



Study on the evolution towards a daily procurement of mFRR

Market Development

22/05/2018

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1 Introduction

1.1 Context and goal of the present design note

The present study investigates the possible evolution towards a daily procurement (currently monthly) of mFRR including the advantages and disadvantages of such a change. Also the need of maintaining different mFRR product types (R3 Flex and Standard) in this context, the impact on reserve sharing as well as the impact of the non-contract bids on the mFRR balancing capacity to be procured are analyzed.

A possible evolution towards daily procurement has yet been presented to the stakeholders in the context of the Working Group Balancing. The mFRR roadmap depicted on Figure 1 was initially presented during the Working Group Balancing meeting of the 17th of March 2016. Figure 2 shows an up to date realization status of this roadmap with elements in green having already been implemented, elements in blue being planned to be deployed before the end of 2018 and elements in orange still in an analysis stage. Daily procurement is foreseen in the third step of the mFRR roadmap.

Also during the meeting of the 31st of October 2017 a clear implementation plan with timings for all balancing products (FCR, aFRR and mFRR) was presented (see Figure 3). According to this planning, daily procurement would be implemented as of begin 2019 for mFRR down and as of begin 2020 for mFRR up.

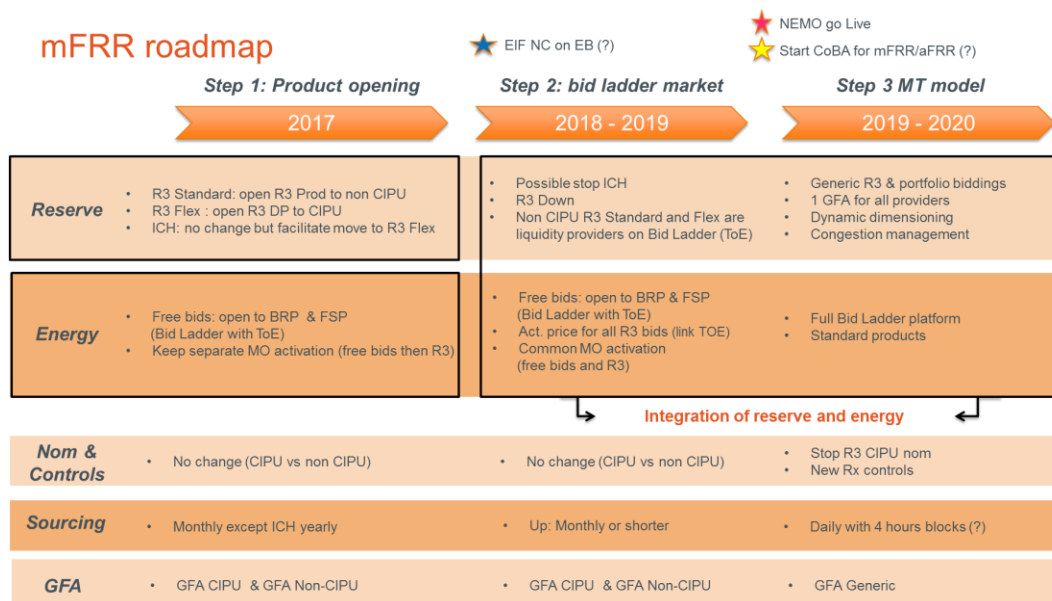


Figure 1 - mFRR roadmap as presented on 17 March 2016 (WG Balancing)

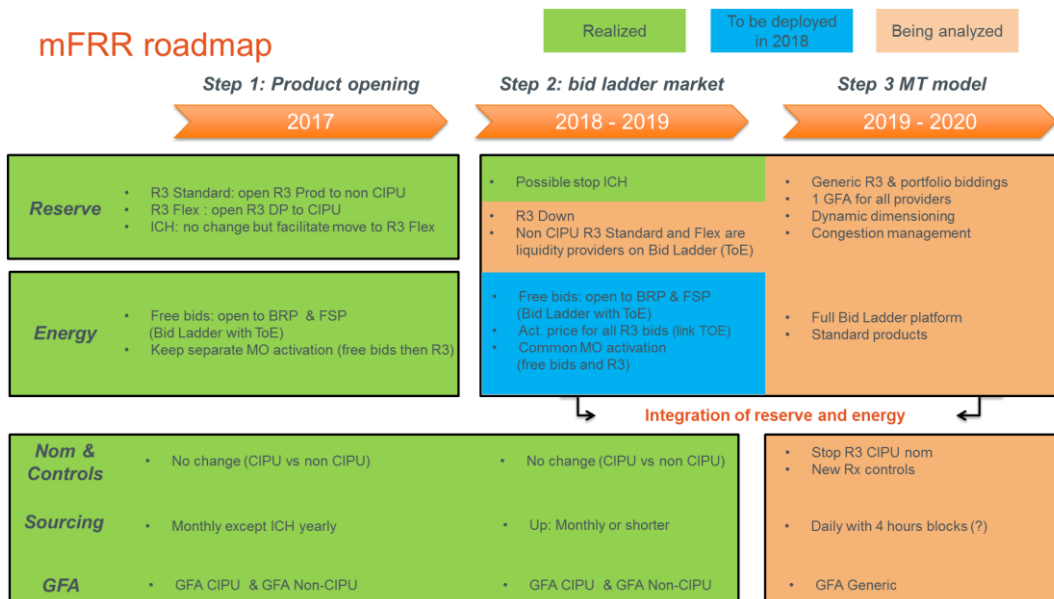


Figure 2 - Status of the mFRR roadmap

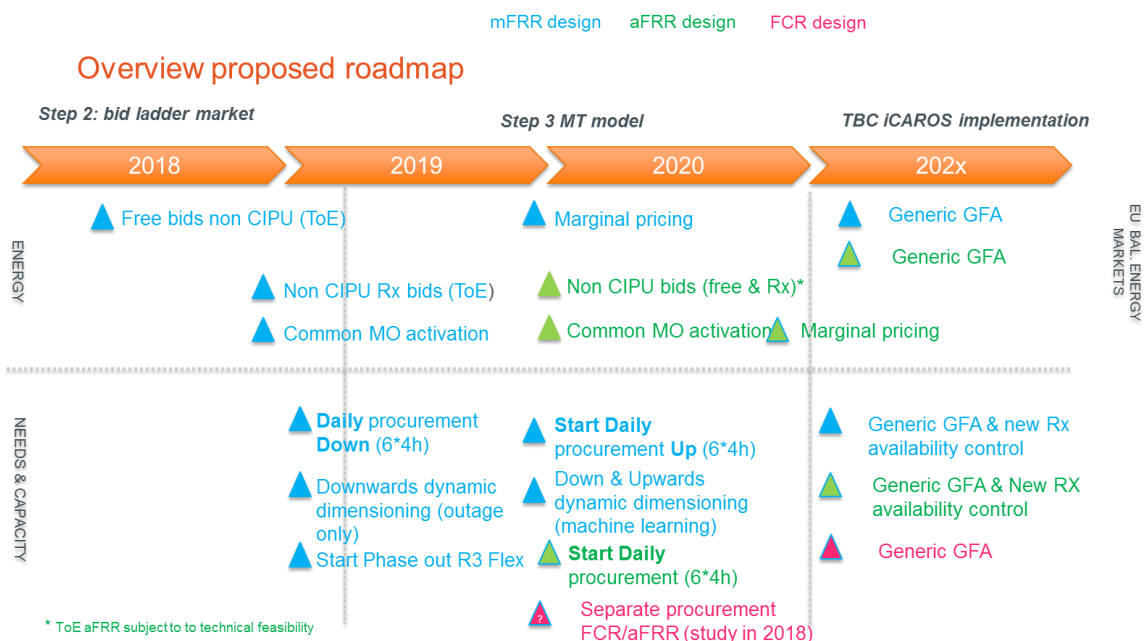


Figure 3 - Roadmap as presented on 30 November 2017 (WG Balancing)

1.2 Structure of the present study

We start the study in section 2 by describing the European legislation on this subject; i.e. the European Guidelines on Electricity Balancing. We then explain the context and the existing situation for mFRR regarding dimensioning, procurement and product mix in Belgium. Finally we compare the situation in Belgium with the one of other European countries.

In section 3, we discuss in detail the different advantages and disadvantages of moving to daily procurement. We then formulate some recommendations for a future operationalization and finally some intermediary conclusions on that question.

In section 4, we discuss the possibility to move to a standard mFRR product and hence stop maintaining two different products, i.e. R3 Standard and R3 Flex. We analyse the advantages, disadvantages and the pre-requisites of such a change. Finally we draw some intermediary conclusions on that topic.

In section 5, we analyze how non-contracted bids can be taken into account in the mFRR procurement process in case of daily sourcing.

In section 6, we describe the impact of daily procurement on reserve sharing.

Finally, we propose a conclusion and the way forward in section 7.

2 Context and As Is situation

2.1 EU Guidelines on Electricity Balancing

The European Guideline on Electricity Balancing entered into force on 18 December 2017. It is a legally binding regulation of the European Commission setting down the rules on the operation of the balancing market, i.e. the markets that TSOs use to procure energy and capacity to keep the system balanced in real time. The objectives of the guideline include increasing the opportunities for cross-border cooperation and improving the efficiency of balancing markets. Some articles of this regulation are particularly relevant in the context of this study.

Articles 3 and 32 (see complete articles in Appendix 1) refer to short-term procurement, level playing field between technologies and non-contracted (free) bids:

- Article 3 stipulates that procurement of balancing services should avoid undue barriers to entry for new entrants. Participation of all resources including demand response and renewables should be facilitated so that they compete at a level playing field with other resources. We will show later (in section 3.1.1) in the present study that procurement close to delivery is key to allow participation of all resources including demand response and renewables.
- Article 32 states that the procurement shall be performed on a short-term basis to the extent of possible and where economically efficient. We can interpret this statement as an encouragement to procure as close to delivery as technically and economically possible. As explained in section 3.3, the shortest term possible being in day-ahead before the day-ahead energy market gate closure. It is indeed not efficient to procure reserve after the day-ahead energy market gate closure as all units able to participate to the reserve market would have possibly been sold in the energy market.
- Also article 32 refers to different types of resources that can be used to cover the reserve needs, i.e. the procured balancing capacity but also the reserve sharing with neighboring TSOs and the non-contracted bids expected to be available. The use of those two last categories of resources in the context of daily procurement is discussed respectively in sections 0 and 5.

Articles 25 and 26 (see complete articles in Appendix 1) sets out rules regarding the requirements of respectively standard (with characteristics common to all TSOs) and specific (with characteristics specific to one TSO) products. These are relevant for the discussion of section 0 on the evolution towards a standard mFRR product. The development of standard product is a must while country-specific products are possible under some clear conditions:

- Article 25 states among other that TSOs shall develop a proposal of standard product for mFRR balancing capacity.
- Article 26 stipulates that TSOs may develop proposal for using specific product. The TSO must follow specific criteria, among other; demonstrate that the standard products are not sufficient for the corresponding country. Also a specific product cannot be considered as an enduring solution and the corresponding TSO shall review at least once every two years the necessity to use specific products in accordance with specific criteria.

