bid with a non-CIPU asset with an aFRRmax per delivery point larger than or equal to 25 MW located in a congested area in the congested direction.
- The possibility exists to update a bid in a red zone (delivery points, activation price, volume decrease), but no volume increase is possible for bids with CIPU assets and bids with at least one non-CIPU asset with an aFRR max per delivery point larger than or equal to 25 MW.
- There are no restrictions for non-CIPU asset with an aFRRmax per delivery point smaller than 25MW.

For the activation in the EMS, the following rules apply:

- All bids are taken into account for the activation in the EMS, without taking into consideration the congested areas/red zones.
- Elia has the right to put a bid (with CIPU assets and/or with non-CIPU assets delivery point with an aFRRmax per delivery point larger or equal to 25MW) in the congested area on unavailable for activation in the EMS. This is done by a manual action during the neutralization time.
- Elia will contact the BSP via phone and via an electronic message to inform him that certain bids will not be activated and that the aFRR services cannot be delivered by those delivery points attributed to that bid.
- There is no obligation for the BSP to re-nominate the deactivated volume.

8.6 Maximum activation price for reserved bids

Thanks to the merit order activation, there is no longer an ex-ante selection of bids and hence additional volumes of non-reserved bids can be offered right before real-time. Once we move to a merit order activation and price caps are removed, it can be assumed that there will be bids at the end of the aFRR merit order with an activation price larger than the cheapest available mFRR bids. Since the aFRR bids are activated automatically by Elia's LFC controller, the most expensive bids with large activations prices could be activated in case of sudden large imbalances.

One could argue that the activation of the most expensive aFRR-bids can be avoided by Elia by activating more frequently cheaper mFRR reserves. Experience today however shows that such an objective can only be partially achieved because of the relatively limited available volume of aFRR (139 MW). Today because of sudden strong variations of the system imbalance the available volume of aFRR gets fully activated on average 2 times per day per direction. As long as the volume of aFRR balancing energy bids remains relatively small compared to the sudden variations in the system imbalance, the activation of the most expensive aFRR bids will be unavoidable.

This situation is depicted in the graph below. The activated bid with the largest activation price for aFRR and mFRR will influence the imbalance price. The aFRR prices could have an impact on the imbalance price. The situation can happen occasionally.

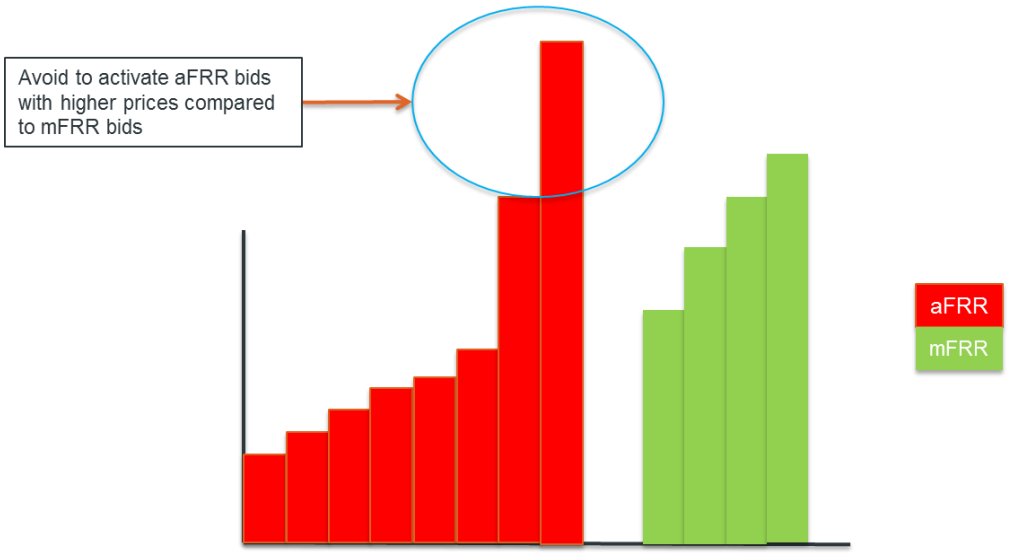


Figure 14 –Merit order for aFRR and mFRR

Therefore Elia considers the introduction of a price cap for the reserved bids which is considerable larger than today's price cap[12] enabling the participation of new technologies but which still limits the exposure of BRPs to extreme imbalance price spikes which are not consistent with the system conditions. This price cap will be determined ex-ante.

It is expected that such a price cap is only required as transitory measure as long as the aFRR market liquidity builds up. In the longer term, it can be assumed that the aFRR market will be more liquid, in particular once the Belgian aFRR will be integrated into a broader European aFRR market (PICASSO project – expected to go live end of 2021).

Based on the feedback of the stakeholders on the new aFRR design received during the public consultation, a price cap for reserved bids will be implemented as a transitory measure. In first instance, an upper limit of 1500€/MWh and a lower limit of -1500€/MWh will be foreseen. In case this price limit is reached frequently, Elia will re-discussed the price cap with the relevant stakeholders.

8.7 Calculation of the ramping rate

Based on the full activation time (FAT), which is today 7,5 minutes, the ramping rate is calculated per bid based on the formula below:

$$ramping\ rate_{bid} = \frac{bid\ volume\ [MW]}{7{,}5\ minutes}$$

[12] Marginal cost of CCGT + 40 €/MWh

9 Processing of the balancing energy bids

After the balancing energy gate closure time, the bids will be firm and Elia will perform some checks and make the bids “ready” for sending to the EMS.

9.1 Checks to be performed

Following checks on the bids will be performed:

1. Checks for bidding principles:
   It will not be allowed to submit balancing energy bids which are not in line with the bidding principles as defined in Section 8.2. Therefore, the bidding principles are already implicitly verified.
2. Check for availability of the bids
   It is possible to put a bid as unavailable. Putting a bid to unavailable can be done in the following circumstances:
   a. For bids in red zones/CRIs
   b. In case of a forced outage
   c. To avoid operational security issues

9.2 Ranking of the balancing energy bids

A separated merit order for the up bids and for the down bids is constructed based on the activation price. The up bids are ranked from a low activation price to a high activation price. The down bids are ranked from a high to a low activation price. This is represented in the graph below.

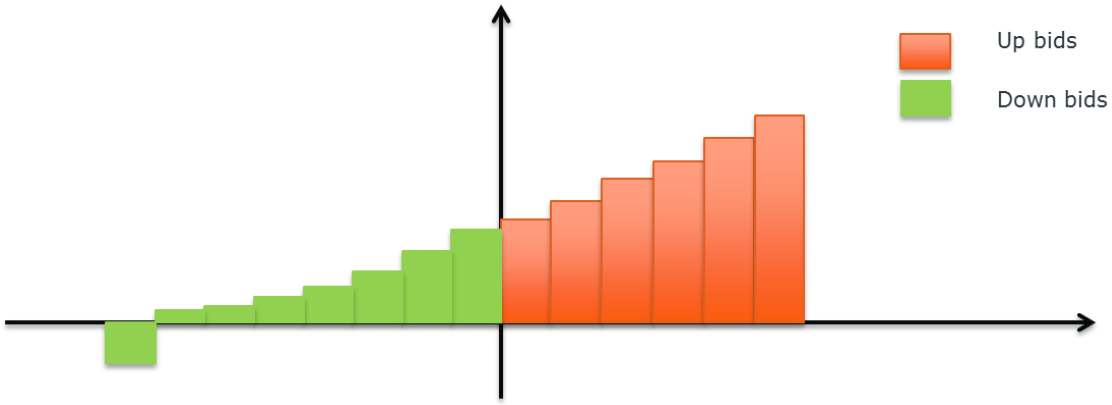


Figure 15 – A separate aFRR merit order for upwards and downwards bids

When two bids have the same activation price, they will have the same ranking and they will be activated pro-rata in the EMS.

9.3 Sending of the bids to EMS

The bids are sent to the EMS for activation.

9.4 Fall back procedures

For each quarter-hour, the merit order list for pro-rata activations needs to be calculated (fall-back). The reserved volume (i.e. 139MW for 2018) is selected. For the up direction, the cheapest bids for the reserved volume are selected. For the down direction, the most expensive bids for the reserved volume are selected. This selection can contain reserved and non-reserved bids. The non-selected volumes are not transferred to I/D bids since this is a fall-back procedure. No additional price cap is foreseen in this procedure. There will be no separate bidding procedure. The bids submitted to the bidding platform for the merit order activation will be used.

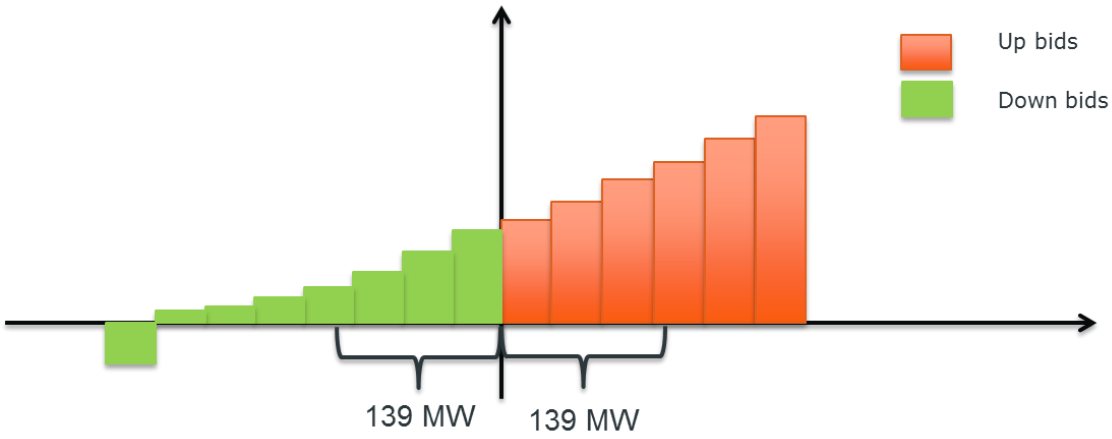


Figure 16 – selection of aFRR bids for pro-rata activation as fall-back procedure

10 Activation in EMS

In this section, more information is given on the activation of the balancing energy bids.

10.1 Pro-rata activation versus merit order activation

Currently, a pro-rata activation is in place, meaning that all bids are activated proportional to their bid volume. For a merit-order activation, only the cheapest bids are activated as depicted in **Figure 17**.

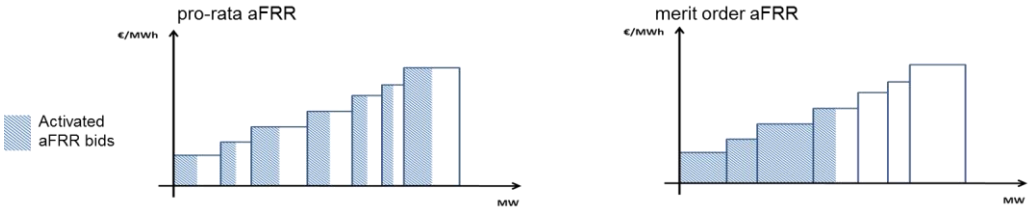


Figure 17 – Pro-rata versus merit order activation

In **Figure 18** below, the determination of the set-point per BSP is explained in a simplified manner. The ACE serves as input for the PI controller. The output of the PI controller is the control target per bid. The sum of the control target per bid indicates the volume that is required to solve the imbalance. The control target per bid has to be translated to the control request per bid which does take into account the ramping rate of the bid. The calculation of the control request is based on the ramping rate and on the control request of the previous timestamp. This is shown in **Figure 19**. The control requests per bid are then aggregated per BSP. This aggregated value per BSP is the set-point that is sent to the aFRR provider. The control request per bid is used for settlement purposes (see Section 11).

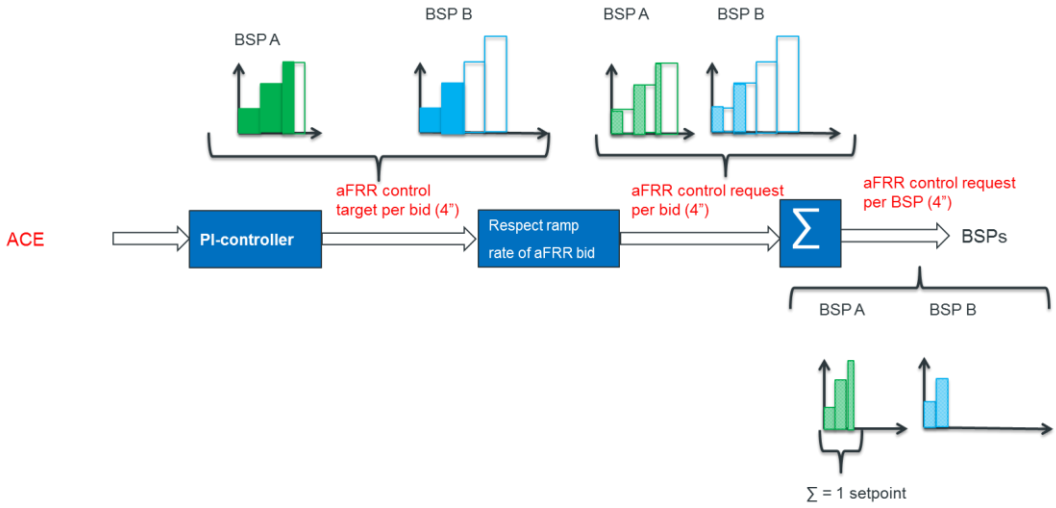


Figure 18 – Determination of the set-point per BSP

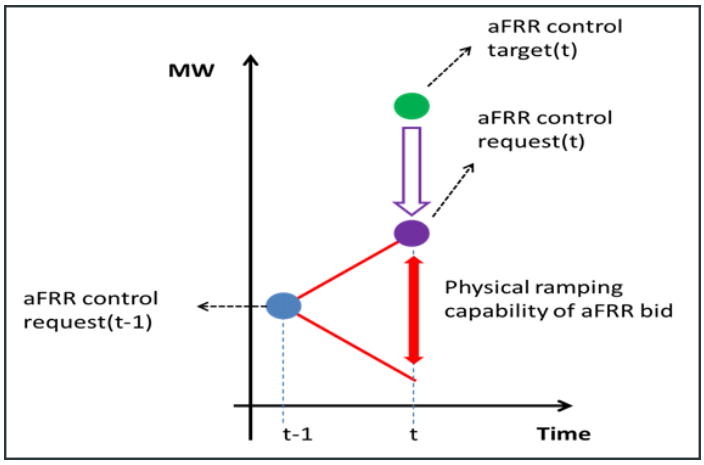


Figure 19 – From control target to control request

10.2 Transition between quarter-hours

As explained in Section 8.2, balancing energy bids have a continuous duration. The volume of a balancing energy bid between consecutive quarter-hours can change.

