Prequalification Process for Balancing Service Providers (FCR, aFRR, mFRR) in Germany ("PQ conditions")

Status: 05 July 2024

Please note: This version of the prequalification conditions is a non-binding translation.
You can find the binding version of the prequalification conditions in German language on regelleistung.net.

Version history

Version	Date	Comment
1.00	26-Oct-2018	• First version of the new prequalification conditions according to the SOGL
1.01	09-Nov-2018	• Correction to the determination of the marketable power of the pool in Section 1.6 and references in Section 4.
1.02	16-May-2019	• General corrections • Definition of the assignment of a RE / RG to a TSO from SOGL in Section 1.2 • Concretization for the aggregation of the power measurement at a RE / RG in Section 1.2 • Definition of setpoint and PQ-relevant value in Section 2.3 • Adjustments to the requirements for forming a RE / RG in Section 2.11 • Adjustments to backup requirements in Section 2.17 • Avoidance of disturbances of the pool operation within the framework of the prequalification procedure in Section 2.19 • Adaptation of energy capacity for the alert state in Section 3.1.4 • Definition regarding restoring energy capacity according to SOGL in Section 3.1.4
1.03	29.05.2020	• General corrections • Integration of wind prequalification requirements in Sections 2.9 and 5.1 • Regulations for plants connected to the CREOS grid in Section 6 • Replacement of the checklist by a query in the PQ portal • Concretization of the marketable power of the pool in Section 1.6 • Specification of requirements for the provision in the event of frequency deviations greater than +/-200 mHz in Section 3.1.3 • Concretisation of FCR trial provision under operational conditions
1.04	03.06.2020	• General revision • Adaptation of rules to the target market design (MARI/ Picasso) • Implementation of decision BK6-19-069 (Additional Properties of Frequency Containment Reserves) • Reference to guidelines for securing balancing power
1.05	05.07.2024	• Adjustment of maximum age of an operating test to 24 months • Clarification for LFC area Amprion-Creos • Sections 2.19 & 5.5 deleted • Addition of English as an alternative to German as an admissible language for 24/7 operations

Preliminary note

The Regulation (EU) 2017/1485 of the Commission of 2 August 2017 establishing a guideline for transmission system operation (hereafter "SOGL") entered into force on 14 September 2017. The SOGL contains, among other things, requirements concerning prequalification processes for balancing service providers (such as BSP) whose implementation in Germany is the responsibility of the German transmission system operators 50Hertz Transmission GmbH, Amprion GmbH, TenneT TSO GmbH and TransnetBW GmbH (hereafter "TSOs"). The TSOs have revised the prequalification conditions ("PQ conditions") for the balancing reserve types FCR, aFRR and mFRR and are publishing these in the present document.

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[Note that Tables 4 to 8 are no longer showing on this list and will have to be restored – tr.]

1 General provisions and explanations of the process

1.1 Introduction and overview of the PQ conditions

The present document describes the requirements that must be fulfilled in the prequalification process ("PQ process") of the German TSOs for successful conclusion of the process. The SOGL uses the term prequalification only in regard to the prequalification of reserve providing units ("RPU") and reserve providing groups ("RPG"). In addition to requirements on RPUs/RPGs, the PQ conditions of the German TSOs include requirements on pools and technical units.

Section 1 of the PQ conditions explains, firstly, a number of fundamental concepts that are of central significance to the PQ process: These are the definition of RPUs/RPGs and pools as well as the requirements concerning their composition [Section 1.2], the handling of changes to the composition of RPUs/RPGs [Section 1.3], the determination of the actual balancing reserve values [Section 1.4] and the determination of values at the pool level [Section 1.5], the difference between PQ power and marketable power [Section 1.6] and the special requirements for negative balancing reserve [Section 1.8].

Secondly, Section 1 also addresses process aspects: the assumption of costs [Section 1.8], the procedure for the PQ process and the applicable deadlines and processing periods [Section 1.9] and the limitation of the period of validity of the prequalification established in accordance with the requirements of the SOGL [Section 1.10].

The main requirements to be evaluated in the PQ process from energy market, (information) technology and administrative/organisational perspectives are addressed in Sections 2 and 3. The requirements that apply in identical or similar fashion to all balancing reserve types are collected together in Section 2, while requirements specific to individual balancing reserve types are addressed in Section 3.

The applicable uniform requirements to all balancing reserve types in Section 2 can be divided into four major topical areas:

- IT requirements and rules concerning data exchange with the reserve connecting TSO
- The operating test or proof from actual provision by which compliance with the requirements with regard to product characteristics (e.g. the required dynamic properties) of FCR, aFRR and/or mFRR are evaluated at the RPU/RPG level by means of a standardised test
- The control system test conducted at the pool level
- Organisational requirements.

Although the test criteria established in the operating test or proof from actual provision for the various balancing reserve types do differ, they can still be effectively described together in Section 2. However, other requirements are so specifically customised to a specific balancing reserve type that they are most effectively described in their own subsections of a separate section of this document [Section 3].

Section 4 contains primarily a reference to the IT requirements and provides an overview of the corresponding requirement documents that are published at https://www.regelleistung.net. The totality of the IT requirement documents is considered part of the PQ conditions.