2.2 FRR dimensioning process

Elia currently uses a “static” method to dimension the balancing reserves, more specifically the reserve needs are determined one year-ahead based on historic system imbalances and renewable prediction errors of the previous calendar year (see Figure 4). These reserve needs are then fixed for the entire year. In such a method, extreme event expected to occur more frequently in the future but only during exceptional conditions are setting the reserve needs for the entire year. This results in oversizing during lower risk periods, while lacking capacity in the periods with real high imbalance risks.



Figure 4 - Static dimensioning

Elia published a “Study on dynamic dimensioning of the FRR needs” in October 2017¹. In this study, Elia presents a new method to “dynamically” size the balancing reserves needs close to real-time, i.e. in day-ahead (as illustrated on Figure 5). Advanced statistic solutions, including machine learning techniques, are used to train a model based on the analysis of historic system imbalances (of the rolling year ending the 31st of the month M-2). The model then takes as input the day-ahead predicted systems conditions (including offshore and onshore wind power, solar photovoltaics, electricity demand and schedules of power plants and transmission assets) to determine the total

¹ See “Projects & Publication” in the context of the Working Group Balancing : http://www.elia.be/en/users-group/Working-Group_Balancing/Projects-and-Publications/Dynamic-dimensioning-of-FRR-needs

needs of balancing reserves. The daily output is the FFR needs for every 6 blocks of 4 hours of the day.

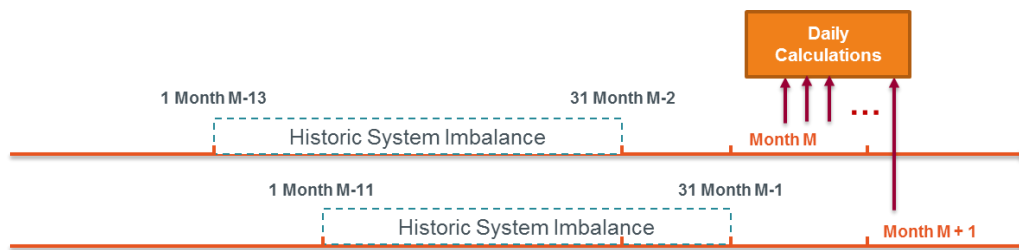


Figure 5 - Dynamic dimensioning

The study demonstrated that the proposed methodology is clearly improving reliability while reducing the cost of balancing compared with the static method. This will be particularly true in the future with increasing renewable generation.

2.3 mFRR product mix and procurement process

In the context of the mFRR roadmap discussed in section 1.1, Elia has worked on the standardization of its mFRR product to ensure level-playing field between the different technologies and types of market players able to participate. As illustrated by Figure 6, until the 31st of December 2016 the product mix was composed of three technology-specific products:

- R3 Prod only open to CIPU units (centralized generation units).
- R3 DP only open to non-CIPU units (demand response and decentralized generation units).
- ICH only open to TSO-connected demand response.
- As of the 1st of January 2017, the technology-specific products R3 Prod and R3 DP have been replaced by the technology-neutral products R3 Standard and R3 Flex. Also ICH has been discontinued as of the 1st of January 2018. Hence all mFRR balancing capacity products are now technologically neutral.

	Situation until 31/12/2016			Current situation	
	CIPU	Non CIPU		CIPU	Non CIPU
Standard product(s)	R3 Prod	-	➔	Standard product(s)	R3 Standard
Specific product(s) (limited energy)	-	R3DP ICH		Specific product(s) (limited energy)	R3 Flex

Figure 6 - Evolution of the mFRR product mix to technology-neutral products

In parallel with the product mix evolution described above, Elia has gradually moved from a yearly to a monthly procurement process (see Figure 7) with the objective of removing undue barriers to entry and allow more participation. The volume procured in monthly auction was first limited to 70 MW in 2016 as test. Note the experience has shown that splitting the volume between two different contract durations is sub-optimal. Indeed it creates two different markets with less dynamics and competition.

Participants must decide in advance in which market they participate and at which price. As a result, the first market can experience a lack of liquidity or prices higher than normal.

In 2017, all R3 Standard and R3 Flex volumes were procured via monthly auctions while only ICH was still sourced in yearly. Since 2018 and the discontinuation of ICH, all mFRR volumes are procured via monthly auctions.

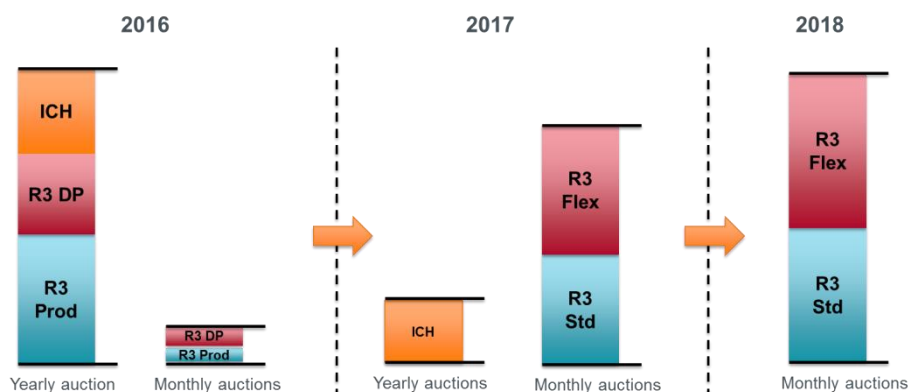


Figure 7 - mFRR procurement evolution (indicative volumes)

Those changes have allowed a better functioning of the mFRR capacity market with as results more volumes offered and slightly lower reservation prices even though volumes procured have increased and the quality of the products have improved (replacement of the volume of ICH by R3 Flex). The average price evolution of the contracted R3 capacity (weighted average R3 Standard/Prod and R3 Flex/DP, ICH is not taken into account) is depicted on Figure 8. The results of all auctions can be consulted on the Elia website.

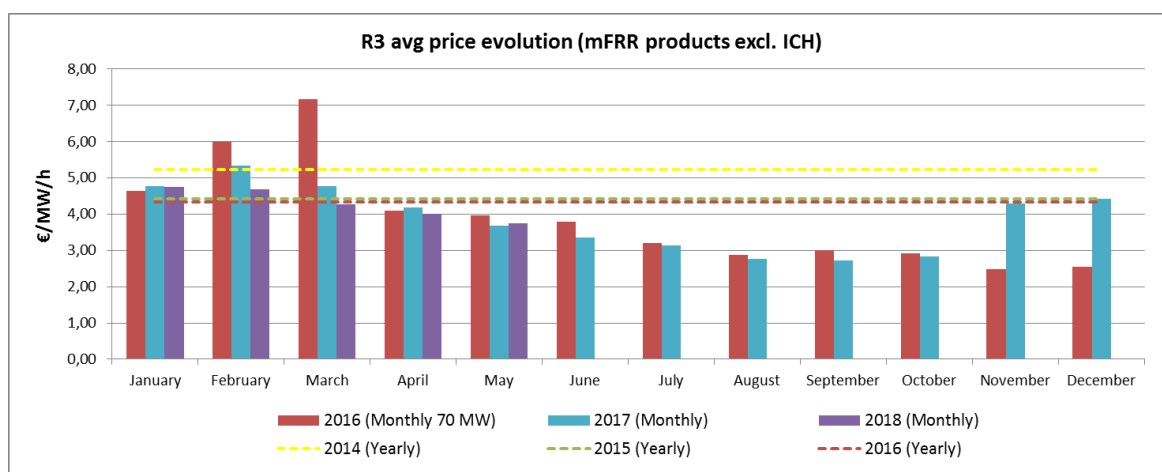


Figure 8 - R3 average price evolution

Elia is looking to further enhance the functioning of the mFRR capacity market by implementing the next steps of the mFRR roadmap mentioned earlier in 1.1 and, among other, a possible daily procurement with a product resolution of four hours.

2.4 Benchmark with neighboring countries

In the survey on “Ancillary services procurement, balancing and market design 2016”² (10/03/2017) by ENTSO-E, a complete benchmark with other European countries is presented. Figure 9 shows the product lead time (time from auction to real time) while **Error! Reference source not found.** Figure 10 shows the product time resolution (minimum time interval for which the product can be bid³). We can divide the countries in four groups depending on the type of auction they run:

- Yearly auctions: France and Lithuania. While Lithuania has a yearly product resolution, it is interesting to note that France has a daily product resolution meaning that during the yearly auction participants have the possibility to bid different volumes per day.
- Monthly auctions: Belgium, The Netherlands, Sweden, UK, Croatia, Slovenia and Latvia.
- Weekly auctions: Finland.
- Daily auctions: Norway, Germany, Denmark, Switzerland, Austria, Slovakia, Romania and Bosnia with a granularity of one or more hours. We observe that this group counts eight countries and is the largest of the four. Also we observe that almost all those countries have a granularity marked as “Hour(s)” on Figure 10 corresponding in practice to blocks of four hours.

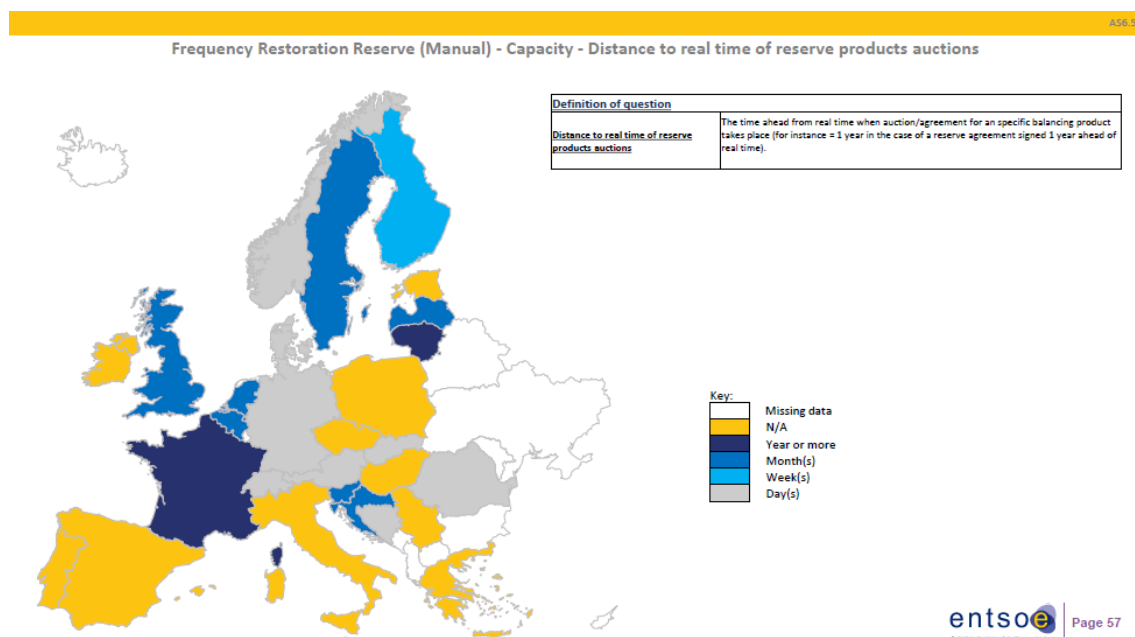


Figure 9 - ENTSO-E benchmark 2016 – Product duration

² <https://www.entsoe.eu/publications/market-reports/#survey-on-ancillary-services-procurement-and-electricity-balancing-market-design>

