FCR evolutions

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Agenda

1. **Legal obligations**
    1. Additional properties
2. **Alignment with aFRR**
    1. Migration from BMAP to BIPLE
    2. Migration of RT communication from EMS towards Flexhub
    3. Change in baseline methodology
    4. Metering requirements for non-prequalified DPs
3. **Additional business improvements**
    1. Energy management strategies
    2. Data exchanges with third parties
    3. Continuous Monitoring
    4. Application of penalties
    5. Improvement for the usage of combo’s (delivery of multiple products at the same time)
4. **Timing**

1. Additional Properties – T&C

Additional properties

Legal requirements – following the incentive study related to additional properties[1] these topics will be introduced in the T&C BSP FCR:

- Reserve Mode
  - Addition of an additional operating mode for LERs
  - Dimensioning of LERs to include RM
  - Activation control principles for RM
- System split
  - System Split Requirements
  - Control principles in case of System Split

In-depth details on these topics can be found in the final report of the incentive study[1].

1 – 20220429_Public consultation on the Analysis and implementation of the FCR evolutions in accordance to article 154(2) of SOGL (elia.be)

What is Reserve Mode and under what conditions is it activated?

The Additional Properties Art. 3 introduces a new operating mode, the Reserve Mode for which:

"*[…], LER FCR providing units (either single or belonging to a LER FCR providing group) that are prequalified for the first time after the entry into force of the Additional Properties and are technically capable (especially inverter-connected assets) shall* ***ensure that close to the upper or lower bounds of the energy reservoir the remaining capacity is sufficient for keeping a proper response on short-term frequency deviations***".

Impact

New LER will require **an additional operating mode**, in which the asset only reacts on the short-term frequency deviation. This includes dimensioning the lower and upper bounds of the energy reservoir to include sufficient capacity to avoid the depletion and saturation of the energy reservoirs of the DPs LER during extended period of frequency deviation events.

→ Prequalification and availability test of new LER-assets will include extra phase to test Reserve Mode.

Following the conclusion of the incentive, Elia does not intend for the time being to introduce Reserve Mode on the existing LER DP.

System Split

What is a system split?

- A system split in a synchronous area is **a separation of the synchronous area** in two or more areas of **different frequencies** due to the generation and load repartition.
- In case of system split, the main risk linked to a Centralized FCR Controller with a unique frequency measurement is that the assets are **not reacting correctly to the frequency**.
- Elia proposes two solutions:
    - Decentralized Frequency Measurement to detect system split
    - Designated zones for system split for assets without a local frequency meter (up to 1.5MW)
        - Electrical zones

Impact

- This principle requires BSPs having a centralized FCR controller, to introduce **an observation function** to detect any errors of the central control among the DPs in the perimeter of its group
- In case of a system split, the BSP must apply **a new control strategy** considering the volumes and natures of assets in resulting areas.

2. Migration of BMAP to BIPLE

Migration of BMAP to BIPLE

Elia will move from the current bidding tool (BMAP) to BIPLE:

- As both aFRR and mFRR are already moved to BIPLE, we plan to move FCR to BIPLE to improve alignment between balancing products and increase efficiency
- Given the shift towards BIPLE, the updates that will be done on BMAP are limited

Impact:

- Change of communication towards ELIA requires IT development on both sides
- Testing & support will be sufficiently foreseen in the timing

3. Migration of RT communication to Flexhub – T&C

Migration of RT communication towards Flexhub

1. Current set-up

- 2s data communicated from BSP to Elia through designated TASE2 connection
- Costly implementation & therefore potential barrier-to-entry for new BSPs

2. Proposed set-up

- Data communicated from BSP to Elia through Flexhub
  - Already in use for LV FCR asset monitoring & aFRR
- Move towards **4s data** granularity
  - Reduction of the amount of data that needs to be provided
  - Simplification and alignment with aFRR

4. Baseline methodology – T&C

Baseline for FCR

The aim is to align the baseline methodology of the FCR product with the aFRR methodology.