If the volume of the bid during the first quarter-hour (Qh1) is equal to the volume of the same bid for the second quarter-hour (Qh2), the last control request of that bid of Qh1 will be taken as starting point for the calculation of the first control request of that bid of Qh2.

If the volume of the bid during the first quarter-hour (Qh1) is larger or smaller than the bid volume during the second quarter-hour (Qh2) and the bid is fully activated in both quarter-hours, a transition in the control request sent by Elia is required. It is described below how this transition will occur.

In the first situation the bid volume for Qh1 is larger than the bid volume for Qh2 and the bid is fully activated during Qh1 and Qh2 (see **Figure 20**). By the change of quarter-hour, the control request needs to go from the bid volume of Qh1 to the bid volume of Qh2. In that specific case, the control request goes directly to bid volume of Qh2. For the remaining part of the quarter-hour the ramping rate, based on the bid volume of Qh2, will be applied (i.e. (volume up Qh2)/7.5 min or (volume down Qh2)/7.5 as indicated in the graph below).

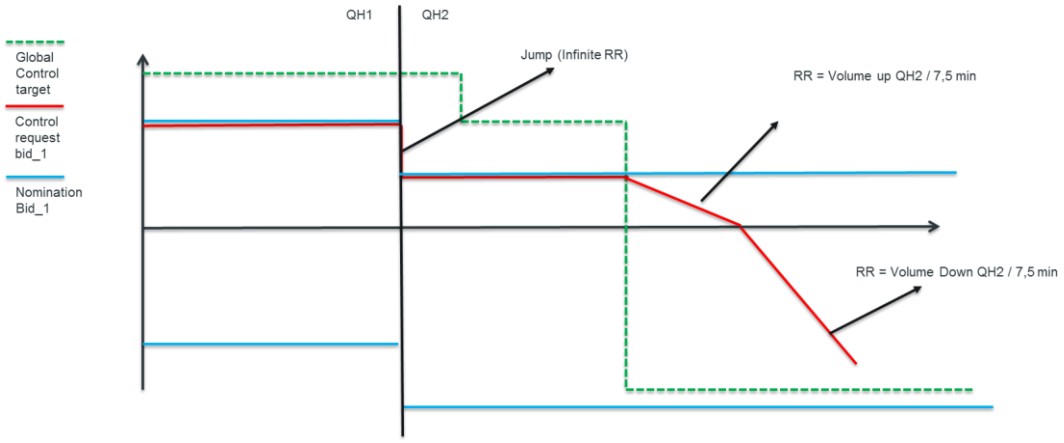


Figure 20 – Transition from one quarter-hour to the next (reduced bid volume).

In the other case, the bid volume of Qh1 is smaller than the bid volume of Qh2 and the bid is fully activated at the end of the first quarter-hour and at the beginning of the second quarter-hour (**Figure 21**). In that case, the control request at the end of Qh1 is the starting point for the control request of the second quarter-hour and the control request will increase taking into account the ramping rate based on the bid volume of the second quarter-hour. This is depicted in the graph below.

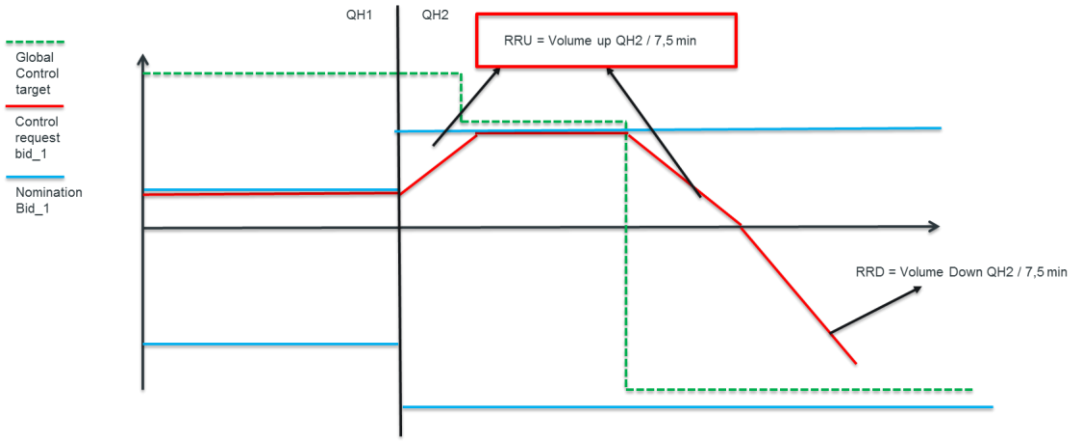


Figure 21 –Transition from one quarter-hour to the next (increased bid volume).

11 Control and settlement of reserved capacity

Each aFRR provider with reserve obligations must offer at least the quantity for which he has an aFRR reserve obligation. The gate closure time for reserved aFRR energy bids is D-1 at 15h00. By submitting energy bids, the aFRR provider informs on how the aFRR obligation for the reserved aFRR is allocated to the aFRR bids. This is a contractual obligation.

For each quarter-hour the number of Missing MW is determined based on the information received at QH-25min (balancing energy gate closure time):

- Upward Missing MW or "R2up_missing"
- Downward Missing MW or "R2down_missing"

11.1 The settlement of the reserved capacity

The settlement of the reserves is done on a monthly basis. The remuneration is the product of the reservation price in €/MW/h, the volume of aFRR reserved in MW and the number of corresponding hours of the delivery period concerned. The upward and downward Missing MW, as defined above, are not remunerated.

11.2 Availability of the reserved capacity

If the aFRR provider has failed for a particular quarter-hour to provide at least the quantity of his aFRR obligations before the gate closure time, a penalty will be applied (see below). The penalty applies to any Missing MW in the up or down direction and for any quarter-hour where the aFRR obligations are not fulfilled.

A penalty will be applied when the obligation on reserved capacity is not met after the balancing energy gate closure time (QH-25min). The penalty will be based on the monthly remuneration for the capacity reserves and is determined per direction. The missing MW (aFRRup_missing and aFRRdown_missing) will not be remunerated and is thus not taken into consideration in the monthly capacity remuneration as explained in Section 11.1. On top of that, the monthly capacity remuneration will be lowered via a penalty. The calculation of this penalty per direction is detailed below.

Penalty_up $= \left(\frac{\sum_{i=k}^{m} missing\ volume_{up}\ (i)}{\sum_{i=k}^{m} reserve\ obligation_{up}\ (i)}\right)$ ** 1.3 * remuneration of the concerned delivery period(s).*

Penalty_down $= \left(\frac{\sum_{i=k}^{m} missing\ volume_{down}\ (i)}{\sum_{i=k}^{m} reserve\ obligation_{down}\ (i)}\right)$ ** 1.3 * remuneration of the concerned delivery period(s).*

With:

- k: first quarter-hour of the concerned delivery periods(s)
- m: last quarter-hour of the concerned delivery period(s)

12 Control and settlement of balancing energy

12.1 Settlement of balancing energy

The settlement of the balancing energy will be based on pay-as-bid. The prerequisites for having a pay-as-cleared settlement for aFRR are defined in the "study on pay-as-cleared settlement for aFRR and mFRR activated energy"[13] and are the following:

- A merit order activation
- Liquid aFRR market

A merit order activation will be implemented. Currently the aFRR market is not liquid enough. More liquidity is expected once the Belgian aFRR will be integrated into a wider European aFRR market (PICASSO project) At least until that moment, a pay-as-bid settlement is required.

12.1.1 General principle for the settlement of balancing energy

During the settlement, there is no difference between CIPU and non-CIPU assets (assets with and without an individual power schedule). The settlement is performed per BSP. Following general principles are applicable for the settlement:

- **Principle 1:**
  The settlement is performed on a monthly basis.
- **Principle 2**
  The settlement is based on 4 seconds data.
- **Principle 3**
  The settlement is based on the requested energy. The calculations are based on the control request per bid (see Section 10.1).
- **Principle 4:**
  A bruto settlement per direction per quarter-hour is performed.
- **Principle 5:**

  In a pay-as-bid settlement regime, the activation price per bid i in the up (down) direction [€/MWh] is multiplied by the requested energy per bid i per quarter-hour in the up (down) direction [MWh]. The sum on all the bids gives the remuneration for the BSP for each direction for each quarter-hour.

  A positive activation price for an upward bid indicates a payment from Elia to the BSP. A negative price indicates a payment from the BSP to Elia. A positive activation price for a downward bid refers to a payment from the BSP to Elia; a negative price refers to a payment from Elia to the BSP.

[13] http://www.elia.be/~/media/files/Elia/users-group/Working-Group-Balancing/Paid-as-cleared/Paid_as_Cleared_FRR_Study_Final.pdf

12.1.2 Calculation of the pay-as-bid settlement

The calculation of the pay-as-bid settlement is done in the following way:

1 The control request per bid is multiplied by the activation price per bid for each 4 seconds. Since a bruto settlement is performed, this is done in the upward and downward direction.

For the up direction:

$$P_{requested_{bid(i)_{up\,(t)}}} * Price_{activated_{bid(i)_{up\,(t)}}}$$

For the down direction:

$$|P_{requested_{bid(i)_{down\,(t)}}}| * Price_{activated_{bid(i)_{down\,(t)}}}$$

With:

- $P_{requested_{bid(i)_{up(t)}}}$: The control request of bid i in the upward direction on a 4 second basis t [MW].
- $P_{requested_{bid(i)_{down(t)}}}$: The control request of bid i in the downward direction on a 4 second basis t [MW].
- $Price_{activated_{bid(i)_{up(t)}}}$: The activation price of bid i in the up direction [€/MWh]
- $Price_{activated_{bid(i)_{down(t)}}}$: The activation price of bid i in the down direction [€/MWh]

2 This multiplication is aggregated on a quarter-hourly basis per bid and per direction and is expressed in €.

For the up direction:

$$\frac{\sum_{t=1}^{225} P_{requested_{bid(i)_{up\,(t)}}} * Price_{activated_{bid(i)_{up\,(t)}}}}{15 * 60}$$

For the down direction:

$$\frac{|\sum_{t=1}^{225} P_{requested_{bid(i)_{down\,(t)}}}| * Price_{activated_{bid(i)_{down\,(t)}}}}{15 * 60}$$

3 The sum is taken for all the bids i per BSP per direction per quarter-hour to obtain the remuneration per BSP per quarter-hour per direction expressed in euros.

Remuneration_up_BSP_qh [€] =

$$\sum_{i \in BSP} \left(\frac{\sum_{t=1}^{225} P_{requested_{bid(i)_{up\,(t)}}} * Price_{activated_{bid(i)_{up\,(t)}}}}{15 * 60}\right)$$

Remuneration_down_BSP_qh [€] =

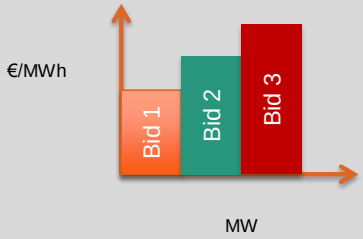
$$\sum_{i \in BSP} \left(\frac{\left| \sum_{t=1}^{225} \mathrm{P}_{\mathrm{requested}_{\mathrm{bid(i)}_{\mathrm{down\,(t)}}}} \right| * \mathrm{Price}_{\mathrm{activated}_{\mathrm{bid(i)}_{\mathrm{down\,(t)}}}}}{15 * 60} \right)$$

The remuneration per quarter-hour is then summed to achieve the remuneration on a monthly basis. A positive remuneration for the upward direction indicates a payment from Elia to the BSP. A positive remuneration for the downward direction indicates a payment from the BSP to Elia.

Two examples are given below for the calculation of the remuneration. In the first example, the BSP has only a positive activation price for upward bids. In the second example, the BSP has a positive and negative activation price for downward bids.

EXAMPLE

- Bid 1, bid 2 and bid 3 belong to the same BSP
- Bid 1 and bid 2 are fully activated during the quarter hour and the control request of bid 3 is given in de table



Bid 1	Time	P_requested_bid(1)_up (t) [MW]	Price_act_bid(1)_up [€/MWh]
1	15:00:00	15	5
2	…	15	5
3	15:15:00	15	5

Bid 2	Time	P_requested_bid(2)_up (t) [MW]	Price_act_bid(2)_up [€/MWh]
1	15:00:00	5	7
2	…	5	7
3	15:15:00	5	7

Bid 3	Time	P_requested_bid(3)_up (t) [MW]	Price_act_bid(3)_up [€/MWh]
1	15:00:00	1,88	10
2	15:00:04	1,8	10
3	15:00:08	1,7	10
4	15:00:12	1,5	10
…	…	0	10
216	15:14:00	1,7	10
217	15:14:10	1,5	10
218	15:14:20	1,4	10
219	15:14:30	1,3	10
220	15:14:40	1,2	10
221	15:14:44	1,1	10
222	15:14:48	1	10
223	15:14:52	0,9	10
224	15:14:56	0,8	10
225	15:15:00	0,7	10

Calculation

$$\text{Remuneration\_bid(1)\_up} = \frac{|\sum_{t=1}^{225} P_{\text{requested}_{\text{bid}(1)_{\text{up}}(t)}}|}{15*60} * \text{Price}_{\text{activated}_{\text{bid}(1)_{\text{up}}(t)}} = \frac{225*15}{15*60} * 5 = 18{,}75€$$

$$\text{Remuneration\_bid(2)\_up} = \frac{|\sum_{t=1}^{225} P_{\text{requested}_{\text{bid}(2)_{\text{up}}(t)}}|}{15*60} * \text{Price}_{\text{activated}_{\text{bid}(2)_{\text{up}}(t)}} = \frac{225*5}{15*60} *7 = 8{,}75€$$

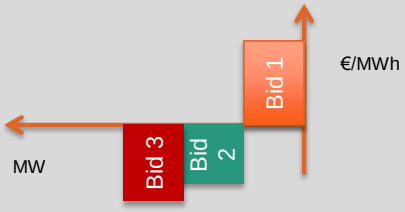
$$\text{Remuneration\_bid(3)\_up} = \frac{|\sum_{t=1}^{225} P_{\text{requested}_{\text{bid}(3)_{\text{up}}(t)}}|}{15*60} * \text{Price}_{\text{activated}_{\text{bid}(3)_{\text{up}}(t)}} = 0{,}19 *10 = 1{,}9€$$

Remuneration_BSP = 18,75+8,75+1,9 = 29,4 €

This gives a positive remuneration for the upward bids, meaning a payment from Elia to the BSP for the concerned Qh.