The appendices collected in Section 5, which are relevant to all balancing reserve types, are the detailed requirements on data exchange with the reserve connecting TSO, differentiated by aggregation levels (TU, RPU/RPG, pool), balancing reserve type (FCR, aFRR, mFRR) and time of exchange (real-time vs. offline) [5.1], the confirmation of the reserve connecting distribution system operator [5.2], the supplier confirmation [5.3] and the declaration of confirmation of the collateral provider in the event of third-party collateralisation [5.4].

The glossary in Section 6 explains and defines a number of terms and abbreviations that are relevant in connection with the PQ process. Two formatting conventions are relevant in this regard:

1. Quotations taken verbatim from the SOGL are designated as source references. This also applies to the legal definitions reproduced in the glossary. All references to legal sources refer to the SOGL, unless expressly noted otherwise.

2. Passages with a more explanatory character are placed in text boxes with a grey background - as illustrated here. The goal of this marking style is to clearly differentiate the actual PQ conditions from solely explanatory material.

The present document addresses the requirements to be evaluated within the framework of the PQ process. The requirements with regard to reservation and activation in the case of engagement (assuming successful prequalification and conclusion of the framework agreement) are not the subject of the PQ conditions; these are primarily addressed in the framework agreement. However, it is evident that significant overlap exists between these requirements. The PQ conditions are formulated such that it is always clear whether a specific requirement refers to the PQ process or to the subsequent reservation and activation or both. For example, the requirements with regard to changes in the pool composition are relevant primarily to the subsequent marketing. It is useful, however, to explain these requirements already in the PQ process, i.e. in the PQ conditions, and to note that these must be continuously complied with.

1.2 Prequalification as reserve providing unit or group; requirements on composition

The prequalification can be requested for an RPU or an RPG:

- "Reserve providing unit" means a single or an aggregation of power generating modules and/or demand units connected to a common connection point fulfilling the requirements to provide FCR [or] FRR (…). (see Article 3 paragraph 2 number 10 SOGL)
- "Reserve providing group" means any aggregation of power generating modules, demand units and/or reserve providing units connected to more than one connection point fulfilling the requirements to provide FCR [or] FRR (…). (See Article 3 paragraph 2 number 11 SOGL)

These definitions should be understood as that the power generating modules and/or demand units grouped into an RPU or RPG must in each case collectively fulfil the present PQ conditions. The power generating modules and demand units comprising an RPU or RPG are referred to as technical units ("TU"). For each TU there must be at least one power measurement. All equipment used for a power measurement are collectively referred to one TU. If multiple power measurements are set up, these power measurements will be aggregated. Within the framework of the power measurement, the entire power within the public grid is decisive, in other words, the electricity own needs of a TU itself must also be taken into account as well as transformer losses, etc.

An RPU consists of one or more TUs. Various TUs at the same grid connection point can also be individually prequalified as one RPUs if they each individually satisfy the PQ conditions. An RPG always consists at least of two TUs at different grid connection points. There is no limit on the number of TUs comprising an RPU or RPG. There are also no limitations with regard to the combination of power generating modules and demand units. The power measurement of a RPU takes place via aggregation of the power measurements of the respective TUs. The power measurement of the RPG takes place via aggregation of the power measurements of the respective TUs and RPUs.

The control characteristics (FCR / aFRR / mFRR) of the RPU or RPG to be prequalified may not influence the operation and in particular the control characteristics, of other RPUs or RPGs. Likewise, the control characteristics of other RPUs or RPGs may not influence the operation, and in particular the control characteristics, of the RPU or RPG to be prequalified. If interactions between RPUs or RPGs cannot be entirely eliminated, the reserve provider is obligated to compensate for the interactions with suitable process-related measures or other measures and to explain this in a separate concept.

Each RPU or RPG has just one Connection TSO and will be connected to the grid of its Connection TSO only. The grid connection points of the TUs of an RPG may be situated at different voltage levels. Until further notice, the TSOs shall refrain from defining ex ante criteria according to Article 154 paragraph 4 and Article 159 paragraph 7 on the basis of which FCR groups and FRR groups could be excluded from the provisioning of reserve. In deviation from this, the reserve connecting TSO can impose restrictions, e.g. for reasons of operational security.

The concept of RPUs and RPGs is illustrated in Figure 1.

Quadrant 1 illustrates two RPUs that each consist of a single TU. At the corresponding grid connection points, other TUs are in fact connected, but the dashed lines make clear that these do not belong to any RPU. However, the TUs shown could collectively form one RPU per grid connection point.

Quadrant 2 shows an RPG that consists of two RPUs. This case should be viewed as optional because both RPUs are by definition already prequalified.

The RPG in quadrant 3 consists of TUs that would not be independently prequalifiable as RPUs. However, the reserve group concept makes it possible to nevertheless strive for prequalification for different TUs at various grid connection points.

Quadrant 4 illustrates that an RPG can also consist of an RPU and additional TUs that are not independently prequalifiable as RPUs.

The blue border makes clear that each RPG and each RPU must be part of a pool. If an RPU consists of a single TU, a pool can also consist of a single TU.

