SEPARATED PROCUREMENT OF FCR AND AFRR PRODUCTS

ELIA

10/07/18

EXECUTIVE SUMMARY

This paper discusses possible evolutions of the FCR and aFRR procurement schemes in Belgium. Currently, aFRR and part of the FCR needs are procured jointly as far as reservation is concerned. In a context where primary and secondary reserves in Belgium have been highly dependent on CCGTs, such an approach was put in place to enable an optimal apportioning of fixed spinning costs over different products, hence over larger volumes. Such assets, which are frequently out of the money due to market situations (i.e. negative Clean Spark Spread, which means that their marginal cost is below the spot price), indeed need a compensation to run at minimum stable generation and be able to offer fast spinning regulation services. The question being in focus in this report is whether the current design remains needed in the future. It is indeed efficient in terms of short-term cost optimization when there are fixed costs involved, but it remains open whether fixed costs will remain needed in the future. Opening the market to new technologies with no fixed costs makes the existing design questionable. In addition, Elia expects that in the future, the existing and future CCGTs will be more probably “in the money”, being able to cover their fixed costs via the energy market and thus making the current “fixed cost based” design less necessary. On the contrary the current mechanism may impede new market entry stemming from smaller actors with different constraints and costs structures (which may in turn limit the perspective of procurement costs reduction in the longer run).

The current situation is therefore compared to alternative designs where FCR and aFRR are procured in distinct processes, and where the procurement of upward and downward aFRR products is separated. To do so – after a recap of the FCR design that is anticipated to be in place by the end 2018 – the study analyzes the different inter-related design elements at stake, namely:

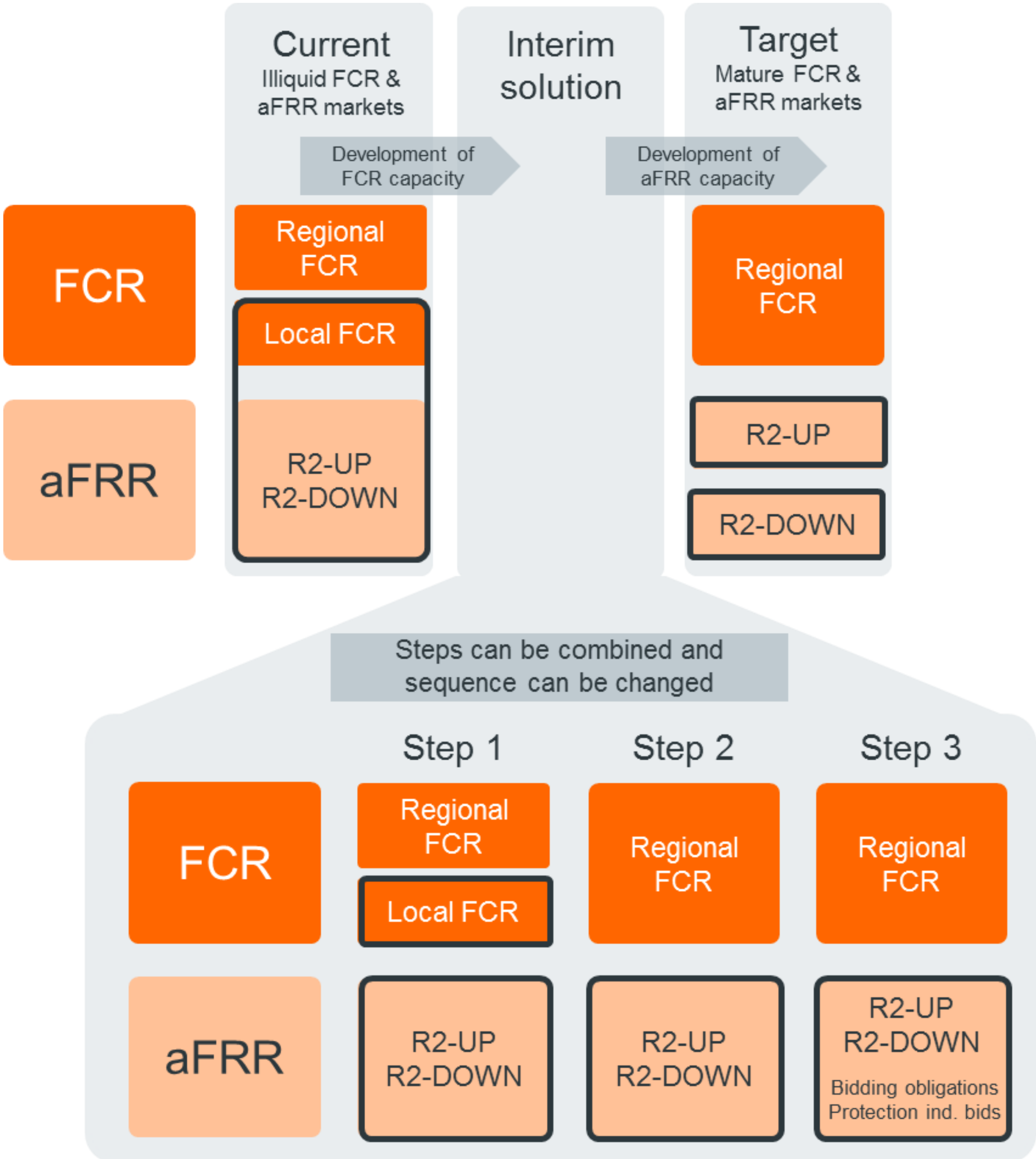
- The pros and cons of a separation of (local) FCR and aFRR products,
- The option to source all FCR via the regional FCR cooperation,
- The frequency, dependencies and timing options of the various auctions and
- The pros and cons of a separation of upward and downward aFRR sourcing (where also other approaches pursuing the same objective of limiting barriers to entry are discussed).

These different design elements are then combined into a sequence of implementation steps, as a starting point for a dialogue with the relevant stakeholders.

The context of this study is that, although the current design has proved to be efficient in the current context, the market situation is about to change, and facilitation of new market entries becomes a higher priority. In particular, the arrival of new entrants able to offer FCR services (e.g. stationary batteries, demand response, decentralized generation,…) is imminently expected and should release the Belgian reliance on CCGTs for FCR. ELIA's objective is to keep Belgian tariffs as low as possible, by optimizing sourcing costs in the short term, and by fostering competition in the longer term.

The study suggests that – as soon as a sufficient volume stemming from such new entrants is in place together with a certain level of competition – FCR products can be separated from the procurement of aFRR. Although from a theoretical perspective the expectation is that such a separation leads to suboptimal results, these short-term effects can be contained if aFRR is procured before a sufficiently liquid FCR market. The key benefit of such a separation appears to be that FCR procurement is no longer technically influenced by the selection of inevitable aFRR assets. It is also a pre-condition to be able to source all primary reserves via a single regional FCR procurement scheme, which is a clear long-term objective for ELIA (expected to reduce FCR procurement costs by 1.48 m€/year). This target only becomes reachable upon further new FCR market entry, up to a point where competition on the R1-200mHz product for the part of the FCR that has to be sourced locally is of adequate level and is full non-dependent on the CCGT technology. Note that very recent market developments show already valuable improvements in this direction.

To be in line with Article 32.3 of the Guideline on Electricity Balancing [1], upward and downward aFRR regulation should also be procured separately, unless an exemption is required. The entry of new technologies in aFRR market are expected to happen slower than for FCR, as there are other obstacles to market entry (e.g. merit order activation, R2-non-CIPU, …) which need to be resolved beforehand. Separating the procurement of upward and downward aFRR products is therefore unlikely to provide the expected benefits in the mid-term. On the contrary, it could lead to significant cost increase due to the fact that fixed spinning costs of inevitable assets would no longer be easily apportioned over the two products. Instead, the report proposes to request a temporary exemption to the application of Article 32.3, and to consider an interim solution where upward and downward secondary reserve procurement remains combined, but are complemented with additional mitigation measures to limit possible barriers to entry. Such measures – which consist of bidding obligations that limit the size and interdependency of R2-UP and R2-DOWN volumes (and possibly refined bid selection rules) – could be implemented during the interim period during which competition in FCR has emerged but is still pending on aFRR. Once this is achieved, upward and downward aFRR procurement can be fully separated.



A number of possible implementation steps have been proposed in order to collect the views of the stakeholders on the best possible approach to reach the target model composed by one regional FCR procurement and two local aFRR procurements (one for each direction). The above implementation steps have been identified according to the initial assumption that the FCR market will develop faster than the aFRR market. If this assumption does not hold, additional steps could be formed that are explained in chapter 4.2. These steps will be reconsidered later during 2018, together with an implementation roadmap that takes into account the more broadly expected evolutions of aFRR in Belgium, in order to have a consolidated approach that limits the number of adaptations and inconsistencies to the extent possible.

TABLE OF CONTENT

1. Introduction

Historically, spinning gas-fired thermal plants (i.e. Combined Cycle Gas Turbines, CCGTs) have been servicing fast spinning reserves such as Frequency Containment Reserves (i.e. FCR, also called primary reserve or R1) and automatic Frequency Restoration Reserves (aFRR, also called secondary reserve or R2) in Belgium. To alleviate specific concerns related to the dependency on a single technology, and to facilitate the entrance of new participants, ELIA has in the past designed specific R1 and R2 products which are procured via a single weekly process, with the aim to minimize the overall procurement costs of FCR and aFRR ancillary services.

Such a design has been particularly useful over the last years because gas-fired plants have been frequently out of the money (i.e. negative Clean Spark Spread), so that acquiring spinning reserves from such assets implies “spinning costs” (also referred to as “must-run costs”, these are the compensation needed to bring non-profitable assets to the minimum stable generation level Pmin). As CCGTs are always unavoidably selected to satisfy the needs of fast reserves, the current approach to combine primary and secondary reserves into a single weekly procurement mechanism, where sets of various R1 and R2 products are combined, specifically aims at ensuring that must-run costs are only counted once and shared over larger volumes.

The emergence of innovative technologies able to deliver primary and secondary regulation services at reasonable cost (i.e. Demand Side Management, stationary batteries and other emerging storage technologies, …) is an important game-changer, as it is expected that these new assets will significantly reduce the dependency on CCGTs and hence the total procurement costs of fast reserve services. However, because the current procurement mechanism in Belgium has been designed specifically to alleviate the domination of gas-fired thermal plants with fixed costs, it has become an open question whether – despite the efficiency of the approach from a short-term cost optimization perspective – it entails the entrance of new market players, and possibly leads to negative effects in the longer run. More generally, the current approach also implies a certain operational intricacy (e.g. understandability of the results, constraints on the way bids must be structured, separated local and regional procurement of primary reserves, …), and it is worth to investigate if such a complexity is still justified.