This was an outcome of the incentive study on combos.

Currently, BSPs do not communicate a baseline to Elia

- The baseline in prequalification & control is based on a 20s average.
- $DP_{ch\text{-}dch}$, is the power used for charging/discharging (in MW) of a DP with LER and is sent in **real-time**

New proposal

- Declarative baseline: Communication of the baseline **60s before the timestep** for which it applies
- $DP_{CH\text{-}DCH}$ removed, addition of $DP_{baseline}$ in RT-communication requirements →**Potential impact on EMS strategy**
- Introduction of the **baseline test**
- **Baseline control** to be investigated
- Prequalification & availability test will require changes to include $DP_{baseline}$

Baseline Test

For a baseline test, the baseline quality is evaluated for Day D on the set of Delivery Points listed for participation to the prequalification test. The baseline test is compliant if the quality factor is higher or equal to 95%. The baseline test will follow the same procedure as with aFRR:

1. For each Time Step “ts” of Day D, the estimated baseline is the sum of the baseline $DP_{baseline}(ts)$ per Delivery Point:

$$\text{estimated baseline}(ts) = \sum_{DP} DP_{baseline}(ts)$$

2. For each Time Step “ts” of Day D, the measured power is the sum of the measured power $DP_{measured}(ts)$ per Delivery Point:

$$\text{measured power}(ts) = \sum_{DP} DP_{measured}(ts)$$

Baseline Test

3. The deviation per Time Step "ts" of Day D is the difference between the estimated baseline and the measured power:

$$\text{deviation(ts)} = \text{estimated baseline(ts)} - \text{measured power(ts)}$$

4. N is the number of Time Steps of Day D
5. The reference baseline is the average of the estimated baseline, in absolute value, over all Time Steps of Day D

$$\text{reference baseline} = \frac{\sum_{\text{Time Steps}} |\text{estimated baseline(ts)}|}{N}$$

6. The quality factor is determined by:

$$\text{quality factor(D)} = 1 - \frac{\sqrt{\frac{\sum_{\text{Time Steps}} \text{deviation(ts)}^2}{N}}}{\max(\text{reference baseline}; 1)}$$

Declarative baseline for FCR

Impact on control:

- **Prequalification test**:
  - the baseline for the test is the last baseline received at the Time Step "ts0 “at the start of the prequalification test
- **Availability control:**
  - the baseline for the test is the last baseline received at the Time Step "ts0 " at which the trigger of the availability test is sent by ELIA

PRE-READ

Prequalification test

The baseline for the prequalification test is defined by taking the average Pmeas(ts) over the 20 seconds preceding the beginning of the test (TS_0-19 to TS_0):

$$baseline = \frac{1}{20} * \sum_{ts=TS_0-19}^{ts=TS_0} Pmeas(ts)$$

Instead, the proposed baseline for the test is the last baseline received at the Time Step "ts0 " at the start of the prequalification test

$$\text{Baseline} = \sum_{\substack{all\ DP \in \\ tested\ FCR\ bid(s)}} DP_{Baseline}(ts0)$$

There should be no change of baseline during the prequalification test.

PRE-READ

Availability test

FCR Power supplied during an availability test is currently determined per Time Step, taking into account all Delivery Points included in the tested FCR Bid(s), as follows:

In the upward direction,

$$FCR\ Power\ supplied_{test}(ts) = \max\{\ baseline - P_{meas}(ts)\ ;\ 0\ \}$$

In the downward direction,

$$FCR\ Power\ supplied_{test}(ts) = \max\{\ P_{meas}(ts) - baseline\ ;\ 0\ \}$$

$$P_{meas}(ts) = \sum_{\substack{All\ DP \in \\ tested\ FCR\ Energy\ Bid(s)}} DP_{measured}(ts)$$