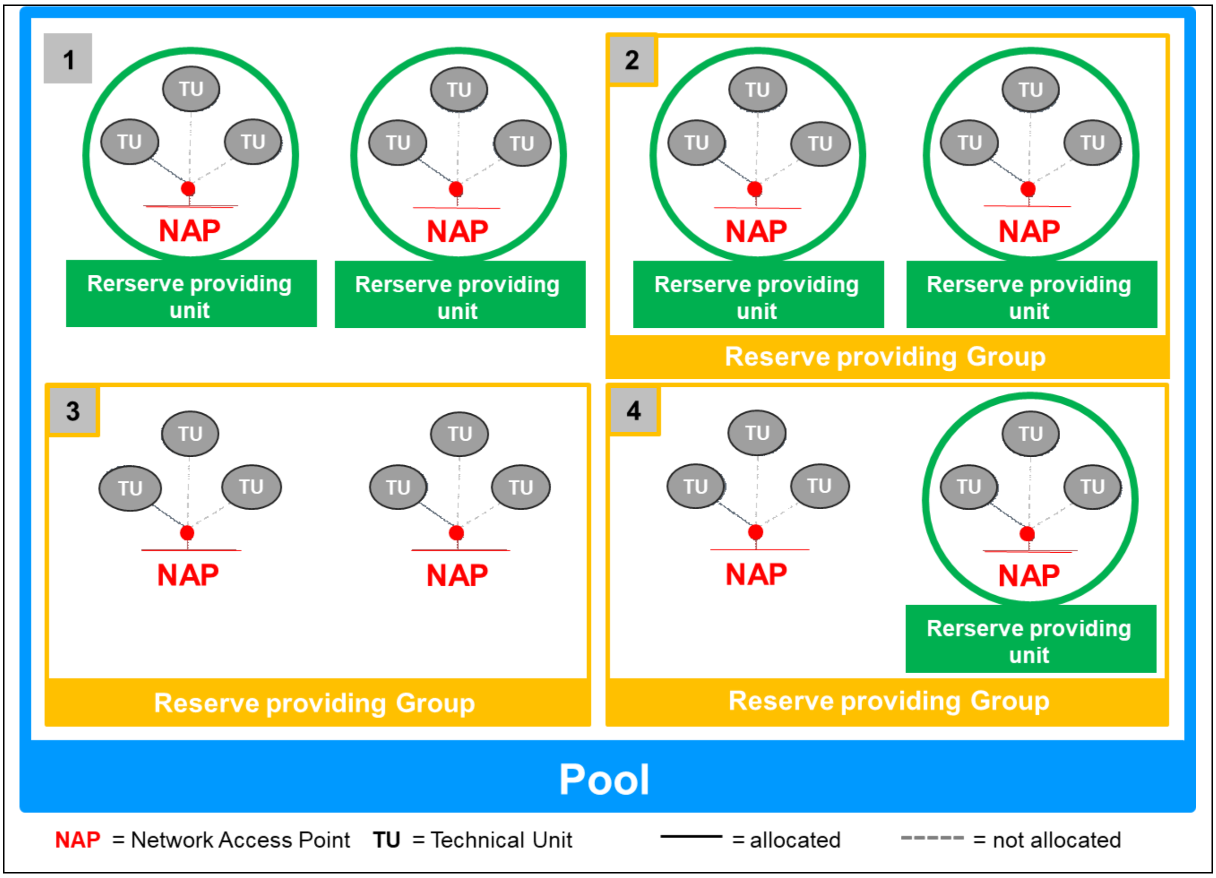

Figure 1: Illustration of reserve providing units and groups

A BSP must establish at least one pool for each balancing reserve type it would like to market. The composition of a pool must – regardless of the balancing reserve type – remain unchanged in each case for a quarter of an hour; at every quarter hour, it may be modified in consideration of the requirement to adapt the anticipated operating point. The rules concerning the operating point as well as the anticipated operating point are described in more detail in Section 5.1.

Upon a change to the pool composition, the BSP must ensure that this procedure does not have any undesired effects on the quality of the reservation and activation of balancing reserve. This requirement also applies in the event of the replacement of a TU, RPU or RPG actively participating in the reservation or activation by another TU, RPU or RPG within a pool. Exclusively in the case of technical faults can the pool composition be changed within a quarter hour. In these cases, the operating point may deviate from the announced anticipated operating point for no longer than the duration of the lead time specific to the balancing reserve type (in the case of aFRR, this is five minutes). Incidents of this type must be appropriately documented by the BSP and submitted to the reserve connecting TSO for review upon request.

Requirements for the structured and standardised recording of technical faults are yet to be developed by the TSOs.

RPUs and RPGs can be formed exclusively within an LFC area (see Article 154 paragraph 5 and Article 158 paragraph 1 point a SOGL). A pool is limited to one LFC area and may consist of various RPUs and/or RPGs within the LFC zone.
The following specific conditions apply to Creos and Amprion, which maintain a joint load-frequency control area:

- For FCR, cross-border pooling of technical units from the Creos and Amprion grid area* is admissible.
- For aFRR and mFRR, RPUs/RPGs and pools may be formed only if they consist entirely of technical plant either from the Creos or the Amprion grid area*
- Dynamic pool allocation of prequalified plants (see above) between pools in the Creos and Amprion grid area* is not possible in the case of aFRR and mFRR.