³ As example: resolution of the Belgian day-ahead energy market is one hour as participants can offer different volumes for every hour of the day

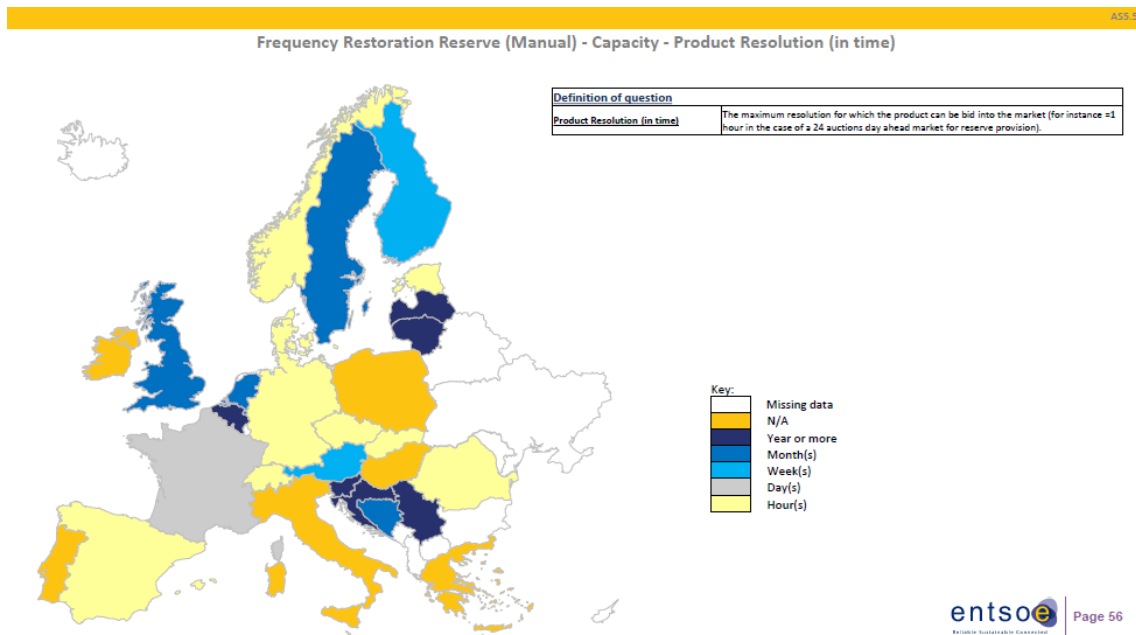


Figure 10 - ENTSO-E benchmark 2016 – Product resolution (time)

2.5 Summary

We observe that the European regulation is striving for procurement of balancing capacity as close as possible of delivery in order to facilitate the participation of all resources in an efficient market.

Also moving to daily procurement with blocks of four hours is a trend among European peers. Within ENTSO-E, two TSOs still run yearly auction (but one does offer a daily product granularity), seven (including Belgium) monthly ones and one weekly ones. Finally eight TSOs, the largest group, are already running mFRR auctions on a daily basis mostly with a granularity of four hours.

Finally it is worth to point out that Elia has established a roadmap perfectly in line with the philosophy of the European regulation towards more standardization, level-playing field and less barriers to entry. This roadmap and its realization status were presented at different occasions in the context of the Working Group Balancing. As shown in 1.1, Elia has already implemented multiples elements of this roadmap with positive return on experience regarding the evolution of the reservation prices and of the number of participants. One of the key elements of roadmap not yet implemented is the move to daily procurement analyzed in the present study.

3 Possible evolution towards daily procurement

In this section, we analyze the advantages and disadvantages of moving from monthly to daily procurement and discuss them in detail. We summarize them in Table 1 and discuss them in detail in sections 3.1 and 3.2. Based on this analysis we formulate some recommendations related to the operationalization in 3.3 and draw an intermediary conclusion in section 0.

Advantages	<ul style="list-style-type: none"> ✓ Allow a more liquid and efficient market ✓ Allow more market dynamics ✓ Allow more mobility of delivery point from one BSP to another ✓ Allow a dynamic dimensioning of the reserve needs ✓ Align with other reserve products ✓ Align with other EU countries ✓ Enable standardization of reserve products
Disadvantages	<ul style="list-style-type: none"> ✓ Visibility on revenue for providers ✓ Operational burden ✓ Operational risks in case of lack of volume in auction

Table 1 - Advantages and disadvantages of moving to daily procurement

3.1 Advantages

3.1.1 Allow a more liquid and efficient market

Reducing the time horizon of the balancing capacity market increases liquidity and efficiency. Indeed when the procurement process takes place close to the delivery it becomes easier for participants to offer their flexibility in the mFRR auction resulting in more volume and a healthier competition. As we explain in detail later in 3.3 we consider that the shortest term possible is in day-ahead before the day-ahead energy market as it is not efficient to procure reserve after the day-ahead energy market closure.

Shortening the time horizon from one month ahead to day ahead allows a more efficient and liquid market because:

- ✓ It reduces uncertainties regarding the capacities that would be technically available. Indeed BSPs (Balancing Services Providers) have a much better view in day-ahead than in month ahead on the technical availability of their flexibility being traditional generation plant (view on possible outage), decentralized generation (view on possible outage, steam demand in case of cogeneration), demand response (view on power offtake) and renewables (view on expected generation). This translates into more volume to be offered and at a price including a lower risk premium in day-ahead than in month-ahead.
- ✓ It reduces uncertainties regarding the capacities that could be sold (throughout the month) in other electricity markets (with shorter time horizons) and also regarding the corresponding prices. BSP can arbitrage with other energy markets to sell his flexibility between the auction time (month ahead in the present case) and the delivery. Note those electricity markets are either energy markets (forward, day-ahead or intraday and even balancing energy markets) or other balancing capacity market (FCR and aFRR). If a BSP sells his flexibility as mFRR in a monthly auction, his flexibility is committed to mFRR during the whole month and he cannot sell it in any other electricity market. Also there is an uncertainty on the profit he could make by selling this flexibility in another electricity market. BSP will reflect the time value of such an option by applying a margin to the price of his flexibility in the monthly auction and / or by limiting the volume offered.

An example is the arbitrage between the current monthly mFRR and weekly FCR/aFRR auctions. Some resources can participate to both auctions. Elia has received the feedback from some BSPs that they prefer not to offer those resources in the mFRR auction as they can possibly earn more revenue in the FCR/aFRR auction even though they are not sure of being selected in that later auction. If they are not selected for FCR/aFRR, it is too late to participate to mFRR and the resource will not get any revenue for balancing capacity. With daily procurement and an appropriate order of auction (FFCR/aFRR then mFRR) as described in 3.3, this problem is solved.

A move from monthly to daily auctions reduces strongly those two uncertainties and will allow the BSPs to offer more volumes at a more competitive price. It will possibly also allow some units that could not participate in monthly auction to enter the market (typical case of the wind for mFRR down).

Below we further detail those arguments for some specific participants: the wind farms, the industrial grid users (demand response and decentralized generation) and the traditional generators.

➤ *Case of wind farms*

With significantly increasing installed capacity, wind farms are expected to play an important role in the provision of FRR (both aFRR and mFRR) in the future. In Belgium, wind farms already provide non-contracted mFRR balancing energy bids (downwards CIPU free bids). In case it would be decided to contract downwards mFRR via balancing capacity auctions as it is done for upwards mFRR, there is no doubt that wind farms would play a key role. Therefore there should be no undue barriers preventing the participation of those units in a balancing capacity market.

In the study “Delivery of downward aFRR by wind farms” published in October 2015⁴, Elia analyzed the provision of downwards aFRR by wind farms. A technical pilot project was conducted and it revealed a significant potential for wind farms to participate in the downwards aFRR market. However it was shown that the aFRR capacity that can be offered by wind farms strongly depends on the product duration and product resolution. Current product duration (monthly) and resolution (base, peak and off-peak) in Belgium would not allow participation of wind farms. Those conclusions for aFRR are also applicable for mFRR. Indeed, from a technical point of view, units able to participate to aFRR can also participate to mFRR. The main differences between the two products are the requirements in terms of activation.

It was shown that wind production forecasts are only reliable as of one or two days ahead. Quality increases towards real-time. The actual monthly duration of the mFRR product along with a lead time of about 2 weeks would prevent wind farms from participating in a FRR capacity market. Wind farms can only commit for a very small (if not null) volume such a long time in advance due to the difficulty to forecast their production.

A combination of long product duration (like monthly) with low product resolution (base, peak and off-peak) does not allow participation of the wind farms. Participants can only offer volume base, peak or off-peak delivery while the production can vary importantly from hour to hour. Even in case of perfect forecasting for the contractual duration, wind farm can only offer the minimum expected production per product block (base, peak or off-peak) during the product duration (month). Figure 11 illustrates this with a simplified example. The blue line is the expected power output assuming a perfect forecasting. The red line corresponds to the minimum expected generation during this period and is what the wind farm is able to offer assuming a baseload granularity (having peak and off-peak does not really improve the situation) and perfect production forecast. This volume, already low, should be further reduced to take into account the forecasting error. It is clear from that figure that the wind farm could in principle contribute significantly more to the FRR down market if the product duration would have been shorter and product resolution higher.

⁴ See on the Elia website: http://www.elia.be/en/users-group/Working-Group_Balancing/Projects-and-Publications/R2-aFRR

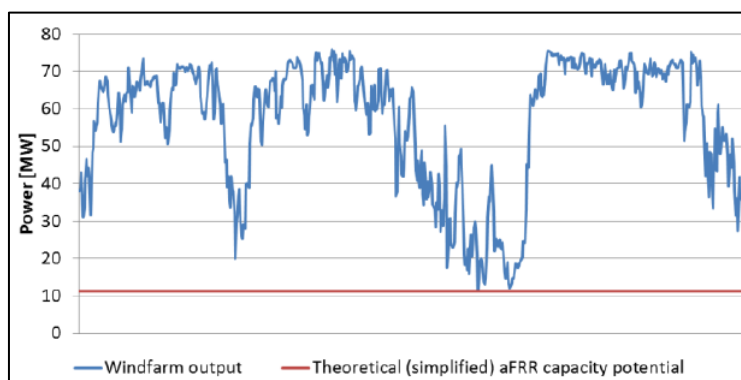


Figure 11 - Impact of product resolution on FRR capacity potential

	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%

Figure 12 - Impact of product duration and resolution on FRR capacity potential

Figure 12 shows an overview of which share of the theoretical downward FRR capacity can be offered for different FRR capacity product durations and product resolutions. Those calculations were performed for one particular onshore wind farm (Estinnes) and the aggregated offshore wind farms based on data for 2014 in the context of the aforementioned study. They assume a perfect forecasting of the wind farms output. Hence these numbers should be further reduced to take the forecasting error into account. It confirms that the current mFRR capacity product in Belgium with long product duration (monthly) and low product resolutions (only base, peak and off-peak) offer almost no potential for stand-alone wind farm participation in a mFRR down capacity market. For weekly product duration there is –at least in theory- a small potential for participation. Considering however that there is also a relatively large uncertainty on week-ahead forecasts (and an additional procurement lead time of some days), it is clear that also here the final potential on weekly basis will be very low.