The baseline is equal to the average power measured during the 20 seconds preceding the moment at which the test signal is sent by ELIA (period TS_0-19 to TS_0):

$$baseline = \frac{1}{20} * \sum_{ts=TS_0-19}^{TS_0} [\ P_{meas}(ts) - CH/DCH\ Correction\ (ts) + FCR\ Requested(ts)\ ]$$

The proposed new baseline for the test is the last baseline received at the Time Step "ts0 " at which the trigger of the availability test is sent by ELIA:

$$\text{Baseline} = \sum_{\substack{all\ DP \in \\ tested\ FCR\ bid(s)}} DP_{Baseline}(ts0)$$

5. Metering requirements for non-prequalified DPs – T&C

Metering requirements for non-prequalified DPs

In the current contract, DPs can deliver without a prequalification test. To give Elia additional confidence that these delivery points are correctly delivering the service, some additional metering requirements are introduced.

Current set up

- FCR$_{max}$ includes a **correction factor Emax**
- The Measurement Device needs to have **a precision of 1% or better** for the whole measurement chain (current transformers, power measurement)
- E$_{max}$ is a value calculated based on Private Measurement precision for each Delivery Point non-compliant with measurement requirements. E$_{max}$ is calculated as **the difference between the worst accuracy over all Delivery Points** included in the prequalification test and the accuracy criteria (1%) as follows

$$E_{max} = 100\% - (worst\ accuracy - 1\%)$$

Metering requirements for non-prequalified DPs

Proposal for FCR

- ELIA proposes the same accuracy requirements as implemented for aFRR
- Each DP that participates in the delivery of FCR must meet these requirements

Power of measured process	VT 1	CT 2	Power meter (with Transfer of Energy)	Power meter (without Transfer of Energy)
	Accuracy class	Accuracy class	Accuracy class	Accuracy class/ requirements
≥ 10MVA	0.2	0.2S	0.2S or 0.25	0.2S or 0.25
≥ 5MVA à < 10MVA	0.2(1)	0.2S(1)	0.5S(1)	0.5S(1)
≥ 1 MVA à < 5MVA	0.2(1)	0.2(1)	0.5	0.5
≥ 100 kVA à < 1MVA	0.5	0.5	1	1
≥ 32kVA and < 100kVA	NA	0.5(4)	2	2%(2,3)
≥ 11kVA and < 32kVA	NA	0.5(4)	2	3.5%(2,3)
≥ 4kVA and < 11kVA	NA	0.5(4)	2	6%(2,3)
< 4 kVA	NA	0.5(4)	2	10%(2,3)

1: Voltage Transformers
2: Current Transformers

6. Energy Management Strategies – T&C

Energy Management Strategies

The current application of the energy management strategies will be updated. This will not be handled via the FCR evolutions, but via the incentive which is currently ongoing.

Results applicable to FCR will be included in the modification of the T&C.

7. Data Exchanges with Third Parties – T&C

Data Exchanges with Third Parties

Addition of a new declaration within the T&C framework to cover the specific cases where the BSP is not the asset/data owner and a third-party will deliver the measurement data of each delivery point to Elia.

This declaration will cover several topics:

- Responsibility for the contractual obligations between Elia and the BSP, including compliance with communication requirements
- Indemnification of Elia regarding any claims brought against Elia by these third-party providers

8. Continuous Activation Monitoring – T&C

Context

Elia is introducing continuous monitoring of FCR activations.

What is the aim of the proposal

- Create a clearer view on quality of delivery
- Harmonization across FCR Cooperation
- Alignment across balancing products

To assess quality of FCR activation of a BSP, **corridor and correlation approaches** are used to quantify & visualize the monitoring results

As a final step, **KPIs** are calculated using these methods **to further quantify the quality** of the FCR activation and to accurately judge the performance of a BSP

→ The calculation of these KPIs will be performed with the data available. No extra data requirements will be imposed.