(* incl. the downstream distribution systems in each case)

1.3 Handling of changes to the composition of reserve providing units or groups

Article 155 paragraph 6 point b (FCR) and Article 159 paragraph 6 point b (FRR) SOGL specify that a prequalification must be renewed when, among other situations, the equipment has changed.

Changes to equipment means here such changes as will result in the inability to fulfil the PQ conditions whose fulfilment has already been evaluated in the PQ process.

A change to the composition of an RPU or RPG requires another prequalification. In this case, the original prequalification expires at the time of the change to the composition, unless the following prerequisites are met:

- In the assessment of the reserve connecting TSO, the RPU or RPG still satisfies the prerequisites for a prequalification even after the change.
- The BSP submits to the reserve connecting TSO an application that describes in detail the desired changes with respect to the status quo, in reference to the already granted prequalification, and requests an updating of the existing prequalification. To simplify the traceability and examination by the TSO, the structure of the application must be oriented around the existing documentation.

If it’s necessary, additional components of the prequalification (such as the control connection) will be inspected.

As described below, the prequalification of groups is based on the principle of an aggregation of individual values. Individual values are recorded per TU or RPU and aggregated into a group value. Changes to the composition of the group can – if possible according to the specific concept – also be implemented in that the group value is redetermined via addition of additional and/or removal of no longer relevant individual values. Only the additional individual values need to be newly recorded, not those that have already been documented. In the case of RPUs, this applies likewise for the TUs of which the RPU is composed.

For the evaluation of the documents by the reserve connecting TSO in the event of a change to the composition of an RPU or RPG, the periods established for a prequalification process according to Section 1.9 generally apply.

1.4 Determining the actual balancing reserve value

The actual balancing reserve value of a TU, RPU or RPG arises fundamentally from the measured value of the incoming injection (or the withdrawal) minus the reported operating point. In determining actual balancing reserve values, the measured value of the power active in the public grid is always decisive and any simultaneous provisioning of other balancing reserve types must be taken into account. The current practice for error attribution is explained in Section 2.12.

For determining the balancing power values, the time at which an activation takes place must be determined. For all matters in connection with the PQ process, the time of activation is always the time at which the corresponding power becomes physically active in the public grid. This general requirement is for special situations defined as follows:

- In the operating test or proof from actual provision, the time of activation of the balancing reserve is considered the time at which the actual value of the injection or withdrawal departs continuously (i.e. for the last time) from the mean value of the injection or withdrawal during the preceding reservation or activation phase.
- With regard to the backup, the time of activation of the backup is the time at which the power of the backup unit(s) (replacement injection) becomes physically active in the public grid.

1.5 Determining RPU/RPG or pool values

The actual balancing reserve value and other relevant data points, such as the operating point, are determined at the level of each individual TU according to the requirements specific to the balancing reserve type. The corresponding values at the level of the RPU or RPG are determined for most relevant variable data (see Section 5.1) as the sum of the values of the TU of which the RPU or RPG is composed. The corresponding pool value is also determined for most of the variable data listed in Section 5.1 as the sum of the values at the level of the RPU and RPG of which the pool is composed. The exceptions for which the calculation procedures described here for the values at the RPU/RPG or pool level are not applicable are addressed in Section 5.1.

1.6 PQ power vs. marketable power

In principle, the following concepts are to be differentiated within the framework of the PQ process as well as any subsequent participation in tenders:

- Prequalified power (PQ power)

  The PQ power of an RPU or RPG is determined via the activation of power on a test basis during the operating test (see Section 2.3) or proof from actual provision (see Section 2.4). During the determination of the PQ power, the activation of the power is tested only for the duration of the operating test, which does not correspond to the duration of a product time slice in the balancing capacity market.

- Marketable power

  In contrast to the PQ power, the marketable power of an RPU or RPG also takes into account the potential activation duration. In consideration of the product structure in the balancing capacity market, the marketable power is the power that can be continuously and fully provided over a period of four hours (FRR) or two hours (FCR) by the RPU or RPG (see also the explanations in Section 2.7). Among other factors, the determination of the marketable power for RPUs and RPGs with limited energy capacity also takes into account the energy capacity and storage management measures.

Once the target market design (see MARI and Picasso) is introduced, the product time slices of the balancing energy market will be shortened from four hours to 15 minutes. For the balancing energy market, the PQ capacity can thus be considered the upper limit of capacity that is available for marketing. The duration of a product time slice in the balancing capacity market remains to be four hours. For marketing on the balancing capacity market, marketable capacity continues to be used as the upper limit. How to deal with limiting factors, e.g. inspections, is explained in the following section and applies to both the balancing capacity market and the balancing energy market.

- Determining the PQ power and marketable power of a pool

  The BSP itself determines the PQ power or marketable power of a pool as the aggregation of the marketable power of the RPUs' and RPGs' values in consideration of a sufficient pool-internal or pool-external backup. The BSP is obliged to take measures to ensure the required availability of the marketed and allocated balancing reserve. The measures shall be described in a concept and submitted to the TSO.

In the event of a successful prequalification, limitations, for example due to inspections, unavailability, e.g. due to seasonal effects, etc. must be taken into account by the BSP in the balancing capacity market and/or balancing energy market within the framework of tenders.