Only in case of daily procurement we see there is a high potential for wind farms to participate in the FRR down capacity market. There is no significant difference between onshore and offshore wind farms with respect to this matter. In addition an increase of product resolution from the current peak / long off-peak products towards 4 to 8 hours blocks would almost double the participation potential.

Hence we conclude the following changes would maximize the potential participation of wind farms in the FRR down capacity market:

- Procurement lead time: as short as possible (e.g. day-ahead);
- Product duration: as short as possible (daily);
- Product resolution: as high as possible (4 hours blocks).

➤ *Case of industrial demand response and decentralized generation*

Industrial grid users can offer directly or through aggregators the flexibility from their industrial process (demand response) or from an onsite generation unit. This flexibility depends typically on the scheduled power (demand response) and also the availability and scheduled output of a possible cogeneration unit (which depends on the steam offtake of the site). It is obvious that moving to daily auctions will allow them to offer more volume as they will have a better view on the flexibility that will be technically available. Note that members of the Working Group Balancing have already mentioned during meetings of the Working Group that moving at least to weekly procurement would allow unlocking some flexibility from industrial grid users. As this flexibility might vary throughout the day, a product granularity higher than the current base, peak and off-peak split would be valuable.

There is another reason why daily sourcing would add value to industrial users. These users typically want the impact of the provision of balancing services on their processes as limited as possible. As a result the number of activations should be limited (case of the current product R3 Flex). By moving to daily procurement, one participant can decide not to offer in any specific day if he had been activated in the previous day(s). He has much more flexibility to actually stop participating to balancing services at some point in time while with the current system he has a strict obligation for a complete month.

As for the case of wind farms, we can conclude that industrial grid users – from a technical point of view - will be able to offer more capacity with a shorter lead time (day-ahead), product duration (daily) and product resolution (4 hours blocks).

➤ *Case of traditional generation*

Traditional generators also have an advantage to move to a daily procurement scheme. It will reduce uncertainties regarding the capacities technically available. Also uncertainties on the possible arbitrage with other electricity markets will be reduced. In day-ahead, the participants are likely to have a realistic view on the possible clearing price of the spot market (as opposed with monthly auction) and can therefore more efficiently arbitrage with the mFRR capacity market.

3.1.2 Allow more market dynamics

A shorter procurement cycle allows more market dynamics which is an advantage for the participants and the society.

A participant not selected has the option to revise his bidding strategy / price in the auction of the next day in order to be selected. Currently a player not selected misses the capacity remuneration of the whole month.

Also in daily tendering market participants will be incentive to bid in at more competitive prices as competition will increased.

3.1.3 Allow more mobility of delivery point from one BSP to another

When a delivery point wants to change from one BSP to another it is currently possible to avoid the loss of one contractual period (one month) of capacity remuneration. This will not be possible anymore in case of Transfer of Energy (ToE). This is illustrated on Figure 13. The test by the new BSP (BSP B) must occur only when the delivery point has officially exited the portfolio of the original BSP (BSP A) after the end of the monthly contractual period. This is because BSPs have to compensate the suppliers of the corresponding delivery points financially. It would indeed not be acceptable to ask BSP A to compensate the supplier for an activation done in the context of a test for BSP B. The process is as follows:

- In month M, DP x is part of portfolio of BSP A but decides to move to portfolio of BSP B. At the end of the month M (monthly contractual period), DP x can leave the portfolio of BSP A. If all administrative procedures related to the ToE are completed, BSP B has DP x in his portfolio and can perform a simulation test in month M+1 for that point.
- Depending on the results of the simulation test, BSP 2 can offer DP x in the auction organized in M+1 for delivery in M+2.
- As a result, there is a loss of capacity remuneration during at least one contractual period, i.e. one month (month M+1 in the example) depending on the duration needed to complete the administrative tasks related to the ToE. Such a delay is possibly a barrier for delivery point mobility from one BSP to another. In case of daily procurement the contractual period becomes one day. Hence in theory the loss of capacity remuneration will be reduced to the time needed to complete the operational task related to the ToE and pool management, organize the simulation test and control its result.

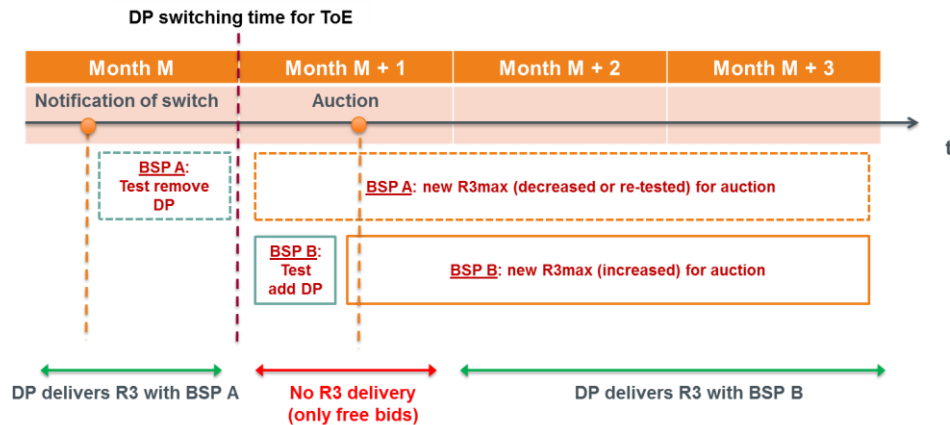


Figure 13 - Delivery Point switch from one BSP to another with ToE

3.1.4 Allow a dynamic dimensioning of the reserve needs

As mentioned in section 2.2, the “Study on dynamic dimensioning of the FRR needs” demonstrated that there is a clear positive business case to move to a dynamic dimensioning: it clearly improves reliability while reducing the cost of balancing compared with the static method.

With such a mechanism, balancing capacity needs are assessed every day in the morning and published around 08:00 as illustrated on Figure 14. The mFRR auction is then run around 10:00 and the results published around 11:00. Market players then participate to the day-ahead energy market closing at 12:00.



Figure 14 - Daily dimensioning and procurement process

Hence a dynamic dimensioning methodology is not possible without the implementation of a daily procurement of at least part of the FRR balancing capacity.

3.1.5 Align with other reserve products

We expect other reserve products, i.e. FCR and aFRR to move to daily procurement as well in a near future:

- In the report Elia published on the R2 non-CIPU pilot project in December 2017, one of the key conclusion is that moving from a weekly to a daily procurement for aFRR is advised to allow the participation of non-CIPU units in aFRR. As a consequence FCR would also follow this move as those two products are currently procured in the same auction for market efficiency reasons (some units do provides the two services at the same time).
- As of November 2018, it is expected that the regional sourcing of FCR will take place via daily auctions⁵. Even though not obligatory it can be expected that national procurement of FCR in Belgium and other countries will follow in order to make the market more efficient.

Currently mFRR procurement already takes place well ahead (month-ahead) of FCR and aFRR (week-ahead). It is not ideal as the units able to deliver other products (FCR or aFRR) than mFRR prefer not to commit to mFRR or only at a high price. This is because reservation prices of FCR and aFRR are typically higher than the ones of mFRR. As recommended in 3.3 procurement of mFRR should take place after aFRR to allow flexibility not sold or partly sold in the FCR/aFRR auction to participate to mFRR. Hence if aFRR is procured in day-ahead, mFRR should also be procured in day-ahead.

Also note that in mFRR down should be procured, this procurement would have to take place in any case in daily to allow participation of wind farms as already mentioned above. It would therefore make sense that both R3 Up and R3 Down product are aligned and both sourced on a daily basis.

⁵ TSOs part of the FCR Cooperation have submitted a proposal to their respective national regulation authorities that can be found the ENTSO-E website: https://docstore.entsoe.eu/Documents/Network%20codes%20documents/NC%20EB/FCR_Proposal-Article%2033_1_EBGL_20180426_FV.PDF

3.1.6 Align with other EU countries

As shown in section 2.4, many countries have already implemented a daily procurement process for mFRR. Those countries have experienced a positive return on experience of such a change.

The long term objective within ENTSO-E remains to have cross border procurement of balancing capacity. The two pre-requisites for such procurement are: harmonized balancing capacity products and availability of cross border capacities. The implementation of those two pre-requisites will be facilitated in case of daily procurement:

- As most of the TSOs are having daily products it seems to be a logic outcome that such a harmonized market will be organized with a daily procurement.
- Also regarding the cross-border capacities that should be available: reserving them long in advance removes them from the forward capacity market. Hence it is more acceptable to do so in day-head in case of daily procurement rather than longer in advance.

3.1.7 Enable standardization of the reserve products

In the next chapter we discuss the possible evolution from two mFRR balancing capacity products (R3 Standard and R3 Flex) to one standard product. We will see that this change presents multiple benefits. We also explain in section 4.3 that daily procurement is a pre-requisite to implement a single standard product. Hence it presents the advantage of allowing the standardization of the reserve product.

3.2 Disadvantages

3.2.1 Visibility on revenue for providers

One could argue that moving to daily sourcing gives less visibility on revenues for the BSPs. Reservation price and the selection of BSPs could indeed potentially vary from day to day which is more frequently than currently with monthly auctions.

On the other hand, it is important to bring out the following nuances:

- mFRR already moved from yearly to monthly while FCR/aFRR moved from yearly to monthly then to weekly. Monthly and weekly procurement can already be considered as short term at the light of typical capital budgeting period when investing in generation units and flexibility in general. However when moving to those shorter term procurement period, we've observed an increase of liquidity combined with a healthy competition and a relative price stability.
- The uncertainty of not being selected in the daily auction is balanced by the fact that daily auction allows more market dynamics than monthly one as explained in section 3.1.2. A BSP has less risk of not being selected for a long period as he can adapt his bidding strategy in the auction of the next day.
- Competitive market players in monthly or daily tendering will be selected for the same duration and have equal revenues. This is only a relevant problem for market parties bidding at the marginal price.