This study, which focuses on the separation of FCR and aFRR procurement as well as on the separate sourcing of upward and downward aFRR regulation, analyzes what are the conditions and consequences to implement these two changes, considering both short-term and long-term effects.

To commence with, the report describes in Chapter 2 the current weekly procurement mechanism for primary and secondary reserves (for FCR, this includes the specific local R1 products, the interactions with the regional FCR cooperation design, as well as the anticipated changes in the regional process).

From this starting point, the main design elements at stake are discussed in isolation in Chapter 3. These elements are:

- §3.1: The pros and cons of a separation of (local) FCR and aFRR products,
- §3.2: The possibility to source all FCR via the regional cooperation mechanism,
- §3.3: The frequency, dependencies and timing of the various auctions and
- §3.4: The pros and cons of a separation of upward and downward aFRR sourcing, as well as other approaches pursuing the same objective of limiting barriers to entry are analyzed.

Chapter 4 then combines these design elements into a set of meaningful implementation steps, in order to trigger a discussion on the preferred implementation strategy.

This document is made available for consultation. The objective is to gather views on the analysis of the conditions and consequences of an evolution of the procurement approach, and also on the proposed implementation plan. This may possibly lead to some adaptations of the implementation plan.

2. Current R1 & R2 procurement mechanisms

We describe in this chapter the current functioning of primary and secondary reserves, so as to remind the reader of the current context and the starting point against which the changes discussed later in this document are to be executed. For pragmatic reasons, the changes within the FCR cooperation which are foreseen during 2018 are also described and will be considered as implemented in our reference case.

2.1. Procurement of R1/FCR services

2.1.1. Local FCR procurement[1]

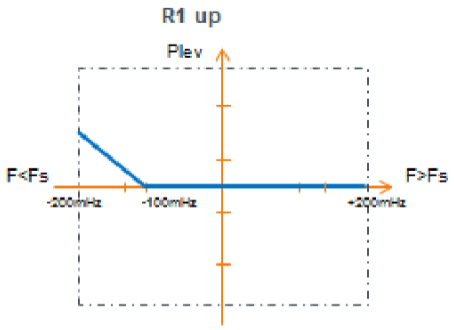
Rules organizing the FCR service (also called Primary reserve of R1) are defined at European level, as well as FCR volumes yearly allocated to each TSO, and can be found in published documents on ENTSO-E website. The key feature of FCR is to be able to react linearly to frequency deviation and to deploy the whole contracted volume within 30 seconds. Currently, the FCR volume that ELIA has to procure is 81 MW of standard R1-200mHz capacity, among which 30% (25MW) must mandatorily be sourced from the Belgian territory according to Article 163.2 of the Guideline on electricity transmission System Operation (SOGL) [2].

Over the years, in addition to the Primary control service defined by ENTSO-E in its operational handbook Policy 1, which comprises one single R1-200mHz symmetric product[2], Elia has developed three specific R1 service types to increase competition and market liquidity

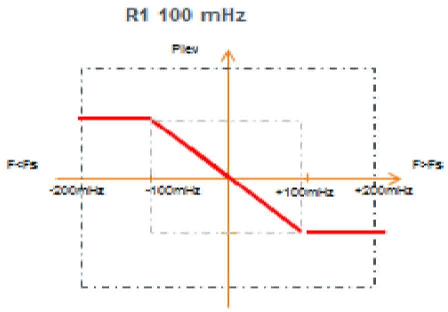
- 2 asymmetrical products, “R1-down” and “R1-up”, for which the supplier needs to react to any frequency deviation bigger than 100 mHz (separated for the positive and negative deviations) – from nominal frequency 50 Hz – as illustrated below:

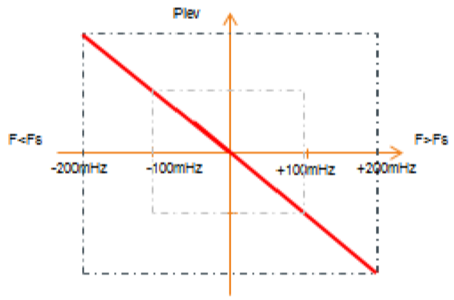
[1] Sources [10] & [8]

[2] R1-200mHz products deploy reserve proportionally to the frequency deviations in the range [49.8Hz, 50.2Hz].



- 2 symmetrical products, R1-100mHz (reaction between -100mHz and +100mHz) and R1-200mHz (reaction between -200mHz and +200mHz, i.e. the standard symmetric product of ENTSO-E), for which the supplier needs to react to any frequency deviation from nominal frequency (50 Hz), as illustrated below:





The combination of the first 3 services (R1-up, R1-down and R1-100mHz) gives Elia an equivalent effect to the R1-200mHz service as defined by ENTSO-E. The rationale of the introduction of these products has been to increase liquidity. As this is an important aspect of the discussion being held in this study, let us explore more in depth the reasoning held to create such local products.

While R1-200mHz is the standard required product as defined by ENTSO-E, frequency deviations occur for the vast majority in the [49.9 Hz, 50.1 Hz] range. CCGT production units, because they can deliver very quickly and frequently fast response flexibility, are currently the only large assets in Belgium performing well on this frequency deviation range. For larger frequency deviations (i.e. more than 100mHz), other existing assets are able to provide an adequate service, especially given the low occurrence of such larger deviations. For example, demand side management in industrial processes can, as long as it is fairly infrequent, reduce load to provide upward regulation, while nuclear reactors or smaller generators (typically co-generation units) can mechanically reduce their output and provide downwards regulation, as long as such cases are not frequent or lasting too long.

The approach of splitting the standard FCR product R-200mHz into smaller pieces has therefore been used to address a genuine liquidity issue on the Belgian market: as there is a limited number of CCGTs available in Belgium, and as these are operated by an even more limited number of market players, separating the R1-200mHz into a combination of three less demanding products enables to actually procure only half of the requested volumes from these most flexible assets, while the remainder can be provided by a larger plate of participants[3]. Consequently, total R1 procurement costs – especially in period of high spinning costs due to negative clean spark spreads – have been reduced with this approach.

Importantly, the local FCR procurement is combined with the local aFRR procurement. Separation of the local FCR and aFRR procurement processes is precisely one of the points being studied in this report. We refer the reader to section §2.3 where the combined R1/R2 procurement mechanism is described.

2.1.2. Combination of local and regional procurement[4]

Since August 2016, Elia is a member of the FCR cooperation where it participates in a common procurement of FCR with 5 other countries (Austria, France, Germany, Netherlands and Switzerland)[5].

Elia is procuring part of the FCR volume in a national auction (see §2.3) and part via the FCR cooperation (see §2.1.3), both on a weekly basis. The fraction that ELIA sources on a national auction corresponds to at least the volume that must mandatorily be procured from assets on the national territory (i.e. 30%) as this is where the reliance on CCGTs is problematic. For the remainder, the FCR cooperation offers a reliable and stable procurement scheme where reserves are exported or imported across the involved countries based on their economic efficiency.

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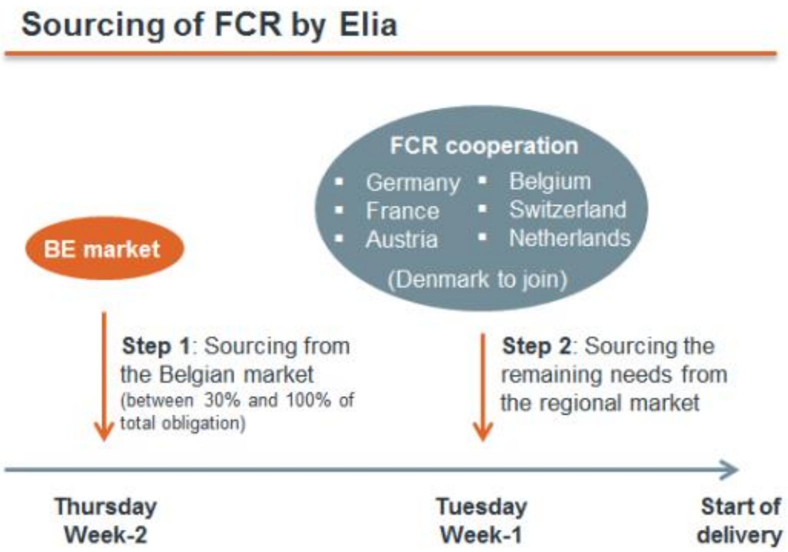
[3] e.g. a requirement of 26 MW of R1-200mHz can for example be composed by 13 MW of R1 100 mHz, 13 MW of R1 up and 13 MW of R1 down. If there exist more assets able to provide these two latter products, then the volume reserved on a CCGT is limited to 13 MW (while it would have been 26 MW without the existence of asymmetric products)

[4] Sources [3] & [9]

[5] Denmark is also expected to join the FCR cooperation in the near future.

The FCR local procurement takes place on the penultimate week before delivery week, on Thursday. The FCR regional procurement happens on the Tuesday of the week that precedes the delivery. In this latter, only the standard R1-200mHz product is procured (unlike in the local procurement where 4 different products are possible – see §2.1.1)



To apportion the volumes between local and regional processes, ELIA adds in each local procurement auction of FCR a "virtual regional divisible offer" corresponding to the volume that can be procured on the regional platform, at the average price of the last regional auction. This volume accounts for 70% of the local FCR need, so as to guarantee that at least 30% of the reserves are acquired locally (to ensure geographical repartition of the reserves as required by the SOGL – see Annex VI in [2]). The volume to acquire from the regional platform can therefore vary from 0% to 70 % of the total Belgian FCR need and is determined by ELIA following economic optimization between local offers and such a "virtual regional offer".

2.1.3. Regional FCR procurement[6]

The regional auctioning mechanism is based on a so-called "Common Merit Order List" (CMOL), where the offers for R1-200mHz standard products from all participating countries are collected and ranked according to their merit order (i.e. with the cheapest

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[6] Source [8]

offer first and the most expensive offer last). The general principle is that the FCR (price-taking) needs of all participating TSOs are filled by this CMOL.

The approach is complemented by import and export constraints, which enable – in accordance with applicable rules (i.e. 30% limitation of Annex VI in [2]) – to spread FCR resources over the synchronous area, limit impact on cross-border transmission margins, and are necessary in case of a system split (i.e. a desynchronization of the continental grid). Such import/export limitations supersede the merit order principle, so that offers are accepted in increasing price order, but subject to these constraints.

Within the FCR cooperation, Belgium and The Netherlands[7] have a mechanism to procure locally part of their FCR obligation[8]; all other participating TSOs source the entirety of their FCR needs via the cross-border mechanism. The above description therefore describes the procurement mechanism applicable to Austria, France, Germany, and Switzerland.