The BSP is obligated within tenders to market only the actually available power that it can provide continuously and reliably over the entire product period. Here, in particular simultaneous, continuous and complete activation of the marketed balancing reserve types need to be taken into account. Interdependencies between consecutive product time slices and the various balancing reserve products and markets must also be considered.
At the pool level, the successful prequalification of a marketable power corresponding to at least the minimum offer volume of the respective balancing reserve type is a necessary prerequisite for the conclusion of a framework agreement.

1.7 Special requirements for the prequalification of negative balancing reserve

Section 1 para. 1 EnWG [German Energy Industry Act] requires that it be ensured that the general public is supplied with a grid-based supply of electricity and gas that is as secure, economical, consumer-friendly, efficient and environmentally sustainable as possible. This means that, for example, in the activation of negative balancing reserve, no fuel may be drained unused or burned unused, or, in the case of the activation by a demand unit, the electricity used may not be consumed without an efficient and meaningful additional purpose. A reduction of the energy efficiency is permitted if this is an inherent component of the process and is not undertaken purely in order to provide balancing energy.

The reserve provider is obligated to ensure the use of the utilised energy according to the principles stated above and to explain this in the context of the PQ process.

1.8 Costs of the prequalification process

All costs of the PQ process arising for the BSP shall be borne by the BSP. All costs of the PQ process arising for the TSO shall be fundamentally borne by the reserve connecting TSO.

> The costs of the PQ process arising for the TSO shall not be invoiced to the PQ applicant by the TSO. The PQ application is in this sense free of charge. However, costs arise in the establishment of the prerequisites for a prequalification (e.g. fulfilment of information technology requirements) that must be borne by the BSP itself.

1.9 Structure of the PQ process; time requirements and deadlines

Eight weeks are available to the reserve connecting TSO to evaluate the completeness of a PQ application. If the application is not complete, the BSP must supply the missing information at the request of the reserve connecting TSO within four weeks; otherwise the application is considered rescinded. A maximum of three months is available for the inspection of the complete documents. In the case of FCR, these periods are standardised in Article 155 paragraph 3 and 4; in the case of FRR in Article 159 paragraph 3 and 4.

The PQ application and the PQ process are carried out exclusively via the PQ portal of the TSO. This also applies to any necessary updates to data or documents. In exceptional cases, it is possible to provide data or documents to the respective reserve connecting TSO by email.

A completely automated check of the completeness by the PQ portal will not be possible in the foreseeable future, because certain content items will still require a manual check even in the future. As long as certain components of the PQ application cannot be uploaded via the PQ portal, the TSO will enable delivery via email.

If the PQ portal is unavailable, PQ applications shall be handled as if they had been transmitted at the time at which the portal became unavailable. In other words, the BSP suffers no disadvantage from a potential unavailability of the PQ portal. If the PQ portal cannot be used, the BSP can transmit the application documents to the reserve connecting TSO by email as proof. Once the PQ portal is available again, the BSP must upload the corresponding information to the PQ portal. However, the date of the corresponding email transmission shall apply as the receipt date.

Operating measure protocols as evidence that the requirements outlined in the PQ conditions are met will be recognised if they were recorded in the previous 24 months. All additional supporting documentation can be used regardless of its age if the latest requirements are met.

In addition to technical competence, proper delivery of the balancing reserve must be guaranteed under operational conditions and the economic power of the potential BSP must be ensured.

1.10 Validity period of the prequalification and changes to the PQ conditions

A granted prequalification applies for five years starting from the date of the prequalification and only under reservation of the continued validity of the information provided to the reserve connecting TSO within the framework of the PQ process.

The BSP in question is free to have the existing prequalification evaluated at any time up to the expiration of the respective prequalification and, if the requirements are met, have it newly prequalified as an RPU/RPG.

The TSOs are entitled to modify the respectively applicable PQ conditions in consideration of a reasonable transition period. The TSOs will take into account the legitimate interests of the market participants as transparently as possible, e.g. through consultations.

A change to the respectively valid PQ conditions can result in the prerequisites for a prequalification no longer being met by individual RPUs or groups, the associated TUs or the pool.

The TSOs are participating in a number of projects regarding cross-border reservation and activation of balancing reserve. This also includes efforts to harmonise various aspects, such as the tender conditions as well as the PQ conditions. Insofar as the need to modify the PQ conditions arises from European cooperation, the TSOs will revise the respectively applicable PQ conditions in a transparent fashion.

2 Uniform provisions for all balancing reserve types

The first topic addressed in this section encompasses the requirements that must be fulfilled by the information technology used by the BSP for data exchange with the reserve connecting TSO.

2.1 General requirements on the information technology of the BSP

The balancing service provider must confirm that the IT requirements described in Section 4 are met and must provide to the reserve connecting TSO the documents described there.

The documents relevant for the preparation of this portion of the PQ process are described in Section 4 and published at https://www.regelleistung.net/. These documents refer to further verifications to be submitted with the PQ application documents such as the IT concept, the IT checklist and a self-assessment of the BSP focused on IT issues. The IT requirements are not identical for all balancing reserve types; however, they are conceptually so similar that they can be considered as "uniform" requirements. The latter also applies to the other provisions addressed in Section 2.

