Requirements for Energy Management Strategies for Delivery Points with Limited Energy Reservoirs (DP with LER)

December 2024

Table of content

1 Introduction

Since the opening of FCR and aFRR products to all technologies, there has been an increase in the number of assets with Limited Energy Reservoirs (LER) participating in the balancing capacity and energy markets. In addition, the volume of LER assets is expected to grow significantly in the future. This could provide opportunities for enhancing liquidity and reducing costs across the aFRR and FCR markets.

However, due to the inherent energy limitations of LER assets, there could be an additional risk that the contracted FCR and/or aFRR Capacity may not be available continuously when Elia needs it. Indeed, there is a risk that the service could not be delivered due to depletion or fulfilling of the energy reservoir. This risk can arise in various scenarios, including but not limited to periods of long activations in the same direction, repeated activations in the same direction without sufficient restoring actions, prolonged frequency deviations in the same direction, or a combination of these events. An example is provided in the figure below, which shows the downward aFRR activations on 7th April 2024. Depending on the size of the reservoir, a BSP which has an aFRR obligation for which it relies on a Delivery Point with LER might need an Energy Management Strategy (EMS) to be able to deliver the service continuously during this period.

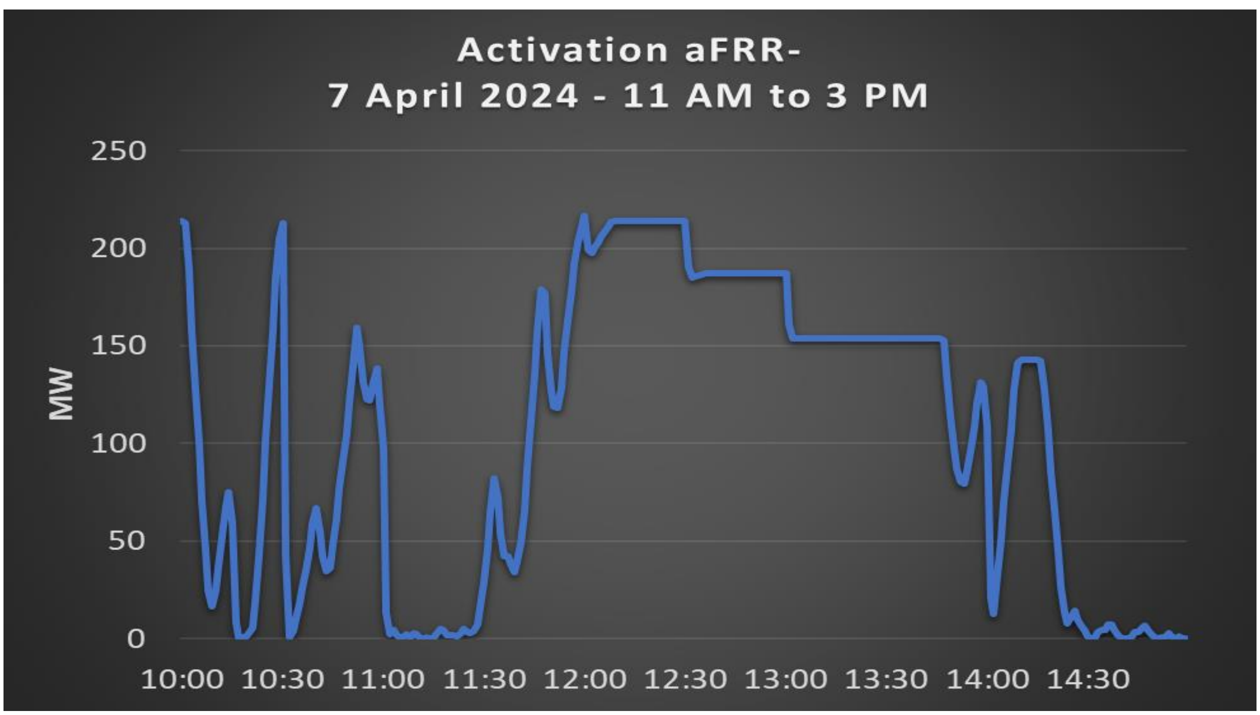

Figure 1: example of large consecutive aFRR- activations.

In this context, it is important to ensure that the contracted reserve capacity is available without interruption, and market parties and Elia have identified the need to clarify the rules in order to:

- Reduce entry barriers while minimizing the risk of undelivered volumes.
- Create a transparent functioning of assets with LER in the market to ensure fair competition among market participants.
- Provide clear guidance to BSPs for their business plans.

The **T&C BSP aFRR** contains several specifications relative to Delivery Points with Limited Energy Reservoir, namely:

- Art. II.1 defined Delivery Points with Limited Energy Reservoir as "*A Delivery Point that contains a Technical Unit which is unable to continuously activate its rated power in the same direction for a period of 4 hours due to the depletion of its energy reservoir, considering that only 50% of the energy reservoir was available at the start of the activation.*"
- In Art. II.3 of the T&C BSP aFRR, it is specified that: "***Each Delivery Point with Limited Energy Reservoir should be included in an energy management strategy****, as described in Annex 2.D.* ***ELIA validates the energy management strategy or provides a justification for rejecting it****. The* ***BSP will****, at all times,* ***operate the Delivery Point with Limited Energy Reservoir in line with the energy management strategy validated by ELIA****.*"
- Annex 2.D of the T&C BSP aFRR specifies that: *"****In case the BSP wishes to add a Delivery Point with Limited Energy Reservoir to its Pool, the BSP needs to send an energy management strategy*** *[...]. The energy management strategy aims to prove the ability of a Delivery Point with Limited Energy Reservoir, on its own or together with other Delivery Points of the Pool, to comply with requirements for provision of the aFRR Service [...]* The required information for the energy management strategy is described in the document "aFRR Energy Management Strategy Requirements" which is published on the ELIA website [...]."