EXAMPLE

- Bid 1, bid 2 and bid 3 belong to the same BSP
- Bid 1 and bid 2 are fully activated during the quarter hour and the control request of bid 3 is given in de table



Bid 1	Time	P_requested_bid(1)_up (t) [MW]	Price_act_bid(1)_up [€/MWh]
1	15:00:00	-15	2
2	…	-15	2
3	15:15:00	-15	2

Bid 2	Time	P_requested_bid(2)_up (t) [MW]	Price_act_bid(2)_up [€/MWh]
1	15:00:00	-5	-7
2	…	-5	-7
3	15:15:00	-5	-7

Bid 3	Time	P_requested_bid(3)_up (t) [MW]	Price_act_bid(3)_up [€/MWh]
1	15:00:00	-1,88	-10
2	15:00:04	-1,8	-10
3	15:00:08	-1,7	-10
4	15:00:12	-1,5	-10
…	…	0	-10
216	15:14:00	-1,7	-10
217	15:14:10	-1,5	-10
218	15:14:20	-1,4	-10
219	15:14:30	-1,3	-10
220	15:14:40	-1,2	-10
221	15:14:44	-1,1	-10
222	15:14:48	-1	-10
223	15:14:52	-0,9	-10
224	15:14:56	-0,8	-10
225	15:15:00	-0,7	-10

Calculation

Remuneration_bid_1_down=$\left|\frac{\left|\sum_{t=1}^{225} P_{requested\,bid(1)\,down(t)}\right| * Price_{activated\,bid(1)\,down(t)}}{15*60}\right| = \frac{225*15}{15*60} * 2 = 7{,}5$ €

Remuneration_bid_2_down = $\frac{\left|\sum_{t=1}^{225} P_{requested\,bid(2)\,down(t)}\right| * Price_{activated\,bid(2)\,down(t)}}{15*60} = \frac{225*5}{15*60} * (-7) = -8{,}75$€

Remuneration_bid_3_down=$\left|\frac{\left|\sum_{t=1}^{225} P_{requested\,bid(3)\,down(t)}\right| * Price_{activated\,bid(3)\,down(t)}}{15*60}\right|$= 0,19 *(-10) = -1,9€

Remuneration_BSP = =7,5-8,75-1,9 = -3,15 €

A negative price for the downwards activations indicates a payment Elia to the BSP for the concerned Qh.

12.2 Control of balancing energy: activation control

The objective of the activation control is to verify that the aFRR services are correctly delivered. These checks are performed on a continuous basis on BSP level, meaning that a BSP has to be compliant with the quality targets for his complete portfolio and not on a delivery point level. The verification is based on data per delivery point (see Section 4.4).

12.2.1 Calculation of the "Deviation"

The deviation is calculated for the upward and downward direction separately and is based on following formula on a 4 second basis t (same formula for upward and downward direction):

"Deviation (t)" = $[\sum_{unit\ i \in BSP} (P_{measurement}(t,i) - P_{baseline}(t-60s,i)) - \Delta P_{sec_{tot}}(t-\Delta ts)]$

With:

- $P_{measurement}(t,i)$ produced at time t by delivery point i of the aFRR provider delivering aFRR services.
- $P_{baseline}(t\text{-}60s,i)$ is the baseline of delivery point i valid at time t sent by the aFRR provider at time t-60 seconds
- $\Delta P_{sec\_tot}(t\text{-}\Delta ts)$ calculated by Elia at time t-Δts (8 seconds), taking into account the FCR volumes if possible.
- The baseline and measurement values are only taken into account when the delivery point i, was actually delivering the aFRR services during the concerned timestamp t. This is indicated via the parameter "avail_sec" which is communicated to Elia per delivery point. A "one" value indicates that the concerned delivery point is delivering aFRR services at that moment.

EXAMPLE

In the table below, the calculation of $\sum_{unit\ i \in BSP} (P_{measurement}(t,i) - P_{baseline}(t-60s,i))$ is illustrated. If the availability flag has the zero value, $P_{measurement}(t)$ and $P_{baseline}(t)$ are put to zero for that timestamp t. In the two last columns, the sum is made of $P_{measurement}(t)$ and $P_{baseline}(t)$ for all the delivery points belonging to the BSP.

t	Time	Avail_sec(t,1)	Pmeas(t,1)	Pbaseline (t,1)	Avail_sec(t,2)	Pmeas(t,2)	Pbaseline (t,2)	∑Pmeas(t)	∑Pbaseline (t)
1	15:00:00	1	10	15	1	25	30	35	45
2	15:00:10	1	11	15	1	25	30	36	45
3	15:00:20	1	12	15	0	20	30	12	15
4	15:00:30	1	13	15	0	20	30	13	15
…	…	…							
216	15:13:30	0	15	15	0	19	30	0	0
217	15:13:40	0	15	15	0	19	30	0	0
218	15:13:50	0	16	15	0	19	30	0	0

The deviation (i.e. between the activated power and the requested power), in absolute values, as calculated in the formula above should remain below a threshold in all circumstances. This threshold is set for each quarter-hour per direction. Due to asymmetrical bids, there is a need for a separate threshold in the two directions. The threshold is determined at 15% of the volume of the activated aFRR bids per direction per aFRR provider.

- S1_up[BSP,k]_up = 0.15 * [aFRRup_activated_bid[BSP,k]
- S1_down[BSP,k]_down = 0.15 * [aFRRdown_activated_bid[BSP,k]

  With:

  - aFRRup_activated_bid[BSP,k] = the sum of the volume of the upwards activated bids by Elia for quarter hour k for the concerned BSP.
  - aFRRdown_activated_bid[BSP,k] = the sum of the volume of the downwards activated bids by Elia for quarter-hour k for the concerned BSP.

The compliancy rate is put at 15%. The results of the R2 non-CIPU pilot project have indicated that it is possible to achieve this compliancy level as indicated in the graphs below.

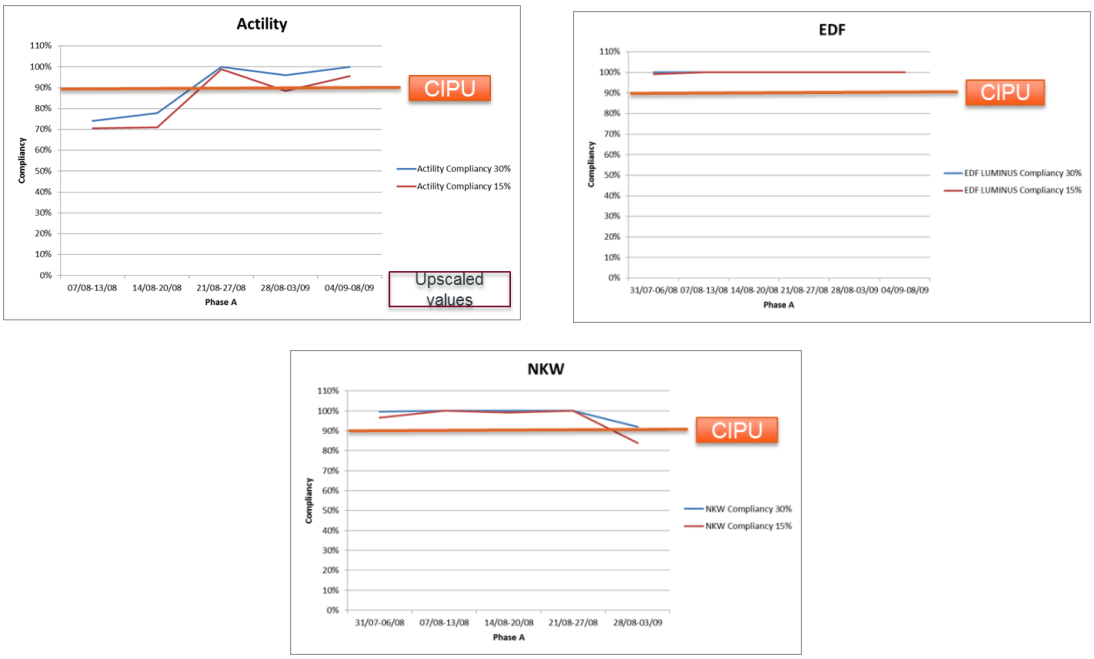


Figure 22 –Achieved quality levels during R2 non-CIPU pilot project.

Elia calculates the discrepancy per direction, for each day, based on the threshold of 15% and the Deviation as follows:

$$\text{Discrepancy\_up} = \int_{day} B\_up\ dt \text{ [in MWh]}$$

With:

- B = | Deviation_up | - S1_up if | Deviation_up | ≥ S1_up
- B = 0 if | Deviation_up | < S1_up

This provision does not apply to the 2% greatest values of the Deviation_up on the considered day. These 2% greatest values are replaced by zero in the above calculation. The values of the Deviation_up are not taken into account when the signal ΔPsec_tot, sent to the aFRR provider by Elia, is erroneous. Elia undertakes to inform the aFRR provider when Elia notices such a situation.

The same reasoning is applied for the calculation of the discrepancy in the down direction.

12.2.2 Calculation of the penalty

The penalty for the activation control will be based on the monthly remuneration for the capacity and the absolute value of the energy remuneration. The formula of the penalty is given below:

Penalty_up = $\frac{\sum_{i=1}^{d} discrepancy_{up}(i)}{\sum_{i=1}^{d} requested\ energy_{up}(i)}$ *1.3 remuneration of the concerned delivery period(s) in the up direction (capacity + |energy|)

Penalty_down = $\frac{\sum_{i=1}^{d} discrepancy_{down}(i)}{|\sum_{i=1}^{d} requested\ energy_{down}(i)|}$) *1.3 remuneration of the concerned delivery period(s) in the down direction (capacity + |energy|)

With:

- d the number of days of the month
- Discrepancy in MWh for the concerned day of the month for up or downward direction
- Requested energy per BSP in MWh for the concerned day of the month for upward or downward direction.

A consecutive failure of this activation control without acceptable explanation and no indication of significant improvement during the consecutive periods can lead to (partial) exclusion of the BSP for the aFRR services for the corresponding volume which was not delivered correctly. In that case, the BSP has to pass the prequalification process for the concerned providing groups successfully before participating at the aFRR service.

In case of erroneous data, and thus no available discrepancy during these timeframes, the penalties will be determined as follows:

- When the total duration in which erroneous data occurs in 1 day ≤ 8 hours, the penalty of that day will be extrapolated:
  - Elia will determine an average penalty for the considered hours based on the timeframes with valid data
  - This average penalty will be applied to the hours with erroneous data.
- When the total duration in which erroneous data occurs in 1 day > 8 hours, the penalty of that day will be eliminated and the penalty of that month will be extrapolated:
  - Elia will determine an average penalty for the considered month.
  - This average penalty will be applied for the considered day with erroneous data.

Non-availability of data or incorrect data on a recurrent basis and without indication of significant improvement during consecutive periods, can lead to suspension of the BSP for the aFRR services until it is proved that the data can be well delivered.

13 Availability check

The goal of an availability control is to check whether the reserved volume of a bid is available for activation during the concerned quarter-hours. Today, the aFRR controller is saturated several times per day. In that case the total volume is activated and during the activation control, it will be checked whether the requested volume is also delivered and thus available. Therefore, there is no need to do an availability control. When more flexibility will enter the aFRR balancing market and as a consequence the aFRR controller is less frequently saturated, the need for an availability control will increase.

An availability control will also be required for the combo of FCR, aFRR and mFRR. In that case, it is required to check whether the reserved volume for FCR, aFRR and mFRR is together available.

13.1 Principles for the availability test

The goal of the test is to check whether the reserved volume of a bid is available for activation at a given time.

13.1.1 General principles:

- **Principle 1:**
  Only the reserved volume of bids with a reserved and non-reserved volume is considered.

- **Principle 2:**
  Elia will always activate 100% of the volume of the reserved bid(s).

- **Principle 3:**
  Elia has the right to test more than one bid simultaneously.

- **Principle 4:**
  Elia will only consider the delivery points attributed to the concerned bid(s) for the verification of the test.

- **Principle 5:**
  Availability tests will not be remunerated as they are part of the contract.

- **Principle 6:**
  An availability test will only be performed in one direction, either up or down.

- **Principle 7:**
  The test profiles are known in advanced by the aFRR provider and will be contractually fixed.

The availability test takes in total 30 minutes. At the starting point, the BSP has 30 seconds to react. The first part of the test (from minute 0 to minute 7,5) allows the BSP to ramp down in case the delivery point(s) are already participating to the aFRR services. The value of the

baseline at the timestamp t=0, is taking as starting point/reference of the test at timestamp t = 7,5 minutes meaning that the aFRR provider is asked to go back to their baseline. After this part, the aFRR provider has 7,5 minutes to achieve the required volume of the bid and he has to keep delivering this volume for 15 minutes. An example of an availability test in the upward direction is given in **Figure 23**. . For the down direction, the test profile will be inversed.