The justification of the combination of local and regional procurement in Belgium – which is well understood and accepted by the TSOs and NRAs of the FCR cooperation – lies on the need to accommodate local reliance on CCGTs, which is done via a local R1 procurement comprising various products and paired with R2 procurement (further explanation in chapter 2.3.

The remuneration of primary control service consists only in a remuneration for the contracted capacity and is based on a "paid-as-bid" principle[9]. In most countries (including Belgium), no remuneration is applied for primary reserve activated energy, whether for symmetrical or asymmetrical products. The cost of the activated energy needs in this case to be factored in the reservation price.

2.2. Procurement of R2/aFRR services[10]

aFRR service is divided into upward and downward reserves, often referred to as R2-UP and R2-DOWN, so that offers can be proposed for each side separately. Bidders of

[7] Netherlands will probably abolish the local auctions in 2018

[8] For Belgium, this is directly linked to the historically low level of liquidity and the consequent concept of having specific asymmetrical products and a combined auction for FCR and aFRR.

[9] See however §2.4 where the paid-as-cleared principle is expected to be implemented during 2019.

[10] Sources [10] & [3]

R2 can however link[11] their upward and downward offers to offer the full aFRR spectrum at once. This is notably useful in case of (large) fixed-costs that thereby can be shared over a larger volume. In other words, aFRR is procured via a combination of symmetrical and asymmetrical products.

One of the discussion points studied in this paper is specifically whether such a hybrid model should be kept, or whether only asymmetrical products should be procured (i.e. remove the possibility to combine R2-UP and R2-DOWN offers, by separating the procurement processes of each product).

The remuneration of secondary control service consists in the remuneration of reservation of the contracted secondary control power, complemented with a payment for the activated energy. Remuneration for secondary reserve services and activated energy are both based on the “paid-as-bid” principle (by opposition of a “paid-as-cleared approach” – see §6.2.5 in [3]).

As said, the Belgian aFRR procurement is combined with the local FCR procurement, which is the other point being studied in this document. We refer the reader to the next section where the current combined R1/R2 procurement mechanism is described.

2.3. Combined local R1/R2 procurement in STAR[12]

Since 2014, short term procurement (i.e. weekly in this case) was introduced for primary and secondary reserves. Short Term Auctioning of Reserves are performed in Belgium via the STAR platform.

Holding a single auction for R1/R2 enables to offer FCR & aFRR services – i.e. the four different R1 products, R2-up, R2-down – via several combinations of mutually exclusive linked bids, and thereby allows division of fixed costs – if any – over bigger volumes. It also prevents that fixed costs are factored-in multiple times in distinct offers. The rationale for this approach is that, historically, primary and secondary reserves have been serviced by a limited number of gas-fired thermal plants, which are frequently out of the money and thereby require the payment of so-called must-run costs to be able to deliver ancillary services. Providers of primary and secondary reserve services thus can bid

[11] In case R2-UP and R2-DOWN are linked, the acceptance of one order implies the acceptance of the other

[12] Source [4]

multiple mutually exclusive sets of linked bids that can be divisible or indivisible, different for incremental or decremental regulation, as well as for peak and off-peak periods[13].

The STAR algorithm has a goal to achieve a minimal total reservation procurement cost, while ensuring that at least the minimum requested volumes for R1 and R2 are satisfied, and while respecting the constraints specific to each (set of) offer(s) received. Given the combinatorial complexity and hence the large number of possible combinations between all bids, an optimization algorithm is used which evaluates all possible combinations in an automated manner. The selected solver is a mixed-integer linear programming where the total reservation procurement costs (in euros) is minimized, subject to problem-specific constraints. For R1/R2, these constraints are:

- Respecting the different R1-products and their characteristics so that sufficient R1 volumes are retained to have a compliant overall reaction across the required frequency distribution spectrum i.e. [-200mHz, +200mHz].
- Linked offers for multiple products are of 'all-or-nothing' type: in case a certain offer part is selected (respectively rejected), all volumes for the different offered products in this bid must be selected (resp. rejected) and not just one product of choice.
- One or more volumes offered via linked offers can be divisible or indivisible. If the volume is given to be indivisible, this means either the entire volume should be taken or none at all.
- The final selected offers and hence volumes must cover at least the minimum volume pursued for both R1 & R2 products in each period.

Note that consequently, it is possible that the volumes of R1 or R2 selected offers exceeds the minimal requested volumes in case such an over-procurement leads to a lower total reservation cost.

In order to guarantee the existence and quality of a solution to this optimization problem, Elia should dispose of not only sufficient volumes but also of as many offers as possible, on a wide variety of individual products and possible product combinations. Not only will this improve Elia's chances to find an optimal solution and possibly avoid iterations

[13] Since this is not particularly relevant for the discussion at stake, and because participants rarely distinguish bids for peak and off-peak periods, this notion is not further taken into account in this document.

and renegotiations, it will also increase the reserve providers' chances of being selected for a certain capacity bid.

To enforce the submission of a wide variety of combinations (and hence to mitigate the effects of links and indivisibilities - see §3.1.3), capacity offers are subject to so-called "bidding obligations". Such obligations impose to bidders offering large volumes to also submit smaller bids and read as follows:

- For each product category, a threshold is defined[14]. Offering volumes above such thresholds is only possible if supplementary bids with smaller volumes are also offered, so that there must exist at least one offer with a volume difference smaller than or equal to the threshold.
- To offer above the thresholds of several products (i.e. linked bids), bidding obligations must be applied to each product distinctively, that is, for unchanged volumes on the other product(s). Linked bids with large volumes on multiple products therefore imply a high number of bids. To contain this number, bidding obligations do not apply distinctively for R2-UP and R2-DOWN, which can thus have the same volumes in each linked bid (i.e. are considered as a symmetric product). We will come back to this later in §3.4.4.
- When comparing each pair of bids, the total cost (i.e. unit price x volume) of the bid with the smallest volume should never exceed the total cost of the other. In other words, prices must increase monotonously with volumes.
- The detailed bidding obligations description (including examples) can be found in [4].

As explained, such obligations facilitate convergence of the selection algorithm and reduces the chances of manipulation, in a context of historical low level of liquidity in Belgium.

2.4. Anticipated changes in the regional FCR cooperation

Multiple changes are currently being prepared at the regional FCR cooperation level. This section describes such evolutions, so as to take the ones that will be implemented shortly into account for our discussion afterwards.

[14] i.e. 14 MW for R1-200mHz; 6 MW for R1-100mHz, R1-down & R1-up; 24 MW for any R2 product

For what concerns the regional procurement of FCR, the TSOs of the FCR cooperation have launched early 2017 a survey to understand the stakeholders' views and needs of evolution. The key outcome has been summarized in a consultation report [5]. Based on these conclusions, a set of concrete proposals has been established [6] and has been lately under formal consultation according to the Guideline on Electricity Balancing. From these two documents, and assuming a favorable support from stakeholders on this later one, the following relevant evolutions within the FCR cooperation are expected to be in place the near future:

1. Auction frequency changed from weekly to daily (all days) auctions
    - The target (Q2-2020) is to have a gate closure time at 08:00 on D-1 with 4-hour products.
2. An intermediary step (Q4-2018) will be to have a gate closure time at 15:00 D-2 and working days only with daily products. Product duration changed from weekly to exclusively 4-hour products (Q2-2020), with an intermediary period where 24-hour products are procured on a daily basis.
3. Indivisible bids allowed. A cost optimization algorithm is used; over-procurements are authorized; no divisible bid can be paradoxically rejected (no rejection under the marginal price for divisible bids). The indivisible bids cannot exceed 25 MW (Q2-2019).
4. TSO-BSP settlement will become paid-as-cleared (currently paid-as-bid), i.e. FCR reservations are remunerated under marginal pricing scheme (Q2-2019).

The above-mentioned consultations also confirm that some elements will not be changed (at least not in the short time and/or with any significant priority):

1. No linked bids nor multiple products will be implemented.
2. No asymmetric products will be developed.
3. No possibility to transfer capacity obligations cross-border.
4. No exclusive bids will be developed.
5. The minimum bid size will remain 1 MW.

These changes – possibly with some adaptations – are likely to be implemented in due time (however subject to positive feedback from the consultation [6] and approval of the relevant regulators), To simplify the discussion below, these changes are therefore assumed to be implemented in due time in the remainder of this document. In particular, **daily regional FCR auction frequency is assumed to be in place by end of 2018.**

Except those specifically discussed in this document, no important changes are currently being planned on the local FCR procurement rules. Significant changes to the aFRR product design and procurement rules are currently being prepared – as part of a more fundamental R2-redesign process – and will be discussed and consulted on later in 2018.

3. Discussion on individual design elements

Now that we have described the existing R1 & R2 procurement mechanisms, as well as the anticipated mid-term changes thereon, let us analyze in isolation the various design elements at stake in the discussion. The following chapter will analyze how these elements can be combined into meaningful implementation scenarios.

3.1. Separation of FCR and aFRR

As explained in Chapter 2, (local) FCR & aFRR are currently procured jointly. Splitting the local procurement of primary and secondary reserves, i.e. procuring both services via different auctions, is the basis of the discussion in this report.

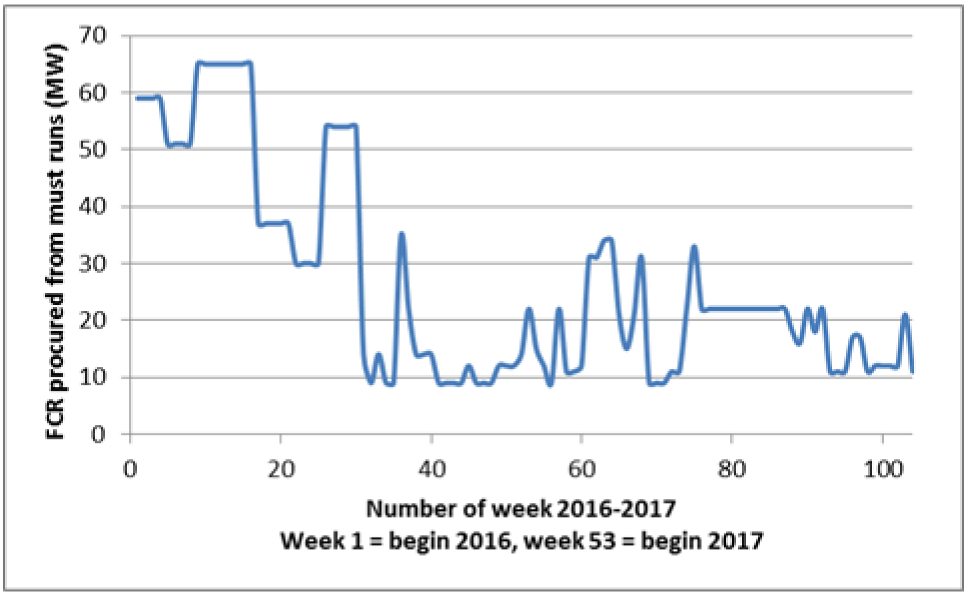
3.1.1. Drivers for splitting the procurement between FCR and aFRR

When discussing a potential separation of the procurement between FCR and aFRR, it is important to look at certain evolutions in the market that could be drivers for change.