Moreover, the **T&C BSP FCR** also contains specific requirements for Delivery Points with Limited Energy Reservoir, including:

- A Delivery Point with Limited Energy Reservoir is defined as ”A Delivery Point for which the full activation of FCR for a period of 2 hours in either positive or negative direction might, without consideration of the effect of an Active Energy Reservoir Management, lead to a limitation of its capability to provide the full FCR activation due to the depletion of its energy reservoir(s) taking into account the Effective Energy Reservoir effectively available.
- ” Each Delivery Point with Limited Energy Reservoir should be included in the Energy Management Strategy […]”
- “In accordance with Art. 156(13)(b) of SOGL, the BSP ensures the recovery of the energy reservoirs as soon as possible and at the latest within 2 hours after the end of the Alert State for any Delivery Point with Limited Energy Reservoir participating to the provision of the FCR Service.”
- “For Delivery Points with Limited Energy Reservoir the BSP communicates to ELIA the available margin (in MWh) via his real-time connection […]”
- “A **BSP needs to present a documented Energy Management Strategy** with which he aims to prove the ability of each Delivery Point with Limited Energy Reservoir to comply with requirements for provision of the FCR Service […]. To this purpose, the **BSP needs to demonstrate that his proposed Energy Management Strategy has no impact on a third party (e.g. on the BRP) and does not use the imbalance market as its only charging strategy**. The required information for the Energy Management Strategy is described in the document “FCR Energy Management Strategy Requirements” which is published on the ELIA website […]”.

The present “Energy Management Strategy Requirements” document complements the T&C BSP aFRR and the T&C BSP FCR by:

- Providing some background information related to the need and use of energy management strategies;
- Providing information related to specific energy management strategies that are allowed and that are not allowed;
- Describing the information required from the BSP for demonstrating that its energy management strategy is compliant.

It should be noted that the approval by Elia of the BSP's EMS aims at guaranteeing that the BSP will be able to provide the service in line with the T&C BSP aFRR and/or T&C BSP FCR. It is however in no case an approval of the pricing strategy of the BSP and it is also without prejudice to any obligation resulting from the T&C BSP aFRR and/or T&C BSP FCR.

In addition of his EMS, Elia asks the BSP to provide the State of Charge (SoC) of each DP with LER to Elia in real-time. This data will be used for monitoring purposes.

2 Scope and need for EMS requirements

2.1 Scope of the EMS requirements

The principal objective of the EMS is to ensure that a DP with LER can provide the contracted services without being limited by its energy reservoir during service delivery. **The EMS requirements thus only apply to the contracted services**, and more **specifically FCR and aFRR** as well as any simultaneous combinations involving these contracted services [1].

No EMS requirements apply for Delivery Points with Limited Energy Reservoir participating solely to non-contracted services, i.e., market segments or services for which there is no obligation to offer the service for a sustained period, such as the day-ahead and intraday energy markets and/or the offering of non-contracted aFRR/mFRR energy bids. However, in case of the simultaneous provision of a contracted service (FCR, aFRR) and a non-contracted service, the energy management strategy must contain some information related to the intended use of the Delivery Point with Limited Energy Reservoir for non-contracted services. This is because the use of the asset for non-contracted services can influence the energy content of the DP with LER, thereby affecting its ability to provide contracted services without interruption.

2.2 Need and purposes for the EMS requirements

As indicated above, EMS requirements have been introduced for ensuring that a contracted service can be delivered when needed. The EMS requirements can be seen as serving two distinct purposes related to two different phases for offering contracted services:

1. **Validation/prequalification phase**. As part of the prequalification, the BSP intending to use a DP with LER must describe the EMS and needs to demonstrate that this EMS allows continuously delivering the maximum volumes of contracted services the BSP intends to offer in the aFRR and/or FCR Capacity auctions.
2. **Service delivery/monitoring phase.** During the provision of the contracted services, the description of the EMS, together with the submission of relevant data, enables monitoring whether i) the DP with LER is effectively operated in line with the validated EMS, and ii) that the EMS remains effectively sufficient for ensuring that the contracted service can be delivered.

[1] EMS requirements could however be introduced in the T&C BSP mFRR in the future.

The two different purposes and phases are summarized in the table below.

	Validation/prequalification phase	**Service delivery/monitoring phase**
When?	Before service delivery / when the EMS is modified	During service delivery
Focus	The maximal volume of contracted reserves that can be provided by the DP with LER	1. the DP with LER is effectively operated in line with the validated EMS 2. the EMS remains sufficient for ensuring that the contracted service can be delivered
How?	By providing a description of the EMS and a proof that the DP with LER can provide the contracted reserves	By providing additional data enabling the monitoring of the operation of the DP with LER[2]

[2] To be implemented after further consultation with market parties and after amendments to the T&C BSP FCR/aFRR.

3 The various Energy Management Strategies

Every BSP with DP with LER must have a validated EMS for the reserves (or combination of reserves) it intends to be contracted for. Before providing an overview of EMS strategies, it is important to highlight certain points:

- The list of energy management strategies presented in this document is not exhaustive. If a BSP considers using a strategy not listed in this document, it should describe it in its EMS. Elia will then analyze whether the strategy ensures delivering the contracted service. If necessary, Elia could update the present document after the analysis of the submitted strategy. In such a case, Elia will first engage in informal consultations before publishing the updated document on the website and no confidential information will be communicated.
- In cases of (suspicion of) market manipulation or if an allowed energy management strategy results in non-compliant delivery of the contracted service, Elia may adapt the EMS requirements by defining additional conditions or withdrawing the strategy from the list of allowed strategies. Elia will justify the decision, informally consult with market parties, and publish the updated document on the website.
- The energy management strategy submitted by the BSP to Elia is considered confidential and will not be published. However, CREG could have access to it if it is deemed necessary.
- The BSP has the possibility to use a combination of energy management strategies.

3.1 Overview of energy management strategies

The table below provides an overview of the allowed and not allowed strategies. The following sections of this chapter further elaborate on each strategy.

<table>
<tr><th>Strategy</th><th>FCR</th><th>aFRR/mFRR</th></tr>
<tr><td>Use of state-of-charge supporting assets</td><td colspan="2">Allowed and potentially sufficient</td></tr>
<tr><td>Use of the Intraday market</td><td colspan="2">Allowed and potentially sufficient</td></tr>
<tr><td>Transfer of obligation</td><td colspan="2">Allowed but insufficient</td></tr>
<tr><td>Asymmetric pricing</td><td>Not applicable</td><td>Allowed but insufficient</td></tr>
</table>

Use of the tolerance band in the activation control	Not allowed[3]	Not allowed
Imbalance charging	Allowed under conditions	Not Allowed

3.1.1 Use of back-up assets

The use of back-up assets refers to the possibility for the BSP to use other technical units to recharge/discharge the DP with LER. He has two possibilities to do so:

- The BSP operates another DP, which can be used to manage the reservoir of the asset with LER when needed, while still delivering the service that he has been contracted for as requested by Elia.
- The BSP has an agreement with the operator of a "back-up technical unit"[4], which can be used to manage the reservoir of the asset with LER when needed, while still delivering the service that he has been contracted for as requested by Elia.