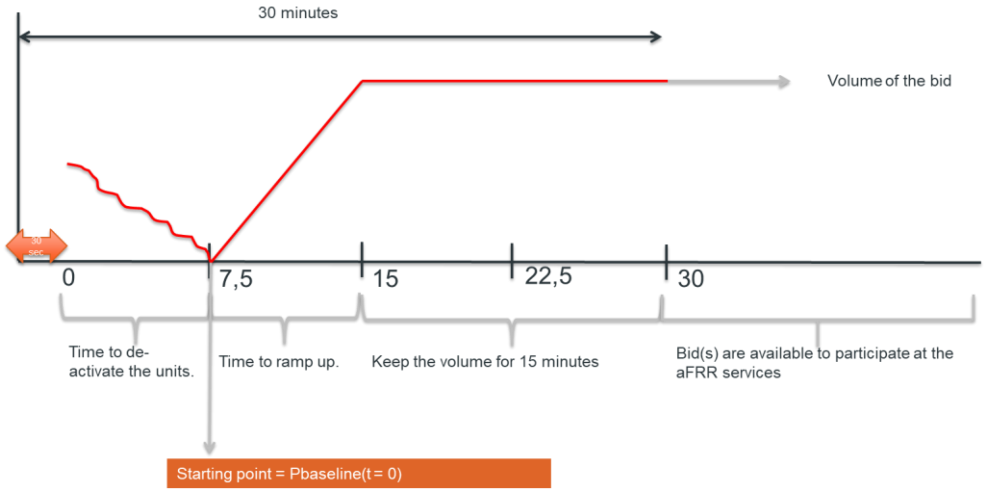


Figure 23 – Test profile for availability test in the upward direction.

A transition period must be foreseen to reach the new set point when the bid(s) are again available for the aFRR services. Multiple solutions are possible and Elia will elaborate on this topic when drafting the T&C BSP.

13.1.2 The trigger for an availability test

- **Principle 8:**
  Elia will use the SCADA to SCADA connection with the aFRR provider to trigger an availability test. Elia will send, via the SCADA connection, the type of availability test (up or down) and the bid(s) to be activated.

- **Principle 9:**
  The BSP acknowledges the good reception of the test request.

- **Principle 10:**
  The configuration and identification of the test signals occur during the prequalification process per aFRR provider.

The table below gives an overview of the test signals that must be parametrized with the aFRR provider.

Signal	Level	Sent By
Test request The test request that Elia will send to the aFRR provider each time a test should be performed. This signal contains the following information: • The type (upwards or downwards) • Bid identification When receiving this signal, the aFRR provider should follow the test profile provided by Elia.	aFRR provider	Elia
Feedback of the test request Each aFRR provider will return a signal to Elia so that it can be verified if its test request has been received correctly. The value is the mirror of the received signal	aFRR provider	aFRR provider

Table 15 – signals to be exchanged

13.1.3 Frequency of activation availability test

- **Principle 11:**
  Elia can trigger the test maximum one time per block of 4 hours per BSP.

- **Principle 12:**
  The average availability test per delivery point is one per month.

- **Principle 13:**
  If the result of an energy test is negative, an additional test can be organized.

13.2 Verification of the availability test

- **Principle 14:**
  Elia will gather the information of all delivery points and analyse the reaction to confirm that the aFRR provider delivered at least its contractual obligation in upward or downward direction.

- **Principle 15:**
  Only the delivery points attributed to the reserved bid(s) which are activated in the scope of the availability test are taken in consideration for the verification of the test.

- **Principle 16:**
  For the verification of the availability test, no margin will be allowed. 15% of the outliers will be excluded (for 4 seconds data).

- **Principle 17:**

All data of all delivery points should be available (after exclusion of the outliers). The delivery points, for which the data is not available, will not be taken into account for the verification of the availability test. In case that the data for the same delivery point is missing in two availability tests, the aFRRmax prequalified volume of the concerned providing group is reduced by the aFRRmax per delivery point of the concerned delivery points. A new prequalification test is required to increase again the aFRRmax prequalified volume of the concerned providing group.

13.3 Settlement of the availability test

The missing MW, i.e. difference between volume required in the availability test and the volume effectively delivered, is determined. Elia will verify whether at least the requested volume is delivered. Only under-delivery is considered in the “missing MW” and thus penalized.

A financial penalty will be applied for the under-delivered volume.

Penalty_up = Missing MW_up * average monthly remuneration in the up direction * 1.3 * number of hours of the delivery periods in the concerned month.

Penalty_down = Missing MW_down * average monthly remuneration in the down direction * 1.3 * number of hours of the delivery periods in the concerned month.

With:

- The missing MW calculated as described above in the up or down direction;
- The average monthly remuneration (€/MW/h) in the up or down direction;
- A multiplication factor equal to 1.3;
- The number of hours of the delivery periods in the concerned month, meaning the delivery periods for which the aFRR provider has a reserve obligation.

The first time, only 50% of the penalty is applied, from the second time, 100% of the penalty is applied.

In case of missing MW and under-delivery, Elia will ask in first instance an explanation on the causes. Elia holds the right to reduce the aFRRmax prequalified volume by the volumes corresponding to the “Missing MW” for the providing groups involved. The BSP will then have to redo the prequalification process to re-assess the original aFRRmax prequalified volume for the providing groups involved.

13.4 Combined availability test

The general principles of a combined availability test with other reserves (FCR and mFRR) are described in this section.

- **Principle 1:**
  Elia will apply a stepwise approach for the availability test. aFRR will be tested before mFRR, and FCR will be tested last.

- **Principle 2:**
  All the products are tested sequentially. During a test of mFRR, the tested volume of aFRR will be fixed and the mFRR volume will be tested on top of the aFRR tested volume. During a test of FCR, the tested volume of aFRR and mFRR will be fixed and the tested volume of FCR has to be provided on top of the aFRR and mFRR tested volume. The reason for this approach is:
    - aFRR reaction must be neutralized to limit influence in metering ;
    - mFRR must be compensated for a larger volume (max size aFRR: 50 MW ; max size mFRR: 100 MW)

14 Baseline check

The baseline (reference power) is a crucial aspect for delivering the aFRR services. Based on the baseline, the delivered aFRR energy is calculated. This delivered energy is required for the settlement, activation check and ToE. Based on the baseline and the measured power, the delivered aFRR energy is determined, as graphically represented in **Figure 24**. The basic aspects of the baseline methodology are explained in Section 4.2.

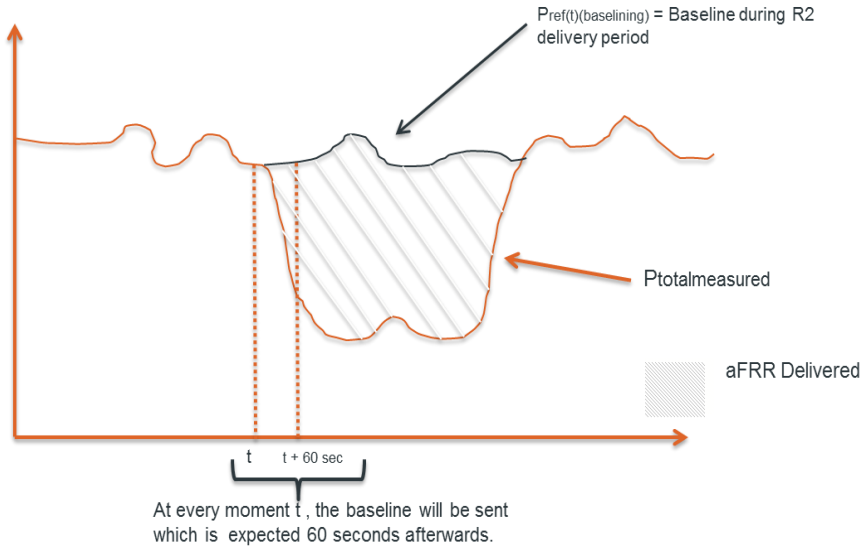


Figure 24 – Baseline methodology

14.1 Verification of baseline

Since the baseline is a crucial element for the good delivery of aFRR service, the goal of a baseline control is to check whether the baseline is correctly determined by the aFRR provider. The quality of the baseline will be verified ex-post on a monthly basis on BSP level. This check will be performed systematically.

For this check, only the delivery points that are not delivering the aFRR service determined each 4 seconds are taken into account. This corresponds to the delivery points which have an avail_sec parameter equal to zero. The aggregated data is sent in real-time. How the delivery point based data is received is described in Section 4.4.

14.1.1 Calculation of the "Deviation"

The deviation is calculated based on following formula on a 4 second basis t:

"Deviation_baseline(t)" = $[\sum_{unit\ i \in BSP} (P_{measurement}(t,i) - P_{baseline}(t-60s,i))]$

With:

- $P_{measurement}(t,i)$ produced at time t by delivery point i of the aFRR provider.
- $P_{baseline}(t\text{-}60,i)$ is the baseline of delivery point i valid at time t sent by the aFRR provider at time t-60 seconds

- The baseline and measurement values are only taken into account when the delivery point i, belonging to BSP, was not delivering the aFRR services during the concerned 4 seconds timestamp. This is indicated via the parameter avail_sec which is communicated to Elia per delivery point. A zero value indicates that the delivery point is not delivering aFRR on 4 seconds timestamp.

2% of the outliers are excluded of the calculated deviation of the baseline per day. Elia calculates the Root Mean Square Error (RMSE) of the Deviation_baseline per day:

$$RMSE = \sqrt{\frac{\sum_{t=1}^{N} Deviation\_baseline(t)^2}{N}}$$

With:

- N is the number of 4 seconds timestamps per day when the delivery points are not participating

The Relative Root Mean Square Error (%RMSE) is calculated by dividing the RMSE by the average daily baseline only taking into account the 4 seconds timestamps when the delivery points are not participating, i.e. avail_sec equal to zero.

$$\%RMSE = \frac{RMSE}{average(P_{baseline})}$$

With:

- Average($P_{baseline}$) is the average daily baseline only taking into account the 4 seconds timestamps when the delivery points are not delivering, i.e. avail_sec equal to zero.

The daily %RMSE is averaged over the month and the monthly value should be lower than 5%.

14.1.2 Baseline quality for aFRR services

The quality target is set to %RMSE of 5% relative to the average daily baseline over the concerned period. 2% of the outliers on a daily basis are excluded to cover communication problems or forced outages which can only be taken into account one minute later due to the fact that the baseline has to be sent one minute in advance.

In the graph below, the results of the R2 non-CIPU pilot project during the last 3 weeks of the participation phase (part A) are evaluated based on the proposed quality target. The quality target is checked each day. It can be clearly seen that all aFRR providers have successfully passed the test for each day during the concerned period (i.e. %RMSE lower than 5%).

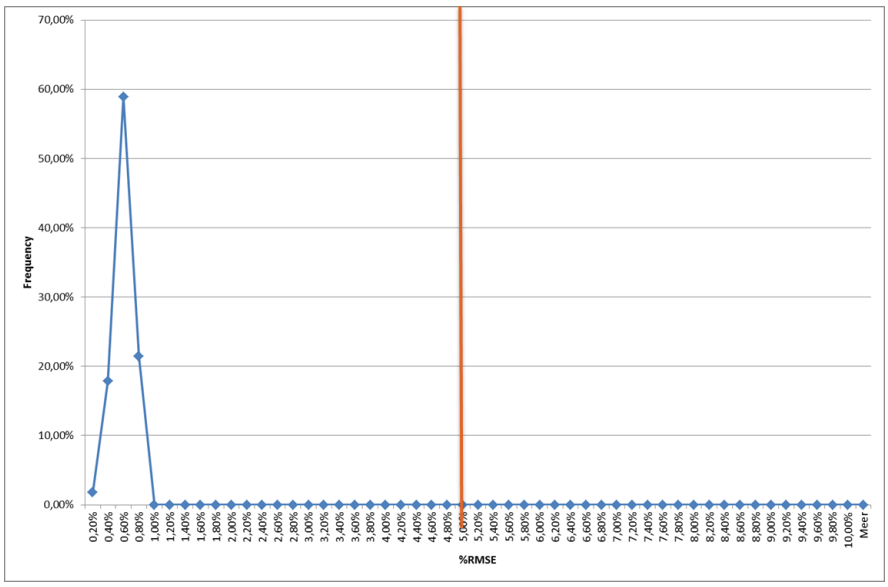


Figure 25 – Results of baseline check on BSP level during R2 non-CIPU pilot project

14.2 Data issues for baseline

The following data issues can have an impact on the achieved quality during the baseline test:

1. Loss of communication between Elia and BSP and therefore no data is received.
2. Loss of delivery point (forced outage) in a portfolio bid. In that case the delivery point is considered as redundant in this bid. Since the baseline is sent one minute in advance, the baseline can only be corrected after one minute.

For both situations (communication loss and loss of a unit), the removal of 2% of the outliers should take into account such situations. Therefore, these situations will not be treated on a case by case basis. These data issues are also included in the analysis of the R2 non-CIPU pilot project performed above and it can be seen that it does not cause problems.

14.3 Penalty

Failure of the baseline test during consecutive months, (i.e. monthly average %RMSE value larger than 5%), without an indication of significant improvement of the baseline quality during those consecutive months can lead to exclusion of the BSP for the aFRR services. In that case, the BSP has to pass the baseline test of the prequalification process successfully before participating to the aFRR service again.

15 Consistency check

The data is received by Elia with a different level of aggregation (from aggregated on BSP level to data per delivery point). Therefore, it is required to perform consistency checks to verify the correctness of the data.