Corridor Approach

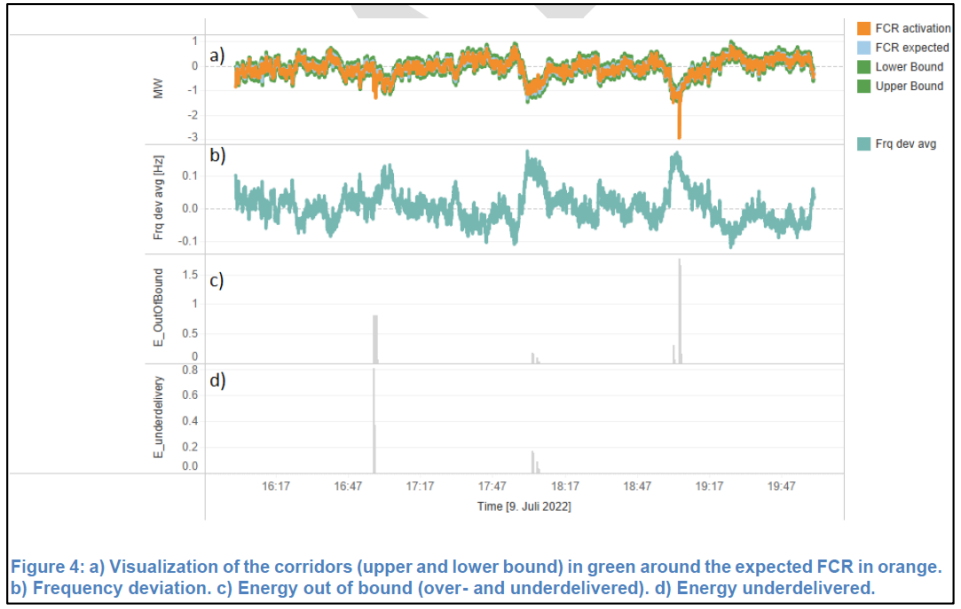
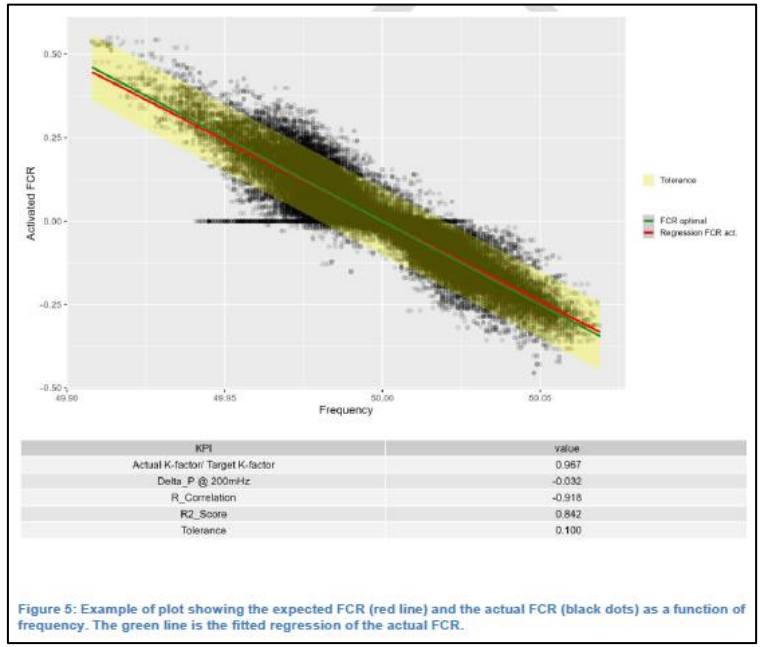


Figure 4: a) Visualization of the corridors (upper and lower bound) in green around the expected FCR in orange. b) Frequency deviation. c) Energy out of bound (over- and underdelivered). d) Energy underdelivered.