This strategy is considered as acceptable as part of the EMS of the BSP, under the conditions and common understanding addressed in the present section.

When applying this strategy, the aFRR baseline of the DP with LER sent by the BSP to Elia will be impacted[5,6]. This is illustrated in the example below, where for the sake of simplicity we consider no aFRR activation during the charging of the DP:

- A DP with LER is only participating to the aFRR service. This DP is included in an aFRR energy bid of 10MW in both directions. The SoC of the DP with LER is at 25% before activation.
- To recover an optimal SoC close to 50% (which allows the DP with LER to provide aFRR up and down during the long duration activations), the DP with LER will have to charge. To do so, it starts charging by offtaking 5MW from to grid, while the other technical unit starts injecting 5MW into the grid.
- In the absence of aFRR activation, the DP with LER will offtake 5 MW from the grid. As a result, the aFRR baseline of the DP with LER is changed from 0MW to 5MW.

---

[3] Currently, there is no tolerance band for FCR. In case an activation control using a tolerance band is introduced in the T&C BSP FCR, similar conditions with respect to the tolerance band would apply as for aFRR, i.e., the tolerance band is not allowed to be used as an energy management strategy.

[4] Being the grid user himself or the BRP of the technical unit.

[5] Exception in the case of a DP inside the aFRR pool: the BSP may decide to deliver the aFRR with the SoC supporting technical unit instead of with the DP with LER. The difference is that the baseline of the battery doesn't necessarily have to be adapted as illustrated in the example below.

[6] From the moment a declarative baseline is applied for FCR, this also holds for FCR.

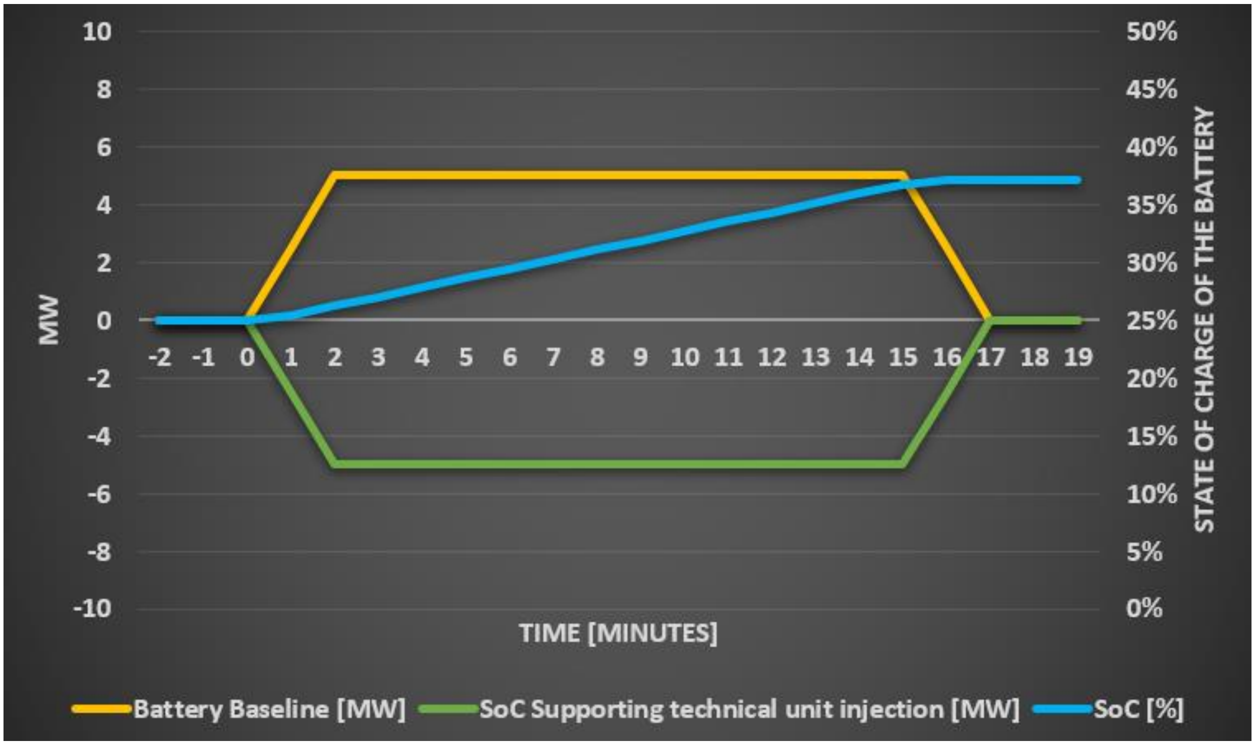

Figure 2: impact of the use of a SoC supporting technical unit on the baseline of the DP with LER

The change of baseline of the DP with LER must be traceable to the use of the SoC supporting technical units. Upon request of Elia, the BSP must justify its baseline modification and explain how he operated the DP with LER and the SoC supporting technical unit used for recharging/discharging during that specific moment.

Note: in order to ensure that the BRPs of the DP with LER and of the other technical unit are not unbalanced by the recharging/discharging period, the BSP shall make the necessary contractual agreements with the BRPs and/or with the grid user. The conditions to have the other technical unit used for recharging/discharging inside or outside the aFRR pool are the following:

- For SoC supporting technical units with schedules, Elia has access to schedules and measurement data. Therefore, these SoC supporting technical units can but do not have to be included in the aFRR pool.
- For SoC supporting technical units without schedules, as there is no possibility for Elia to trace the baseline modification to the use of the SoC supporting technical unit if this unit is outside the aFRR pool, it is requested to include the SoC supporting technical units in the aFRR pool (f.i. part of the aFRR Supporting Providing Group).
- An exception however is granted to technical units without schedules that participate to a FSP Contract DA/ID and for which the activation is performed in line

with the conditions of the FSP Contract DA/ID, as Elia has access to the data necessary to allow traceability of the baseline modifications.

3.1.2 Use of intraday market

This strategy refers to the possibility for the BSP to use the intraday market to manage its SoC. It is considered as acceptable as part of the EMS of the BSP, under the conditions and common understanding addressed in the present section.

For the sake of simplicity, we consider in this section that the BRP_{Source} is the same party as the BRP_{BSP}. When this is not the case, the BSP shall make the necessary contractual agreements with the BRPs and/or with the grid user to ensure that the balancing position of the different parties is not impacted during the recharging/discharging period.

Imposing a SoC supporting technical unit to be reserved for each asset with LER delivering aFRR/FCR/combo's can be suboptimal from an economic perspective. Accessing alternative recharging assets on the intraday market may be economically beneficial.