The following checks will be performed on a 4 seconds basis:

- Real-time Aggregated data with a different level of aggregation:
  - $P_{measured,\text{nominated}} = P_{measured,\text{participating}} + P_{measured,\text{non-participating}}$
  - $P_{Baseline,\text{nominated}} = P_{baseline,\text{participating}} + P_{Baseline,\text{non-participating}}$

- Aggregated data of the nominated delivery points received versus data per delivery point
  - $\sum_{i \in BSP} P_{measured,DP}(i) = P_{measured,nominated}$
  - $\sum_{i \in BSP} P_{baseline,DP}(i) = P_{baseline,nominated}$
  - $\sum_{i \in BSP} P_{avail_{sec},DP}(i) = P_{avail\_sec,nominated}$

- Aggregated data of the participating delivery points received in real-time. Only those delivery points with an avail_sec equal to one will be taken into account.
  - $\sum_{i \in BSP \text{ and } avail\_\text{sec}=1} P_{measured,DP}(i) = P_{measured,participating}$
  - $\sum_{i \in BSP \text{ and } avail\_\text{sec}=1} P_{baseline,DP}(i) = P_{baseline,participating}$
  - $\sum_{i \in BSP \text{ and } avail\_\text{sec}=1} P_{avail_{sec},DP}(i) = P_{avail_s,participating}$

- Aggregated data of the non-participating delivery points received in real-time. Only those delivery points with an avail_sec equal to zero will be taken into account.
  - $\sum_{i \in BSP \text{ and } avail\_\text{sec}=0} P_{measured,DP}(i) = P_{measured,non-particpating}$
  - $\sum_{i \in BSP \text{ and } avail\_\text{sec}=0} P_{baseline,DP}(i) = P_{baseline,non-participating}$

With:

- $P_{measured,nominated}$: The measured power aggregated for all the delivery points which are attributed to a bid on the bidding platform, sent in real-time.
- $P_{measured,\text{participating}}$: The measured power aggregated for all the delivery points which are delivering the aFRR services during a 4 seconds timestamp, sent in real-time.
- $P_{measured,\text{non-participating}}$: The measured power aggregated for all the delivery points which are not delivering the aFRR services during a 4 seconds timestamp, sent in real-time.
- $P_{measured,\text{DP,real-time}}$: The measured power per delivery point, sent in real-time.
- $P_{measured,DP}$: The measured power per delivery point.

- $P_{\text{Baseline,nominated}}$: The baseline aggregated for all the delivery points which are attributed to a bid on the bidding platform, sent in real-time.
- $P_{baseline,\text{participating}}$: The baseline power aggregated for all the delivery points which are delivering the aFRR services during a 4 seconds timestamp, sent in real-time.
- $P_{Baseline,\text{non-participating}}$: The baseline aggregated for all the delivery points which are not delivering the aFRR services during a 4 seconds timestamp, sent in real-time.
- $P_{baseline,DP,\text{real-time}}$: The baseline per delivery point, sent in real-time.
- $P_{baseline,DP,}$: The baseline per delivery point.
- $P_{avail_{sec},DP,\text{real-time}}$: The avail_sec per delivery point, sent in real-time.
- $P_{avail_{sec},DP}$: The avail_sec per delivery point.

A consecutive failure of the consistency check without acceptable explanation and no indication of significant improvement of the data quality during the consecutive periods can lead to exclusion of the BSP for the aFRR services. In that case, the BSP has to pass the communication test of the prequalification process successfully before participating at the aFRR service.

16 Perimeter correction

Among the market situations without ToE two options exist:

1. either the same entity is BSP and BRP (BSP= BRP[14] and BRP=BRPsource=BRP_{BSP}) (implicit opt-out)
2. either the BSP is an independent entity but there is an explicit opt out agreement (as mentioned in section 1.2) between the BSP, the associated BRP (BRP_{BSP}), the BRP of the asset that will deliver aFRR (BRP_{source} in this case) and the supplier.

In those cases, Elia will only correct the balancing perimeter of the BRP_{BSP} on a quarter-hourly basis, with the requested energy ($E_{requested}$) per direction during each quarter-hour as is explained in detail in Section 16.1. An overview is provided in following figure:

	Transfer of Energy	Implicit opt-out	Explicit opt-out
Relation between market actors	1. BRP is different from Supplier and/or 2. BRPfsp is different from at least one BRPsource on delivery point	BSP = Supplier = BRPbsp = BRPsource	Agreement between FSP, Supplier and their respective BRP's (BRPbsp and BRPsource) to discard a market situation with ToE.
Section in the ToE rules	Section 8.1: Market situation with transfer of energy	Section 8.2: Exceptions	Section 8.2: Exceptions
Perimeter correction of BRP	• BRPsource is corrected with $E_{delivered}$ • BRPbsp is corrected with difference between $E_{delivered}$ and $E_{requested}$	BRP (=BRPbsp = BRPsource) is corrected with the requested energy = $E_{requested}$	• BRPbsp is corrected with the requested energy = $E_{requested}$ • BRPsource is not corrected

16.1 Calculation of the requested energy ($E_{requested}$) on a quarter-hour basis

The requested volume is calculated on the level of the BSP its whole portfolio for a certain quarter-hour.

If Elia activates **2 upward** aFRR bids the requested volume upwards is:

[14] Which is the case for CIPU units.

- E_req_bsp_up_qh [MWh] = $\frac{\sum_{t=1}^{225} \text{P\_requested\_up\_bid1 (t)}}{15*60} + \frac{\sum_{t=1}^{225} \text{P\_requested\_up\_bid2 (t)}}{15*60}$, with t the 4 second time interval during a quarter-hour.

And if Elia activates 2 **downward** aFRR bids during this quarter-hour in question the requested volume downward is:

- E_req_bsp_down_qh [MWh] = $\frac{\sum_{t=1}^{225} \text{P\_requested\_down\_bid1 (t)}}{15*60} + \frac{\sum_{t=1}^{225} \text{P\_requested\_down\_bid2 (t)}}{15*60}$, with t the 4 second time interval during a quarter-hour.

17 Imbalance pricing

For the determination of the imbalance price, the marginal price for upward regulation (MIP) and for downward regulation (MDP) is calculated. The definitions are given below:

- The ***marginal price for upward regulation*** is, for a given quarter-hour, the highest unit price of all upward activations ordered by Elia for maintaining the balance in the Belgian LFC Block.
- The ***marginal price for downward regulation*** is, for a given quarter-hour, the lowest price of all downward activations ordered by Elia for maintaining the balance in the Belgian LFC Block.

Elia will considers the application of an average weighted imbalance pricing for aFRR but will further analyses this. A final proposal shall be made in the course of 2019 also considering the choices made in the framework of the development of the regional exchange of aFRR.

In the framework of the European PICASSO project discussions are ongoing with all relevant stakeholders on how the prices of activated aFRR bids shall set the marginal price for the balancing energy settlement[15]. Once a clear recommendation has been taken and once Elia will move to a marginal pricing approach, Elia will consider this in its local aFRR design.

[15] https://consultations.entsoe.eu/markets/afrr_implementation_framework/

18 Publications on the website of Elia

In the scope of this new design, the publications on the website of Elia will be updated. This chapter describes the foreseen updates.

18.1 Available regulation capacity

The available aFRR volume and the bidding prices per product are published on the website of Elia. For aFRR, the published volume will no longer be limited to the contracted volume, i.e. 139 MW in 2018. The volume of all available aFRR bids will be published in both the graph and table.

Also the bidding prices per product are published today. For the new aFRR design the marginal aFRR price, i.e. the price of the bid with the largest activation price for the up direction and with the lowest price for the down direction, will be published.

The bidding prices per volume level are published today on the website in graph and table format and should be updated in function of the volumes available for the aFRR services. On top of that, a separate merit order for aFRR and mFRR will be published in an anonymous way in the up and the down direction. The publication for the up direction is presented in **Figure 26**.

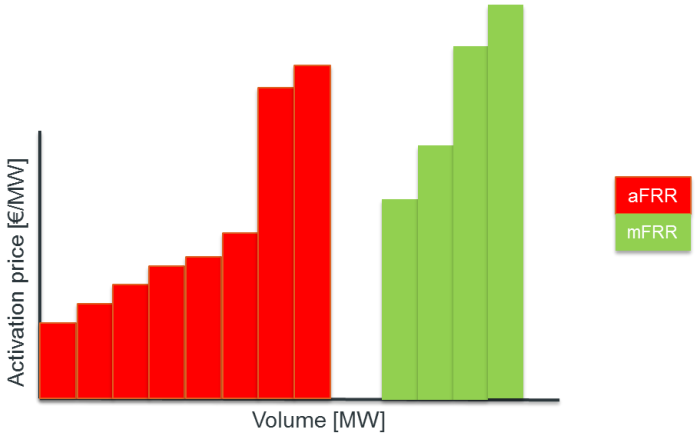


Figure 26 – aFRR and mFRR merit order in the up direction

18.2 Close to real-time publications

Close to real-time, the activated volumes per product are published on a minute basis as shown in the table below.

			Strategic Reserves	Upward regulation volume								Downward regulation volume				
					aFRR		mFRR						aFRR		mFRR	
Time	SI (MW)	NRV (MW)	SR (MW)	GUV (MW)	IGCC+ (MW)	R2+ (MW)	Bids+ (MW)	R3Std (MW)	R3Flex (MW)	ICH+ (MW)	Inter-TSO Import (MW)	GDV (MW)	IGCC- (MW)	R2- (MW)	Bids- (MW)	Inter-TSO Export (MW)
22:17	-85,20	87,72		87,72	12,28	75,43	0,00	0,00	0,00			0,00	0,00	0,00	0,00	
22:16	-98,84	73,21		73,21	10,35	62,86	0,00	0,00	0,00			0,00	0,00	0,00	0,00	
22:15	-82,88	62,18		62,18	10,82	51,36	0,00	0,00	0,00			0,00	0,00	0,00	0,00	
22:14	-71,59	42,48		42,48	8,22	34,27	0,00	0,00	0,00			0,00	0,00	0,00	0,00	
22:13	-57,79	26,21		26,21	6,50	19,71	0,00	0,00	0,00			0,00	0,00	0,00	0,00	
22:12	-16,77	-0,46		8,03	1,35	6,68	0,00	0,00	0,00			8,48	8,48	0,00	0,00	
22:11	22,18	-21,17		4,64	0,20	4,44	0,00	0,00	0,00			25,82	25,82	0,00	0,00	
22:10	72,50	-69,40		3,44	0,00	3,44	0,00	0,00	0,00			72,83	72,83	0,00	0,00	
22:09	81,01	-77,56		5,95	0,00	5,95	0,00	0,00	0,00			83,50	83,50	0,00	0,00	
22:08	83,67	-74,21		11,24	0,00	11,24	0,00	0,00	0,00			85,45	85,45	0,00	0,00	
22:07	66,67	-33,11		21,27	0,08	21,19	0,00	0,00	0,00			54,38	54,38	0,00	0,00	
22:06	-23,12	31,36		31,36	2,78	28,57	0,00	0,00	0,00			0,00	0,00	0,00	0,00	
22:05	-59,74	26,69		26,69	6,82	19,87	0,00	0,00	0,00			0,00	0,00	0,00	0,00	
22:04	11,38	-14,82		10,57	0,80	9,77	0,00	0,00	0,00			25,38	25,38	0,00	0,00	
22:03	36,86	-33,52		12,43	0,00	12,43	0,00	0,00	0,00			45,95	45,95	0,00	0,00	
22:02	26,82	-14,66		14,96	1,97	12,99	0,00	0,00	0,00			29,62	29,62	0,00	0,00	
22:01	11,10	-44,32		2,56	0,77	1,79	0,00	0,00	0,00			46,88	45,05	1,83	0,00	

Figure 27 – Table activated volume per product

The table above should also be published for the marginal prices for the aFRR and mFRR products on a minute basis with a reasonable delay of publications[16]. The marginal prices are calculated based on the bids which have been activated up so far for the concerned imbalance settlement period. This publication does not include the imbalance prices.

18.3 Evolution of System Imbalance and Net Regulation Volume

The graph below should be updated by publishing aFRR and iGCC separately.

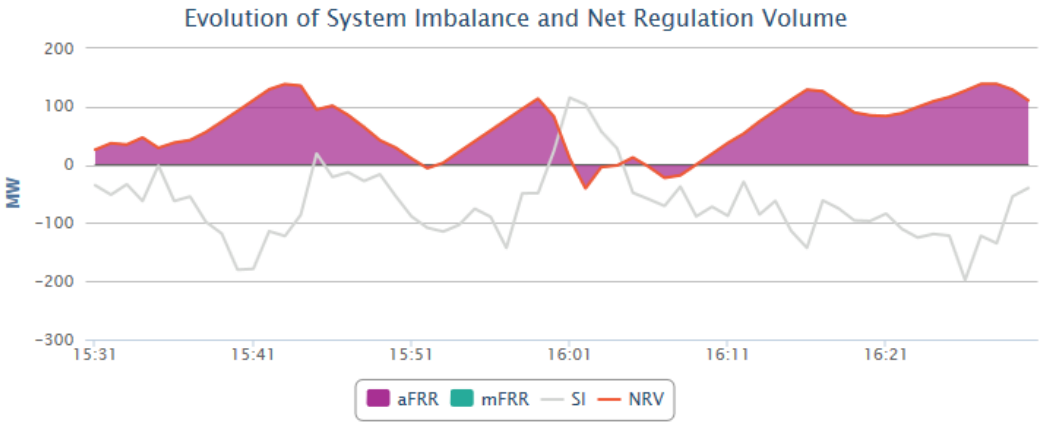


Figure 28 – Graph with the evolution of System Imbalance and Net Regulation Volume

[16] The duration of the delay will be confirmed during the IT assessment.

18.4 Used regulation capacity

Currently, the activated volume as well as the incremental and decremental price on quarter-hourly basis are yet published per product.

For the aFRR product, this incremental (decremental) price is currently the weighted average price for the up (down) direction. In the future, the marginal aFRR price on quarter-hourly basis will be published (in the up and down direction) taking into account the minimum activation time of a bid to set the price (see Section 17).

Elia will considers the application of an average weighted imbalance pricing for aFRR but will further analyses this. A final proposal shall be made in the course of 2019 also considering the choices made in the framework of the development of the regional exchange of aFRR. In that case, Elia will consider for the aFRR product that the incremental (decremental) price is the weighted average price for the up (down) direction.

PART 2: aFRR design with transfer of energy

Part II of the aFRR design note describes the additional design elements necessary to allow market access to the aFRR market via a transfer of energy (hereafter referred to as “ToE”) mechanism.

This part II provides an analysis and a description of the design elements necessary for the extension of the ToE to the aFRR market, while considering the technical feasibility aspects linked to the specific design elements related to ToE. This provides Elia a first indication about the complexity of implementation linked to such an extension.