2.2 Data exchange with the reserve connecting TSO

The BSP is obligated according to the provisions below to provide the following data to the reserve connecting TSO:

1. Master data
2. Data as proof of fulfilment ("offline data")

3. Real-time data

Offline data and real-time data are variable data. With regard to variable data, three aggregation levels are to be differentiated: 1. TU, 2. RPU/RPG, 3. Pool. The determination of the values for the respective aggregation level is described in Section 1.5. The exceptional cases in which values for the aggregation levels RPU/RPG or pool are not determined according to the calculation procedure described in Section 1.5 are addressed in Section 5.1.

2.2.1 Master data

For the entry of the master data for the TUs and RPUs/RPGs encompassed by the PQ application, the TSOs provide the so-called equipment data sheet. This is an Excel file form to be filled out by the BSP and sent to the reserve connecting TSO along with the PQ application documents. The current equipment data sheet is published at https://www.regelleistung.net.

The equipment data sheet is generally self-explanatory. With regard to the description of the grid connection situation in the equipment data sheet, the following rules apply:

- The BSP must specify the grid connection point or grid connection points for each TU and each RPU/RPG.
- If a TU has multiple grid connection points, generally only one grid connection point (the primary grid connection point) is to be specified. In this case, the BSP can determine the primary grid connection point itself, but the requirements for the grid connection point or grid connection points must be consistent with the requirements for the composition of the RPUs/RPGs.
- In exceptional cases, the reserve connecting TSO can also require the specification of additional grid connection points.

2.2.2 Data as proof of fulfilment ("offline data")

The BSP must record data as proof of fulfilment ("offline data") according to the requirements in Section 5.1 and archive these for a period of at least six weeks. In addition, it must provide the reserve connecting TSO with the data according to the requirements of the TSO.

The TSOs will in future establish an interface for the regular transmission of the offline data. In good time prior to the implementation of the interface, the BSP must configure its IT systems such that it can continuously transmit the offline data to the reserve connecting TSO in a format yet to be determined and in accordance with an also yet to be determined transmission cycle.

As of the time when the interface enters into operation, the BSP is obligated to provide the offline data to the reserve connecting TSO in a yet to be determined format and according to the yet to be determined transmission cycle.

Until establishment of the interface, the offline data shall be transmitted in a data format yet to be defined by the TSO according to the requirements and upon request by the reserve connecting TSO.

2.2.3 Real-time data

The BSP must provide data as real-time data according to the requirements in Section 5.1 to the reserve connecting TSO. The data transfer shall take place in coordination with and according to the requirements of the reserve connecting TSO.

Because the control systems of the TSOs differ, the implementation of the transmission of the real-time data listed in Section 5.1 takes place according to TSO-specific requirements.

2.2.4 Requirements for variable data

The requirements described in Section 5.1 apply to the exchange of variable data (offline data and real-time data).
The reserve connecting TSO can impose additional requirements on the BSP for verification of the correct fulfilment with regard to the aggregation or disaggregation of the variable data.

The TSOs intend to utilise such additional requirements in individual cases in order to, for example, directly assess the quality of the fulfilment via certain new technologies or to clarify grid topology issues.

2.3 Operating test

Every RPU or RPG must complete an operating test and verify that it complies with the requirements formulated here.

The operating test – in other words the activation of balancing reserve on a test basis – is a relevant test within the framework of the PQ process. The operating test is in principle a practical test according to standardised criteria, with which the BSP verifies the technical suitability of its RPUs/RPGs. The operating test (and the data collected thereby) is documented in an operating log, which must be submitted by the BSP with the application documents. The standardisation of the operating test described below makes it possible to largely automate the evaluation of the operating measure protocol. The operating test is normally carried out independently by the BSP. Coordination with the reserve connecting TSO is however requested in cases in which a BSP intends to prequalify 150 MW of power or more.

The operating test serves the following purposes:

- Determine the PQ power of the RPUs/RPGs at the level of each RPU/RPG.
- Evaluate whether an RPU/RPG can reliably reproduce a specific operating behaviour.

- Test the control and regulation capability of the RPUs/RPGs and determine the resulting balancing power inputs on the basis of standardised control commands.
- Ensure that each RPU/RPG is correctly connected to the pool and integrated into the control network of the BSP.

In addition to the data for the RPU/RPG in question, the data for the TUs comprising the RPU/RPG must also be collected, recorded and provided with the PQ application documents in separate operating measure protocols. The transmission of operating measure protocols to the reserve connecting TSO is done via the PQ portal.

The requirements for the operating test do differ by balancing reserve type; in all cases, however, the illustration of the power measurement has the characteristic shape of a so-called "double-peak curve". The BSP controls the operating test from its own control system; participation during the test by the reserve connecting TSO is not generally planned.