There is however a risk that the ID trade is not corresponding to a change of the injection in (offtake from) the grid. This can be illustrated in the example below:

- The Belgian system is short, the SoC is reaching its limit.
- A counterparty BRP is long and accepts to be closer to a balanced position.
- An ID deal is settled between the BRP_{BSP} and the counterparty BRP which is long.

This leads to a balanced position of the BRP_{BSP}, as the ID deal will solve the issue of the SoC of the battery and the service will be considered as delivered (as the BSP will have modified its baseline in an appropriate way), but physically, there is no change of the injection in (offtake from) the grid as the counterparty BRP is only trading his already present imbalance. This eventually leads to an equivalent to imbalance charging, as in total there will be more offtake in the system.

This risk is expected to be much higher if the ID deal is occurring close to real-time, as assets which have the technical ability to react fast are expected to be either offered as balancing energy to Elia, or already used for self-balancing.

An additional risk is the limited liquidity on the local ID market close to real-time. Recent statistics show that, between 1h30 and 1h before the start of the delivery of the quarter-hour, the liquidity for 1h-blocks taking place on EPEX Spot or Nord Pool can be considered as sufficient. Therefore, the BSP has the possibility to assume in its EMS simulations that the liquidity for 1h-blocks on the ID market is always present. However, liquidity for 30-minutes blocks is very limited. Concerning 15 minutes product, the liquidity has increased significantly since April 2023, but it is not yet at the level of the 1-hour blocks.

Therefore, the BSP can use the intraday market to restore the energy content of its DP with LER as follows:

- The ID deal must be closed at least 1 hour before the start of the delivery of the quarter-hour (i.e. before the gate closure time of the cross-border ID market). ID deals beyond this 1-hour limit are not allowed. This provision allows to limit the risk of trades without impact on grid injection (offtake) and to increase the liquidity, especially in critical situations for the grid.
- The BSP can use the 60' products without restriction.
- If the BSP wants to use 15' and/or 30' products, he must demonstrate that the liquidity was sufficient for its intended use (i.e. demonstrate that the required volumes were effectively present in the order books). If Elia observes that the volumes for 15' and/or 30' products continue to increase, Elia will consider further relaxing this condition.
- The nomination must be instructed on the Elia HUB ID until 1 hour before the start of the quarter-hour and must be tagged as being used for SoC management[7].
- The ID trade can but does not have to be settled through a NEMO. However, it is not allowed to have a framework agreement with a BRP accepting to sell or buy the volumes required by the BRP_{BSP} without the BRP taking the necessary actions to compensate the trade.

It should be noted that the BSP must be able to still deliver the offered volume even in case of recharging/discharging in the same direction as the requested activations. For example, a BSP who relies only on a 10MW DP with LER to deliver aFRR, who plans to submit bids with a same volume in both direction and who needs to buy 4MW on the ID market according to its EMS, cannot bid more than 6MW in each direction in the capacity auctions. As a result, in this case, a derating of 4MW is necessary.

3.1.3 Transfer of obligation

The BSP uses a transfer of obligations in line with the modalities in the T&C BSP FCR and the T&C BSP aFRR. For the sake of clarity, transfer of obligations is allowed for a BSP identifying that it might not be able to provide the service. However, it cannot be accounted for to prove that the EMS submitted by the BSP enables delivering the contracted service, as there is no guarantee that the BSP will find a counterpart.

[7] This functionality is to be added by Elia in the Elia hub ID.

3.1.4 Asymmetric pricing for aFRR

Asymmetric pricing refers to the BSP adapting the price of the aFRR Energy Bid(s) based on the SoC, resulting in a change of the probability of being activated in a given direction. This strategy is considered as acceptable as part of the EMS of the BSP, under the conditions and common understanding addressed in the present section.

This strategy can be efficient in reducing the costs on the aFRR market as:

- It is efficient in limiting the need to rely on potentially costly SoC supporting technical units or ID trades;
- The aFRR Energy Bids containing DPs with LER are expected to be earlier in the merit order in the direction improving the SoC.

It should however be noted that the aim of the asymmetric pricing cannot be that the BSP is positioning the aFRR Energy Bid at the end of the merit-order in function of the SoC irrespective of the opportunity costs, which would potentially lead to a significant and artificial increase of costs. Elia refers to the CREG's presentation during the workshop on the 24th of February 2022 for more details[8]. In any case, this strategy is not considered to be sufficient on its own, as it cannot be excluded that all bids in the local merit order are activated.

As stated in the introduction, the approval by Elia of the BSP's EMS aims at guaranteeing that the BSP will be able to provide the service in accordance with T&C BSP aFRR. It is, however in no case an approval of the pricing strategy of the BSP.

3.1.5 Use of tolerance band in activation control[9]

The aFRR Energy Discrepancy determined as part of the activation control for aFRR considers a permitted deviation. Systematically using the resulting tolerance band as strategy would consist in systematically delivering more or less than the aFRR requested based on the SoC of the DP with LER, while avoiding costs related to the activation control incentives. Therefore, this strategy is not allowed as it would lead to systematic service delivery discrepancies, while this is not the tolerance band's objective.

3.1.6 Imbalance charging

Imbalance charging refers to the recovery of the SoC by changing the offtake from (injection in) the grid without any compensation measures (SoC supporting technical units or trades

---

[8] The presentation is available on the Elia website.

[9] Currently, this only applies to aFRR. However, this will also apply to FCR from the moment a continuous activation control with tolerance band, similar to the one used for aFRR, would be introduced in the T&C BSP FCR.

on the ID market) and irrespective of the system imbalance. In practice, a BSP doing imbalance charging would change the baseline of its DP with LER and its BRP would be exposed to the imbalance tariff[10].

The strategy is not allowed for aFRR.

For FCR, imbalance charging is currently allowed under the following restrictions (annex 2.D of T&C BSP FCR):

- The BSP needs to demonstrate that its proposed Energy Management Strategy has no impact on a third party (e.g. on the BRP).
- Its EMS does not use the imbalance market as its only charging strategy.

There are currently European discussions concerning the allowed EMS for FCR, which might lead to a future revision of the (conditions related to) this exception.

It must further be noted that, under the conditions referred to in the terms and conditions for balance responsible parties (T&C BRP), DPs with LER could be used by the BRP to contribute in real time to the overall objective of maintaining the balance of the Belgian control area by deviating from the balance of its balancing perimeter. While such actions could also help in certain moments to restore the state-of-charge to a more desired level, an energy management strategy solely based on such opportunities is not considered to be sufficient to guarantee that the requested service can be delivered.