Evolution of the dependence on a single technology with fixed costs (CCGTs)

Historically, the Belgian FCR and aFRR markets have not been very competitive and have been dependent of one technology: CCGT units have been indispensable in order to secure the required reserves. This means that even during periods where the spot prices are below the marginal cost of these units (i.e. out of the money units), they are still needed for reserve provision. Normally when a unit is out of the money, it is not selected for reserve provision because it needs to cover its costs to run a minimal stable generation Pmin (i.e. must-run costs) via the reserve bids, which becomes very expensive. As a result, in a market where different technologies compete, these bids would not be accepted. However, due to the absence of such alternatives in Belgium, CCGTs have to remain spinning only to provide reserves and therefore, their must-run costs must be compensated via these reserves.

Nevertheless, the dependence on CCGTs has improved over the past years (notably via the products discussed in this document, such as asymmetric R1 products and regional FCR cooperation). This is one of the reasons why the combined procurement FCR/aFRR needs to be reassessed. Improvements are more significant for the case of FCR, where nowadays most of the times only one CCGT is needed, as can be deducted from the graph below. From this graph, it can be seen that the FCR market gets more and more independent from CCGTs (on the contrary to the aFRR market which is still highly dependent on these assets).



However, it could be expected in a relatively distant future that the existing and possible new CCGTs would be more often in the money. As consequence, there would be no must-run costs to cover when these units participate to the ancillary service market and the main issue of dependence to the CCGTs described in this paragraph would vanish. The certainty of this development is however too low and ELIA considers useful to investigate alternative market design solutions.

Expected new entrants

Another driver to reassess the joint procurement of FCR/aFRR is the arrival of new technologies that can provide reserves. Up to now, ELIA sees that a big part of the Belgian FCR demand is provided by decentralized production units or load. On top of this, the battery technology has been advancing rapidly and significant amount of FCR is expected to be provided by this new technology. For example, in Germany there was already several hundreds of MW of FCR offered by batteries at the end of 2017. Looking at the current evolutions in Europe, Elia believes that batteries will get a substantial amount of the FCR market in Belgium within the next years.

3.1.2. Short-term optimality

The key advantage of a joint procurement of FCR and aFRR services as currently in place is that it enables to perform a full cost optimization. This is true in general – from a theoretical perspective, a joint optimization can only lead to (same or) better results – and in our particular case – it can be proven that it facilitates the apportioning of spinning costs over R1 & R2 volumes.

Let us illustrate this by a fictive and simplified example:

- Suppose there are only two bidders, both being able to provide FCR & aFRR services.
- Bidder A has a fixed cost to operate of 300 €, and a variable reservation cost (i.e. opportunity cost) of 25 €/MW for both FCR & aFRR.
- Bidder B has no fixed cost, but a higher reservation cost of 45€/MW.
- The demand for both FCR and aFRR are 10 MW each.

In case of combined auctions, the least cost sourcing solution consists of procuring both services from Bidder A, for a total cost of 800 € (300€ + 20 MW x 25€/MW), hence 40€/MW. In case of separate procurements, Bidder B will be selected at the first auction (for a total cost of 450 € = 10 MW x 45 €/MW), because – assuming Bidder A is fully risk averse – he would have to include all its fixed and variable costs at the first auction, and would thus submit a total cost of 550 € (300 € + 10 MW x 25 €/MW) hence 55/MW. Since Bidder A is rejected at the first auction, he will again bid a total cost of 550 € on the latter auction (i.e. his fixed costs have not been covered yet), and once again be outbid by Bidder B. The total sourcing cost in case of separate auctions would thus be 900 €. This is because a combined optimization procures both services at once and enables to apportion the fixed cost over a larger volume, which is in this example necessary to make Bidder A competitive.

Obviously, Bidder A may anticipate its overall lower costs on both auctions, and thus apportion its fixed costs over the two mechanisms. However, this could imply a financial risk, and ultimately – in one way or another – a higher sourcing cost[15].

Note that the possibility to combine offers for both FCR and aFRR regulation is fully optional, so that assets only able, efficient or willing to participate to some services can do so. Hence, as a principle, the total sourcing cost for both services is optimized and efficient with the current approach.

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[15] However, as will be discussed later (see §3.3.3), if Bidder A is the only asset capable to offer aFRR, and if aFRR procurement happens before FCR, then the total procurement cost for both services is in theory the same as for a combined procurement

We conclude from this example that – in the short run – a combined optimization is in theory the most efficient approach as it enables to always select the cheapest overall solutions, especially in the presence of fixed costs. This observation is nevertheless only valid in the short-term, as it does not take into account longer terms effects. This is discussed in the next sub-section.

3.1.3. Barriers to entry

Currently, CCGTs are the main providers of both FCR & aFRR services. The emergence of new competitive technologies (Distributed Energy Resources, stationary batteries, demand response) is a potential game changer, although the expectations in terms of their ability to offer FCR and aFRR services differs in terms of timing. The current levels of liquidity in the FCR and aFRR indeed yet remain rather limited, but the perspective of substantial improvements on FCR in the foreseeable future is seriously envisaged, unlike for aFRR where the expectation is that market development will take longer.

The discussion on splitting FCR & aFRR procurements strongly relates to the question on whether the current design impedes the entrance of new players not able to offer the full product spectrum and/or for whom management of fixed costs is a less important concern (but who have other categories of constraints such as rebound and maximum duration limits).

With the current STAR design, a bidder can submit “indivisible linked volumes” for all FCR and aFRR products (see §2.3). This enables to price each service depending on volumes accepted for other services. Mechanically, the STAR algorithm will in practice only consider the total cost of the bid, for the sum of all proposed services (hence irrespective of how these costs have been apportioned to the different services by the bidder), because the cost of accepting one product of choice cannot be exploited. Although this appears as a meaningful principle, the problem is that – in many occasions – some CCGTs are “inevitable” on some services.

In particular, CCGTs are expected to remain necessary to fulfil the aFRR requirements at least in the near future. Accepting a CCGT bid to satisfy the secondary reserve requirements thus implies to also accept the linked FCR volumes (in case of linked bids). This creates a barrier for other market players who only offer FCR: their bids are not selected because another bid – potentially less competitive on primary reserves – must be selected to satisfy the secondary reserve needs.

This issue has been partially addressed by so-called “bidding obligations” (see §2.3), which impose bidders to slice (combination of) indivisible volumes into smaller parts, so that multiple combinations of volumes must be offered.

Although such bidding obligations mitigate the problem, it remains problematic to select indivisible offers based on their total cost – hence not directly on the relative price of each individual service. This indeed largely complicates the bidding strategy: traditional players have to support the burden caused by bidding obligations (i.e. additional complexity caused by multiple bids) and new entrants have no guarantee to be selected despite very attractive prices. The awarding method might therefore be perceived as non-transparent because it is hard to predict if a bid will be selected (since a bid cheaper than the average price is not necessarily retained in the minimal cost solution). Transparency is a key element to foster competition.

Splitting the FCR/aFRR procurement processes increases the chances of new entrants with competitive bids on specific services to be retained: by fully separating the procurements, the fact that some assets are inevitable on one side does not mechanically impact the procurement on the other side. Such a more transparent and flexible market design facilitates market entry and is likely to decrease sourcing costs in the longer run.

Therefore a separation of primary and secondary control reserves procurements has the perspective to alleviate barriers to entry and as a result increase liquidity in the market, with the likely consequence of reducing ELIA’s procurement costs in the longer run. Arguably, if longer-term efficiency is the ultimate target, the possible deterioration of the short-term sourcing costs (as explained in §3.1.2) has to be considered as an acceptable investment to reach this target, as long as this cost increase is contained and temporary.

Additionally, given the long-term target of ELIA to source the entirety of its FCR needs via the regional FCR cooperation processes (see below in §3.2), procurement of FCR and aFRR reserves will be decoupled in any case at some point in time.

Further, since newcomers in FCR are expected to operate their service under genuinely lower costs than traditional thermal plants (which is the reason why they enter the market), the co-optimization of R1 & R2 should in principle lose its reason to exist: new FCR players should in general outbid traditional assets with fixed costs (otherwise, they would not enter the market).

Finally, separating FCR from aFRR is an indirect consequence of article 32.3 of the Guideline on Electricity Balancing [1].

Conclusively, the separation of FCR and aFRR procurement appears as a desirable evolution.

3.1.4. Conditions to split FCR & aFRR

Such a FCR/aFRR separation will however only reveal its full value if the arrival of such new entrants is effective, which is not the case yet but is expected to happen relatively soon for FCR (the arrival of new technologies being expected in the next months and years based on the public announcement made and, on the developments occurring in other countries). In other words, splitting into two distinct schemes the R1 and R2 procurement too early might significantly inflate short-term procurement costs without delivering the expected benefits, if only a very limited volume of newcomers is available.

Note that the existence of two venues to procure FCR – first a local one (with more products but which outputs less transparent prices), followed by a regional one (which is more transparent but only offers one single product and is currently also typically less rewarding), offers to new entrants a mitigation to the concerns at stake. Indeed, new arrivers able to serve FCR in any case have the possibility to offer their services via the regional FCR cooperation if they are not accepted in the local scheme. This means that the arrival of new players remains possible in the current scheme.

ELIA thus suggests waiting for the availability of a sufficient volume of these new assets before separating the local FCR procurement from aFRR. This is indeed a way to resolve the "chicken & egg problem", which is: a separate FCR market only becomes efficient with a certain level of liquidity, while the combined FCR/aFRR is not particularly attractive to new entrants and may limit positive liquidity evolutions. The fact that there exists an alternative regional FCR venue, already considered as fairly liquid and competitive, addresses this issue as it allows to wait for the necessary local FCR volumes to be available before performing the split.

