Incentive EMS – workshop

21 June

Agenda

1. **Context**

2. EMS requirements
    - What is it about?
    - Current EMS requirements for aFRR and FCR
    - Why we need EMS requirements

3. Phase 1: Determine the volumes that can be continuously delivered with the EMS – case of combos

4. Phase 2: Ensuring operation of the DP LER in line with the EMS and monitoring options

5. Preliminary conclusions and next steps

Context of the incentive (recall from WG BAL 18/12/2023)

EMS requirements today

- For **aFRR and FCR, Delivery Points with Limited Energy Reservoir (DP LER) must currently provide their Energy Management Strategy to Elia**, which aims to prove the ability of the Delivery Point (on its own or together with other Delivery Points in the pool of the BSP) to comply with the requirements of the aFRR/FCR Service.
- **Elia publishes documents describing a non-exhaustive list of Energy Management Strategies (EMS)** that Elia could approve or not approve, **and the corresponding information required from the BSP**.
- The **current EMS requirements for aFRR and FCR however do not (explicitly) consider the simultaneous participation of a Delivery Point to multiple (balancing) services**.
- No specific and systematic control mechanism is in place for monitoring the correct execution of the Energy Management Strategy.

Relevant evolutions

- It is expected that **the amount of Delivery Points with Limited Energy Reservoir participating to the balancing markets will increase, and that these DPs could stack revenues from different market segments.**
- **Discussions are ongoing at European level on EMS requirements for FCR.**

Context - Objective and work plan (recall from WG BAL 18/12/2023)

The **objective is to develop/adapt/expand the EMS requirements for Delivery Points with Limited Energy Reservoir that participate to multiple services**

This objective is translated into a **work plan consisting of 4 steps**:

Focus of this workshop

1) Provide an **overview of the current EMS requirements for FCR and aFRR and inform stakeholders on the progress on the discussions on European level on the harmonization of FCR requirements**
2) **Assess the sufficiency of the current EMS requirements in the context of a DP participating to multiple market segments** (FCR, aFRR, mFRR and/or DA/ID markets)
3) **Assess the need for specific control mechanisms** to ensure BSPs respect the EMS strategies and, if applicable, define possible control mechanisms
4) **Develop/adapt/expand the current documents describing the EMS requirements**

First insights

Note that a priori, the focus of the incentive is on evaluating the EMS requirements in case of a combo and on assessing the need for specific control mechanisms. Nevertheless, Elia will take the opportunity to re-evaluate certain assumptions currently taken (e.g., absence of sufficient liquidity for sub-hourly products on the ID market) and/or certain processes (e.g., process for updating the data set for the statistical analysis.

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EMS requirements: What is it about?

- The **EMS 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 service**.
- **Each DP with Limited Energy Reservoir participating to FCR or aFRR should be included in an EMS** that is submitted to Elia. Validation of the EMS is performed by Elia.
- **The EMS requirements published by Elia aim to provide clear guidance** for ensuring that the EMS is consistent with the correct delivery of contracted reserves. This need was identified by market parties and Elia in order to:
    1. Reduce entry barriers while limiting the risk of undelivered volumes.
    2. Foster transparency to guarantee a fair competition between market parties.
    3. Provide clear guidance to BSPs for their business plan.
- Currently, there are EMS requirements for FCR and aFRR (with guidelines published on Elia website)
    1. FCR: EMS requirements
    2. aFRR: EMS requirements
    3. All technical documents concerning ancillary services
- The BSP is contractually obliged to operate the Delivery Point(s) with Limited Energy reservoir in line with the corresponding EMS validated by Elia

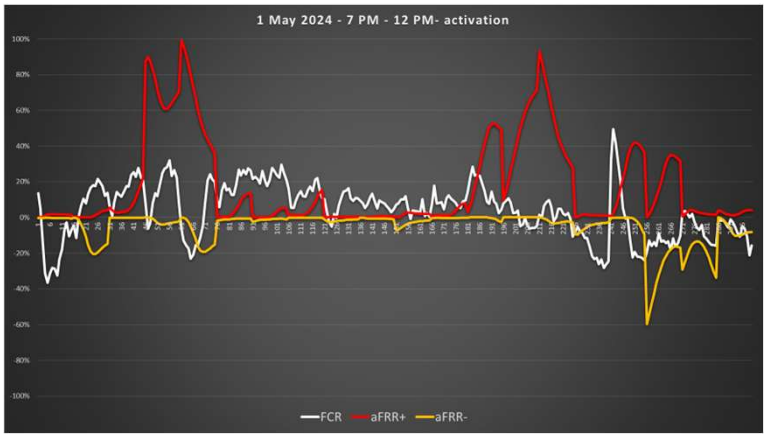
FCR and aFRR are different products with different requirements

FCR

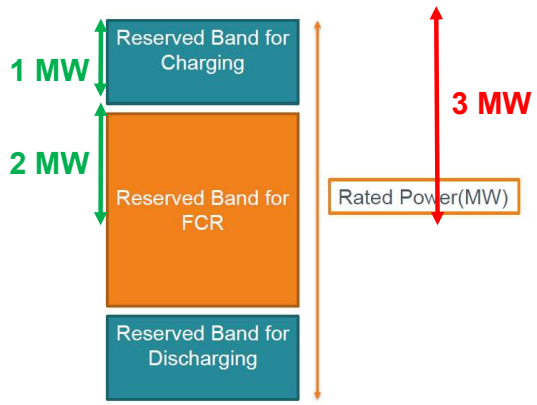
- Low energy content during regular service delivery (symmetrical product with a lot of fluctuations, relatively low average power requested relative to awarded capacity)
  - ➢ The power band required for charging/discharging is typically limited
- The requirements are twofold:
  1. Be able to provide the service in regular operation
  2. Ensure the availability of energy content equivalent to a full activation of the awarded volume for 25 minutes for cases where an alert state would be triggered (~Tmin LER)

aFRR

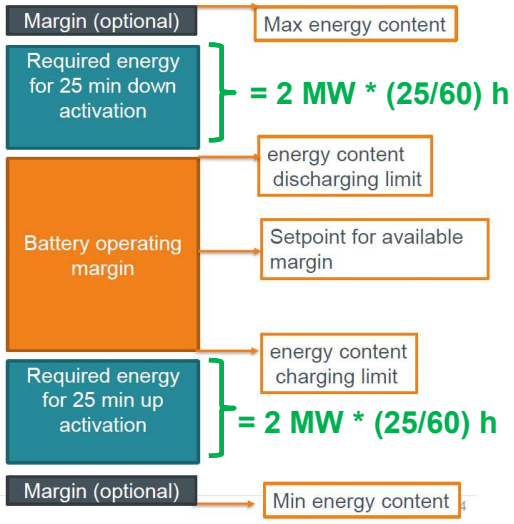
- Higher energy content during regular service delivery (No symmetrical product, slower fluctuations).
  - ➢ The power band required for charging/discharging is generally much la
- No energy band imposed (e.g., for alert state)
- The only requirement is to be able to provide the service in regular operation