[10] This change of baseline applies for aFRR and will also apply for FCR at the moment a declarative baseline for FCR is introduced.

4 Description of the EMS

The description of the EMS for one or more DP with LER contains at least the following information:

- The identification and characteristics of the DP with LER for which the EMS is submitted.
- An exhaustive description of the energy management strategy.
- An indication of whether or not the submitted EMS is intended to replace an earlier validated EMS.
- An overview of the contracted services for which the DP with LER is intended to be used, including an overview of the maximum volumes the BSP intends to offer for each of the contracted services at a given moment in time.
- If applicable, an overview of the intended use of the DP with LER for non-contracted services in moments the contracted service is also offered.
- An indication of whether the BSP intends to prove the effectiveness of the EMS via a deterministic analysis or via a simulation based on historical data. In case the BSP opts for a deterministic proof of the effectiveness of the EMS, a description of the proof. In case the BSP opts for a proof based on a simulation, the assumptions used by the BSP (e.g., related to the liquidity on the intraday market).

To this end, the BSP must use the "EMS description" template published on the Elia website, which contains more information related to the specific information to be provided. Note that the template could evolve over time based on a return of experience.

4.1 Maximum volumes of contracted services

With respect to the maximum volumes the BSP intends to offer for each of the contracted services at a given moment in time: the BSP could describe one or different EMS for different volumes it intends to offer at a given time for instance depending on the market conditions (e.g., aFRR Up only, aFRR in both directions, aFRR Down Only, FCR Only). In that case, the BSP must also provide a proof of the effectiveness of the EMS for each of these cases.

Similarly, in case a DP with LER (or group of DP with LER) is intended to be used for offering different contracted services at the same moment (e.g., a certain volume of FCR and a certain volume of aFRR in one/both directions), the BSPs must comply with the following elements:

- The maximal volumes for each of the contracted services must be clearly specified.
- The BSP must provide a proof of the effectiveness of the EMS in delivering all contracted services.

- The specific rules for each reserve must always be respected (e.g., the energy bands for FCR).

Concretely, it means that one validation must be done for the following cases:

- FCR only.
- aFRR up only.
- aFRR down only.
- Symmetrical aFRR.
- Every combination of aFRR with FCR.

4.2 Use of the DP with LER for non-contracted services

As stated in Section 2.1, in case the DP with LER is intended to be used for the simultaneous provision of a contracted service (e.g., FCR, aFRR) and a non-contracted service (e.g., intraday markets, portfolio balancing), the energy management strategy must contain some information related to the intended use of the Delivery Point with LER for non-contracted services. Concretely:

- The description of the EMS must clearly specify the following information related to the use of non-contracted services.
  - the maximal power that could be used for offering non-contracted services together with the contracted service; and
  - The conditions related to the energy management strategy under which this power is considered not to be available and would hence not be used (e.g., depending on the SoC).
- In case the BSP demonstrates the effectiveness of the EMS, the intended use of the DP with LER for non-contracted services must be taken into consideration.
- The BSP needs to operate the DP with LER in line with the validated EMS strategy, and hence also in line with the intended use for non-contracted services.

Example: provision of aFRR symmetrical and Intraday

One DP with LER intends to provide aFRR symmetric. Let's assume that the DP with LER is a large-scale battery of 50 MW/200 MWh with a prequalified symmetrical aFRR of 36 MW (14 MW of reserved power for EMS).

When the energy level is satisfactory (level to be clarified in the EMS), the BSP intends to use the power reserved for restoring the energy content (14 MW) for performing ID transactions. In his EMS, the BSP must clearly state:

- The maximal power: the power reserved for EMS regulation.

- The conditions related to the energy management strategy under which this power is considered not to be available and would hence not be used: when the energy level is not satisfactory (with the level being defined in the EMS).

4.3 Demonstration of the effectiveness of the EMS for delivering the maximal volumes of contracted services the BSP intends to offer

For any contracted reserve or combination thereof, the BSP must demonstrate that the EMS is sufficient for continuously delivering the maximum volumes of contracted services the BSP intends to offer in the aFRR and/or FCR Capacity auctions.

To do so, the BSP has two possibilities: a deterministic proof (further described in Section 4.3.1) and a proof by simulation (further described in Section 4.3.2). Lastly, in the case of combinations, the BSP must provide additional information on the potential combinations as stated in Section 4.2.

4.3.1 Deterministic proof

The BSP can demonstrate deterministically that it can continuously provide the maximum volume of reserves. For example, this can be achieved using a dedicated SoC-supporting technical unit that is always available to fully cover long-term activations.

The deterministic proof must be clear and leave no doubt about the ability to provide the service without interruption. If any doubt remains, the BSP should submit proof via a simulation based on historical data.

4.3.2 Proof by simulation based on historical data

4.3.2.1 General Principles

To prove the sufficiency of the EMS for delivering the maximum volumes of contracted services the BSP intends to offer, the BSP can provide a simulation of its assets based on historical data.

Specifically, the BSP should demonstrate that the energy management strategy ensures that the energy content in the reservoir remains at all times within the limits allowing it to deliver the contracted service(s) for the period covered by the dataset.

For FCR, the DP with LER must at any moment have sufficient energy available to deliver the full contracted FCR volume for an equivalent of 25 minutes in both directions.

Section 5 provides some illustrative examples concerning the proof of the maximal volumes of aFRR and FCR to be provided.

4.3.2.2 Data made available by Elia and data to be provided by the BSP

To enable a simulation of the EMS based on historical data, Elia makes available a dataset containing data that should be considered by the BSP and a template with the data of the simulation to be provided by the BSP. The simulation must be carried out with the most recent data made available by Elia on its website and the template should be used to provide the requested data[11]. The simulation must be as close as possible to the actual behavior during operations.

For FCR, only the frequency data is needed, and it would be made available with the template.

Concerning aFRR, following the connection to the Picasso platform, the required data will be adapted. The data for aFRR will be composed of:

- The incremental and decremental local merit order.
- The global Control target for aFRR.
- (New) The aFRR Cross Border Marginal Price (CBMP).

The provided data must be used to simulate the behavior of the DP with LER in terms of delivered power and SoC over the duration of the simulation.

- For FCR, the power to be delivered can be deducted from the grid frequency.
- For aFRR, the power to be delivered depends on the energy bid prices as well as the data provided by Elia.

[11] BSP can use previous datasets up to two months after the publication of a new dataset.