Setting strict quantitative indicators (e.g. available new FCR volumes, number of players involved, …) to trigger the separation appears very challenging at this stage. Rather, ELIA suggests to monitor the offered volumes by new entrants as well as the level of competition to source the part of the FCR need that has to been delivered locally, and to regularly reevaluate the situation. **Once true competition has emerged in FCR and CCGTs are no longer inevitable, the conditions to make the split will be met and the implementation of the changes can be started. FCR will then no longer be procured together with aFRR and new entrants will become able to compete freely and in a**

very transparent way with the historical assets for both local and cross-border provision.

3.2. All FCR procured regionally

The current mechanism – although it mitigates the concern at stake – nevertheless suffers from some operational and conceptual drawbacks. Sourcing one need via two different auctions undeniably complicates the operational processes. The apportioning method – where a "virtual bid" is placed in the local scheme at the price of the last regional auction – also isn't totally optimal from a conceptual perspective[16]. Finally, ELIA is genuinely convinced of the benefits of European (or at least regional) integrated market platforms, that fosters competition. The benefits of sourcing all R1 needs via in the regional FCR cooperation therefore appear as evident to ELIA.

Despite this position – which is clearly supported by the other TSOs in the FCR cooperation (who already do or will do so) – it however only becomes possible if a decent local market – i.e. capable to serve the minimal volumes of R1-200mHz that needs to be sourced nationally by multiple actors/assets and having enough competition – has emerged.

The current approach for FCR procurement, where at least 30% of Belgian FCR needs (i.e. the minimal volume that needs to be sourced nationally) are procured via a local process (STAR), and the remainder is procured via the regional cooperation has been designed because of two objectives:

(1) enable to combine the procurement of FCR and aFRR and apportion must-run costs of "inevitable CCGTs" over larger volumes, and

(2) enable 4 different FCR products (i.e. R1-100mHz, R1-UP and R1-DOWN on top of the standard R1-200mHz, see §2.1.1) with the objective to reduce the reliance on CCGTs by introducing alternative products which are suitable to alternative technologies.

Point (1) has already been discussed at length in the previous section. Concerning point (2), in case of separation of FCR and aFRR procurement processes, and since only the standard R1-200mHz product is expected to be available in a foreseeable future in the

[16] In effect the local offers are compared against the prices of the regional auction for a delivery two weeks earlier, although in practice the regional prices are quite stable

regional cooperation, the existence of a local R1-only procurement process may remain justified solely by the need of these alternative products.

We discussed earlier (§3.1.4) the conditions to split FCR and aFRR, driven by the arrival of newcomers in the FCR segment. We also explained (§2.1.1) that the introduction of asymmetric local products in Belgium has been due to a willingness to reduce the dependency on CCGT units. If a split of primary and secondary reservations only occurs once sufficient additional available volume has arrived in the FCR segment, then the need for such local products – which is mainly due to the reliance on CCGTs – also reduces at least to some extent. **ELIA thus sees the conditions to abandon local products at least as strict as the conditions for a FCR/aFRR split.** One of the stakes at hand is therefore whether the FCR/aFRR split should be concomitant with a full merge with the Regional FCR procurement, or whether an interim period is required during which part of FCR is still procured locally – with a combination of symmetric and asymmetric products – but no longer together with aFRR. This is further discussed in §4.2.

Note that the disappearance of asymmetrical R1 products will inevitably be seen as step backward for some of the current providers of such services. Combining different blocks to satisfy a standardized need is however a typical aggregation function. Until now, ELIA has executed this function for local FCR (by combining R1-100mHz, R1-UP and R1-DOWN products to replicate the R1-200mHz standard need) because of a specific context. In principle, the aggregation role should/could however return to the market once reliance on CCGTs is no longer a key concern[17]. ELIA estimates that – once the liquidity in the local FCR segment for the 200 mHz product has reached a decent level – the absence of local specific products (i.e. R1-UP, R1-DOWN, R1-100Mhz) could be compensated by the benefits of a procurement of all Belgian FCR needs via the FCR regional cooperation if the market manages to organize aggregation of sub-products by itself.

The key benefits when sourcing all FCR regionally are:

- Optimal apportioning of local and cross-border procured volume,
- More stable prices (hence more reliable investment signals),
- Level playing field for all regional players,

[17] In particular, ELIA excludes as a principle the possibility to collect asymmetric orders prior to the FCR cooperation process, and to therewith create and submit standard synthetic R1-200mHz offers to the regional process. This role belongs to aggregators and not to TSOs.

- Design less prone to strategic bidding,
- Simplified operational processes (both on TSO's & market's sides, especially in case of increased auction frequency),
- In line with the integration of the balancing markets which is the main goal of the Guideline on Electricity Balancing (although the integration of balancing capacity markets is not mandatory).

Conclusively, the question of whether – in case of a separation of local FCR and aFRR procurement – all R1 needs should be immediately procured solely via the FCR Regional Cooperation is intrinsically linked to level of competition for the local part of the R1 needs at that time.

Importantly, the last weeks preceding the publication of this final study have shown significant improvements in the Belgian FCR competitivity, with larger volumes of R1-200mHz being executed locally (which makes the need of asymmetrical R1 products less evident – although they still participate to the competition in FCR). Such a development – in case it becomes a confirmed preamble of a sustained trend – is a clear step to support an efficient separation of R1 and R2 procurements, as well as the full sourcing of FCR via the regional cooperation.

Let us now derive a ballpark estimation of the possible FCR sourcing cost reductions that can be expected. Suppose that enough volume and competition is in the Belgian FCR market. The prices in the local auction would naturally converge with those in the FCR Cooperation. This is because, in case of lower prices in Belgium, BSPs will offer their bids to the regional market to get better profit (also benefiting from the future marginal pricing in FCR Cooperation). As a result, Elia would buy even the 30% that is needed locally from the FCR Cooperation.

Considering the above assumption, a comparison can be made between sourcing all the FCR from the FCR Cooperation and the existing case with the partial sourcing via the local auctions. For this we are going to use the data of 2017 and see what would have happened if there was enough competition and Elia had sourced all the FCR from the regional market. In practice, we will compare the actual costs of 2017 with a multiplication of the total FCR demand of Elia (68MW) with the price of FCR Cooperation for each week.

Actual FCR costs 2017	Costs if full sourcing from FCR Cooperation	Gain if full sourcing from FCR Cooperation
10.15 m€/year	**8.67 m€/year**	**1.48 m€/year**

3.3. Auction frequency and dependencies

3.3.1. Time dependencies against day-ahead market

There is more than a preference – in whatever setup – to procure balancing services such as FCR and aFRR prior to the day-ahead market. This is indeed necessary to secure the availability of the desired resources, who can then lean on the day-ahead market to offer any spare capacity left after the procurement of all ancillary services.

Asset owners willing to provide ancillary services will in principle contemplate the day-ahead market as a benchmark to set their Ancillary Services bid prices. This is equally true for the asset owners who have already committed their energy via longer-term contracts: setting the reserves procurement schemes prior to the day-ahead market allows them to "rebuy" the committed energy from the exchange, and thereby free-up capacity to deliver the service. In order to secure the provision of reserves and by this the operation of the power system, **ELIA only exclusively considers procuring its balancing services prior to D-1 12:00.**

3.3.2. Short-term procurement "to the extent possible"

The Guideline on Electricity Balancing (Art. 32.2(b) in [1]) states that balancing capacity procurement process "shall be performed on a short-term basis to the extent possible", which suggests that daily procurement is the target[18]. However, the sentence is complemented by "and where economically efficient", which provides room for interpretation.

More generally, it seems to be commonly accepted that shorter procurement cycles – coupled with products of shorter duration – reduce the underlying business risks. This is true for small players with varying flex resources (who have a better visibility on their

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[18] This could be enforced more strictly by the revised European electricity regulation, part of the Clean Energy Package for All Europeans which is currently negotiated.

flexibility on D-1/D-2 than on W-1/W-2) and for larger traditional players (e.g. weekly products do not provide the necessary granularity to accommodate large variations of the Clean Spark Spread over a week, on top of the increased difficulty to accurately estimate these spreads well in advance). Consequently, daily procurement of FCR or aFRR services has the prospect to reduce the sourcing cost of these products.

On the other hand, a more frequent procurement scheme mechanically implies additional operational burden on both TSOs' and market parties' sides. In addition, in case of severe liquidity issues, having a procurement more ahead of real time might be preferred by the TSO, who then has more time to react, negotiate and ensure that the service is fully available, and at reasonable price.

Generally speaking, ELIA strives to implement as short term as possible mechanisms for balancing services. Starting from the current situation (i.e. weekly procurements of FCR & aFRR), the change towards daily processes should however be executed gradually and with caution, by taking into account the liquidity levels as well as the interactions of such changes with other planned design changes.

We also remind that the TSOs of the FCR cooperation, following the above reasoning and comforted by the ad hoc consultations ([5] & [6]), decided to move to daily the regional FCR procurement by the end of 2018.

Note that the frequency of aFRR auctions are out of the scope of this study and will be discussed later during 2018 in a separate consultation addressing other R2 design modifications.

3.3.3. Time dependencies between FCR and aFRR

Let us now discuss – in case of a split between FCR and aFRR procurement processes – which one should occur first.

In Belgium, aFRR is clearly the scarcest service – currently exclusively satisfied by CCGTs – and the pace at which this market will develop is currently unknown and being investigated[19]. ELIA's reasoning is that the services with potentially the lowest liquidity and highest cost for society should be procured first. Because alternatives to CCGTs may take more time to arrive, ELIA considers that aFRR is the most critical service from a

[19] ELIA's "New aFRR design", which will be consulted upon later in 2018, specifically tries to improve this situation, notably by facilitating entrance of non-CIPU units.

cost/sourcing point of view. **Sourcing aFRR first has the clear advantage to ensure that the critical assets have not been previously committed to other services (i.e. FCR in this case), and is therefore the preference of ELIA independently from any other consideration**.

Such a sequence is also likely to mitigate the possible unfavorable short-term financial effects touched up in §3.1.2. Indeed, in practice, the must-run costs of inevitable CCGTs will have to be paid during aFRR reservation, so that any leftover capacity can then be put in competition with other FCR assets afterwards, leading to lower total sourcing costs. In addition, for a given total sourcing cost, there may be a preference that the prices are more attractive on aFRR (which is the case if all must-run costs are supported by aFRR) as this incentivizes entrance on this market.

Note that one might argue that this latter argument suffices to implement the separation of FCR and aFRR procurement without awaiting for further FCR market developments. This is however dangerous, as if none of the two markets is adequately competitive, the risk of overpaying for the services becomes significant (i.e. little competition in FCR would allow bids with already paid must-run costs to bid only slightly below other CCGTs not yet committed, in case CCGTs are still inevitable).

3.4. Exclusively asymmetrical aFRR procurement

So far, we have focused on the links between FCR and aFRR. Let us now concentrate solely on aFRR (under the implicit assumption that aFRR is procured separately from FCR).