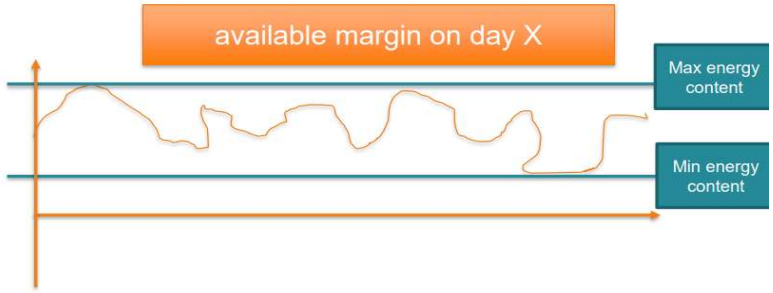
Current EMS requirements - FCR



Example with a 3 MW/3 MWh battery (2 MW FCR + 1 MW of charging band)



BSP is free to choose how to manage the energy (EMS charging technique and power band) as long as the 25 minutes criteria is respected



- Requirement: ensuring 25 minutes of full-activation in both directions (energy bands) at all time.
- Proof to be based on 1-year statistics of frequency data: objective is to ensure that energy bands an be respected.
- Demonstrate that the proposed charging strategy/energy management strategy has no impact on a third party (e.g., on the BRP) and does not rely on mbalance charging as the only charging strategy/

European level discussion on FCR harmonization

Principal discussion points at European level are:

1. **T_min LER:**
    - Currently at 25 minutes in Belgium.
    - Discussions ongoing at European level to harmonize this.

2. **Imbalance Charging:**
    - Discussions are on-going.
    - Currently allowed in Belgium if (from T&C FCR):
        - no impact on a third party (e.g. on the BRP) and,
        - does not use the imbalance market as its only charging strategy.

Current EMS requirements - aFRR

- Instead, **the BSP must demonstrate his capability to continuously deliver the service**.
- The demonstration must be done either deterministically or by simulations over a dataset.

- To manage the energy content, the BSP can reduce the physical injection/offtake of the battery as long as there are guarantees that the required aFRR capacity remains to be provided (e.g., taken over by a back-up asset or an intraday trade performed sufficiently long in advance).

- Additionally, the BSP can use an energy management strategy that reduce the need to rely on SoC supporting assets or ID trades

Allowed EMS techniques (not exhaustive)

Allowed

1. Intraday markets
2. Back-up assets

Allowed but not sufficient

1. Transfer of obligation
2. Asymmetric pricing

Not allowed

1. Use of tolerance bands in activation control
2. Imbalance charging*

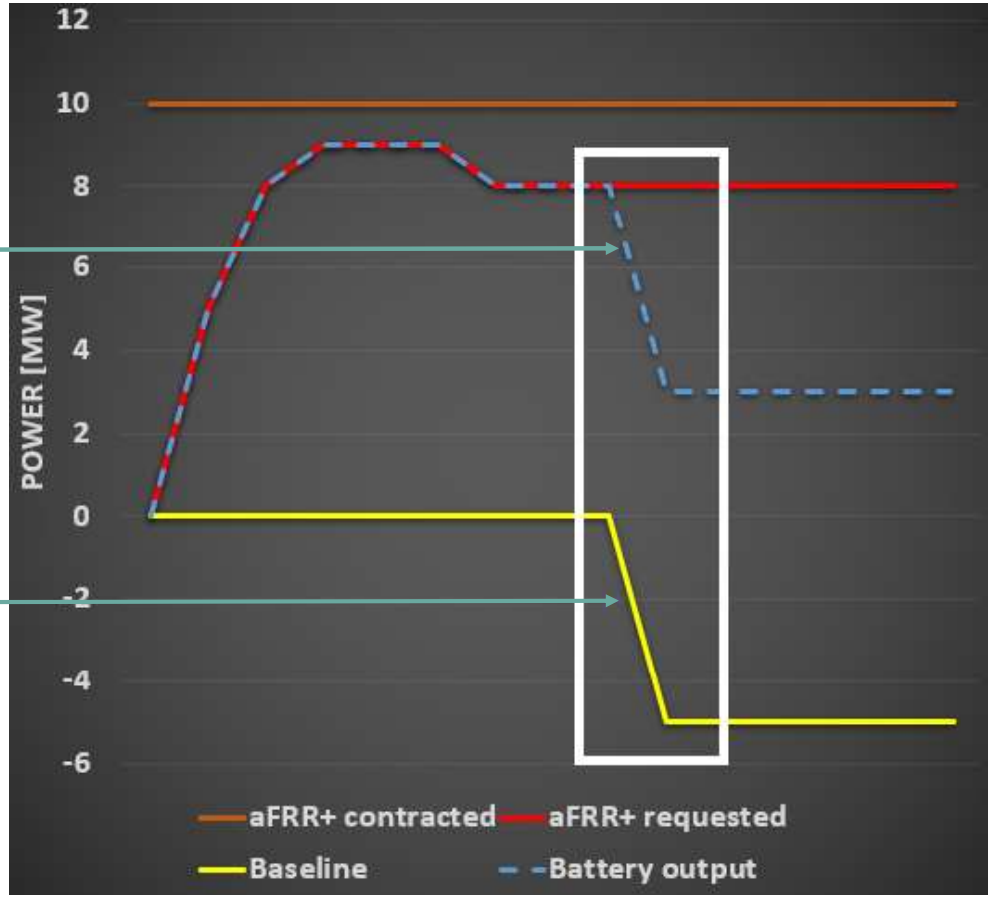
Current EMS requirements – illustration for a battery delivering aFRR