5 Examples of the determination of the maximal volumes of aFRR and FCR that can be continuously delivered

In this section, examples of the determination of maximal volumes of aFRR and FCR are presented. The examples are based on a fictional battery of 50 MW / 100 MWh with an EMS based on ID transactions and asymmetric pricing of aFRR energy bids. It must be noted that the examples described below are only intended for illustrative purposes. The examples do not represent an indication of a strategies preferred by Elia and do not necessarily represent the most optimal way of ensuring the continuous delivery of a service with a DP with LER.

5.1 Maximal quantity of aFRR in one direction

When only offering aFRR Capacity in one direction (either upward or downward), the power available for (dis)charging can be quite high. Indeed, assuming the battery is operated at 0 MW in absence of aFRR activations or state-of-charge supporting intraday trades, the baseline can in the most extreme case be adapted to 50 MW offtake (injection) while still being capable of offering 50 MW of upward (downward) aFRR. This means that an activation of 50 MW in the upward/downward direction can be fully compensated by a state-of-charge supporting intraday trade. Assuming the EMS results in making such intraday trades, the BSP needs to ensure that i) at all moments the SoC allows delivering the aFRR requested up to the moment the energy related to the intraday trade arrives, ii) that the battery can effectively absorb the energy related to the intraday trade. Assuming this is the case, the maximal quantity of aFRR that can be continuously delivered in one direction corresponds to the nominal power.

5.2 Maximal quantity of aFRR symmetrical

When the BSP intends to offer aFRR symmetrical (i.e., the same volume of aFRR Capacity in the upward and in the downward direction), it is assumed here that the energy content would be regulated to be maintained around 50% of SoC, resulting in 50 MWh available energy in each direction if the SoC is perfectly at 50%. Because that both upward and downward capacity must always be made available and assuming that the BSP intends to prove his capability of delivering a symmetrical volume higher than 25 MW, any state-of-charge supporting action and corresponding change of the setpoint of the battery will not fully offset an activation of the full volume. The BSP can however proof via a simulation based on a statistical dataset that the EMS allows to always deliver the requested service.

The graphs below present a graphical example of the simulation results for a moment with a relatively large activation of aFRR in the upward direction. In red, the SoC is presented. When the SoC starts decreasing, due to the high aFRR up activation, the maximal amount of

ID transactions are activated. The ID transactions are represented via the white line. In this illustration, it is assumed that the BSP intends to provide a proof that 24 MW of aFRR in both directions can continuously be delivered. As a result, the maximum change of the battery setpoint and corresponding SoC-supporting intraday trades correspond to 26 MW.

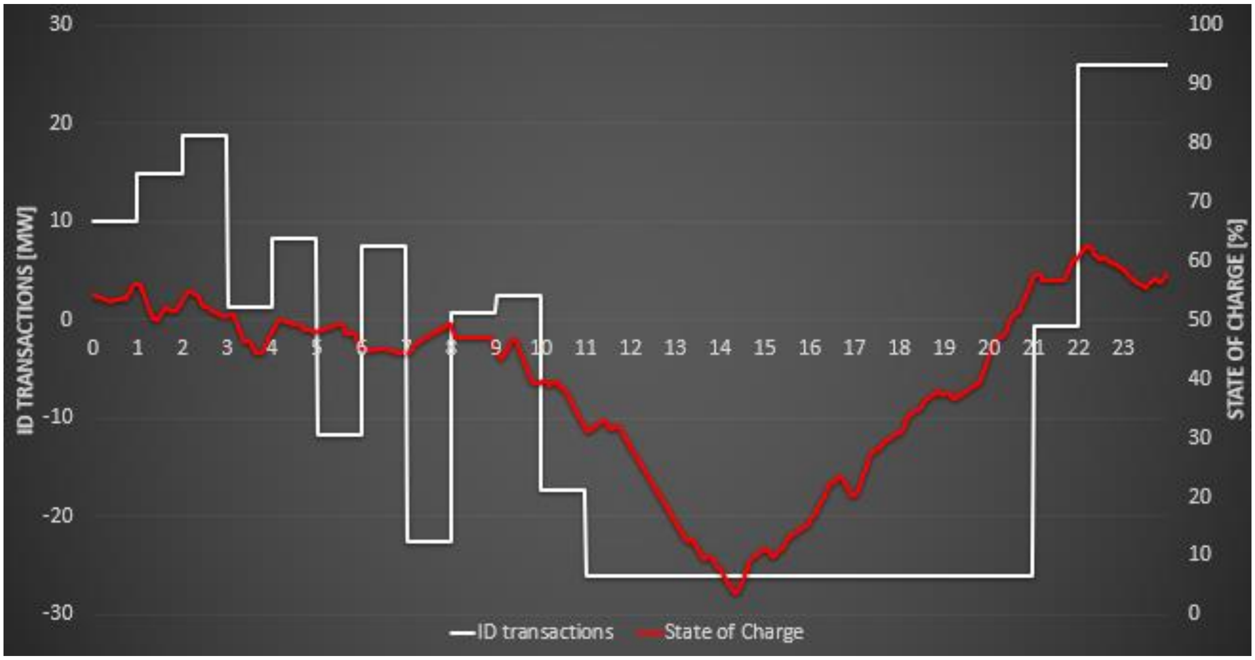

Figure 3: example of a large activation of aFRR upward. ID transactions are at the maximal level of -26 MW.

A larger amount of aFRR and a corresponding smaller amount of potential ID transactions could have led the battery to fail during that precise moment.

5.3 Maximal quantity for the combo aFRR and FCR

Concerning the combo aFRR/FCR, the determination of the maximal volumes that can be continuously delivered is slightly more complex as it relates to the combination of two different products. In the example below, a rationale is presented.

5.3.1 Determining the maximal quantities of each product individually

Three different products are considered: FCR, aFRR up and aFRR down. It is considered that the provision of aFRR up and aFRR down only leads to similar maximal volumes. Nevertheless, the provision of aFRR symmetrical (aFRR up and aFRR down simultaneously) leads to different maximal volume. In the graph below, the maximal capacity of aFFR in one direction, aFRR symmetrical and FCR are presented separately.

The horizontal axis represents the ratio between the energy and the power of the battery. Concretely, the graph presents an illustration of the evolution of the maximal offered volumes that can be delivered as a function of the energy to power ratio of a battery. The values presented here are only for illustration. They depend on each BSP (and their relevant EMS).