In addition, in order to assess the economic opportunity of such an extension, a questionnaire for market parties, is inserted in annex 1. This questionnaire aims at having a better view on the type of assets and delivery points that will be providing aFRR and their eligibility for the ToE mechanism, as well as the possible market interest and potential for a ToE-mechanism applied to the aFRR market.

Both the insights from the technical feasibility (and complexity) and the market questionnaire will be used and further elaborated upon in a second part of this study that will provide an implementation roadmap for the new aFRR design. This will be available for consultation with Elia’s implementation study for aFRR before the end of 2018.

To conclude, part 2 of the study should be considered as an additional layer on top of the design described in part 1. Where relevant any deviations from the design elements described in part 1 will be clearly identified and explained in this part.

19 Structure – part 2 of the design note

The structure is based on the overall aFRR process as illustrated in figure 29. Processes described in the first part of the design note on which ToE has an impact, are highlighted in this figure.

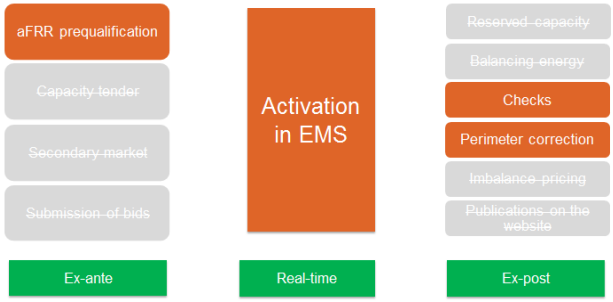


Figure 29 – general aFRR process with specific blocks that are impacted by ToE.

Part 2 of the design nota is therefore structured as follows:

1. A description of the legal framework of the ToE mechanism
2. Wrap up of main principles applicable to the ToE mechanism
3. The impact of the ToE mechanism on the aFRR process:
    - Ex ante
        - aFRR prequalification process (incl. contracting)
    - Real-time
        - Activation phase : notification towards BRPsource
    - Ex-post
        - Checks: individual baseline check
        - Perimeter correction (of BRPsource and BRPbsp)

    In case of ToE the following additional process needs to be put in place:

    ⇨ Publication flexibility volumes

4. Conclusion

20 Legal framework

The Electricity Law relative to the organization of the electricity market of 29th of April 1999 was amended on 13th of July 2017 in order to create a framework for the participation of demand side flexibility and the storage of electricity.

Conform Art. 19bis §2 of the Electricity Law, Elia draws up a proposal of the Transfer of Energy rules[17] (ToE-rules). These ToE-rules describe, amongst others[18], the phased implementation of ToE (Section 5 of the ToE-rules) in the different market segments and the specific feasibility studies that Elia performs in parallel of each extension of the application field of ToE. Such a feasibility study aims at demonstrating the technical and economic feasibility of implementing ToE.

The ToE mechanism has already been implemented or is announced to go-live in the following market segments:

1. the market segment for non-reserved tertiary reserves from non-CIPU technical units coupled to a quarter-hour meter, as from 1/6/2018;
2. the market segment for reserved tertiary reserves from non-CIPU technical units coupled to a quarter-hour meter as from 1/12/2018;
3. Strategic reserve by SDR-units units as from 1/11/2019

In each of the aforementioned market segments delivery points with a yearly average net-offtake on a yearly basis are eligible for ToE, in accordance with Sections 7.3 and 10.2 of the ToE-rules. This same condition will apply in case a ToE is implemented for the market segment of aFRR. Furthermore, delivery points will need to be linked to a quarter-hour meter (AMR), so that energy can correctly be appointed to the correct BRPsource and consequently ensure that the perimeter correction of the BRPsource can correctly be executed.

[17] The ToE-rules can be consulted on Elia's website via the following link: http://www.elia.be/en/products-and-services/balance/transfer-of-energy

[18] The ToE-rules further describe the principles to determine the activated flexibility volume; to correct the quarter-hour imbalance resulting from the activation of demand side flexibility by a BSP and the exchange of information and data necessary for the implementation of ToE.

21 Wrap up of main principles applicable in case of transfer of energy

This section illustrates the main principles by a use case with a delivery of an **upward aFRR** activation by a **reduction** in **net-offtake**.

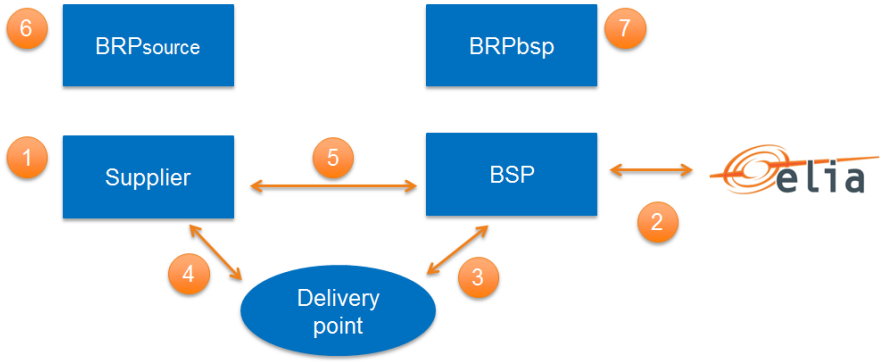


Figure 30 – overview

1. The **supplier** buys energy in advance (via the BRPsource) on the electricity market, for example in day-ahead. The amount of energy the supplier buys in advance depends on the estimated energy offtake of each access point in his portfolio. In this example access point = delivery point.
2. Elia activates **upwards aFRR** by sending a continuous (on a 4'' interval) aFRR setpoint (ΔPsec_tot) to the BSP, who delivers the service to Elia.
3. The BSP operates his pool and steers different delivery points in his pool for the effective delivery of the requested upward aFRR by Elia. This example shows how one **delivery point operating under a ToE-regime** reduces his consumption in real-time.
4. By reducing its consumption, **the supplier cannot invoice** this activated energy anymore to his final customer (=delivery point). Nonetheless the supplier **sourced** this **energy** in advance on the electricity market (step 1.).
5. The delivered energy is **financially compensated** between BSP and Supplier, either based on bilaterally agreed price or, in absence of such a bilateral agreement, the BSP and supplier apply the regulated transfer price (determined by CREG). The BSP will thus compensate the supplier for the sourced (but not invoiced) energy due to the activation of upward aFRR.
6. The balancing perimeter of the **BRPsource** is corrected on a quarter-hourly basis for the delivered volume of aFRR. This neutralization is performed in order to neutralize the impact on the balancing perimeter of the BRPsource.
7. The **BRPbsp** needs to take up the balancing responsibility for the activation of the requested flexibility. The **BRPbsp** is responsible for the difference between the delivered volume and the requested volume of flexibility.

22 Transfer of energy design

This section describes the impact of ToE on the business processes for aFRR.

22.1 aFRR qualification process[19]

One of the key steps during the prequalification process consists of the contract signature, as described in Section 5.3.2 of part 1 of the design note. Additional contractual elements which need to be met for market situations with ToE are the following:

1. The FSP is committed to agree[20] with the supplier the modalities of the financial compensation between both himself and the supplier;
2. The FSP is committed to set up a banking guarantee for all delivery points that operate under a ToE mechanism;
3. In case of the presence of a contract valorising the difference between the nomination and the actual position of the end client (also referred to as “pass-through contract”), the FSP engages himself that the contractual regime between end customer and supplier is clearly known to Elia.

22.2 Activation phase

During an activation of aFRR by a non-CIPU asset in a market situation with ToE, the BRPsource of those delivery points which are activated needs to be informed about the possible impact on his balancing perimeter, to avoid that this BRPsource takes counteractions to neutralize/reverse the activation.

Due to the characteristics of the aFRR product, a notification message **prior to or during** the activation is not considered feasible in an accurate manner as:

[19] The qualification process is generally described in Section 5 of part 1 of the design note.

[20] In the absence of such an agreement with regard to the financial compensation, the Commission determines the default price formula between the FSP and the supplier. These modalities are described in CREG’s decision 1607 which can be consulted via the following link : https://www.creg.be/nl/publicaties/beslissing-b1677

- **Requested volume of flexibility**: the requested energy (ΔPsec_tot) sent to the BSP is a signal continuously re-calculated on a four second interval. Therefore, no insight on the expected requested energy can be given prior the activation.
- **Direction of the aFRR signal**: as the requested energy (ΔPsec_tot) is continuously recalculated the direction of the aFRR signal can evolve from an upwards regulation towards a downwards regulation. Therefore, no insight on the direction of the aFRR signal can be given.
- **Delivery by the BSP**: The BSP is free to reorganize its portfolio in real-time for the effective delivery, meaning that all delivery points that are included in the bids submitted on the bidding platform for the concerned Qh can be used for the effective delivery of the service. The freedom of the BSP to reorganize its portfolio in real-time causes that Elia cannot anticipate which delivery points will be used for effective delivery of the aFRR service.

The first moment when Elia can inform the BRPsource for the activation that occurred in its balancing perimeter is after each quarter-hour during which an activation of aFRR occurred, provided that the BSP informs Elia about the delivered energy in its portfolio. In parallel with the second notification from the BSP in the market for mFRR, the BSP will need to communicate the following information to Elia at the latest 3 minutes after the activation, for those market situations with ToE[21]:

- **the list of delivery points** that were used during each quarter-hour when an activation took place.
- **the volume (energy) delivered** on a quarter-hour basis, by each delivery point for those time intervals during which an activation took place the preceding quarter-hour in MWh.

The notification of Elia towards the BRPsource takes place at the latest 3 minutes after the quarter-hour during which an activation took place, based on the distribution of the activated volume (energy) over the different delivery points, as communicated by the BSP to Elia during his notification at the end of each quarter-hour during which an activation took place. The following schedule clarifies both the notification message from BSP to Elia and the notification message from Elia to BRPsource.

[21] if the BSP uses at least one delivery point during a quarter-hour of activation, a notification message needs to be send for all delivery points for that concerned quarter-hour of activation.

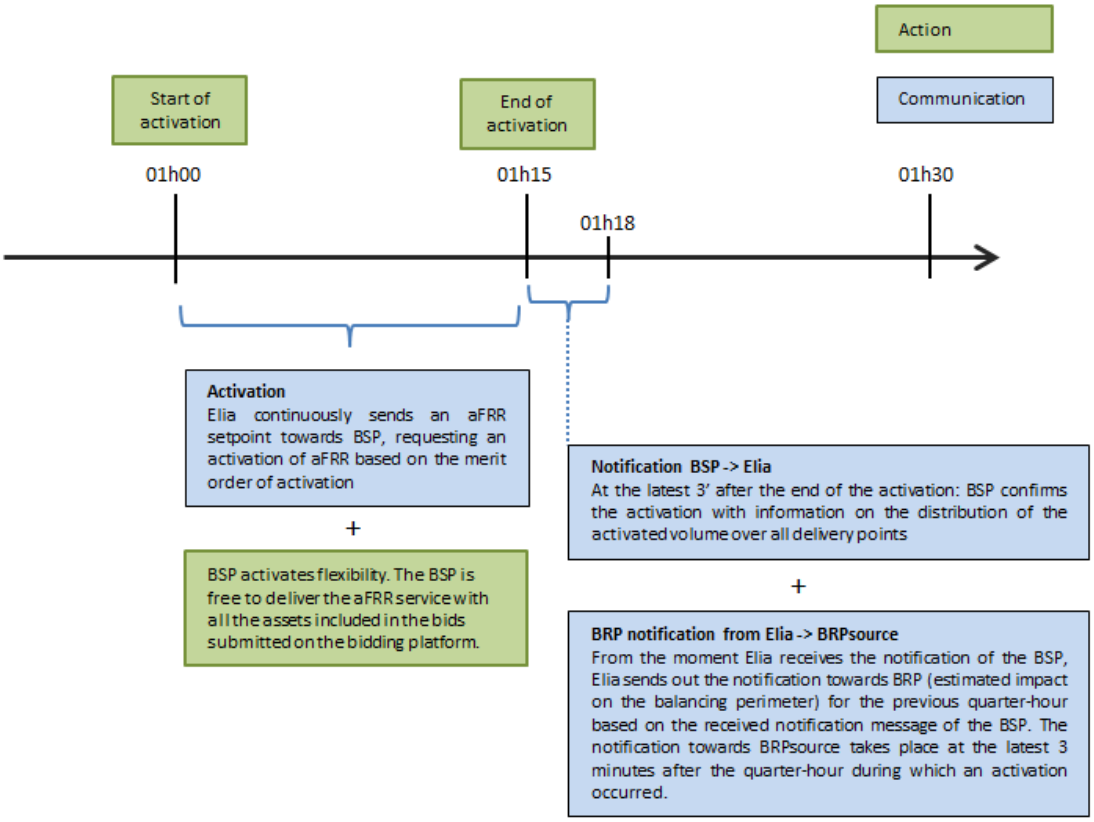
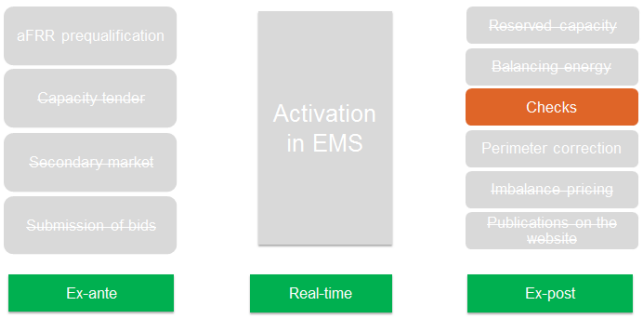


Figure 31 – overview of notification messages for those market situations with ToE.

Penalty-mechanism for failed notification message

In case the BSP fails to notify Elia within 3 minutes after the end of the activation, the activation will be registered as failed. If Elia notices that three or more consecutive failed activations within a period of 30 calendar days, it will notify the BSP and reserves the right to suspend the BSP from the bidding procedure for a period of 30 calendar days.