Reduction of the injection of the battery at the moment:

- a SOC supporting asset is activated (covering part of the aFRR requested)
- The period for which an ID deal for SoC management starts

Subsequent reduction of the baseline of the battery. Note that:

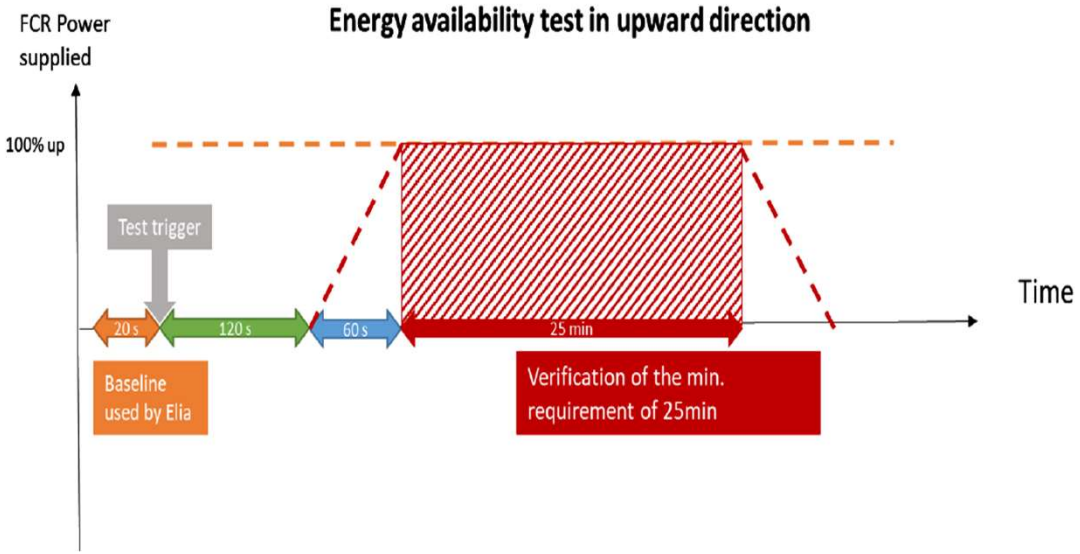
- a change of baseline is only needed in case of a SoC supporting asset outside of the aFRR Pool or in case of an ID deal for SoC management.
- no baseline modification is needed in case the back-up asset is within the aFRR Pool of the BSP.



Current monitoring of the EMS

- **FCR:** monitoring is effectuated via **Energy availability Test,** in which we test the availability of the 25-minutes energy.

- **aFRR:**
  - Ad-hoc monitoring
  - No systematic control mechanisms in place



Why are the EMS requirements useful/needed?
Risk of long duration activation

- **Main risk:** in case of long aFRR/FCR activations, the **contracted aFRR/FCR might not be available due to depletion of the energy reservoir or due to a fully filled energy reservoir**
  - Note: Long aFRR/FCR activations do not happen very frequently today* but …
  - … in these moments, it is particularly important for Elia to be able to count on the dimensioned reserves

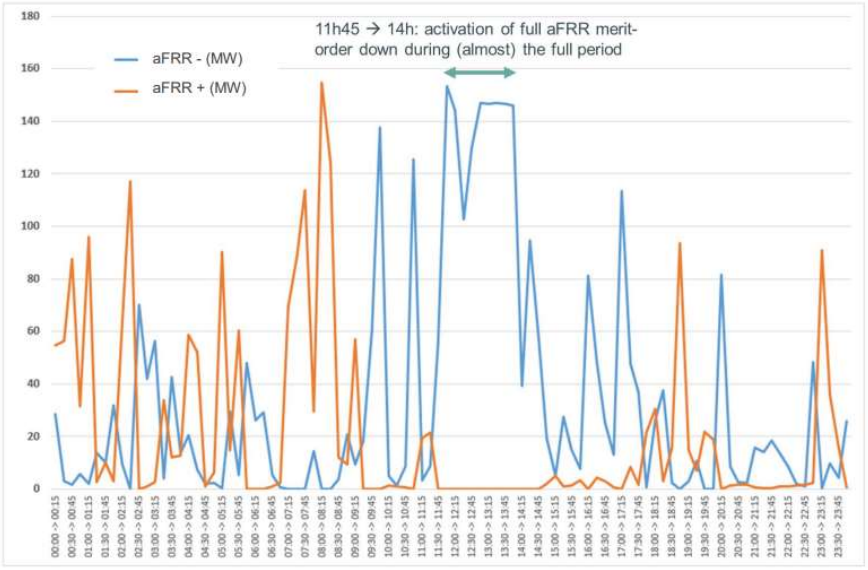


Figure 1: example of continuous downward activation of aFRR for a period of more than 2 hours (example for 25/04/2022)

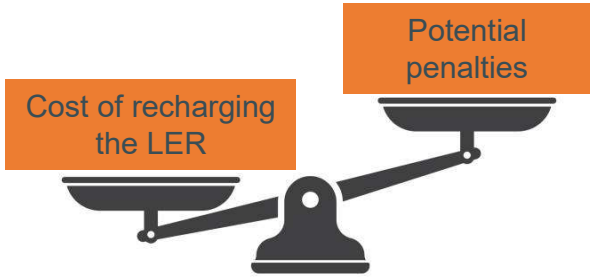
- Two different cases can be distinguished:
  1. In the capacity auction, higher volumes are offered then can be continuously delivered with the EMS of the BSP → Tackled via current EMS requirements
  2. The EMS would allow to continuously deliver the offered/awarded volumes but the LER DP(s) are not operated in line with the EMS → Breach of contractual obligation
     + FCR: energy availability tests
     + aFRR: ad-hoc monitoring

* The frequency of long aFRR activations might be different in the future (e.g., FRR activation trigger, connection to European balancing platforms)