3.2.2 Operational burden

The move to daily auctions means more operational burden for the market participants:

- BSPs have to send capacity bids to Elia on a daily basis. This can be mitigated by using standing orders and early gate opening time (already in place for energy bids of R3 Standard and R3 Flex), i.e. BSPs can send capacity bids (volume and prices) for a period longer than one day and long enough before the actual auction (exact timing would be subject to implementation choice and discussion with BSPs). On a daily basis, BSPs then have the possibility to revise the prices and volumes initially entered.
- BSPs have to handle the results of daily auctions: control auction results and take appropriate action when selected / not selected. This will indeed require more administration on the BSP side.

3.2.3 Operational risks in case of lack of volume in auction

In case of shortfall of volumes in a mFRR capacity auction, a fallback is applicable: the auction is ended and all selected volumes are awarded. Subsequently a new gate is opened for the remaining volume. The gate closure time of this additional auction round is determined by Elia and published on the Elia website. For mFRR, the default gate closure time is one week after the first auction round. This gives one week to market participants to offer additional volumes.

In case of daily procurement, the second auction round needs to be organized quickly after the first one, i.e. during the same day. This gives less time to find additional

volumes in the market. In such an exceptional situation, Elia will be proactive in contacting all BSPs to make sure they offer all volumes available in the second auction round.

3.3 Recommended operationalization

In case of daily procurement for mFRR, the mFRR auction should be run in day-ahead before the day-ahead energy market gate closure but after the combined auction for FCR and aFRR to optimize the efficiency of the market. The reasons are the following:

- Before the day-ahead energy market gate closure: this avoids that units would be sold in the energy market and as result unable to participate to the mRR auction.
- After the combined auction for FCR and aFRR: in its study on “Separated procurement of FCR and aFRR products” being currently publicly consulted (public consultation running from the 20/04/2018 until 22/05/2018), Elia explains that the services with potentially the lowest liquidity and highest procurement cost should be procured first. As FCR and aFRR are technically more demanding, they typically have a higher procurement cost and their market is less liquid than mFRR. Procuring FCR/aFRR before mFRR ensures that:
 - Assets commit first to product with the lowest liquidity (FCR/aFRR), i.e. the most difficult to procure.
 - Assets not selected or partly selected in FCR/aFRR auction can still offer their residual capacity to the mFRR market.

Also in order to limit the operational burden, an early gate opening time combined with the possibility to enter standing orders should be implemented as described in 3.2.2.

3.4 Intermediate conclusion

The implementation of a daily procurement of mFRR balancing capacity has some very positive advantages. It is no surprise that it has been implemented in other European countries and is encouraged by European regulations. It removes undue barriers for entry and allow all types of participant (being traditional or renewable generators, aggregators and industrial users) to offer their flexible capacities with less uncertainties regarding availability and opportunity cost. As we've seen the product resolution should also be refined in order to reap all those benefits.

It also enables participants who were not selected in an auction to adapt their bidding strategy in the auction the day after so that they don't lose a complete month of remuneration. Then it ensures that delivery points can move more freely to the portfolio of a given BSP to another.

Daily procurement is also a pre-requisite for the implementation of a dynamic dimensioning that Elia has proposed in the context of another study.

Finally it has the benefits of aligning with other European countries and with the other balancing capacity products (FCR and aFFR) in Belgium that are also likely to move to daily procurement.

We also discussed the disadvantages of such a change like less visibility on revenue for providers, more operational burden and less time for running a second auction in case of volume lack. All of them can be at least partly mitigated and do not outweigh all advantages that we have described. We therefore recommend implementing the following process:

- Daily procurement process for mFRR together with a product resolution of 4 hours (6 blocks of 4 hours). Daily procurement should apply for the total volume of mFRR as experience as shown that volume split is sub-optimal (see section 2.3)
- Organize the process as close as economically efficient and technically possible to delivery meaning before gate closure time of the day-ahead energy market and after the FCR / aFFR auction.

We recommend an implementation by begin 2019 for mFRR down should there be volume to procure and by begin 2020 for mFRR up as presented during the meeting of 30 November 2017 of the Working Group Balancing (see on Figure 3).

4 Possible evolution towards a standard mFRR balancing capacity product

R3 Flex was introduced in 2017 as the successor of R3 DP. It has the same product characteristics as R3 DP but is technology-neutral unlike R3 DP which was open to non-CIPU units only. R3 DP was created in 2013 as a complement to R3 Prod with the objective to open mFRR to non-CIPU units. R3 Prod has no limit in terms of activation which was a barrier to entry for demand response and decentralized generation. R3 DP was implemented with a maximum of 8 activations per month, each of them lasting maximum 2 hours with at least 12 hours neutralization time between two consecutive activations. Those limited energy requirements allowed non-CIPU units to offer a volume available 100% throughout the monthly contractual period.

In the previous section, we've shown that moving to a daily procurement of mFRR presents some great benefits. We show in the current section that in case of daily sourcing with an appropriate product granularity, maintaining two different products i.e. R3 Standard and R3 Flex becomes less relevant.

Evolving towards a single standard mFRR product presents some advantages but also the risk of pushing some flexibility out of the market. We discuss this in detail in sections 4.1 and 4.2 and summarize in Table 2. We discuss the pre-requisite of such a change in 4.3 and finally draw an intermediary conclusion in section 4.4.

Advantages	<ul style="list-style-type: none"> ✓ Better answer operational needs of the system ✓ Valorize flexibility more fairly ✓ Allow a full merit order for the activation of mFRR energy bids ✓ Simplify products and processes
Disadvantages	<ul style="list-style-type: none"> ✓ Risk of pushing some existing flexibility out of the market

Table 2 - Advantages and disadvantages of moving towards a standard mFRR product

4.1 Advantages

4.1.1 Better answer operational needs of the system

A significant increase of the offshore wind production is expected by 2020 in the Belgian offshore area. Once all offshore parks will be fully operational the total installed capacity will increase to 2300 MW. In the "Offshore Integration Study" published on February 2018⁶, Elia has investigated the impact of storm events. Because all Belgian offshore wind parks are situated close to each other in the North Sea, it has been observed that they all behave in a similar way facing a storm and that impact will mainly differ because of wind turbine technical characteristics⁷.

Storm events caused by high wind speed can therefore trigger substantial imbalances in the Belgian control area. They can also last for a long duration (from 2 to 12 hours as explained in the aforementioned study). Furthermore wind power variations during storms are very volatile. We can observe oscillation of wind speed around the wind speed cut out with as results random round-trips between cut out and cut in of wind production. The current product mix of R3 Standard and R3 Flex will not satisfy the future reserve needs induced by such a storm events.

We illustrate this with a recent example on Figure 15. On the 2nd and 3rd of January 2018, a storm event caused the cut out of wind farms (loss of up to around 700 MW) multiples times in a row. We see on the figure that the wind power was first cut out on the 2nd around 9:00 until 15:00 (event of +- 6 hours). Then again on the 3rd it was cut out as of 02:00 then cut in three times in a row with stabilization at around 15:00 (event of +- 13 hours). It is quite clear that the product R3 Flex shows its limits when dealing with such type of event as it can only be activated max 2 hours and with 12 hours between two activations (8 hours as of 1st of December 2018 as foreseen in the mFRR product update). Elia can simply not rely on this product for that kind of event.

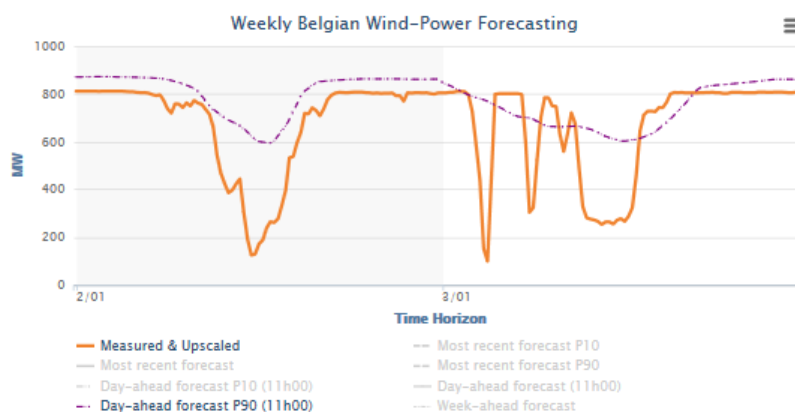


Figure 15 - Storm on 03/01/2018

⁶ See Elia website http://www.elia.be/en/users-group/Working-Group_Balancing/Projects-and-Publications/Study-on-the-integration-of-offshore-wind-in-the-Belgian-balancing-zone

⁷ The wind speed cut out which corresponds to the technical limit from which a wind turbine stops producing because of too high wind speeds (protection mode)

4.1.2 Allow full competition between technologies

Elia currently procures R3 Standard and R3 Flex jointly with as constraint a minimum volume of R3 Standard (300 MW in 2018). Above this minimum volume of R3 Standard, R3 Standard bids are in direct competition with R3 Flex bids. That means that Elia will select R3 Flex bids if they are cheaper (even by a small margin) than R3 Standard. Hence the higher quality of R3 Standard is not fully valorized and those resources could be pushed out of the market.

With a standard mFRR product all resources will directly compete with the same product characteristics. That would ensure full level playing field between all technologies and allow retaining in the market the resources that can help the system the most.

4.1.3 Allow a full merit order for the activation of mFRR energy bids

Elia is currently implementing a new merit order for the activation of mFRR energy bids going live on the 1st of December 2018. As shown on Figure 16, free bids will be activated in a common merit order with R3 Standard while R3 Flex will still be activated at the end of the merit order due to the limited number of activations per contractual period of this product (while the number of activations of R3 Standard is unlimited). R3 Flex activations must therefore be spared to avoid having no R3 Flex anymore available before the end of the contractual period.

Moving to a standard mFRR product has the benefit of allowing the implementation of a full merit order activation.

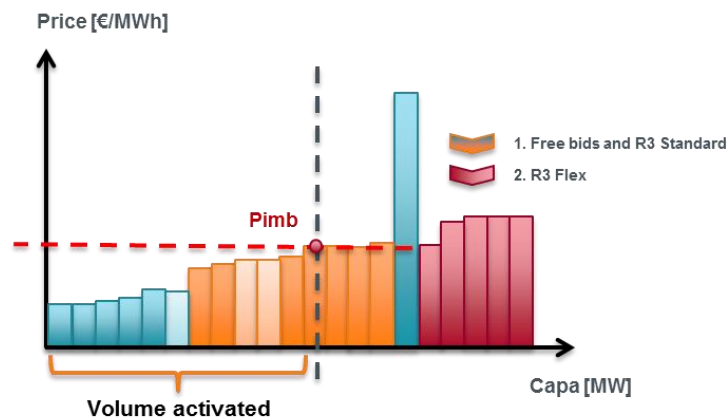


Figure 16 - Merit order for the activation of mFRR energy bids as of 01/201/2018

4.1.4 Simplify the products

A standard mFRR product has the benefit of simplifying the contracts, operational processes and IT systems for Elia and for the BSPs. As explained in 2.1, a specific product (like R3 Flex) cannot be considered as an enduring solution following the European Guideline on Electricity Balancing and TSO using specific product(s) must demonstrate once every two year the necessity of keeping such product(s) according to some specific criteria.