- This approach checks whether the Balancing Service Provider (BSP) satisfies the minimum delivery requirement by creating **an envelope** (a "corridor") which considers **the frequency or change of frequency to determine the minimum delivery**

Correlation Approach



KPI	value
Actual K-factor/ Target K-factor	0.967
Delta_P @ 200mHz	-0.032
R_Correlation	-0.918
R2_Score	0.842
Tolerance	0.100

Figure 5: Example of plot showing the expected FCR (red line) and the actual FCR (black dots) as a function of frequency. The green line is the fitted regression of the actual FCR.

- Another approach to check whether the Balancing Service Provider (BSP) satisfies the minimum delivery requirement is to fit **a linear regression between the actual FCR and the frequency**
- The linear regression allows some Key Performance Indicators (KPIs) to be defined and these can be used as a reference to evaluate the behavior of the BSPs

9. Continuous Activation Control & Application of penalties – T&C

Continuous Activation Control: FCR Requested & corridor calculation

There are three legal obligations defining the minimum FCR requirements:

1. SOGL - Article 156 art. 7

   a) An FCR providing unit or FCR providing group with an energy reservoir that does not limit its capability to provide FCR shall activate its FCR for as long as the frequency deviation persists.

2. SOGL – Article 154 (7)

   a) the activation of FCR shall not be artificially delayed and begin as soon as possible after a frequency deviation;

   b) in case of a frequency deviation equal to or larger than 200 mHz, at least **50 %** of the full FCR capacity shall be delivered at the latest after **15 seconds;**

   c) in case of a frequency deviation equal to or larger than 200 mHz, **100 %** of the full FCR capacity shall be delivered at the latest after **30 seconds**;

   d) in case of a frequency deviation equal to or larger than 200 mHz, the activation of the full FCR capacity shall rise **at least linearly** from 15 to 30 seconds; and

   e) in case of a frequency deviation smaller than 200 mHz the related activated FCR capacity shall be at least **proportional with the same time behaviour** referred to in points (a) to (d).

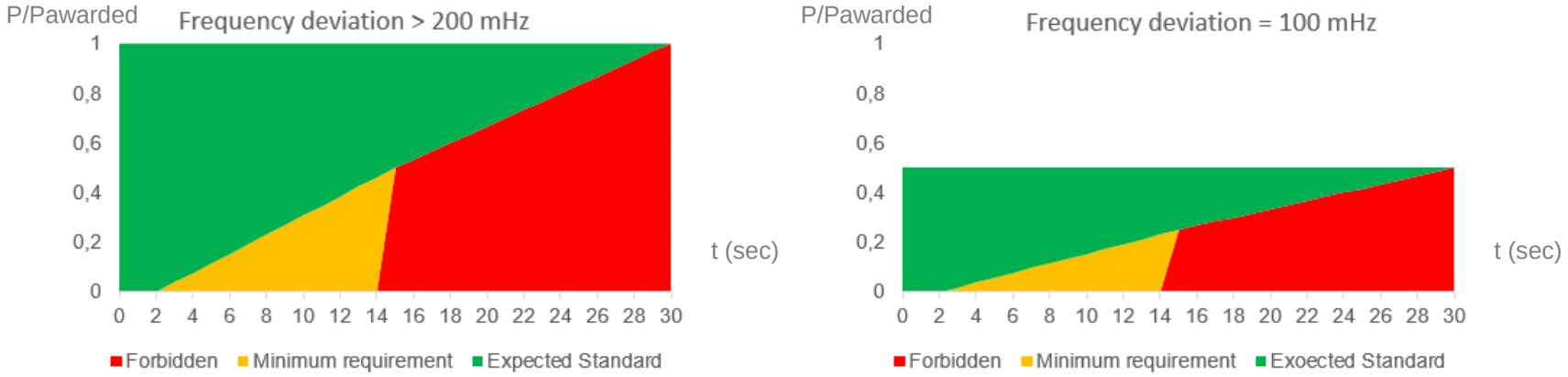
3. Proposal on additional properties of FCR pursuant SOGL 154(2)

   a) All TSOs of a synchronous area shall have the right to specify, in the synchronous area operational agreement, common additional properties of the FCR required to ensure operational security in the synchronous area, by means of a set of technical parameters and within the ranges in Article 15(2)(d) of Regulation (EU) 2016/631 and Articles 27 and 28 of Regulation (EU) 2016/1388.