Why are the EMS requirements useful/needed? EMS not followed

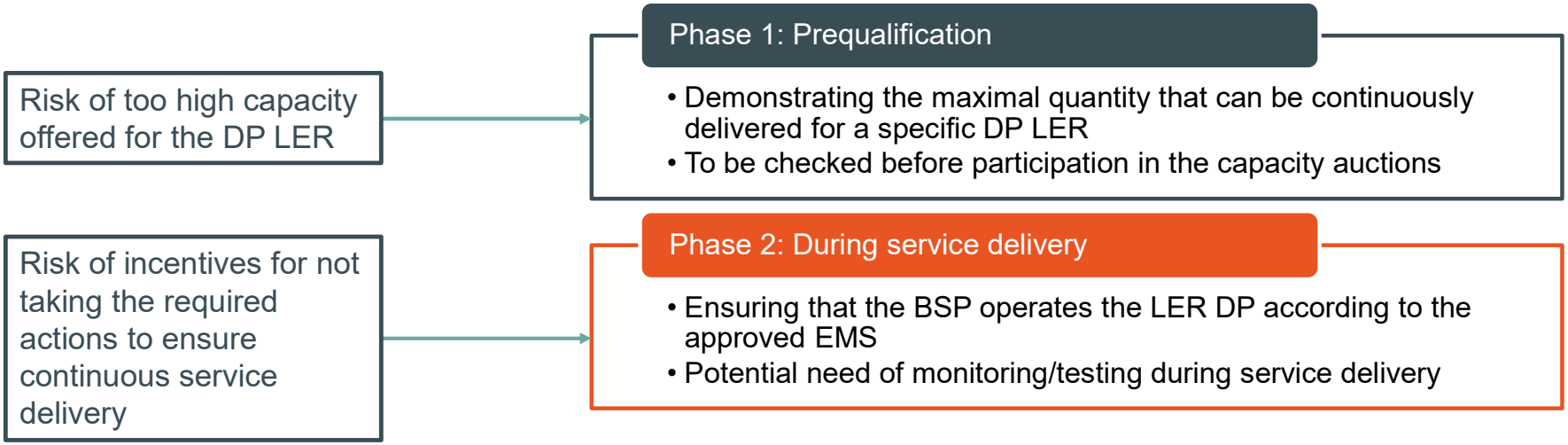
There might be incentives for the BSP to deviate from the validated EMS in certain moments

- The action to recharge the LER DP could in certain moments come with a significant cost (ID deal in stressed situation, cost of activating an expensive back-up asset, etc.).
- The action to recharge the LER DP typically comes with a certain lead time (e.g., activation time back-up asset, time between XBID GCT and period for which the ID trade is made).
  - ➢ The action that needs to be taken to ensure the ability to continuously deliver the service needs to be taken before it is known whether there will be a long aFRR/FCR activation
- ➢ The incentives provided via the MW not made available or the aFRR energy discrepancy might in certain moments not sufficient to ensure the actions to recharge the LER DP are taken in all moments



Why are the EMS requirements useful/needed?

- The EMS requirements have been created **to respond to two different needs**:
  1. Demonstrating the maximum quantity of contracted aFRR/FCR that could be continuously delivered by the LER DP (on its own or together with other DPs in the pool) with the EMS proposed by the BSP.
  2. Ensuring that the BSP effectively operates at all times the LER DP in line with the approved EMS.



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4. Phase 2: Ensuring operation of the DP LER in line with the EMS and monitoring options

5. Preliminary conclusions and next steps

Maximal volumes that can be continuously delivered with a given EMS Impact and types of "combo"

Phase 1: Prequalification

- Demonstrating the maximal quantity that can be continuously delivered for a specific DP LER
- To be checked before participation in the capacity auctions

This **need for demonstrating that a certain volume can be continuously delivered only exists for contracted services** (FCR, aFRR, mFRR) (linked to the contracted period).

However, the **use of a DP LER for non-contracted services*** impacts the energy in the reservoir and hence **could impact the ability to continuously deliver a certain volume for a contracted service**.

For the use of a DP LER for multiple services at the same time, **2 different cases** should be considered:

1. The **DP LER is intended to be used for two contracted services** → **Focus now on FCR and aFRR but Elia will investigate other products (mFRR)**
2. The **DP LER is intended to be used for a contracted service and for a non-contracted service** → **Similar requirements should apply for how non-contracted services should be considered in the EMS for a contracted service**

* Non-contracted services comprise Intraday and day-ahead trades (outside the EMS), non-contracted aFRR/mFRR energy bids, reactive balancing, maximization of self-consumption, …

Maximal volumes that can be continuously delivered with a given EMS
DP LER participating to contracted FCR and aFRR - Example 1

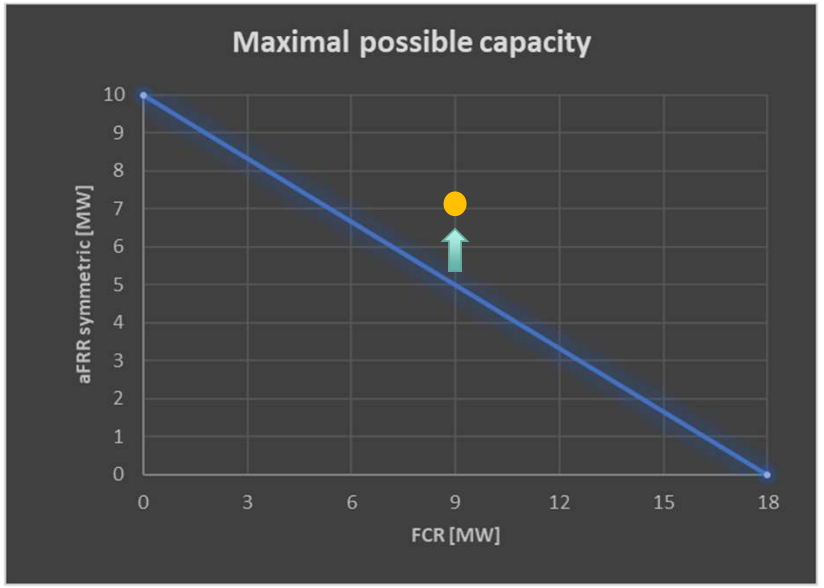
Consider **a 20 MW/40 MWh battery** with the following volumes that can be continuously delivered for aFRR and FCR separately:

- aFRR: 10 MW symmetrically
- FCR: 18 MW (symmetrically)

Assume that the BSP is awarded for 9 MW of FCR => how much volume could be offered in the subsequent* aFRR capacity auction?

Pro-rata approach ?