- **FCR:** as the service is much less intense in terms of energy compared to aFRR, a smaller energy content is required compared to aFRR. Therefore, already with a relatively limited energy content, the provided FCR power (compared to the total power of the asset) is relatively large. As FCR is symmetric, there is an upper limit for the power band for SoC management.
- **aFRR in one direction.** The charging band is included in the service as it is unidirectional. Under the assumptions taken in Section 5.1, the maximal admissible quantity would be 100%. By considering intraday deals in blocks of one-hour with a gate-closure-time one hour before the start of the period for which the energy is traded, the worst-case scenario is a full activation of the contracted capacity at the start of an hour, in which case the state-of-charge supporting intraday deals only contribute to the energy management after almost 2 hours.
- **Symmetrical aFRR** is symmetric as FCR and the energy demand is higher than FCR. It leads to an increased need for the power band for SoC management and more energy within the battery.

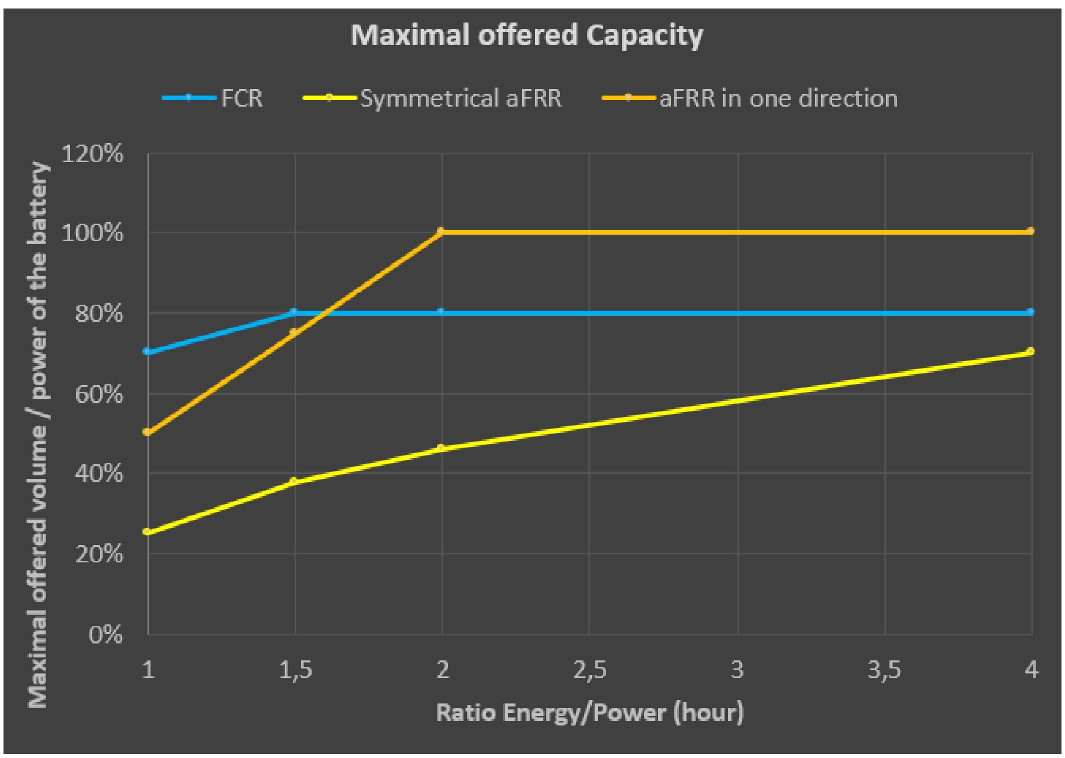

Figure 4: examples of maximal FCR/aFRR depending on the ratio Energy to Power

5.3.2 Combining aFRR and FCR

As described above, there are three different products that can be combined: aFRR up, aFRR down, and FCR. The maximal allowable quantity of one product is therefore linked to the capacity of the two other products.

As FCR will be auctioned first, it is reasonable to set the quantities of aFRR down and aFRR up in function of the awarded FCR. As the aFRR up and the aFRR down are bid simultaneously, the total admissible quantity for a combo product should be know in advance.

For each FCR amount, the BSP could dedicate a specific band and a specific energy level. In the table below, we assume that the BSP would set a charging band equivalent of 20% of the contracted FCR and an energy equivalent of 90 minutes per MW of FCR awarded. Of course, the BSP is free to allocate different values based on its internal strategy.

FCR part of the battery			Remaining battery for aFRR provision			Max aFRR to be awarded	
FCR provided [MW]	FCR charging band [MW]	FCR energy [MWh]	Remaining Energy [MWh]	Power Remaining [MW]	Hours equivalent	Only aFRR one direction [MW]	aFRR symmetrical [MW]
0	0	0,0	100,0	50	2,0	50	23
5	1	7,5	92,5	44	2,1	44	22
10	2	15,0	85,0	38	2,2	38	20
15	3	22,5	77,5	32	2,4	32	18
20	4	30,0	70,0	26	2,7	26	16
25	5	37,5	62,5	20	3,1	20	14
30	6	45,0	55,0	14	3,9	14	11
35	7	52,5	47,5	8	5,9	8	7
40	8	60,0	40,0	2	20,0	2	2

This table is only for illustrative purposes and assumes FCR and aFRR activations are fully independent of each other. Based on this table, it is possible to have two curves showing the maximal amount of aFRR and maximal symmetrical aFRR for each level of awarded FCR.