4.2 Disadvantages

As mentioned, R3 Flex / R3 DP were introduced as a less technically constraining product to allow units with a limited number of possible activations to participate to the mFRR capacity market. Moving to a standard mFRR product more demanding in terms of activation could possibly exclude some units that are not willing or not capable to participate to the standard product.

If the implementation of such a product is decided, everything should be put in place to make sure the existing flexibility that has been built up through the years remains valorized in the market. Some pre-requisites described in the next section should be met before moving to a standard product. Subject to discussion with the stakeholders, the implementation of those pre-requisite should allow the current R3 Flex participants to valorize their flexibility in a standard mFRR product.

4.3 Link with daily sourcing and pre-requisite

When R3 DP was introduced (2013), tenders were organized on a yearly basis and BSPs had to commit for a complete year. Monthly sourcing was initiated in 2016 with a limited volume of 70 MW. Since 2017 the complete volume of mFRR is procured on a monthly basis. Monthly auction offers more flexibility than the original yearly tenders but BSPs still have to commit for a period of one month which is quite long. Additionally the lack of activation price for non-CIPU units does not allow BSPs to reveal the true value of their flexibility. Those limitations justified the need to maintain a product as R3 Flex with energy limitations (maximum number activations per month, maximum activation duration and minimum neutralization time between two consecutive activations). The implementation of a standard mFRR product with as consequence the end of R3 Flex can only take place if the following pre-requisite should be met:

- Implementation of daily auctions organized in day-ahead (short product duration and lead time) with 4 hours blocks (high product resolution). This allows a BSP to have a clear view on the availability of his flexibility as described in 3.1.1 and offer it only in the blocks of 4 hours during which he is willing to be activated. It also allows a BSP who has been activated to decide whether or not he wants to keep on offering his flexibility in the subsequent days.
- Implementation of a free activation price for all participants (CIPU and non-CIPU units) with high price cap (13 500 €/MWh) and possibility to re-nominate this price close real-time. Note this is being implemented for the 1st of December together with Transfer of Energy mechanism for mFRR contracted bids (R3 Standard and Flex). Such an activation price allows all technologies to reveal the true value of their flexibility. This is also true for prolonged activation as BSPs have the possibility to update the activation price close to delivery. Combined with a full merit order activation purely based on activation price, a BSP is free to increase his activation to be placed later in the merit order.

4.4 Intermediate conclusion

The implementation of a standard mFRR product has the advantage to better answer the needs of the system in the future given offshore integration and risk of storm events. It allows a level playing field between all technologies and valorization of the participants depending on the quality of the flexibility they offer. By rationalizing the product mix it also simplifies the corresponding contracts, operational processes and IT systems and offers a more enduring solution with regards to the European regulations. Finally it enables a complete merit order activation of all mFRR energy bids purely based on their activation price.

Nevertheless, there is risk of excluding some flexibility from the market. We therefore detailed the pre-requisite that should be met before implementing a standard mFRR product: daily auctions organized in day-ahead with 4 hours blocks and a free activation with a high price cap and the possibility to update the activation price close to real time. We believe that if those pre-requisites are properly implemented, the current flexibility participating to R3 Flex will still be valorized in the market and be able to participate to the standard product.

We recommend implementing a standard mFRR balancing capacity product and stop R3 Flex by begin 2020. This is in line with what has been announced during the meeting of the 30th November 2017 of the Working Group Balancing (see slide 17). This will allow to implement the pre-requisite mentioned above and will provide the participants with a transition period to adapt by begin 2020.

5 Impact of non-contracted mFRR (free bids) on mFRR balancing capacity to procure

5.1 Current situation

Paragraph 1(c) of Article 32 (see complete article in Appendix 1) of the European Guideline on Electricity Balancing stipulates that volume of non-contracted balancing energy bids (hereinafter referred to as "free bids") expected to be available shall be taken into account for the provision of reserve capacity. The objective is to reduce to the capacity to procure based on the volume of non-contracted bids expected to be available. However the following elements must be highlighted in the current context where the volume needs and means to be procured are determined on a yearly basis:

- One year-ahead no view is available on the amount of free bids that will be there in real time.
- There are days during which no free bids will be available.
- The European regulation sets out rules stipulating that all TSOs shall have sufficient reserve capacity on FRR at any time in (Paragraph 4 of Article 157 of the European Guidelines on Electricity Transmission System Operation, see complete Article in Appendix 2).

For those reasons Elia has currently no other choice than not taking any volumes of free bids into account.

5.2 Future prospects with daily procurement of mFRR

Moving to daily procurement could allow taking into account some volumes of free bids to determine the mFRR balancing capacity to procure and hence reduce it. Trying to estimate the volume of free bids available ex-ante even in day-ahead is extremely challenging and could lead to inaccurate results. Nevertheless due to the difficulty to forecast the free bids, daily procurement is an absolute pre-requisite to take the free bids into account but even then some conditions need to be respected.

5.2.1 Two types of mFRR energy bids

It is important to classify the mFRR energy bids (free and contracted bids) into two categories that are relevant in the context of the present analysis:

1. The mFRR flexibility available in real time via energy bids but which will not or will not be fully offered in the mFRR capacity auctions as its amount of flexibility that will be available in real time is not known in advance for technical / operational reasons (even in day-ahead).
 - Due to forecast uncertainties: An example applicable for downwards mFRR are the wind farms which are able to participate to a capacity auction in day-ahead (as discussed in 3.1.1) but which are likely to offer less capacity than available in real time as they need to take a safety margin for the forecast error.
 - Due to dispatch uncertainties: traditional generation units like thermal and hydro plants actively contribute to the amount in free bids offered in real-time. However the amount of balancing energy bids depends on their schedule (if running at its maximum power a unit cannot offer any upwards flexibility but only downwards flexibility). This schedule is optimized against the hourly day-ahead energy price. As a result this schedule and hence the flexibility available is only known after the publication of the day-ahead energy market results meaning a few hours after the mFRR daily capacity auction. Also upwards and downwards flexibility from non-CIPU units (load and decentralized generation) which is offered on Bidladder but not offered in the capacity auctions for one of the uncertainties mentioned above falls also in that category of bids.

Depending on the predictability of the corresponding available volumes, we believe those bids could be taken into account to reduce the mFRR balancing capacity to procure.

2. The mFRR energy bids available in real time and which will be offered in the mFRR capacity auctions as they can guarantee their availability in advance.

We believe that those resources could only be taken into account to reduce the mFRR balancing capacity to procure when there are enough free bids to cover the complete mFRR needs but not if they only partly cover them. We illustrate this with an example on Figure 17. In this example the mFRR balancing capacity needs are 600 MW and we consider that 300 MW of those needs can be covered by free bids from this second category. Intuitively we would conclude that we would only need to procure 300 MW. The issue is that the resources we were expecting to provide free bids will inevitably participate to the mFRR auctions (as they earn a stable reservation price by doing so) and will not be there as free bids. As a result we see that in real time the total mFRR available is lower than the needs which is not acceptable. The additional required volume of mFRR is not secured via this partial procurement.

However if the considered available free bids were higher than the needs (higher than 600 MW), not procuring anything would have still allowed to respect the reserve needs. We illustrate this with another example on Figure 18.

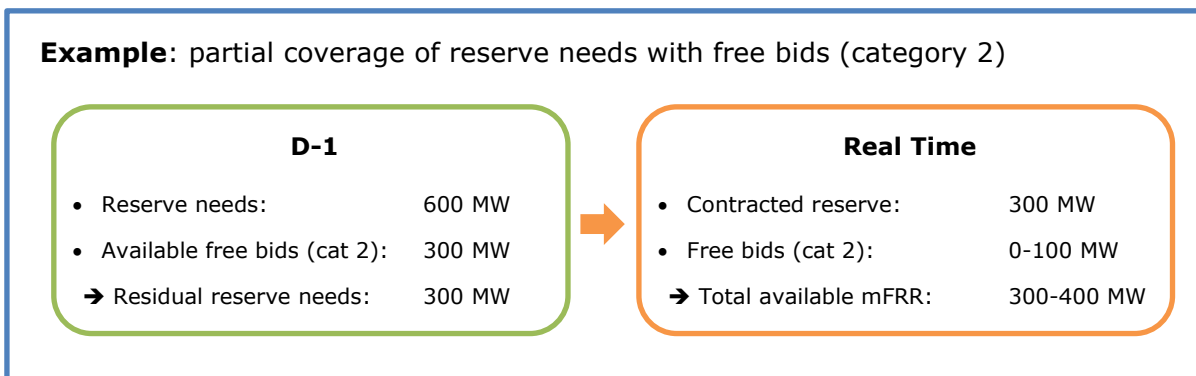


Figure 17 - Example partial coverage of reserve with free bids

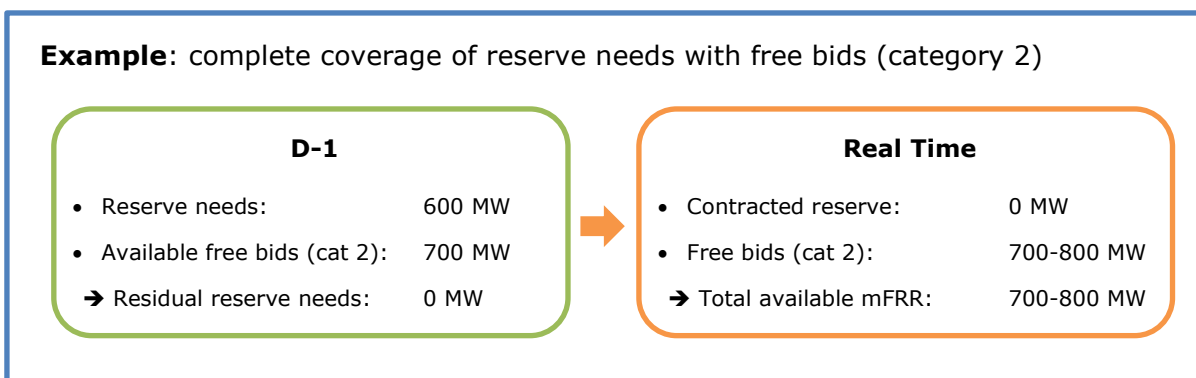


Figure 18 - Example complete coverage of reserve with free bids

5.2.2 Additional elements to be considered

Should free bids taken into account when calculating the mFRR balancing capacity to procure, other additional elements should be carefully considered:

- Deciding not to procure mFRR balancing capacity could make some flexibility disappear on the long run. While some units consider the capacity remuneration as a side payment and get other revenue streams, some units solely rely on the R3 reservation payment to exist and cover their costs. Without capacity payment those units would simply close. In the long run this might lead to higher costs for society if new peak power units need to be brought to market via a mFRR balancing capacity product.
- Deciding to procure on some days and not during others or changing the volume to procure often does not promote the stability requested by the BSPs. Those indeed require a foreseeable and stable revenue stream to maintain and further develop the flexibility.