- ⇨ Only **5 MW** of symmetrical aFRR could be offered (= (9/18)*10 MW)
- ⇨ However, likely **more volumes could actually be offered.**
  - ⇨ Assuming 10 MW/10 MWh of the battery would be sufficient to deliver 9 MW symmetrical FCR, the remaining part of the battery that could be used for aFRR would be 10 MW/30 MWh (=> 3 hours battery instead of 2-hour battery)



Determining the maximum aFRR volume that could be continuously delivered given a certain FCR obligation requires a more detailed approach / a proper simulation (because FCR and aFRR are intrinsically different).

* Assumption that the aFRR capacity auction comes after the FCR auction as will be the case after the go-live of aFRR dynamic dimensioning

Maximal volumes that can be continuously delivered with a given EMS
Simplified example (1/4): battery with aFRR EMS based on intraday

Assumptions:

- Consider a battery that requires 1MWh per MW FCR awarded
- This battery has an aFRR EMS based on ID trades
- ID trades have a lead time of up to 2 hours

➢ Worst-case: full aFRR activation starting immediately after the ID GCT ⇨ the battery needs to be able to provide the full power for 2 hours

Symmetrical aFRR

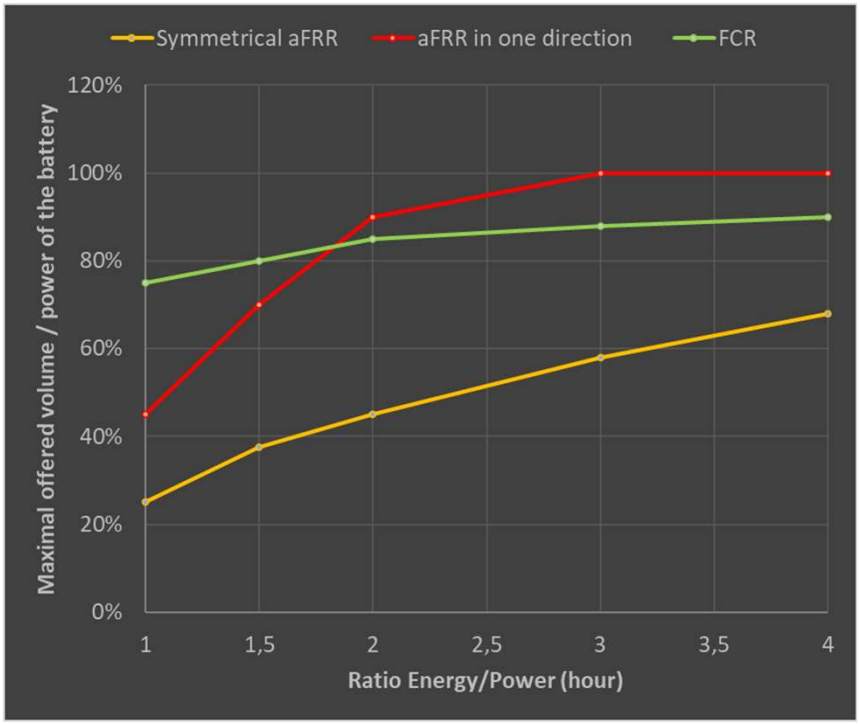
- Symmetrical product
- A 2-hours battery could provide close to 50% of its power
- As the battery has a higher energy content, the aFRR power that could be offered increases (and vice versa)

aFRR in one direction

- Not symmetrical
- A 2-hours battery could provide close to 100% of its nominal power (optimistic example assuming the SoC managed to be at 100% or 0%).

Maximal volumes that can be continuously delivered with a given EMS
Simplified example (2/4): battery with aFRR EMS based on intraday

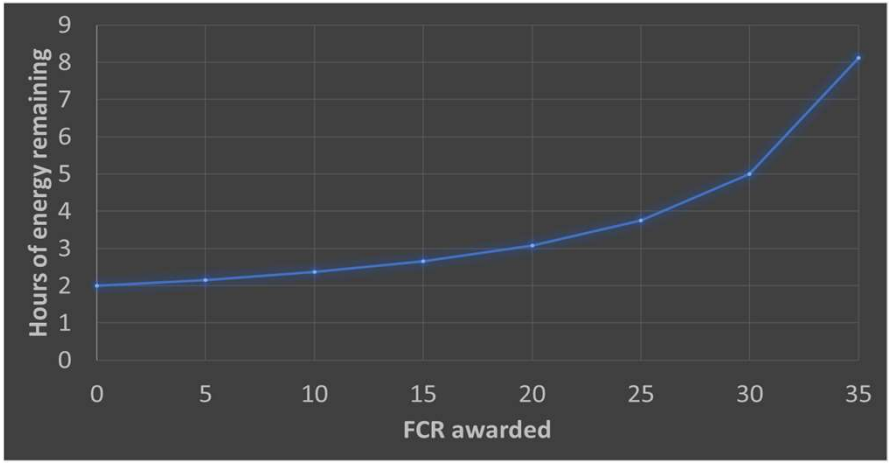
- The aFRR volume that could be continuously delivered increases with the energy content of the battery
- For symmetric aFRR (SoC managed at 50%)
  - 1-hour battery: close to 25% because 2-hours energy equivalent in each direction.
  - 2-hours battery: close to 50% (same reason as above)
  - Higher energy battery: increasing but slower because power band always required.
- For aFRR in one direction (SoC managed at 100% or 0%)
  - Close to 100% power could be possible for a 2-hours battery.
- For FCR:
  - One-hour battery could already provide a high percentage.
  - Power offered increases with more energy.
  - EMS charging band will always be required (symmetrical product)



Maximal volumes that can be continuously delivered with a given EMS
Simplified example (3/4): battery with aFRR EMS based on intraday