Continuous Activation Control: FCR Requested & corridor calculation

These requirements create the following allowable profiles:

Visual representation of expected FCR activation for a frequency deviation of at least 200 mHz and of 100 mHz



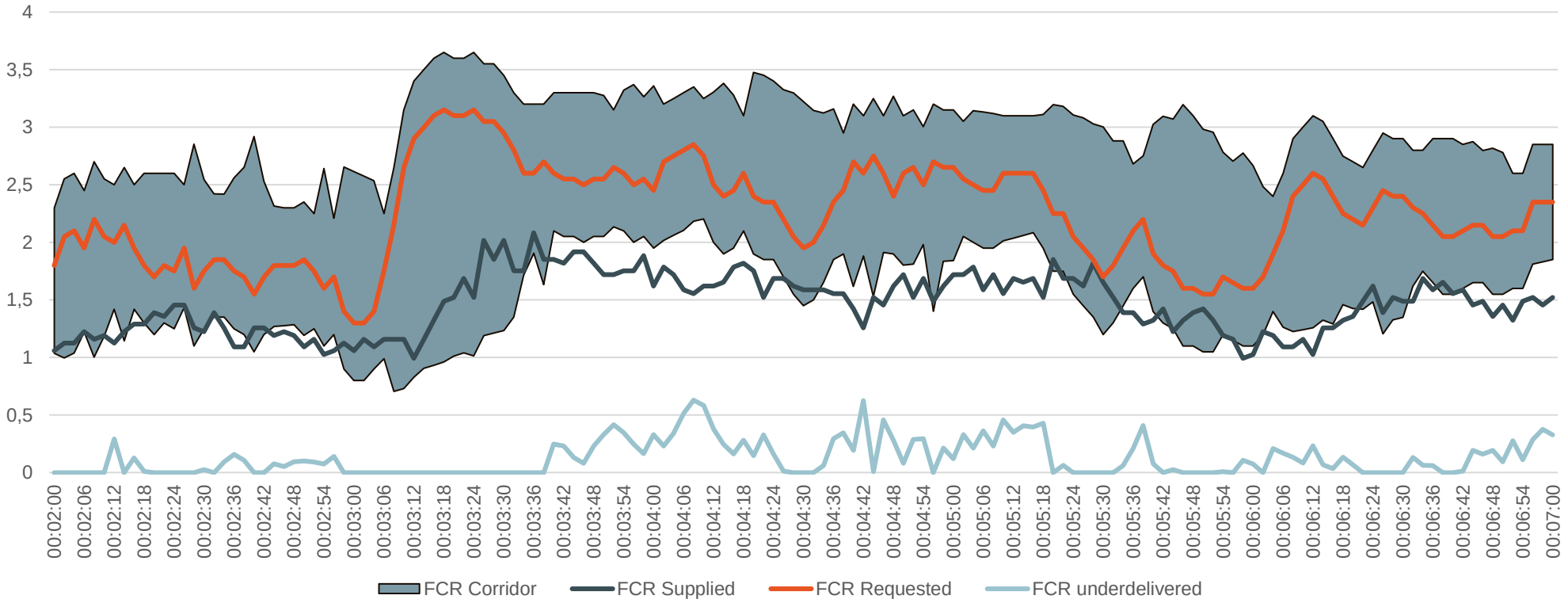
Note: The yellow part is allowed if approved by TSOs during prequalification. The 2 seconds allowed to activate FCR is a minimum requirement from SAFA.