22.3 Checks and settlement



For delivery points with a ToE, an ad-hoc additional baseline check per delivery point will be performed by Elia, on top of the baseline check that is performed under Section 14.1.2. Since the baseline is a crucial element for the determination of the effective delivery of aFRR

services (and the perimeter correction of the BRPsource), the goal of a baseline control is to check whether the baseline is correctly determined by the aFRR provider. The quality of the baseline will be verified ex-post **on a monthly basis** on delivery point level. The same quality targets as mentioned under Section 14.1.2 will be put forward for the baseline test per delivery point.

For a delivery point with an average baseline per day[22], larger or equal than 1MW, the results are shown in **Figure 32**. It can be seen, that for the same period of the participation phase as mentioned above, the quality targets are met.

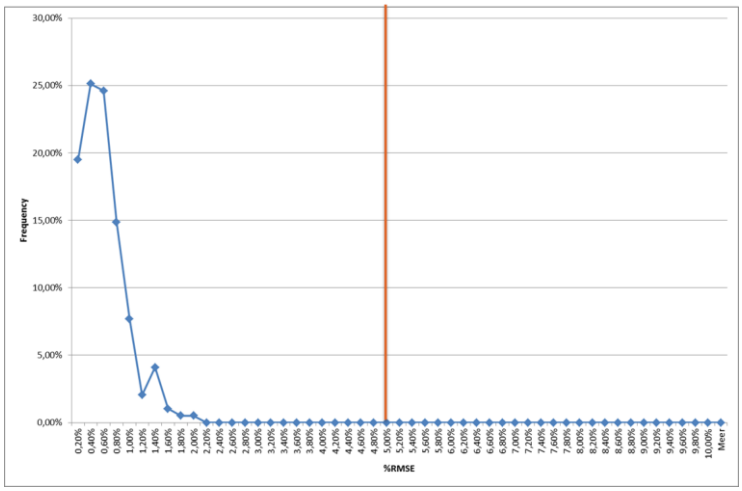


Figure 32 – Results of baseline check on delivery point level for delivery points < 1 MW

For a daily average baseline smaller than 1 MW, the same results are shown in **Figure 33**. In 90% of the cases, the quality targets are met. Therefore, the same quality targets are also kept for those small delivery points. However, please note that the quality of the baseline will be determined on a monthly basis and thus if certain daily quality targets are not met, the average on a monthly basis can give a %RMSE value smaller than 5%.

[22]Average (Pbaseline) is the average daily baseline only taking into account the 4second timestamps when the delivery points are not delivering, i.e. Avail_sec equal to zero for the delivery point in question.

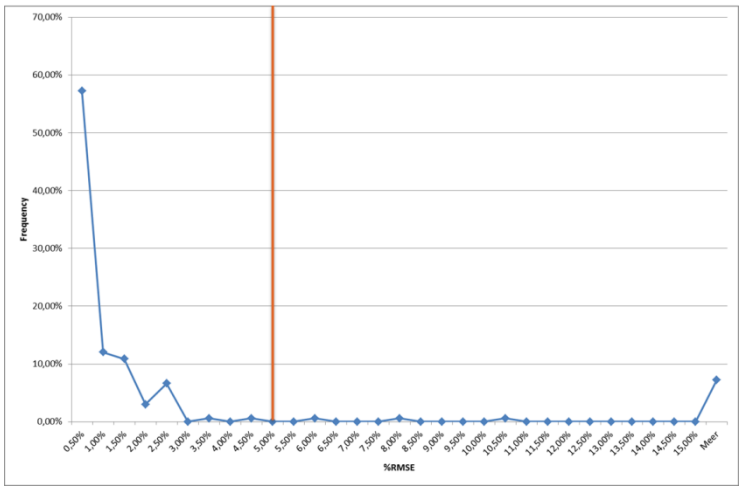
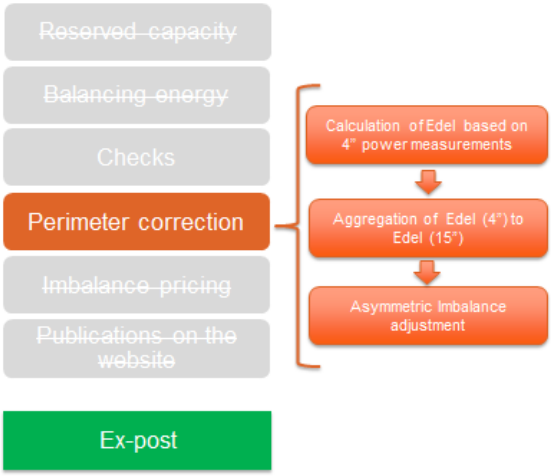


Figure 33 – Results of baseline check on delivery point level for delivery points < 1 MW

22.4 Perimeter correction of the BRPsource and BRPbsp

This section describes the correction of the balancing perimeter of the BRPsource and BRPbsp, for those market situations with a ToE. In order to perform an accurate correction of the balancing perimeter (of BRPsource and BRPbsp) **3 additional process blocks** are identified specifically related to ToE:



The two main drivers for these 3 additional blocks are the following:

1. The perimeter correction described under Section 16 (situation with no ToE) is based on the requested energy (Erequested), while in a market situation with ToE **an additional correction** is **required** based on the **delivered energy** (Edelivered). An overview is provided in the following table:

Elements	Transfer of Energy	Implicit opt-out	Explicit opt-out
Relation between market actors	1. BRP is different from Supplier and/or 2. BRPfsp is different from at least one BRPsource on delivery point	BSP = Supplier = BRPbsp = BRPsource	Agreement between FSP, Supplier and their respective BRP's (BRPbsp and BRPsource) to discard a market situation with ToE.
Section in the ToE-rules	Section 8.1: Market situation with transfer of energy	Section 8.2: Exceptions	Section 8.2: Exceptions
Perimeter correction of BRP	1. BRPsource is corrected with **the delivered energy = $E_{delivered}$** 2. BRPbsp is corrected with difference between $E_{delivered}$ and $E_{requested}$	BRP (=BRPbsp = BRPsource) is corrected with the requested energy = $E_{requested}$	BRPbsp is corrected with the requested energy = $E_{requested}$

2. The calculation of the delivered energy is based on 4 second power measurements in contrast to mFRR where the delivered energy is based on 15 minute metering data. Therefore important additional computational processes need to be put in place.

We continue by describing the main principles for correction of the BRPsource and BRPbsp in the next section, followed by a detailed description of the 3 additional blocks per section:

1. Calculation of the delivered energy (Edel) based on 4 second power measurements
2. Aggregation of delivered energy on 4second basis towards 15 minute basis
3. Asymmetric Imbalance Adjustment

22.4.1 Main principles for the perimeter correction of the BRPsource and BRPbsp

The correction of the balancing perimeter of BRPsource and BRPbsp in a market situation with ToE[23] is as follows:

- The **BRPsource** is corrected on a monthly basis with the delivered energy by the BSP, aggregated on the level of the balancing perimeter and aggregated on a quarter-hourly basis. This is done because the intervention of this BSP cannot have

[23] In case of an exception to a market situation with ToE as described in Section 8.2 of the ToE-rules (explicit and implicit opt-out regime), the BRPbsp is corrected with the requested energy and the BRPsource is not corrected, as also explained in Section 16 of part 1 of the design note.

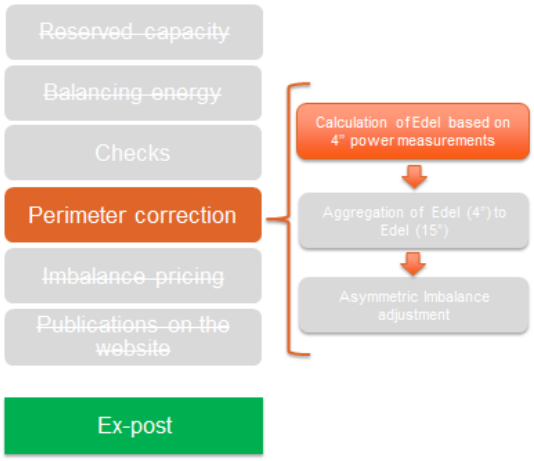
any disadvantage for other market actors, following the fourth principle of study 1459 of CREG.

- The **BRPbsp** is corrected with the difference between the delivered energy and requested energy, aggregated on level of the balancing perimeter and aggregated on a quarter-hourly basis. In this way, the difference between the delivered energy and requested energy is allocated to the balancing perimeter of the BRPbsp, on which the imbalance tariff is applied. This is in line with the third principle of study 1459[24] of CREG, which states that FSP (to be read as "BSP" in this example) must take up the balancing responsibility for the activation of flexibility (via a third party BRPbsp or by becoming his own BRP).

In order to guarantee the confidentiality of the different market parties Elia corrects the balancing perimeter of BRPsource per quarter-hour and on the level of the portfolio. In this way the effects of the activation are displayed on an aggregated level and confidentiality of the market actors is guaranteed.

As explained, to perform a perimeter correction of the BRPsource and BRPbsp, both the requested energy (E_{req}), as explained under Section 16 and the delivered energy (E_{del}) need to be calculated. This calculation of the delivered energy is explained hereafter.

22.4.2 Calculation of the delivered energy (Edel) based on 4'' power measurements



The calculation of the delivered energy is done on the level of the delivery point based on the difference between the baseline and the 4 second power measurements. The delivered energy on a 4 second basis is calculated for those delivery points that were notified by the

[24] http://www.creg.info/pdf/Studies/F1459NL-2.pdf

BSP, as explained under Section 3 and only for those time-intervals for which the delivery point in question was participating in the aFRR service (Avail_sec = 1) are considered.

For an **upward activation** (reduction in net-offtake) the delivered energy on a 4 second interval per delivery point is calculated as:

- $Edel_{DP\_t}$ = min (Baseline_dp (t − 60) − Pmeasured_dp (t); aFRRmax[25])

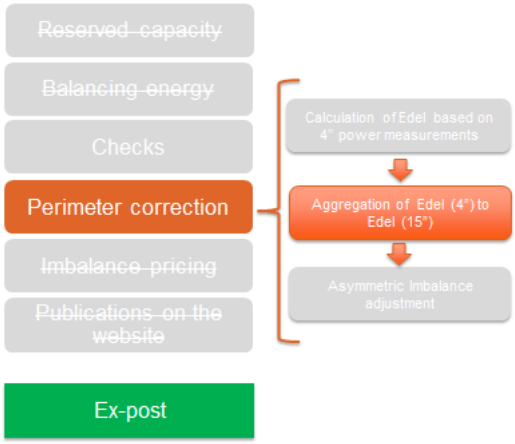
For a **downward activation** (increase net-offtake) the delivered energy per delivery point is calculated as follows:

- $Edel_{DP\_t}$ = min (Pmeasured_dp (t) − Baseline_dp (t − 60); aFRRmax[26])

  With

  - $P_{measured\_dp}(t)$: the 4 second power measurements that Elia receives in real-time for moment (t)
  - Baseline_dp (t − 60): the reference value communicated by the BSP 1 minute before real-time, indicating the foreseen injection (or offtake) for the considered delivery point
  - aFRRmax: as defined under Section 1.3.

22.4.3 Aggregation of Edel on 4 second basis to Edel on quarter-hour basis



The delivered energy per delivery point on a 4 second basis calculated under previous section is now aggregated on a 15 minute basis.

For an **upward or downward activation** the delivered energy per delivery point on a 15 minute interval is calculated as:

- $Edel_{DP} = \sum_t^n Edel_{DP\_t}$

[25] The aFRRmax for an upward activation

[26] The aFRRmax for a downward activation

With

- $\mathrm{Edel}_{\mathrm{DP\_t}}$: the delivered energy on a 4 second basis as calculated under Section 22.4.2.
- n = amount of 4 second intervals in a quarter-hour

The calculation of the delivered energy **only takes place** for those time intervals during which the delivery point in question was delivering aFRR. It is therefore possible that during one quarter-hour a delivery point is delivering aFRR multiple times as explained in the following illustrative example.

EXAMPLE

This example shows a delivery point that delivers aFRR by a reduction in net-offtake at the start and the end of a certain quarter-hour. The example demonstrates that the delivery point does not participate between 15:00:12 and 15:14:00. As was mentioned earlier, **only those timeframes during which the participation takes place (**thus when Avail_sec = 1 ≠0) are **considered**.

t	Time	Avail_sec = 1	$P_{measured}$	Baseline
1	15:00:00	Yes (Avail_sec = 1)	1,88	1,9
2	15:00:04	Yes (Avail_sec = 1)	1,8	1,9
3	15:00:08	Yes (Avail_sec = 1)	1,7	1,9
4	15:00:12	Yes (Avail_sec = 1)	1,5	1,9
…	…	…	…	…
216	15:14:00	Yes (Avail_sec = 1)	1,7	1,8
217	15:14:10	Yes (Avail_sec = 1)	1,5	1,8
218	15:14:20	Yes (Avail_sec = 1)	1,4	1,8
219	15:14:30	Yes (Avail_sec = 1)	1,3	1,8
220	15:14:40	Yes (Avail_sec = 1)	1,2	1,8
221	15:14:44	Yes (Avail_sec = 1)	1,1	1,8
222	15:14:48	Yes (Avail_sec = 1)	1	1,8

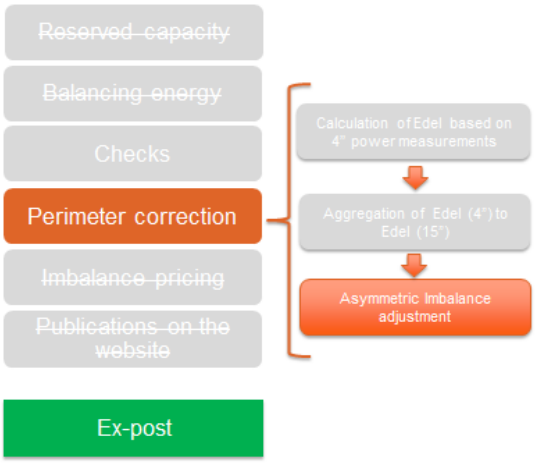
223	15:14:52	Yes (Avail_sec = 1)	0,9	1,8
224	15:14:56	Yes (Avail_sec = 1)	0,8	1,8
225	15:15:00	Yes (Avail_sec = 1)	0,7	1,8

Therefore the delivered energy per delivery point is first calculated for each 4second timeframe

- from t = 1 to t= 4
- from t= 216 to t= 225

and then the delivered energy **for each 4 second timeframe** is summed to calculate the delivered energy on a quarter-hour basis.