Example with a battery of 50 MW/100 MWh

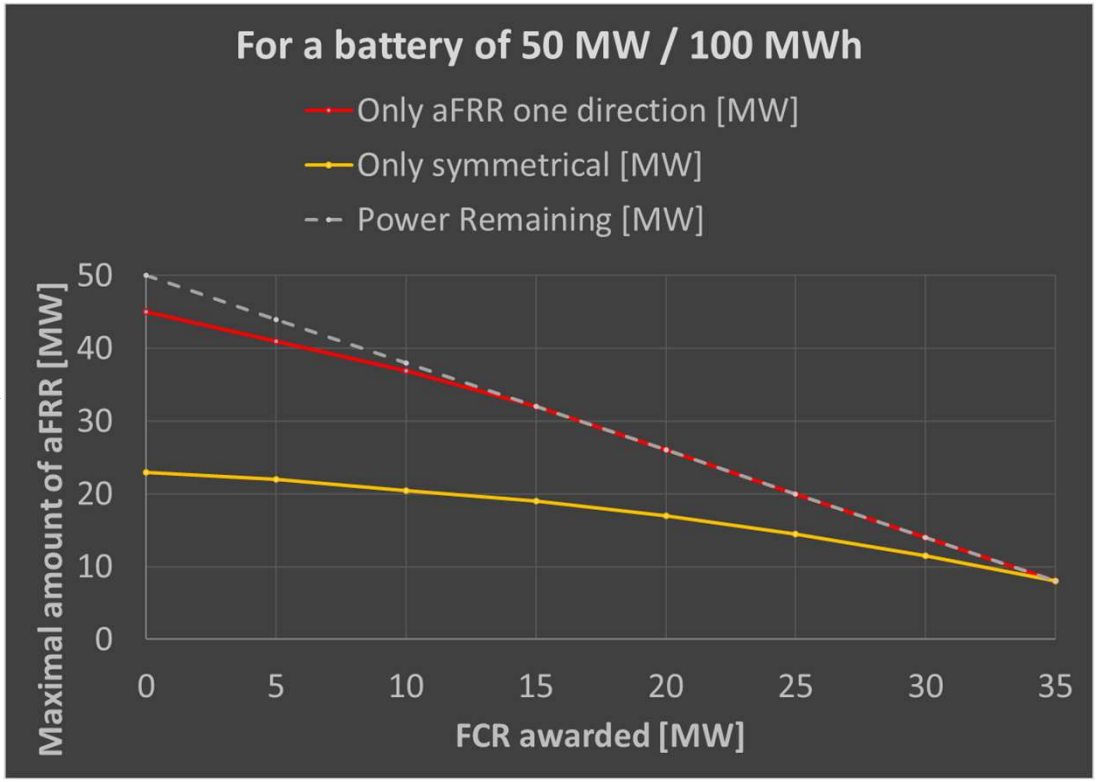
FCR part of the battery			Remaining battery for aFRR provision			Max aFRR to be	
FCR provided [MW]	FCR charging band [MW]	FCR energy [MWh]	Remaining Energy [MWh]	Power Remaining [MW]	Hours equivalent	Only aFRR one direction [MW]	Only symmetrical [MW]
0	0	0	100	50	2,0	45	23
5	1	5	95	44	2,2	41	22
10	2	10	90	38	2,4	37	20.5
15	3	15	85	32	2,7	32	19
20	4	20	80	26	3,1	26	17
25	5	25	75	20	3,8	20	14.5
30	6	30	70	14	5,0	14	11.5
35	7	35	65	8	8,1	8	8
40	8	40	60	2	30,0	2	2



- Assumption: FCR takes a 20% charging band and 1-hour of energy
- By considering the requirements for FCR and aFRR, it can be observed that **the the remaining energy content relative to the remaining power of the battery increases as more FCR is awarded.**

Maximal volumes that can be continuously delivered with a given EMS
Simplified example (1/4): battery with aFRR EMS based on intraday

As more FCR is awarded, a higher share of the remaining power could be continuously delivered for aFRR (in particular in case of symmetrical delivery)



Maximal volumes that can be continuously delivered with a given EMS
Conclusions from the example

1. It is **not straightforward to simply derive from the individual EMS for FCR and aFRR the maximal volumes combined FCR and aFRR volumes that could be continuously delivered.** This because:
    - FCR, symmetric aFRR, and aFRR in one direction are different products with different energy requirements.
    - The volumes that can be offered depend on the energy content available.

2. **It seems possible to demonstrate** which combinations of FCR and aFRR volumes could be continuously delivered (e.g., a statistical demonstration showing that certain volumes of FCR and aFRR can be continuously delivered while respecting the FCR energy bands).

To provide a clear framework for combo's of contracted services, **Elia therefore recommends**:

- **Describing the EMS requirements for FCR and aFRR in a single document** that describes i) the FCR requirements, ii) the aFRR requirements, iii) the requirements in case the BSP would like to combine contracted products
- **Harmonizing certain requirements for the FCR and aFRR EMS** (e.g., dataset for the statistical analysis)
- **Requesting only a single EMS to be described by the BSP* that includes the different contracted services (including combo's) for which the DP LER is to be used**

Note that in case the BSP does not intend to use the same DP LER for different contracted services at the same time, the current EMS for FCR and aFRR would remain to be sufficient and can be combined in a single document.

Maximal volumes that can be continuously delivered with a given EMS
Consideration of non-contracted services

For the use of a DP LER for multiple services at the same time, **2 different cases** should be considered:

1. The DP LER is intended to be used for two contracted services → Focus now on FCR and aFRR but Elia will investigate other products (mFRR)
2. The DP LER is intended to be used for a contracted service and for a non-contracted service → Similar requirements should apply for how non-contracted services should be considered in the EMS for a contracted service

As indicated, the **use of a DP LER for non-contracted services** impacts the energy in the reservoir and hence **could impact the ability to continuously deliver a certain volume for a contracted service**

Therefore, Elia believes the **intended use of the DP LER for non-contracted services needs to be described in the EMS as far it is relevant for ensuring the ability to continuously deliver the contracted service**. This would include:

- the power that would be used for non-contracted services
- The conditions under which this power could or would not be used (e.g., depending on the energy content of the reservoir and the awarded volumes)
- The consideration of any lead times for stopping the provision of non-contracted services (if applicable)