In the current mechanism, upward aFRR regulation (also called R2-UP) and downward aFRR regulation (also called R2-DOWN) are the two asymmetrical products procured via the STAR mechanism (see §2.3). Importantly, the STAR approach allows to link the acceptance of volumes for regulation in both directions, which in effect allows to submit symmetrical aFRR products (i.e. where volumes in both directions are offered at once).

Article 32.3 of the Guideline on Electricity Balancing [1] **states that the procurement of upward and downward balancing capacity for the frequency restoration reserves shall be carried out separately.** Though, the guidelines also state that each TSO may request exemptions to this requirement under some conditions (notably a demonstration that such an exemption leads to higher economic efficiency).

This section discusses the rationales as well as the pros and cons of such a separation, as well as possible alternatives (which would require an exemption).

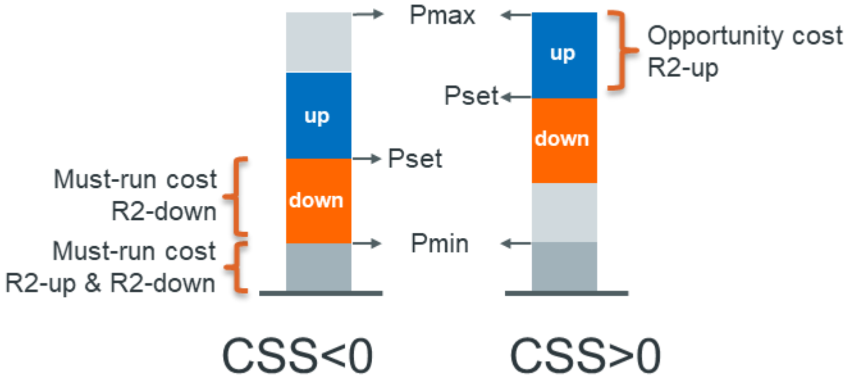
3.4.1. Short-term optimality

Thermal plants – CCGTs in particular – typically have asymmetric aFRR reservation costs. Let us distinguish the case where the Clean Spark Spread (CSS) is positive from the case where it is negative. For the sake of this theoretical exercise, the variability of the CSS over the delivery period and its impact on the pricing strategy have been neglected. The impacts of the offered volume on the efficiency change and the possible need for derating are also neglected.

By definition, *in the money* CCGTs (i.e. positive CSS) are expected to be fully committed on the bulk market. Being able to depart from this maximal output to be available for downward regulation R2-DOWN does not imply significant costs[20]. On the contrary, *in the money* CCGTs willing to offer R2-UP services will arbitrate between the profit of selling energy on the bulk market and reducing ex-ante their output to be able to be activated upward. R2-UP offered prices should thus replicate such loss of opportunity (i.e. CSS). R2-UP and R2-DOWN reserves can thus be offered separately (at a fairly modest cost for R2-DOWN, and at an opportunity CSS-related cost for R2-UP), so that a separation of both procurements does not lead to any evident concern.

The situation is however different in case of negative CSS. *Out of the money* CCGTs are by definition not running, hence unable to offer any aFRR service. In order to offer secondary regulation, the assets need to be running and will require a compensation for the loss of being spinning at its lowest stable generation set point (i.e. at Pmin). Spinning at this minimal level enables to offer upward regulation, while offering downward regulation requires an additional compensation to increase the output level above the minimal setpoint Pmin (and thereby become able to reduce output in case of activation).

[20] This is because the asset does not need to change its setpoint to offer this capability, and will be compensated by the remuneration on the activation in case this capability is activated.



The current STAR design, where offers for upward and downward services can be combined, allows optimizing short-term sourcing costs in case of negative CSS and apportions the must-run costs of CCGTs to both services.

For example, suppose a CCGT able/willing to offer 20MW of symmetrical R2 has a cost to spin at Pmin of 300 €, plus 15€/MW for an increased base power level. Its total compensation for a symmetrical product should be at least 600€ (300€ + 20MW x 15€/MW). In case of exclusively asymmetric products, the minimum price for 20 MW of R2-DOWN would also be the same 600€. Though, if R2-UP bids must be set fully independently and without knowledge of the results of the R2-DOWN auction, then a minimum price of 300€ to compensate the spinning cost at Pmin would appear logical. This latter cost for upward regulation sums up to the cost of downward regulation and gives a total offered cost of 900€ (to be compared with the 600 € of the combined approach). In other words, fully independent upward and downward procurement schemes may in the worst case imply that spinning costs are counted twice. We discuss in §3.4.3 the influence of the sequence of auctions for asymmetric products as a mitigation to this effect.

A separation of upward and downward procurement via exclusively asymmetric R2 products creates in this case a similar issue as the one explained in §3.1.2, that is, fixed costs are no longer apportioned between both services via the platform, and bidders thus have to apportion their fixed costs over the two products based on their best estimations. This inevitably implies a risk which will materialize in inflated short-term sourcing costs (which at best are modest, and at worst double counts the fixed spinning costs).

If such a separation takes place where the aFRR market is still fully dependent on CCGTs, it could result in significant sub-optimalities because the BSPs will have to take into account different possible market outcomes when allocating their must run costs to their bids. Fully risk averse bidders in particular will price their bids to ensure that must-run costs are compensated in case only the upward, only the downward or both volumes are accepted.

At this point, it is important to show the potential increase in market prices in a quantitative way in order to get a better view on the maximum risk associated. The assumption for the analysis is that in a worst case a BSP includes in both his bids the must run costs (calculated as below). Efficiency of assets and other technicalities of the assets are also neglected, and a unique efficiency is considered (irrespective of the output level). The analysis is done with the procurement data of 2017 following these steps:

1. Run the STAR solver with FCR demand at zero (this creates a modified base-case for aFRR free from the influence of FCR, and enables to identify the selected CCGTs),
2. Identify the minimum stable generation (Pmin) of each selected CCGT (this gives an approximation of the must-run volumes).
3. Multiply the Clean Spark Spread – if negative – of the corresponding week for which the bids were constructed with the Pmin.
4. Sum the results of the previous step to obtain an estimation of the upper bound of short-term cost increases.

Increase in R2 costs: actual value	Max increase in R2 costs: actual value
7.97m€	**22.92%**

It should be noted that this method does not take into account the bidding behavior of the BSPs and the forecasting they do for the CSS as it uses the real values that are known only ex-post to the BSPs. This adds some additional uncertainty to the results and the outcome could be even worse because the BSPs could use a higher value for the CSS to cover the risk coming from potential forecast errors.

Given the expectation that reliance on CCGTs for aFRR will not disappear in the short-term and that negative CSS situations will continue to occur, the current design seems suitable because a full separation of upward and downward regulation is very likely to have a negative impact on short-term sourcing costs. We discuss in the following paragraphs if such a change is nonetheless appealing in the longer-term by improving the attractiveness of the aFRR market for new entrants.

3.4.2. Barrier to entry

Market entry in aFRR is expected to happen slower than in FCR, notably because there are certain barriers that limit entry to aFRR at the moment (CIPU-only, weekly procurement, pro-rata activation). Arguably, the emergence of additional aFRR capacity is also likely to happen at different paces for upward and downward regulation, as both services can be provided by different classes of assets. Surely, in case numerous new assets with no or limited fixed spinning costs have entered aFRR, a separate procurement for both directions is no longer an issue: CCGTs are no longer inevitable, new entrants are supposedly more cost efficient than CCGTs and do not suffer from the same level of fixed costs to be apportioned to different services.

Let us therefore focus on the transitory period between now (full reliance on CCGTs) and the long-term situation (full competition on both upward and downward services). In case competition gradually emerges in one direction (say R2-DOWN), the key question is whether the current STAR design – which allows to link R2-UP and R2-DOWN indivisible bids – is detrimental to these new entrants.

Suppose that a new entrant is willing to offer R2-DOWN services, while CCGTs remain “inevitable” for R2-UP. In this case, similarly as for the link between FCR and aFRR discussed above, the fact to allow symmetric UP/DOWN products is probably detrimental to the new entrant. Indeed, even though the new entrant has a very competitive offer on R2-DOWN, the STAR algorithm might nevertheless select the more expensive R2-DOWN capacity of the CCGT that is linked to an inevitable R2-UP capacity. This is because the algorithm will in fact only consider the cost of the symmetrical product and will see no alternative than accepting it. **A fully separated procurement of R2-UP and R2-DOWN capacity alleviates this possible barrier to entry**. ELIA though is of the opinion that – at this moment – there are more significant barriers that impede market entrance, on which ELIA is putting all its focus. Separating R2-UP and R2-DOWN while the market is contractually closed to flexibility sources that may benefit from this feature, will create significant inefficiency without obvious benefits.

3.4.3. Sequence of asymmetric aFRR products

In case of a separation of R2-UP and R2-DOWN products, the following sequences can be contemplated:

1. R2-UP and R2-DOWN are procured simultaneously,
2. R2-DOWN is procured before R2-UP, or

3. R2-UP is procured before R2-DOWN.

The first option (procuring both services simultaneously without giving the opportunity for any link between them) is surely most problematic to address the concern of apportioning fixed spinning costs. A rational bidding behavior would in such a case be to include these costs in the bids of the two services, leading to non-economic sourcing costs in case both are accepted. This is because bidders will not know in which auction they will be accepted.

Following the reasoning held earlier (see §3.3.3), the scarcest service should be sourced first. Hypothetically, this is R2-UP, notably because the R2 non-CIPU pilot project [7] has recently shown that R2-DOWN capacity could become more quickly available. It can also be argued that, in case of negative CSS, auctioning firstly R2-DOWN would capture (almost) the entirety of the CCGTs spinning costs (i.e. the costs to run at Pmin plus the additional costs to run at the setpoint above Pmin that enable downward regulation). This may make the R2-UP less attractive for new entrants, who would compete with CCGTs that have virtually no marginal offering costs (their spinning cost being already covered when procuring R2-DOWN services).

Therefore, the third option – R2-UP is procured before R2-DOWN – seems to be the preferred option. Such a preference is however far from strong or obvious and is based only on a pilot with limited volumes. The assumption will need to be reconfirmed in the future.

3.4.4. Possible interim aFRR improvements

From the above, we can deduct that the current STAR mechanism for aFRR (i.e. taking apart FCR) is on the one hand efficient when it comes to apportion fixed spinning costs and minimize total short-term sourcing cost (§3.4.1), but that on the other hand it may be the cause of barriers to entry for new players active solely in one direction, hence possibly do not allow costs to decrease in the longer run (§3.4.2).