22.4.4 Asymmetric Imbalance adjustment



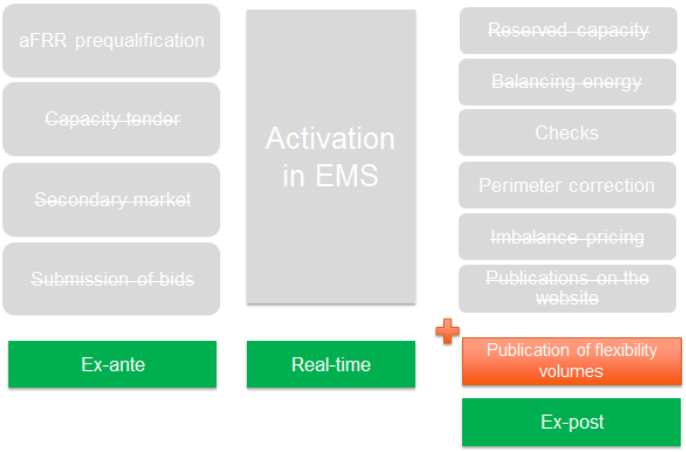
If the BSP delivers a larger volume than requested by Elia, the delivered energy per delivery point (Edel) is adjusted on a pro-rata basis to the sum of the individually delivered volumes of flexibility of all concerned delivery points, so that the total delivered volume of flexibility, added across all delivery points that participate in the delivery of flexibility, is equal to Elia's requested energy. This is also called the asymmetric imbalance algorithm and an example is provided under annex 3.

This delivered energy per delivery point calculated after the asymmetric imbalance adjustment, is then used for the correction of the balancing perimeter of the ARPsource and ARPfsp.

22.5 Publication of the flexibility volumes

On top of the previously discussed process blocks, **an additional block** is required concerning the communication of flexibility volumes, in order that the concerned market

parties receive validated flexibility volumes on a quarter-hourly basis for those delivery points activated in a market situation with ToE.



The publication of the flexibility volumes is done in line with Section 15 of the ToE-Rules published on Elia's website[27] and follows the same approach as the communication of flexibility volumes for mFRR. In short:

1. Elia communicates the imbalance volume **to the BRP** (BRPfsp and BRPsource) at the latest by the end of month M + 2 following the month during which the activation took place.
2. Elia makes the validated flexibility volumes available **to the Supplier**, aggregated per quarter hour and per BSP for those delivery points in the Suppliers' portfolio, by the end of M + 2 following the month during which the activation took place.
3. Elia makes the validated flexibility volumes available **to the BSP**, aggregated per quarter hour and per Supplier for those delivery points in the BSP his portfolio, by the end of M + 2 following the month during which the activation took place.

22.6 Conclusion

Part 2 of this design note described the additional layer of design, implementation and administrative actions for BSPs, BRPs and Elia implied by the extension of the ToE mechanism to the aFRR market segment. The application of the ToE mechanism impacts the prequalification process, the activation process as well as the checks and settlement of the aFRR service, the perimeter correction and the data publication process.

As indicated in the preamble, and provided that the proposed design is acknowledged by the stakeholders, a technical implementation description and economic opportunity analysis will be performed based on this design. The conclusions of this study and analysis as well as, a recommendation with respect to the opportunity to extend the ToE mechanism to the aFRR market, will be included in an addendum to the "implementation plan" that will also be

[27] http://www.elia.be/en/products-and-services/balance/transfer-of-energy

consulted upon by the end of 2018. This will, amongst other things, allow fulfilling the criteria set out in Section 5 of the ToE-rules.

One of the key criteria concerning the economic opportunity analysis concerns the share of non-CIPU technical units that would provide aFRR with the use of the ToE mechanism[28].

In order to get better insights into this question, Elia includes in the present design note a questionnaire for BSPs and any other concerned stakeholder in annex 1. The purpose of this questionnaire is to better estimate the potential and the effective volume of non-CIPU units that would provide aFRR (with a focus on the share with ToE).

[28] only applicable for those delivery points with a yearly average net-offtake character

23 General conclusions and next steps

This design study describes the opening of the aFRR balancing market to all resources independent of the voltage level and the type of BSP. This opening of the aFRR market is also required in order to fulfil the legal requirements as imposed by Article 3 of the Guideline on Electricity balancing. Compared to the current aFRR product, the new approach includes following important changes:

- A proposal to move from a weekly to a daily procurement procedure
- A proposal to have a separated procurement for FCR and aFRR
- Bidding obligations to incentivize asymmetrical bids in the capacity procurement tender
- Balancing energy gate closure time for submission of aFRR energy bids close to real-time.
- A merit order selection and activation

From a theoretical perspective the ToE mechanism can be applied to the aFRR market. However, the application of the ToE mechanism to the aFRR market implies an additional layer of design, implementation and administrative actions for BSPs, BRPs and Elia. More in particular, the application of the ToE mechanism impacts the prequalification process, the activation process as well as the checks and settlement of the aFRR service, the perimeter correction and the publication process.

Provided that the proposed design of the ToE mechanism to the aFRR market is acknowledged by the stakeholders, a technical implementation description and economic opportunity analysis will be performed.

In a following phase, an addendum of the aFRR design study, i.e. the roadmap study, will be drafted and consulted upon. The goal of this roadmap study is to:

- Propose an implementation road map with respect to the proposed aFRR design as outlined in Part 1 of the design note. This includes also the evolution covered in the study on “separated procurement of FCR and aFRR products”.
- With respect to the implementation of a ToE mechanism for the aFRR market as outlined in Part 2 of the design note:
    1. Propose a technical implementation description and roadmap for ToE;
    2. Propose an economic opportunity study;

Based on the insights from point 1 and 2 above, and in line with the prescriptions of Section 5 of the ToE rules, propose a recommendation with respect to the opportunity to extend the ToE mechanism to the aFRR market and if so, according to which roadmap/timing.

24 Annex 1: Survey for market actors

Disclaimer: answers will be treated anonymous. Numbers and other results will only be published in an aggregated manner to ensure confidentiality of the market parties.

#	Question	Answer
1	What's the current total capacity of your portfolio in Belgium [in MW] for aFRR (both upwards and downward) coming from non-CIPU assets?	
2	How do you expect this capacity to evolve towards 2020, 2023 and 2025?	
3	What's the capacity share of net-offtake assets (based on a yearly average) in your non-CIPU portfolio **in Belgium** [in MW] for which you can offer aFRR? How do you expect this aFRR capacity to evolve in 2020, 2023 and 2025? **Ex**: if the current total capacity of your portfolio that provides aFRR (question #1) is 100MW, please explain the share of net-offtake assets[29] (and net-injection) in your non-CIPU portfolio.	
4	What is the share of assets that operate under a pass-through contract ("contract valorising the deviation between the nomination and the real position of the end-client") in the following two categories: 1. Non-CIPU assets with an average net-offtake on a yearly basis providing aFRR 2. Non-CIPU assets with an average net-injection on a yearly basis providing aFRR	
5	Which technologies of non-CIPU assets and what volume of your current portfolio in Belgium would be used for both aFRR and mFRR?	
6	How do you expect these technologies and volume to evolve in 2020, 2023 and 2025?	
7	Do you consider the ToE mechanism as currently defined in the Electricity Law a useful mechanism in the framework of the aFRR market?	

[29] A net-offtake asset is an asset which has an average net-offtake on a yearly basis, while a net-injection asset has an average net-injection on a yearly basis.

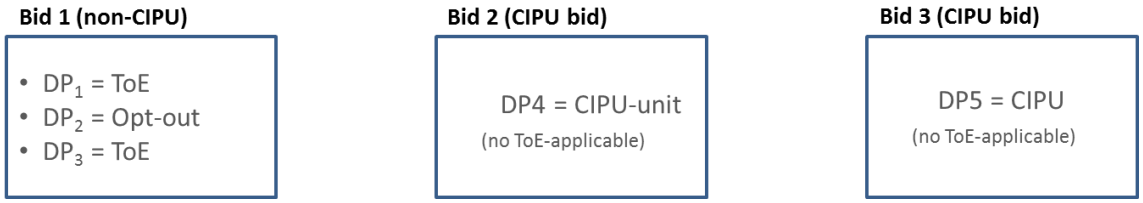
	If you don't consider this useful: - please explain why and - would you use the opt-out mechanism for the participation of your non CIPU units to the aFRR market? If no, please explain why.	
8	If you do consider the ToE-mechanism useful, do you - Expect to use the ToE framework (considering its current definition in the Law, i.e. applicable to Net-Offtake) when participating to the aFRR market? - If so for what volume and by when? - What would be, if any, the minimum market conditions for you to participate (economical and technical)? - Would you consider these minimal market conditions already fulfilled at this stage and do you expect them to be fulfilled by 2020?	
9	Are there alternative and/or complementary market (entry) arrangements to the ToE mechanism?	
10	Do you expect some technologies coming from residential households to be able to participate to aFRR in 2025 **in Belgium**? If yes, which ones? Do you have an expectation in terms of volume?	

25 Annex 2: Case study

This example[30] shows an upward activation of aFRR during a certain quarter-hour 1 (Qh1) and illustrates the different steps of the settlement in case of ToE for some delivery points.

Assumptions:

- Upward activation during the whole activation period Qh1
- 3 bids of aFRR were offered by a BSP. The non-CIPU units are activated by a reduction in net-offtake via non-CIPU units and a net-injection increase via CIPU units.
- The BSP operates a portfolio of CIPU units and non-CIPU delivery points. Certain non-CIPU units operate under a ToE-regime, whole others under an explicit opt-out regime.



1. Elia sends an aFRR set-point to the BSP on a 4 second basis. The BSP has then the free choice to execute the delivery with all delivery points which are taken up in the bids submitted on the bidding platform as explained in Section 3.
2. The BSP notifies Elia, at the latest 3 minutes after the quarter-hour of activation, with the delivery points that executed the delivery of aFRR and the corresponding volume delivered (on a quarter-hour basis) per delivery point
    - Non-CIPU:
        - DP1 delivered 5 MW
        - DP2 delivered 3 MW
        - DP3 delivered 12 MW
    - CIPU:
        - DP5 delivered 5 MW

    Attention: DP5 was notified by the BSP, indicating the BSP did not follow the economic merit order for the effective delivery of flexibility.
3. Elia calculates the requested energy during QH1 (sum of aFRR setpoints send to the BSP)
    - Erequested: 25 MW

[30] It consists of a theoretical example.

Elia calculates the delivered energy[31], during QH1 for the delivery points which were notified by the BSP

- Non-CIPU:
  - DP1 delivered 4,8 MW
  - DP2 delivered 3,2 MW
  - DP3 delivered 17,4 MW
- CIPU:
  - DP5 delivered 5,1 MW

The BSP delivered 4,8 MW + 3,2 MW + 17,4 MW + 5,1MW = 30,5 MW while the activation was equal to 25 MW.

⇨ Overdelivery of 5,5 MW for the whole quarter-hour Qh1.

4. Elia verifies whether the delivered volumes for each delivery point are within the limits as states in the Grid User Declaration (the so called $aFRR\_{Max}$ per delivery point). If the delivered volume per delivery point exceeds the $aFRR\_{Max}$ per delivery point the delivered volume is limited to $aFRR\_{Max}$ per delivery point. In this example however, we take the assumption that the delivered volumes are within the limits as stated in the Grid User Declaration.
5. Elia adds the requested volume to the balancing perimeter of the BRPbsp
   - ➢ Perimeter BRPbsp = - 25 MW
6. Elia reduces the delivered volume per delivery point on a pro-rata basis with the total of overdelivered volume. This way the overdelivery of the BSP is reduced to the requested volume
   - DP 1= 4,8 – (5,5 * 4,8 / 30,5) = 4,8 – 0,86 = 3,94 MW
   - DP 2 = 3,2 – (5,5 * 3,2 / 30,5) = 3,2 – 0,57 = 2,63 MW
   - DP 3 = 17,4 – (5,5 * 17,4 / 30,5) = 17,4 – 3,14 = 14,26 MW
   - DP 5 = 5,1 – (5,5 * 5,1 / 30,5) = 5,1 – 0,92 = 4,18 MW

   - ➢ Delivered volume by the BSP = 3,94 + 2,63 + 14,26 + 4,18 = 25 MW
7. Elia adds the delivered energy calculated under step 6 to the balancing perimeter of the BRPbsp, and this for the delivery points that act under a ToE-regime.
   - ➢ Perimeter BRPbsp = 3,94 + 14,26 = 18,2 MW

[31] The delivered energy in this example is directly given on a quarter-hour basis. However, as explained under Section 22.4, first the delivered energy is calculated on 4-second interval and afterwards on a quarter-hour basis.

- The BSP delivered the requested energy, however he (nor his BRP) has right on the overdelivered volume.

8. Elia corrects the balancing perimeter of the BRPsource (for the delivery points under a ToE-regime) with the delivered volume as calculated under step 6.

   Elia corrects the perimeters of the BRPsource(s) as follows:

   - $BRP_{source,DP1}$ = + 3,94 MW
   - $BRP_{source,DP2}$ = no correction (delivery point in an explicit opt-out regime)
   - $BRP_{source,DP3}$ = + 14,26 MW

Conclusion:

- Perimeter $BRP_{source,dp1}$ is left with a positive imbalance of 0,86 MW (= 4,8 MW – 3,94 MW)
- Perimeter $BRP_{source,dp2}$ is not corrected and will settle his imbalance with the BSP/BRPbsp via an opt-out agreement.
- Perimeter $BRP_{source,dp3}$ is left with a positive imbalance of 3,14 MW (=17,4 MW - 14,26 MW)
- Perimeter BRPbsp (which is also $BRP_{source,dp5}$) is corrected with requested energy (under step 5).