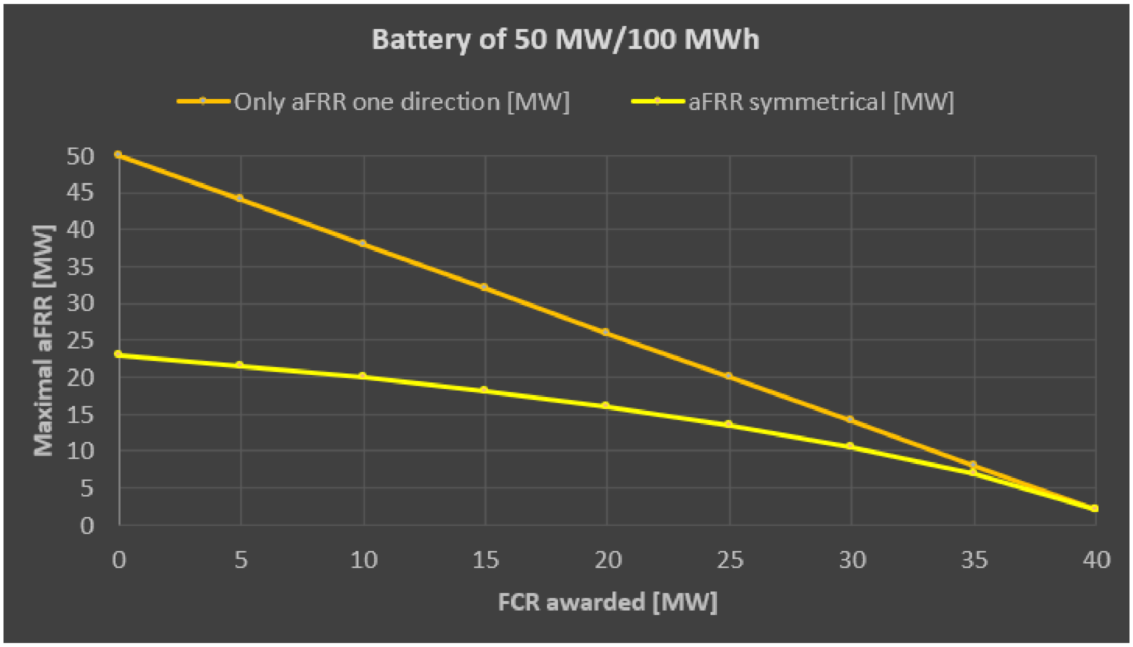

Figure 5: Example of maximal aFRR in function of the volume of FCR awarded

For each awarded quantity of FCR, we therefore have something that can be presented as below. The points are the values when it is only one direction or when it is symmetrical.

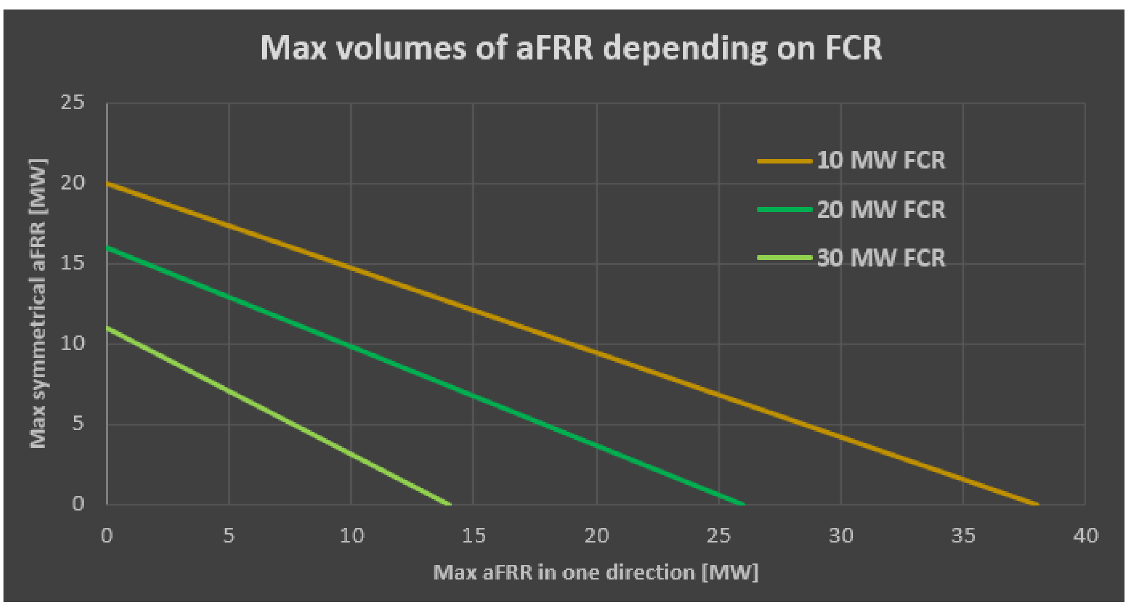

Figure 6: Example of maximal aFRR in one direction and symmetrical aFRR

The transformation from the graph above to aFRR down and aFRR up can be done by doing a linear combination of both.

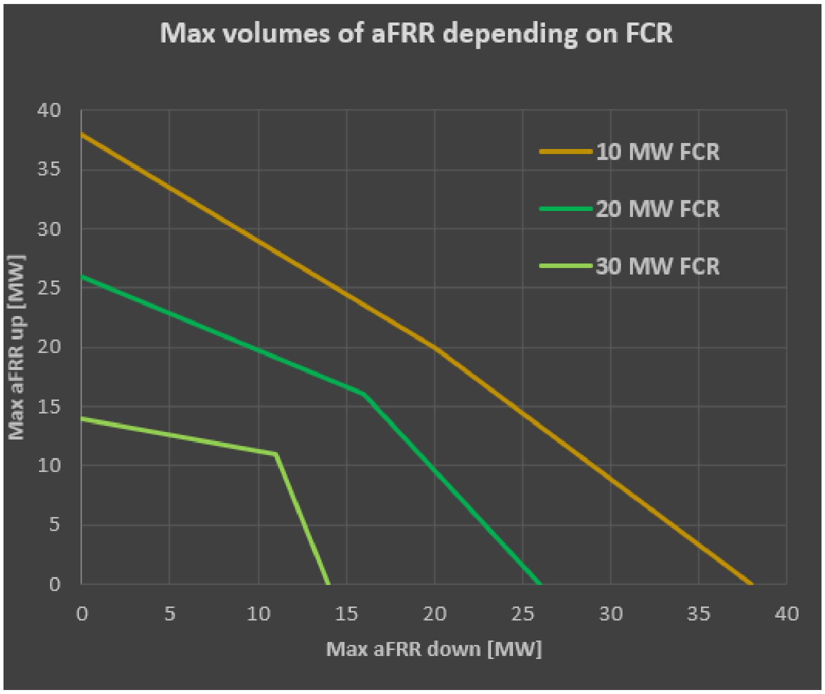

Figure 7: Example of maximal aFRR upward and aFRR downward

5.3.3 The proofs by simulation

In case the BSP intends to deliver both contracted FCR and contracted aFRR with one or more DP with LER, the BSP is not required to provide the proofs for every single potential point of the curves presented above but rather to provide a few simulations that would allow to make a reasonable assessment of the EMS in general.

6 List of abbreviations

aFRR	Automatic Frequency Restoration Reserves
CREG	Commission for Electricity and Gas Regulation
DP with LER	Delivery point with limited Energy Resources
EMS	Energy Management Strategy
FCR	Frequency Containment Reserves
ID	Intraday
LER	Limited Energy Resources
mFRR	Manual Frequency Restoration Reserves
QH	Quarter-hour
SoC	State of Charge