Despite the obligation stemming from the Guideline on Electricity Balancing to separate upward and downward aFRR procurements, it may be inopportune to plan for such a separation for now: given the expected lower pace of market development for aFRR, the separation may be insufficient to materially speed up market entry, while it is likely that in the meantime the aFRR sourcing costs would be substantially inflated.

Let us therefore explore if there are alternative options which can lead to similar mitigation effects on barriers to entry, and which at the same time do not lead to such a risk of significant cost increases in the short run.

Bidding obligations

The key concern with the current design is when the necessity to accept one direction of a symmetric offer discards the chances of alternative competitive offers in the other direction to be accepted. This concern is actually very similar to the one explained in §3.1.3 concerning links between FCR and aFRR.

An already implemented mitigation measure for this later issue is to impose "bidding obligations", which force the bidder to complement large offers with a combination of offers of smaller incremental volumes. Such a measure has however not yet been imposed on R2-UP and R2-DOWN separately, because the combinatorial impact of enforcing such constraints on several dimensions would make it very impractical operationally[21].

Though, in case FCR is no longer sourced simultaneously, imposing bidding obligations on the two aFRR directions is no longer problematic in this respect and appears as a logical quick fix, quite aligned with the current practice. The key would be to oblige bidders to "break up" large symmetrical bids into a panel of smaller symmetric bids, asymmetric bids in both directions and bids with different volumes for upward and downward regulation. Such rules – in the spirit of the current bidding obligations – will avoid that assets able to offer symmetrical aFRR "monopolize" both markets because of their inevitable selection on one direction, hence will enable other competitive offers to be accepted. Bidding obligations also ensure that the market is not dominated by large indivisible bids (see next subsection). Bidding obligations are therefore expected to largely address the concern of barriers to entry.

In terms of cost optimization, as such rules also can only lead to identical or better results[22], this approach does not suffer from the same concern as a full separation of R2-UP and R2-DOWN. **Consequently, if the conditions to separate upward and**

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[21] 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. To contain the number of bids to be submitted, bidding obligations have not been imposed separately on R2-UP and R2-DOWN products in the current design.

[22] Under the legitimate assumption that bidding rules enforce additional order submission but do not affect the total price of the bids that would have been sent without such obligations

downward aFRR procurement (i.e. liquidity improvements) are not met, imposing bidding obligations to R2-UP and R2-DOWN – once aFRR is procured separately from FCR - appears as a necessary interim solution with similar benefits under more contained risks.

The exact parametrization of such rules however still need to be studied further, in consultation with relevant stakeholders, and with the objective to find a balance between facilitating the issue at stake and keeping the operational burden to an acceptable level.

Merit order rule & indivisibilities

Let us now discuss another detail design element which is often seen as a threat for new entrants because it makes the results more difficult to anticipate. As a starting point, recall that the algorithm (see §3.2 in [4]) minimizes the total reservation procurement cost, subject to:

1. Respecting the bid constraints (incl. "indivisibility" ands "link across products") and
2. Ensuring that selected volume must <u>at least</u> cover the minimum volume pursued for aFRR products in both directions.

Importantly, a strict merit order rule is not directly imposed in the algorithm. While intuitively, one could expect that an optimization algorithm conforms to the merit order rule (i.e. it is optimal to first accept the cheapest bids), this is not necessarily the case in the presence of indivisibilities. Enforcing explicitly that each bid can only be accepted if all bids at better prices are accepted (i.e. enforcing the merit order rule[23]) may indeed lead to accepting quantities above the minimum volumes pursued, in cases where the last accepted bid is indivisible. Departing from the merit order rule then allows to reduce the over-procured volume (hence also the objective function) by rejecting bids with inferior prices than the last accepted one, so that perturbing the merit order rule reduces the

[23] Note that the merit order rule is to be understood in a context of two linked products. The merit order rule therefore reads:

- a bid j can only be accepted if its total cost TC_j is at least equal to the sum of the variables $\dot{P}_{up}$ and $\dot{P}_{down}$ multiplied by the corresponding Q_{up_j} and Q_{down_j} volumes of the bid j (i.e. $j\ is\ accepted \Longrightarrow TC_j \geq Q_{up_j}\dot{P}_{up} + Q_{down_j}\dot{P}_{down}$)
- where $\dot{P}_{up}$ and $\dot{P}_{down}$ represent the prices of the last accepted unit in each direction, also taking into account symmetric bids (i.e. $\dot{P}_{Direction} \geq \frac{TC_i - Q_{Opposite_i} \cdot \dot{P}_{Opposite}}{Q_{Direction_i}}$ for all accepted bids i with $Q_{Direction_i} \geq 0$).

In plain English, this means that acceptance of bids is based on the comparison between their (weighted) average prices and the (average) price of the last accepted bids objective function. Because they are more flexible, this is typically more frequently happening to divisible bids in case indivisible bids are large. **In other words, in the current design, some bids may be rejected even though more expensive ones have been accepted.** Being rejected despite offering better prices may be seen as unfair and not transparent, especially for smaller players who submit small (divisible) bids and cannot anticipate their acceptance despite competitive prices.

Strictly imposing the merit order rule in the algorithm is a way to absolve this concern. However, if the market is dominated by large indivisible bids, strictly imposing merit order rules may lead to material short-term increases in aFRR sourcing costs. If this is a concern, there also exist intermediary approaches with less drastic impacts on the objective function, which intent to “protect” only divisible bids. In particular, one can complement the cost optimization (with possible over procurement) with a restriction that no divisible bid can be paradoxically rejected[24]. Such approaches appear as promising but deserve further detailed analysis.

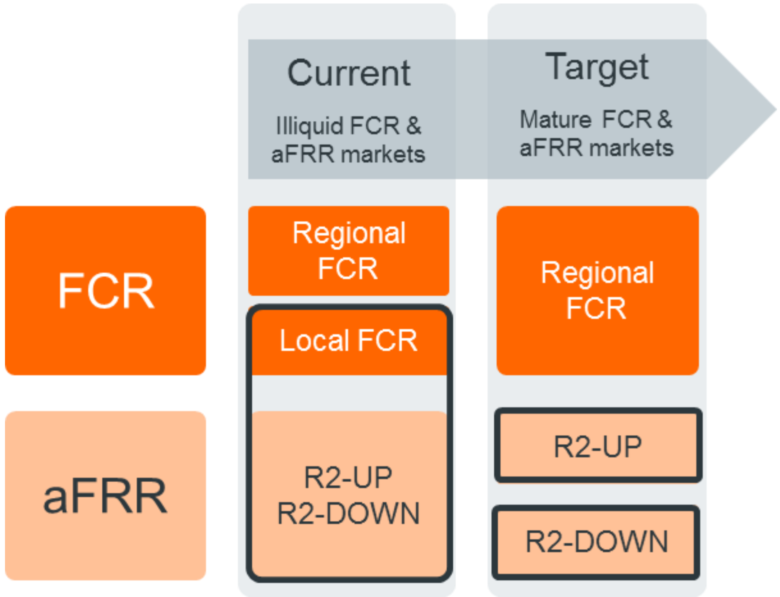
In summary, a separation of aFRR into exclusively asymmetric products becomes relevant if there is a decent level of competition on each direction. This is currently not the case, and aFRR market development is expected to take some time. Therefore, **ELIA considers requiring an exemption to the obligation to separate upward and downward aFRR procurement, conform to article 32.3 of the Guideline on Electricity Balancing.** During this period, ELIA could implement temporary mitigation measures to limit barriers to entry on the aFRR provision, by imposing bidding obligations and possible refinements of the selection algorithm. Such changes, which are expected to cover the transition period until competition in aFRR has emerged, still need to be elaborated and parametrized in detail.

[24] This is the approach retained in similar contexts such as DAM, or Regional FCR cooperation in the future (see [6]).

4. Implementation roadmap

4.1. Target model

A clear long-term target model emerges from the previous chapter, that sees primary reserves solely sourced via the Regional FCR cooperation; and secondary reserves procured separately for upward and downward regulation. This is indeed fully in line with Article 32.3 of the Guideline on Electricity Balancing [1], and with ELIA's willingness to favor fair competition and to rely on liquid markets – regional and/or European wherever possible – to efficiently source its ancillary services.



Primary reserve is currently mainly procured via the Regional FCR cooperation, where multiple improvements are being planned. A minimum 30%[25] fraction of the Belgian FCR needs are nevertheless procured locally, to cope with a specific context of reliance on CCGTs. Once a relief of such a dependency materializes for FCR and sufficient competition has emerged for the part of the needs that has to be sourced locally, then a full sourcing of all Belgian needs via the regional cooperation becomes realistic and desirable. Similarly, once the non-dependency on CCGTs for aFRR in both directions materializes, then a separation of upward and downward procurement (i.e. exclusively asymmetric products) also becomes possible.

[25] i.e. only the fraction that needs to be procured locally is dependent on Belgian CCGTs, as for the remainder the FCR cooperation offers a fairly competitive regional market. This explains why a minimum of 30% is procured locally.

However, there remains a chicken and egg problem: if the target design reliefs market entry concerns, but if at the same time its implementation requires that a sufficient level of liquidity has emerged, then it could be that the implementation of the target model never occurs. Therefore, it might be necessary to implement the target model gradually, so that short-term sourcing cost increase is contained, and barriers to entry are removed as quickly as possible. This is to facilitate ELIA's objective to reduce as much as possible the sourcing costs of balancing reserves, by enabling short-term optimization while fostering competition in the longer-term. The next chapter closes this study by proposing such a step-by-step implementation. Its objective is to trigger a discussion with the stakeholders about the preferred implementation sequence and the possibility of merging some steps.

4.2. Possible interim steps

To discuss possible interim implementation steps, let us consider that the competition in FCR arises first, and that aFRR liquidity improves at a later stage (and that these developments thus happen in sequence). The starting point is the situation as expected to be in place by the end of 2018 (see §2), that is, a combined local FCR/aFRR auction, complemented with a daily regional FCR procurement.

The conditions to enable a split of FCR and aFRR into separate mechanisms are that at least a sufficient volume of FCR has entered the Belgian market so that local FCR no longer relies on CCGTs (see §3.1.4). Following the reasoning held in §3.3.3, ELIA's preference is that the aFRR procurement occurs before FCR, because aFRR remains the scarcest service that needs to be secured first by ELIA. Also because of the apportioning rule, the local FCR mechanism must occur before the regional one. **A first interim step (STEP1) could thus be to split the procurement of R1 and R2 and to keep the local auction for R1. The local aFRR auction would be organized prior to local and regional FCR auctions.**

The positive consequences of such an interim step is that – since it is no more technically possible to link FCR & aFRR offers – the selection of a bid stemming from an inevitable asset in aFRR no longer enforces that this asset is also selected for FCR. It also more generally makes market results easier to understand and anticipated. Keeping R1-UP and R1-DOWN products has the advantage that the trigger for the separation, (i.e. that CCGTs are no longer inevitable for primary reserves) can occur quicker[26].