An operating test is necessary when:

- An RPU/RPG is to be prequalified for the first time
- A TU or RPU/RPG changes BSPs
- The validity of a prequalification expires regularly after five years and the data collected during regular operation, as described below, cannot be used to verify the continued fulfilment of the requirements;
- The requirements described in Article 155 paragraph 6 or Article 159 paragraph 6 have been fulfilled; in other words: "in case the technical or availability requirements or the equipment have changed". Here, changes to equipment means only such changes that result in the possibility that the requirements evaluated in the PQ process may no longer be complied with.
- Upon changes to the composition of an RPU or RPG due to removal and/or addition of TUs, insofar as the synthetic test described below cannot take the place of the operating test
- The reserve connecting TSO orders the operating test for legitimate reasons

In the case of initial prequalification or a fundamental change in composition, the interaction of all TUs of an RPU/RPG of a pool must be verified. This means the TUs of all RPUs/RPGs must in principle simultaneously complete the initial operating test. In this context, it should be ensured that the general characteristics of the RPUs/RPGs in the respective constellation are fully observed. In the case of a target PQ power of more than 150 MW, the reserve connecting TSO must be informed before running the operating test. The reserve connecting TSO shall then decide whether it is possible to deviate from the requirement of simultaneous activation and whether the individual values can be aggregated synthetically.

BSPs that participated in the activation of balancing reserve within a period of 24 months prior to submission of the prequalification application can dispense with an otherwise required operating test, if the continued fulfilment of the requirements can also be verified on the basis

of the data collected during regular operation. Reservation and activation data of the relevant TU or RPU/RPG from real activation processes of reserve can be used as long as these data are not older than 242 months and it is clear from these data that the requirements evaluated within the framework of the operating test are still complied with.
This only applies for the case of regular renewal of a prequalification upon expiration of the validity within five years after granting of the prequalification.

In addition to this, it is possible to use the synthetic test for changes to the composition of an RPU/RPG. Because all operating measure protocols exist at the level of the TUs, changes to the composition of the RPUs/RPGs can be reconstructed:

- If a TU leaves the RPU/RPG, the data collected for this TU can be removed from the data set. The data set can then be reanalysed with regard to whether the prerequisites for prequalification are still fulfilled and what PQ power still remains.
- If a TU is added to the RPU/RPG, it is sufficient if this TU has completed an operating test without all TUs or RPUs of the RPU/RPG also simultaneously taking part in this operating test. The data collected for the TU can also be added to the data set and thereby permit an evaluation that takes the additional TU into account.

The timely notification of the reserve connecting TSO by the BSP according to Section 1.3 is a prerequisite for the process described above.

In principle, an operating test must be completed for every RPU/RPG to be prequalified per balancing reserve type. However, if it can be verified with the same operating test that the PQ conditions are fulfilled with respect to more than one balancing reserve type, the verification applies to all balancing reserve types for which the PQ conditions are fulfilled. The operating test for a prequalification in the negative direction can be combined with the operating test for a prequalification in the positive direction so that the verification can be provided for both directions (three reservation phases and two activation phases in each case, see Figure 3).

2.3.1 Relevant data points; reservation and activation phases

During the operating test, the following data must be recorded by the BSP for transmission to the PQ portal:

- Injection or withdrawal of the corresponding TU and RPU/RPG
- Operating point of the corresponding TU and RPU/RPG
- Setpoint (in the case of FCR, this arises from the frequency deviation)

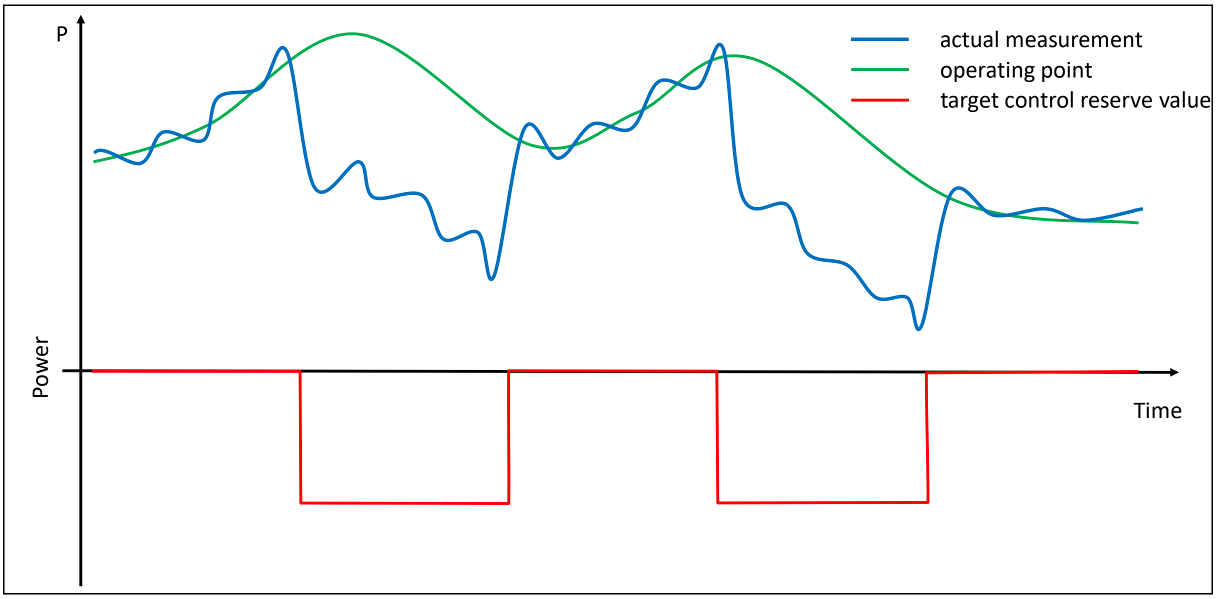

Figure 2: Raw data recorded during the operating test

The actual balancing reserve value is determined from these data as the difference between the actual power and the operating point. The resulting "double-peak curve" consists of three reservation phases and two activation phases. This is shown schematically in the following figure for the case of providing negative balancing reserve. These requirements apply correspondingly for activation in the positive direction.