Moreover BSPs will need to monitor Elia's website and see each morning whether Elia will procure volumes the next day for specific timeslots. In case Elia would only procure volumes on an ad hoc basis for specific periods, there is even a risk that not all market parties will be still operationally equipped to participate to ad-hoc tenders. Therefore we

recommend that when mFRR balancing capacity volumes needs to be procured:

- the needs should be communicated long beforehand.
- the periods with balancing capacity tendered should be long enough.

5.3 Intermediate conclusion

Non-contracted mFRR (free) bids could, under some conditions, be considered to cover the reserve needs of Elia. Daily procurement is an absolute pre-requisite for doing so.

The choice of making use of non-contracted bids should be taken carefully, depending on assurance with respect to availability, procurement considerations (no partial procurement possible) as well as the more structural short and long terms effects on the mFRR reserve market. This is particularly true for existing balancing capacity markets like mFRR up where an important part of the reserves is yet covered by assets whose main income is the capacity remuneration or by flexibility developed by demand side management. The cost savings on the short term triggered by a decision to fully stop having capacity remuneration might potentially be outweighed by more important costs on the longer run and hence have a detrimental effect on the total costs for society.

6 Impact on reserve sharing

6.1 Current situation

Paragraph 1(c) of Article 32 (see complete article in Appendix 1) of the European Guideline on Electricity Balancing stipulates that volume of reserve sharing applicable shall be taken into account for the provision of reserve capacity. The objective is to reduce the capacity to procure based on the volume shared with other TSOs. For 2018, Elia has sharing agreements of 250 MW with RTE and 300 MW with Tennet for upwards balancing capacity. The availability of those contracts is non-guaranteed but high (as example observed availability was above 99% in 2016) and they should be activated in last resort. Also the possibility to activate those reserves depends on the capacity available on the border in real time. As explained in its analysis on the evaluation of the balancing capacity to procure for 2018⁸, Elia currently takes into account 250 MW of reserve sharing for upwards reserves (with a certain product availability and limited number of hours of activation) from neighboring countries as available hence the smallest of the contracts. This assumption is justified by the fact that it is not possible to have any view in year-ahead on the capacity that will be actually available on the border in real time.

6.2 Rules given new European regulations into force

The European Guideline on Electricity Transmission System Operation (SOGL) entered into force in September 2017. It sets out rules regarding dimensioning methodology TSOs have to comply with following the entry into force (TSO must submit a methodology proposal by the 15th of September 2018 to their national regulators). Paragraphs (j) and (k) of Article 157 (see complete article in Appendix 2) describe the constraints that apply when taking into account reserve sharing as balancing capacity means (downwards and upwards).

- **Downwards reserve:** paragraph (k) describes that the reserve sharing that can be taken into account to cover the negative reserve needs is limited to the difference between the size of the negative dimensioning incident (N-1) and the capacity required to cover imbalance during 99% of the time.
- **Upwards reserve:** paragraph (j) describes that the reserve sharing that can be taken into account to cover the positive reserve needs is limited to the difference between the size of the positive dimensioning incident (N-1) and the capacity required to cover imbalance during 99% of the time. Additionally the reduction of the positive reserve capacity cannot exceed 30% of the size of the positive dimensioning incident (this limitation is not applicable for downwards reserve needs).

⁸ As approved by the CREG, see CREG's decision (B) 1631

Note those specific constraints were not applicable when evaluating the balancing capacity to procure for 2018 (exercise performed in 2017 and approved by the CREG following its decision (B)1631 of the 6th of July) as the Guideline was not yet entered into force. Those rules might however impact the volumes of sharing which will be considered in 2019 to cover the mFRR reserve needs.

6.3 Future prospects with daily procurement of mFRR

We've seen that the potential of reserve sharing that can be taken into account is limited by three constraints:

Constraint 1: Available reserve sharing volumes

Only the volumes for which there is a formal sharing agreement with other TSOs can be taken into account. Elia has currently (non-guaranteed) sharing agreements of 250 MW with RTE and 300 MW with Tennet. Elia is currently discussing with TenneT and RTE about the possibility to align the existing reserve sharing agreements with the SOGL requirements and henceforth to be able to carry the reserve sharing possibility forward in 2019. In addition Elia is also exploring, together with NGET and NemoLink the possibility to implement a sharing agreement with the UK once NemoLink will be operational. The ability of taking one or more reserve sharing agreements into account for the volume needs for 2019 will depend on the state of advancement of the discussions with the partners.

Constraint 2: The ATC (Available Transfer Capacity) on the borders

It is obvious that balancing energy from a neighboring country can only be shared if the capacity on the border is available in the right direction. More specific for upwards reserve sharing available capacity on the border should be available in the import direction. Reversely for downwards reserve sharing cross border capacity should be available in the export direction.

Constraint 3: The allowed volumes of sharing

The System Operations Guideline stipulates that reserve sharing can only be used for a limited volume. On this topic the paragraphs (j) and (k) of Article 157 of the European Guideline on System Operation are relevant (see above 2.1 and complete article in Appendix 2). These restrictions are motivated by the fact that the concept of reserve sharing has been developed to allow TSOs to use the same reserve for covering potential imbalances happening in multiple balancing areas (probability that imbalances occur simultaneously in the different areas is low).

Constraint 1 aforementioned is stable, i.e. sharing agreement with neighboring TSOs can evolve over time but they do not change on a daily basis. However the impact of constraints 2 and 3 aforementioned on possible reserve sharing can change on a daily basis:

Constraint 2: in case of daily procurement of mFRR balancing capacity, one could argue that the available cross-border capacity could be predicted in day-ahead. Obviously those predictions should be performed before the mFRR balancing capacity auction which, as discussed previously, should take place before the day-ahead energy market gate closure time. Making such a prediction at that point in time corresponds to actually predicting the outcome of the day-ahead flow-based European market clearing algorithm and intraday capacity allocation (which can yet influence the available intraday capacity after the day ahead coupling) and is therefore not possible in an accurate way. Henceforth, as far as the amount of available cross-border capacity is concerned, we believe we will have to continue to rely on past statistics of availability.

Constraint 3: this constraint was not taken into account up to now as the corresponding European regulation was not into force. This constraint might become only relevant in case the combination of available reserve means (constraint 1) and available ATC (constraint 2) is allowing to share a volume which is actually bigger than the allowed volume of sharing as determined by SO GL.

In case of yearly procurement this constraint would have to be estimated in a static / worst case situation. However in case of daily dimensioning with daily procurement, this constraint could be assessed in a more optimal way based on the system conditions. We illustrate this below on Figure 19 for upwards mFRR and on Figure 20 for downwards mFRR. The yellow areas are the possible reserve sharing volumes that can be taken into account following the European rules while the orange arrows represent the mFRR balancing capacity to procure.

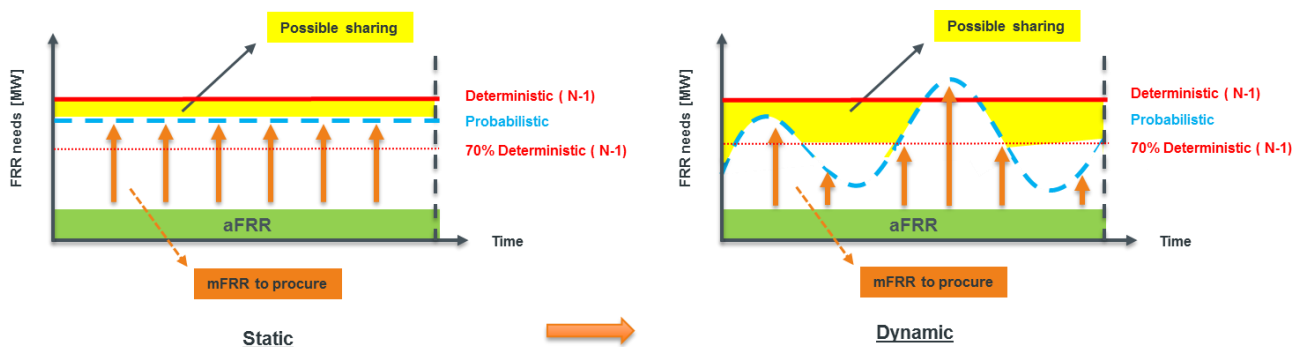


Figure 19 - Impact on upwards reserve sharing of daily dimensioning and procurement

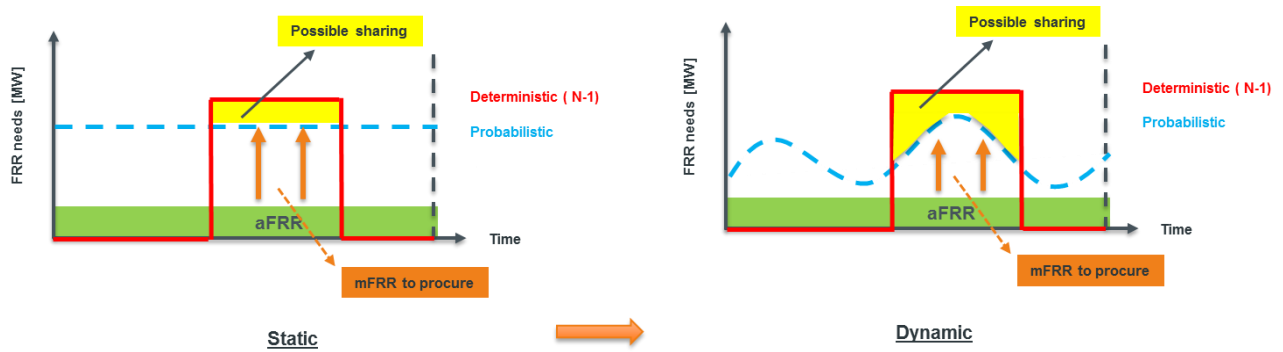


Figure 20 - Impact on downwards reserve sharing of daily dimensioning and procurement

6.4 Intermediate conclusion

Moving to daily procurement of mFRR balancing capacity could allow – only under certain conditions – to determine the volume of reserve sharing in a dynamic and more optimal way. However in other conditions the implementation of dynamic procurement and dimensioning wouldn't have any impact on the sharing volumes which can be considered.

In general we expect that the reserve sharing potential will remain limited by the sharing agreements, the caps imposed by SOGL as well as the available cross-border capacity. As far as the latter is concerned, we believe that an approach based on past availability is more suitable than an approach based on predicting the outcome of the day-ahead flow-based clearing algorithm and intraday capacity allocation (which can yet influence the available intraday capacity after the day-ahead coupling) which is not possible in an accurate way.