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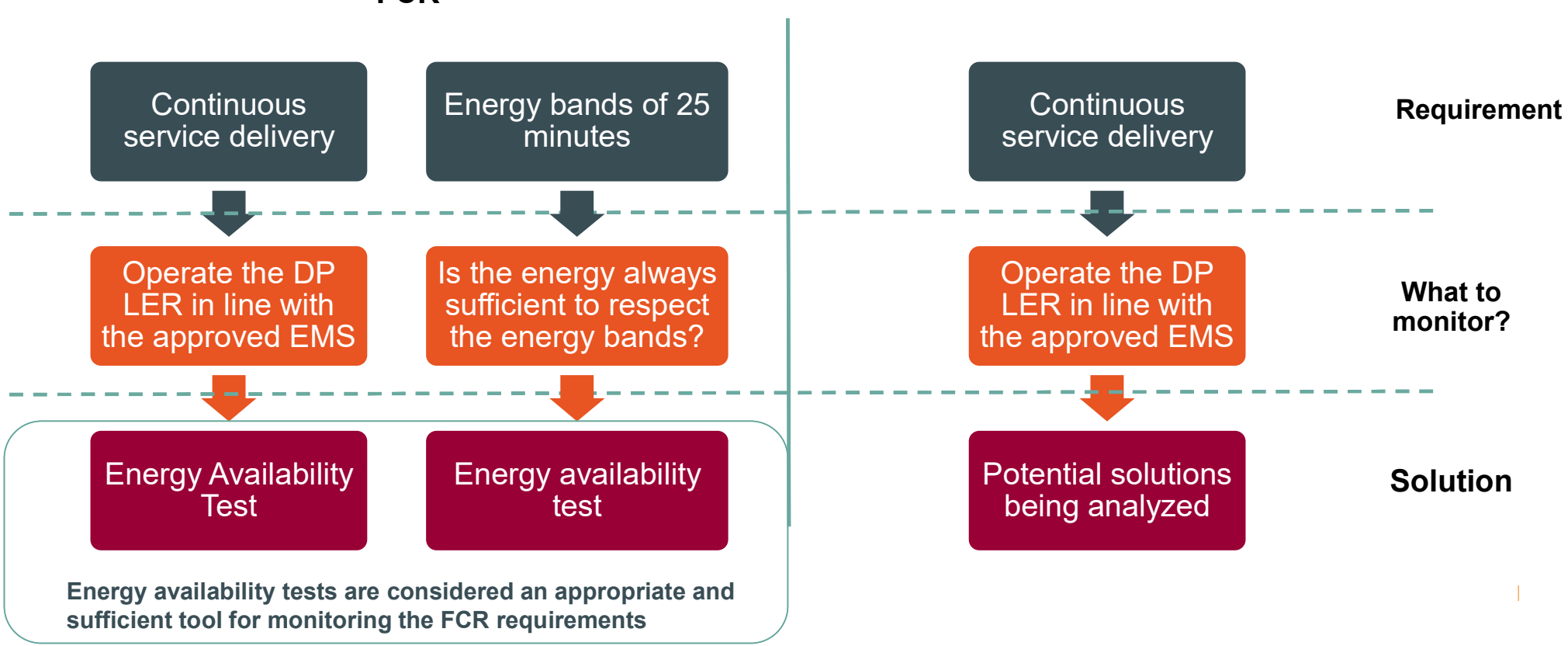
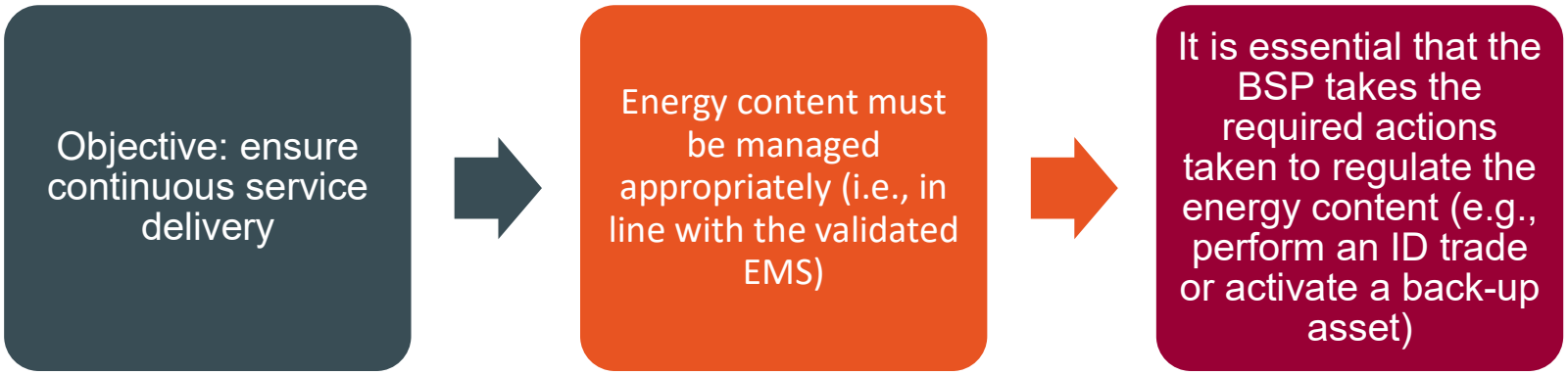
Phase 2: EMS monitoring – FCR and aFRR

What do we have to monitor?



Phase 2: EMS monitoring for aFRR



What could be relevant to structurally monitor is that:

- the change of the power output of the DP LER (and potentially its baseline) is effectively linked to a SoC supporting action
- the SoC supporting actions are taken at the moments they are needed to ensure the ability to continuously deliver the service
- non-contracted services are performed to the extent that the ability to continuously deliver the contracted service is not jeopardized

Phase 2: EMS monitoring (for aFRR)
What are potential solutions?

Three options are currently being considered.

1. **Continuous monitoring of the execution of the validated EMS.**
   - Would allow for perfect monitoring
   - Likely becomes highly complex and likely requires BSPs to send additional information in real-time

2. **Ad-hoc monitoring**
   - An analysis of several moments/days over the year is performed (e.g., moments with long activations in a given direction)

3. **Energy availability tests**
   - Similar to FCR, tests are implemented.

Phase 2: EMS monitoring (for aFRR)
What are potential solutions?

Three options are currently being considered.