As the liquidity in the FCR segment further improves, the need for ELIA to aggregate R1-UP, R1-DOWN and R1-100mHz into the standard R1-200mHz also reduces. Once CCGTs are no longer inevitable for FCR and enough competition (both in terms of volumes and number of actors) has emerged on the entire 200 mHz FCR spectrum, then negative impacts on procurement costs are fully mitigated. The conditions to benefit from the other advantages of procuring all FCR needs via the regional cooperation are met. **A second possible interim step (STEP2) would therefore be to source all FCR regionally, after having held a local aFRR auction combined for up and down services.** This enables all the benefits listed in §3.2.

Note that the very latest developments in the FCR market have already shown a drastic reduction of the use of R1-UP and R1-DOWN products. Thus, despite these asymmetric bids still contribute to the competitiveness of the market, their absolute necessity becomes somewhat less evident. Would the local R1-200mHz market development continue on such a positive trend, the need for the intermediate STEP1 would progressively vanish. Depending on the rapidity of these evolutions, the separation of FCR and aFRR procurement could become concomitant to the full sourcing of FCR via the Regional Cooperation (i.e. skip STEP1 and go directly to STEP2).

Because aFRR is no longer combined with FCR, bidding obligations can be implemented on aFRR bids, to make sure that bidders willing to offer aFRR in both directions propose different sets of product combinations (see §3.4.4). This facilitates new market entries who no longer see the market monopolized by actors offering symmetrical products. Possibly, other tweaks in the selection algorithm (e.g. protection of divisible bids, merit order rule…) could also be contemplated. **A third envisaged interim step (STEP3) thus consists of a refined (i.e. bidding obligation, with potentially other improvements) aFRR procurement combined for upward and downward capacity, followed by a fully regional FCR procurement**.

In principle, it actually appears as logical that bidding obligations for R2-UP and R2-DOWN products are implemented as soon as R2 is no longer sourced together with R1

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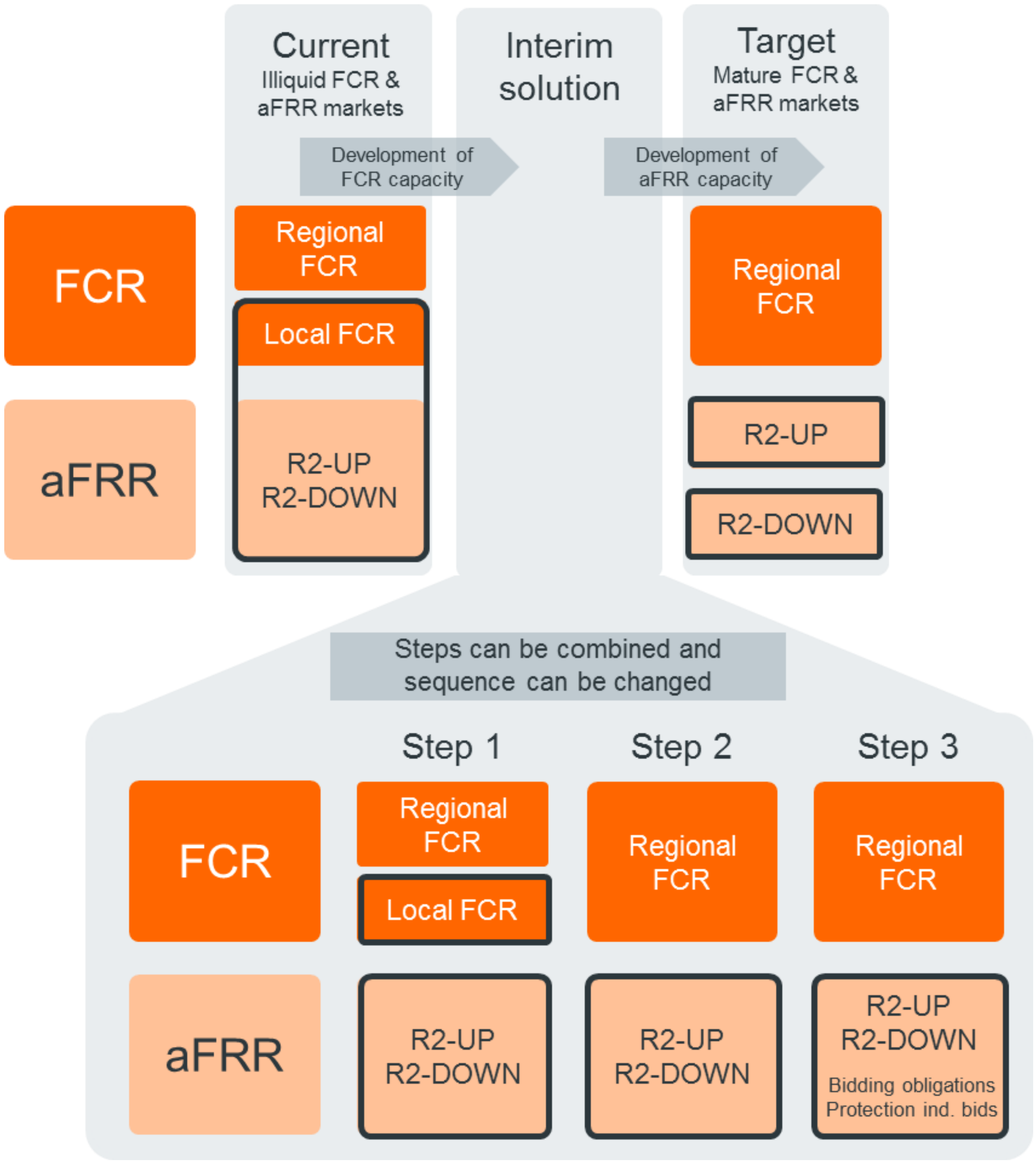
[26] See footnote 3 on page 5. In essence the volume of new FCR assets needed to become independent of CCGTs and have an adequate competition level in case asymmetric products are available is half of the volume needed in case of only R1-200mHz products.

(because the main cause for not implementing bidding obligations on R2 asymmetric products yet is because it would be operationally too cumbersome for Elia and BSPs – see §3.4.4). Skipping STEP2 and implement STEP3 directly therefore appears as a plausible plan, which however needs to be envisaged in light of all the other ongoing-developments in this domain, and considering the other implementation constraints.

From this situation, the change towards the full target model, i.e. the relief of the derogation and sourcing of aFRR via exclusively asymmetrical products only depends on the emergence of new assets participating to aFRR in each direction. **Such a last step would thus happen with the arrival of sufficient competition in aFRR for both directions, no longer dependent on technologies with high fixed-costs (i.e. CCGTs). In order to achieve this, the aFRR market should be open to R2-non CIPU and R2 merit order activation should be in place. As this point in time, arguments for derogation to Article 32.3 of the Guideline on Electricity Balancing are no longer valid.**

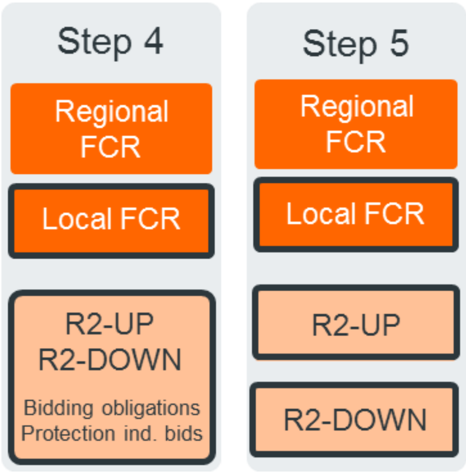

Current
Illiquid FCR & aFRR markets
Interim solution
Target
Mature FCR & aFRR markets
Development of FCR capacity
Development of aFRR capacity
FCR
aFRR
Regional FCR
Local FCR
R2-UP
R2-DOWN
Regional FCR
R2-UP
R2-DOWN
Steps can be combined and sequence can be changed
Step 1
Step 2
Step 3
FCR
aFRR
Regional FCR
Local FCR
R2-UP
R2-DOWN
Regional FCR
R2-UP
R2-DOWN
Regional FCR
R2-UP
R2-DOWN
Bidding obligations
Protection ind. bids

Let us summarize the conditions and consequences of these different steps:

	Preconditions	Change	Consequences
Step 1	- CCGTs avoidable locally on FCR on R1-100mHz - Adequate competition for the part of FCR that has to be sourced locally (considering asymmetric products)	- Distinct local aFRR (first) and FCR (second) procurements	- FCR no longer technically influenced by inevitable aFRR assets - More transparent market results and better investment signal
Step 2	- CCGTs avoidable locally on FCR on R1-200mHz - Adequate competition in for the part of FCR that has to be sourced locally with only R1-200mHz products	- FCR entirely sourced regionally	- Stable prices (cross-border coupling effects) - Simplified processes - local asymmetric FCR products no longer available
Step 3	- technical assessment and parametrization of the approach - Adaptations in R2 market to facilitate new entrants already in place (including R2 merit order activation and contractual opening of R2 non-CIPU)	- Implementation of bidding obligations for R2-UP & R2-DOWN - Possible modifications of the aFRR procurement algorithm	- Market entry for asymmetric aFRR assets is facilitated - If procurement algorithm is modified: more transparent market results providing better investment signal and limited increase of procurement costs on the short-term
Target	- CCGTs avoidable locally on aFRR (both directions) - Adequate competition on aFRR (both directions)	- Separation of R2-UP and R2-DOWN procurement	- More transparent market results and better investment signal - Compliance with GLEB §32.3 without need for exemption

This gradual implementation of the target model, together with the preconditions and consequences of each step, has been presented in this report for consultation, with the objective to collect input and thoughts of the stakeholders about what is the best implementation strategy to reach the target design for FCR and aFRR sourcing. From the feed-back received, its seems that reducing the number of implementation steps is desirable. The different implementation steps presented above could therefore be combined.

It needs to be underlined that the different steps identified above have been constructed based on the assumption that competition arises in FCR market first and then the liquidity increases in the aFRR market. However, if this assumption does not hold, one could imagine a set of potential steps that include adaptations in the aFRR market at an earlier stage as shown in the following graph.



Considering these pre-conditions for a split, but also other implementation constraints and wishes, a pragmatic project roadmap will be developed by ELIA later in 2018, which will take into account the implementation plans for the aspects discussed in this document with the other ongoing developments on FCR and aFRR markets, and provide a credible and robust path towards market development of primary and secondary reserves.

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