7 Conclusion and next steps

Based on the assessment made in the present study, we recommend that all mFRR reserves are procured on a daily cycle with 4 hours blocks. The auction should be organized in day-ahead before the gate closure time of the energy market and after the FCR / aFRR auction. We've seen that such development brings some strong benefits which outweigh the disadvantages it has. Also most of the disadvantages we described can be mitigated. Therefore we recommend to start to procure mFRR down reserve directly in a daily cycle and to start with a daily procurement for mFRR up by begin 2020, in line with the timeline presented during the meeting of 30 November 2017 of the Working Group Balancing (see on Figure 3).

We believe that moving to a unique standard mFRR balancing capacity product (instead of keeping the two products R3 Standard and R3 Flex) is the way forward. Such a change is however only possible in case certain conditions (daily procurement, free activation price with gate closure time for balancing energy bids close to real time and high price cap) are met and in case a sufficient long transition period is foreseen for the current R3 Flex (upwards mFRR) providers to reorganize – when required - their portfolio of flexibility. We recommend therefore implementing a standard mFRR balancing capacity product and stopping R3 Flex (upwards mFRR) by begin 2020. This is in line with what has been announced during the meeting of the 30th November 2017 of the Working Group Balancing (see slide 17).

Non-contracted mFRR (free) bids could be considered to cover the mFRR reserve needs of Elia. However an absolute pre-requisite for doing so is the move to daily procurement. The choice of making use of non-contracted bids should be taken carefully, depending on assurance with respect to availability, procurement considerations (no partial procurement possible) as well as the more structural short and long terms effects on the mFRR reserve market. This is particular true for existing balancing capacity markets like mFRR up where an important part of the reserves is yet covered by assets whose main income is the capacity remuneration or by flexibility developed by demand side management. The cost savings on the short term triggered by a decision to stop having capacity remuneration might potentially be outweighed by more important costs on the longer run and hence have a detrimental effect on the total costs for society.

Moving to daily procurement of mFRR balancing capacity could allow – only under certain conditions – to determine the volume of reserve sharing in a dynamic and more optimal way. However in other conditions the implementation of dynamic procurement and dimensioning wouldn't have any impact on the sharing volumes which can be considered. In general we expect that the reserve sharing potential will remain limited by the sharing agreements, the caps imposed by SOGL as well as the available cross-border capacity. As far as the latter is concerned, we believe that an approach based on past availability is more suitable than an approach based on predicting the outcome of the day-ahead flow-based clearing algorithm and intraday capacity allocation which is not possible in an accurate way.

Appendix 1 - Relevant articles from the European Guideline on Electricity Balancing

Article 3 - Objectives and regulatory aspects:

1. This Regulation aims at:

(e) 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;

(f) 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;

(g) facilitating the participation of renewable energy sources and support the achievement of the European Union target for the penetration of renewable generation.

Article 25 – Requirements for standard products

...

2. By two years after entry into force of this Regulation, all TSOs shall develop a proposal for a list of standard products for balancing capacity for frequency restoration reserves and replacement reserves.

...

4. 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.

5. 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.

6. Standard products for balancing energy and balancing capacity shall: (a) ensure an efficient standardisation, foster cross-border competition and liquidity, and avoid undue market fragmentation; (b) facilitate the participation of demand facility owners, third parties and owners of power generating facilities from renewable energy sources as well as owners of energy storage units as balancing service providers.

Article 26 – Requirements for specific products

1. Following the approval of the implementation frameworks for the European platforms pursuant to Articles 19, 20 and 21, each TSO may develop a proposal for defining and using specific products for balancing energy and balancing capacity. This proposal shall include at least:

- (a) a definition of specific products and of the time period in which they will be used;
- (b) a demonstration that standard products are not sufficient to ensure operational security and to maintain the system balance efficiently or a demonstration that some balancing resources cannot participate in the balancing market through standard products;
- (c) a description of measures proposed to minimize the use of specific products subject to economic efficiency;
- (d) where applicable, the rules for converting the balancing energy bids from specific products into balancing energy bids from standard products;
- (e) where applicable, the information on the process for the conversion of balancing energy bids from specific products into balancing energy bids from standard products and the information on which common merit order list the conversion will take place;
- (f) a demonstration that the specific products do not create significant inefficiencies and distortions in the balancing market within and outside the scheduling area.

2. Each TSO using specific products shall review at least once every two years the necessity to use specific products in accordance with the criteria laid down in paragraph 1.

...

Article 32 – Procurement Rules (Chapter 2 – Balancing capacity)

1. All TSOs of the LFC block shall regularly and at least once a year review and define the reserve capacity requirements for the LFC block or scheduling areas of the LFC block pursuant to dimensioning rules as referred in Articles 127, 157 and 160 of Regulation (EU) 2017/1485. Each TSO shall perform an analysis on optimal provision of reserve capacity aiming at minimisation of costs associated with the provision of reserve capacity. This analysis shall take into account the following options for the provision of reserve capacity:

(a) procurement of balancing capacity within control area and exchange of balancing capacity with neighbouring TSOs, when applicable;

(b) sharing of reserves, when applicable;

(c) the volume of non-contracted balancing energy bids which are expected to be available both within their control area and within the European platforms taking into account the available cross-zonal capacity.

2. The rules for the procurement of balancing capacity shall comply with the following principles:

(a) the procurement method shall be market-based for at least the frequency restoration reserves and the replacement reserves;

(b) the procurement process shall be performed on a short-term basis to the extent possible and where economically efficient;

(c) the contracted volume may be divided into several contracting periods.

3. The procurement of upward and downward balancing capacity for at least the frequency restoration reserves and the replacement reserves shall be carried out separately. Each TSO may submit a proposal to the relevant regulatory authority in accordance with Article 37 of Directive 2009/72/EC requesting the exemption to this requirement. The proposal for exemption shall include:

(a) specification of the time period during which the exemption would apply;

(b) specification of the volume of balancing capacity for which the exemption would apply;

(c) analysis of the impact of such an exemption on the participation of balancing resources pursuant to Article 25(6)(b);

(d) justification for the exemption demonstrating that such an exemption would lead to higher economic efficiency.

Appendix 2 – Relevant articles from the European Guideline on Electricity System Operation

Article 157 – FRR dimensioning (1/2):

1. All TSOs of a LFC Block shall set out FRR dimensioning rules in the LFC Block operational agreement.
2. The FRR dimensioning rules shall include at least the following:
 - (a) all TSOs of a LFC block in the CE and Nordic synchronous areas shall determine the required reserve capacity of FRR of the LFC block based on consecutive historical records comprising at least the historical LFC block imbalance values. The sampling of those historical records shall cover at least the time to restore frequency. The time period considered for those records shall be representative and include at least one full year period ending not earlier than 6 months before the calculation date;
 - (b) all TSOs of a LFC block in the CE and Nordic synchronous areas shall determine the reserve capacity on FRR of the LFC block sufficient to respect the current FRCE target parameters in Article 128 for the time period referred to in point (a) based at least on a probabilistic methodology. In using that probabilistic methodology, the TSOs shall take into account the restrictions defined in the agreements for the sharing or exchange of reserves due to possible violations of operational security and the FRR availability requirements. All TSOs of a LFC block shall take into account any expected significant changes to the distribution of LFC block imbalances or take into account other relevant influencing factors relative to the time period considered;
 - (c) all TSOs of a LFC block shall determine the ratio of automatic FRR, manual FRR, the automatic FRR full activation time and manual FRR full activation time in order to comply with the requirement of paragraph (b). For that purpose, the automatic FRR full activation time of a LFC block and the manual FRR full activation time of the LFC block shall not be more than the time to restore frequency;
 - (d) the TSOs of a LFC block shall determine the size of the reference incident which shall be the largest imbalance that may result from an instantaneous change of active power of a single power generating module, single demand facility, or single HVDC interconnector or from a tripping of an AC line within the LFC block;
 - (e) all TSOs of a LFC block shall determine the positive reserve capacity on FRR, which shall not be less than the positive dimensioning incident of the LFC block;
 - (f) all TSOs of a LFC block shall determine the negative reserve capacity on FRR, which shall not be less than the negative dimensioning incident of the LFC block;
 - (g) all TSOs of a LFC block shall determine the reserve capacity on FRR of a LFC block, any possible geographical limitations for its distribution within the LFC block and any possible geographical limitations for any exchange of reserves or sharing of reserves with other LFC blocks to comply with the operational security limits;
 - (h) all TSOs of a LFC block shall ensure that the positive reserve capacity on FRR or a combination of reserve capacity on FRR and RR is sufficient to cover the positive LFC block imbalances for at least 99 % of the time, based on the historical records referred to in point (a);

Article 157 – FRR dimensioning (2/2)

(i) all TSOs of a LFC block shall ensure that the negative reserve capacity on FRR or a combination of reserve capacity on FRR and RR is sufficient to cover the negative LFC block imbalances for at least 99 % of the time, based on the historical record referred to in point (a);

(j) all TSOs of a LFC block may reduce the positive reserve capacity on FRR of the LFC block resulting from the FRR dimensioning process by concluding a FRR sharing agreement with other LFC blocks in accordance with provisions in Title 8. The following requirements shall apply to that sharing agreement:

(i) for the CE and Nordic synchronous areas, the reduction of the positive reserve capacity on FRR of a LFC block shall be limited to the difference, if positive, between the size of the positive dimensioning incident and the reserve capacity on FRR required to cover the positive LFC block imbalances during 99 % of the time, based on the historical records referred to in point (a). The reduction of the positive reserve capacity shall not exceed 30 % of the size of the positive dimensioning incident;

(ii) for the GB and IE/NI synchronous areas, the positive reserve capacity on FRR and the risk of non-delivery due to sharing shall be assessed continually by the TSOs of the LFC block;

(k) all TSOs of a LFC block may reduce the negative reserve capacity on FRR of the LFC block, resulting from the FRR dimensioning process by concluding a FRR sharing agreement with other LFC blocks in accordance with the provisions of Title 8. The following requirements shall apply to that sharing agreement:

(i) for the CE and Nordic synchronous areas, the reduction of the negative reserve capacity on FRR of a LFC block shall be limited to the difference, if positive, between the size of the negative dimensioning incident and the reserve capacity on FRR required to cover the negative LFC block imbalances during 99 % of the time, based on the historical records referred to in point (a);

(ii) for the GB and IE/NI synchronous areas, the negative reserve capacity on FRR and the risk of non-delivery due to sharing shall be assessed continually by the TSOs of the LFC block.

3. All TSOs of a LFC block where the LFC block comprises more than one TSO shall set out, in the LFC block operational agreement, the specific allocation of responsibilities between the TSOs of the LFC areas for the implementation of the obligations established in paragraph 2.

4. All TSOs of a LFC block shall have sufficient reserve capacity on FRR at any time in accordance with the FRR dimensioning rules. The TSOs of a LFC block shall specify in the LFC block operational agreement an escalation procedure for cases of severe risk of insufficient reserve capacity on FRR in the LFC block.