Solutions	What is it?	Pros	Cons
Continuous monitoring	The execution of the EMS is continuously being monitored	Would allow complete and clearly-defined checks and consequences	Likely becomes highly complex and likely requires BSPs to send additional information in real-time
Ad-hoc monitoring	An analysis of several moments/days over the year is performed	Could be less complex to implement	Time consuming Consequences might need to be larger in case of deviations from the validated EMS
Energy availability tests	Similar test than for FCR	Easy to implement Clear framework	Effectiveness of the test (see hereafter) Costs of the tests

Energy Availability Tests for aFRR

- Concept: test the availability of the energy for providing aFRR by sending a demand for a full activation of the contracted service for a certain period (ex: 1-2 hours).
- **Main drawbacks:**
  1. **Potentially not effective for ensuring the LER DP is operated in line with the validated EMS**
     - An energy availability test could be effective in ensuring that a BSP can execute the validated EMS.
     - However, an energy availability test **might be insufficient for ensuring that a BSP will execute** the EMS during normal operation (i.e., when no test is performed and it is not known whether a long aFRR activation will effectively take place).
  2. **Expensive**
     - (Energy) availability tests are not remunerated and these costs are likely to be considered in the capacity bids
     - Energy availability tests could lead to a (temporary) removal of a potentially large fraction of the available aFRR Energy Bids, which could lead to higher FRCE and/or higher activation costs
  3. **Could reduce offered aFRR volumes**
     - if tests would happen after a long activation, BSPs might need to reserve more energy in the battery to be able to pass the test (thereby artificially worsening the worst-case scenario) and therefore would reduce the volumes that could be offered

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5. **Preliminary conclusions and next steps**

Preliminary conclusions

1. **The objective of the EMS requirements is twofold**:
   a. Demonstrate the volumes of contracted services that can be continuously delivered (Phase 1 – during prequalification)
   b. Function as a reference of how the LER DP should be operated in order to ensure the ability to continuously deliver the service (Phase 2 – during normal operation)

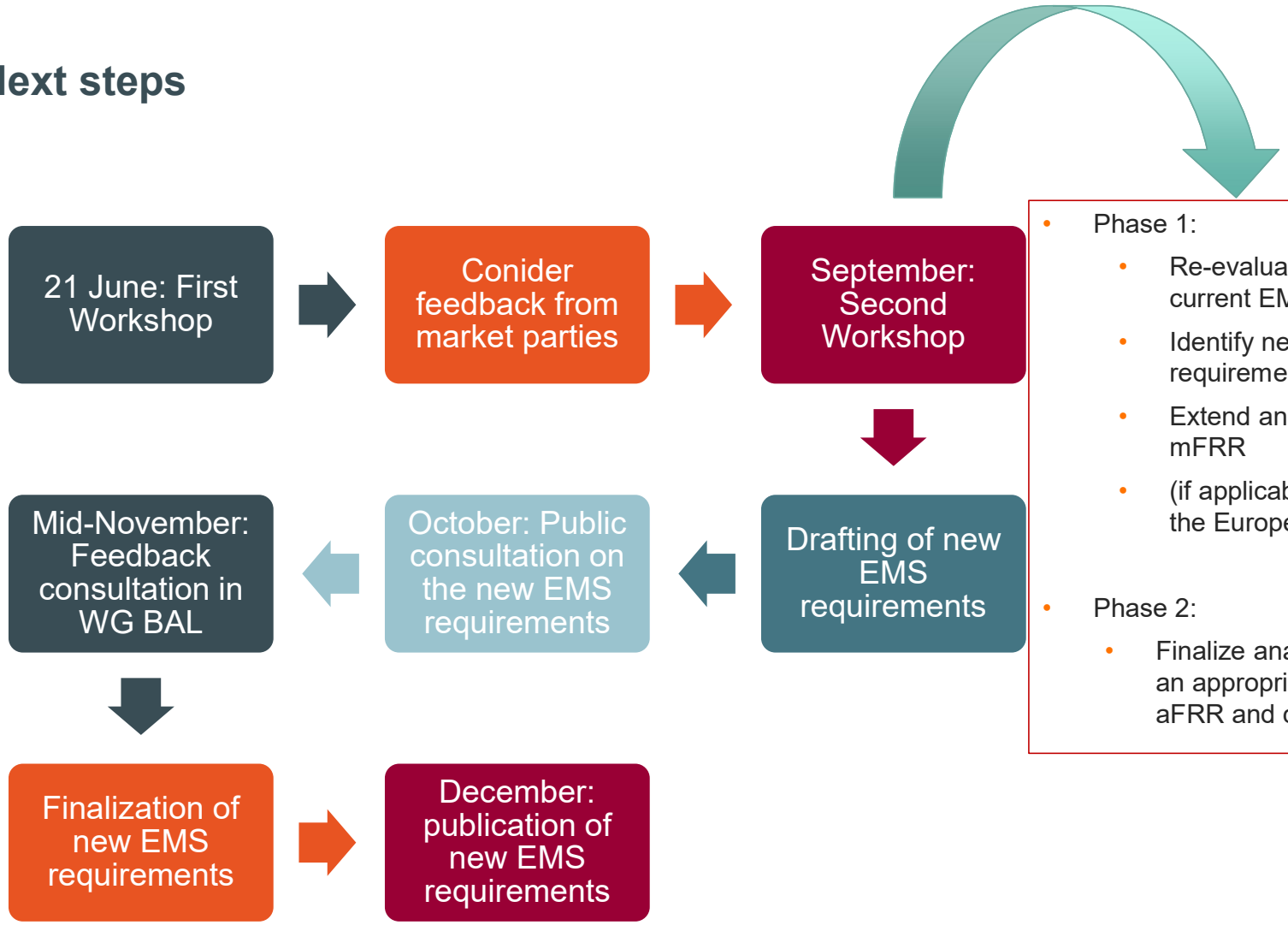
Phase 1 : Determination of the maximum volume that can be continuously delivered for a given EMS

2. **In case a LER DP is intended to be used for multiple contracted services at the same time:**
   - **The combined volumes that can be offered cannot be simply derived from the individual EMS of the different services**
   - **It seems possible to demonstrate which combinations of contracted services could be continuously delivered**
   - **Elia therefore recommends combining the EMS requirements for all contracted services in a single document**
3. While no EMS is needed for non-contracted services, the **intended use of the DP LER for non-contracted services needs to be described in the EMS submitted for contracted services**

Phase 2 : Monitor that the DP LER is operated in line with the validated EMS

4. **No additional monitoring needs are identified for FCR**
5. For aFRR, **three different possibilities are being further considered**:
   - Continuous monitoring.
   - Ad-hoc monitoring.
   - Extension of the “Energy Availability Test” to aFRR.

Next steps



- Phase 1:
  - Re-evaluate certain assumptions in the current EMS requirements
  - Identify needs for alignment to merge requirements for the combo FCR/aFRR
  - Extend analysis and conclusions to mFRR
  - (if applicable) consider further updates on the European discussion for FCR
- Phase 2:
  - Finalize analysis and recommendation for an appropriate monitoring approach for aFRR and combos.

Discussion/questions