The corridor for FCR delivery is based on these profiles, taking into account +/- 5% insensitivity (of nominal power).

Continuous Activation Control & Penalties

Proposal:

$$P = \left(\frac{FCR\ overdelivered\ (W) + FCR\ underdelivered\ (W)}{FCR\ Requested\ (W)}\right) * Remuneration\ (W) * \quad Factor\ (to\ be\ calibrated)$$



10. Improvements in the simultaneous delivery of multiple products – T&C

Improvements in the simultaneous delivery of multiple products

The results of the previously performed incentive study[1]:

- **FCR & aFRR:**
  - Implementation of a declarative FCR baseline
  - Integrated activation control for FCR and aFRR
    - In case of combo: Assume perfect delivery for FCR, error will be attributed to aFRR

- **FCR & mFRR:**
  - No changes required to current design

The results of the EMS incentive will also be considered.

1: 20221010_Public consultation on an analysis of the possibility to offer different (elia.be)

11. Timing

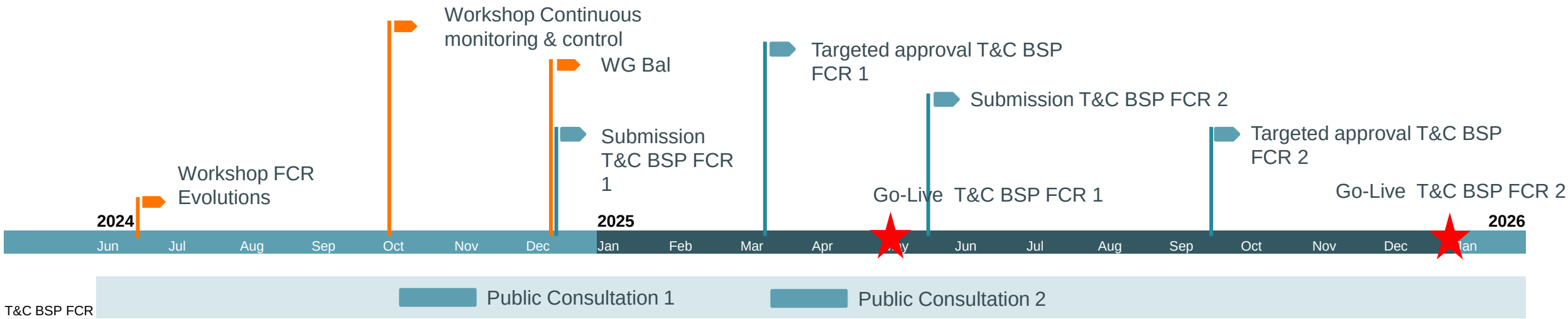
Timing

FCR Evolutions will follow a two-part trajectory:

- Part 1: FCR Evolutions ~ Q4 ‘24
- Part 2: Continuous Monitoring & Activation Control ~ Q2 ‘25

Go-live of additional properties, metering requirements for non-prequalified DPs and data exchange with third parties is foreseen in May 2025

All other topics are scheduled to go live Q4 2025 to foresee enough time for implementation & testing



Overview of T&C & Go-live topics

	T&C 1 ~ PC Q4 ‘24	T&C 2 ~ PC Q1 ‘25
1	**Additional Properties**	Continuous activation monitoring
2	Migration of RT communication	Application of penalties
3	Change in baseline methodology	
4	**Metering requirements for non-PQ DP**	
5	EMS	
6	**Data Exchange with 3rd parties**	
7	Combos	

	Go-live 1 ~ Q2 ‘25	Go-live 2 ~ Q4 ‘25
1	Additional Properties	Continuous activation monitoring
2	Metering requirements for non-PQ DP	Application of penalties
3	Data Exchange with 3rd parties	Migration from BMAP to BIPLE
4		Migration of RT communication
5		Change in baseline methodology
6		EMS
7		Combos

Thank you.