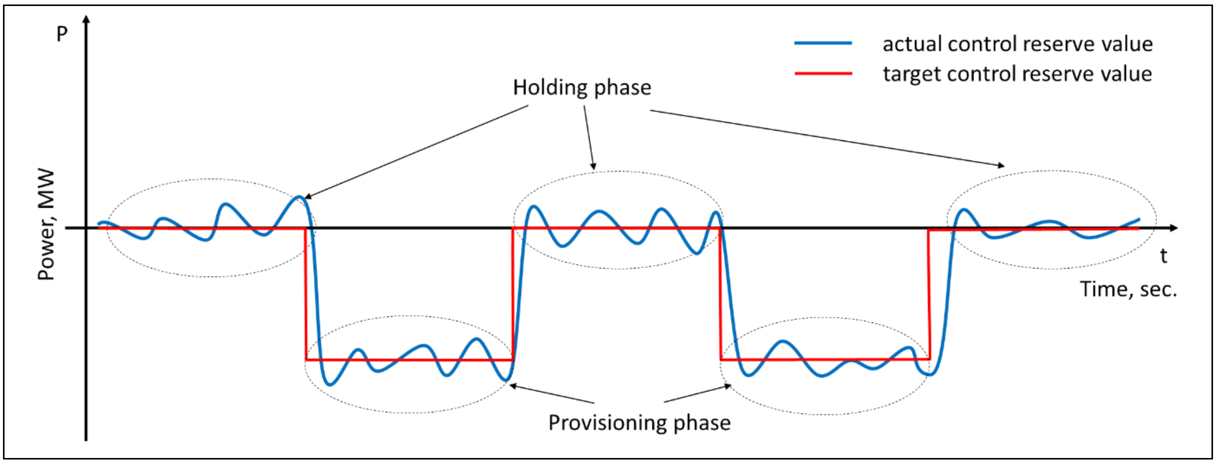

Figure 3: Evaluation of the operating test through combination of the raw data

Pursuant to the balancing group contract, the BSP is also obliged to manage the balancing group in a balanced manner during the operating test.

For all three balancing reserves, the operating test is based on the requirement of a setpoint that the RPU/RPG must achieve within 30 seconds (FCR), 5 minutes (aFRR) or 12.5 minutes (mFRR). Achieving of the setpoint corresponds to complete provision. The RPU/RPG must continue the complete activation phase according to the product specific requirements (see

Section 2.3.4). So then the setpoint requirement during the test is cancelled and the injection or withdrawal must return to the initial value withdrawn within 30 seconds (FCR), 5 minutes (aFRR) or 12.5 minutes (mFRR). To ensure the reliable reproducibility, this simulation of an activation is then repeated once again.

The following sections describe in detail the relevant quantitative test criteria:

1. Determining the prequalified balancing reserve power
2. Checking compliance with the requirements of the corresponding balancing reserve type, e.g. with regard to a maximum response time
3. Quality check of the provided balancing reserve with regard to the dispersion of the actual active power values

If necessary, the operating test can be used for determining or checking additional parameters, such as the power limits or the aFRR gradient (see the explanations in Section 5.1).

2.3.2 Time periods of an operating test

Each reservation and each activation phase encompasses:

- Power change periods (PCP)
- Stationary period (SP).

In the case of FCR, a

- transient period (TP)

is also defined.

The start and end of the respective periods are defined differently for the three balancing reserve types. The underlying measurement values also differ in their time resolution. While the FCR and aFRR operating tests are based on values with a time resolution of 1 to 4 seconds, the minute averages are used for the mFRR operating test. The interpolation of values is not permitted. The recorded values must be entirely evaluated.

<u>FCR</u>

For FCR, the power change period begins with the setpoint change, in other words the PQ-relevant arithmetic average value of the respective reserve or delivery phase specified by the BSP for the purpose of the operating test (which corresponds to a frequency deviation of +/-200 mHz), and lasts a maximum of 30 seconds. If the actual balancing reserve value reaches the setpoint before 30 seconds have elapsed, then the power change period ends at the time the setpoint is reached for the first time. The latter transitions immediately to the transient period. The PQ-relevant average value for each reservation and activation phase is determined as the arithmetic mean of the actual balancing reserve value over the entire transient and stationary period (in other words, the PQ-relevant average value and start of the transient period can in some circumstances only be determined together). As an additional requirement, the actual balancing reserve value, which corresponds to the prequalifiable power determined on the basis of the operating test, must be reached at least once within the power change period.

The transient period begins at the end of the power change period, i.e. no later than 30 seconds after the setpoint change. It ends 90 seconds after the setpoint change.

The stationary area begins 90 seconds after the setpoint change and lasts at least 13.5 minutes.

Figure 4 schematically depicts the actual balancing reserve value (y axis) over time (x axis) and illustrates the different periods.

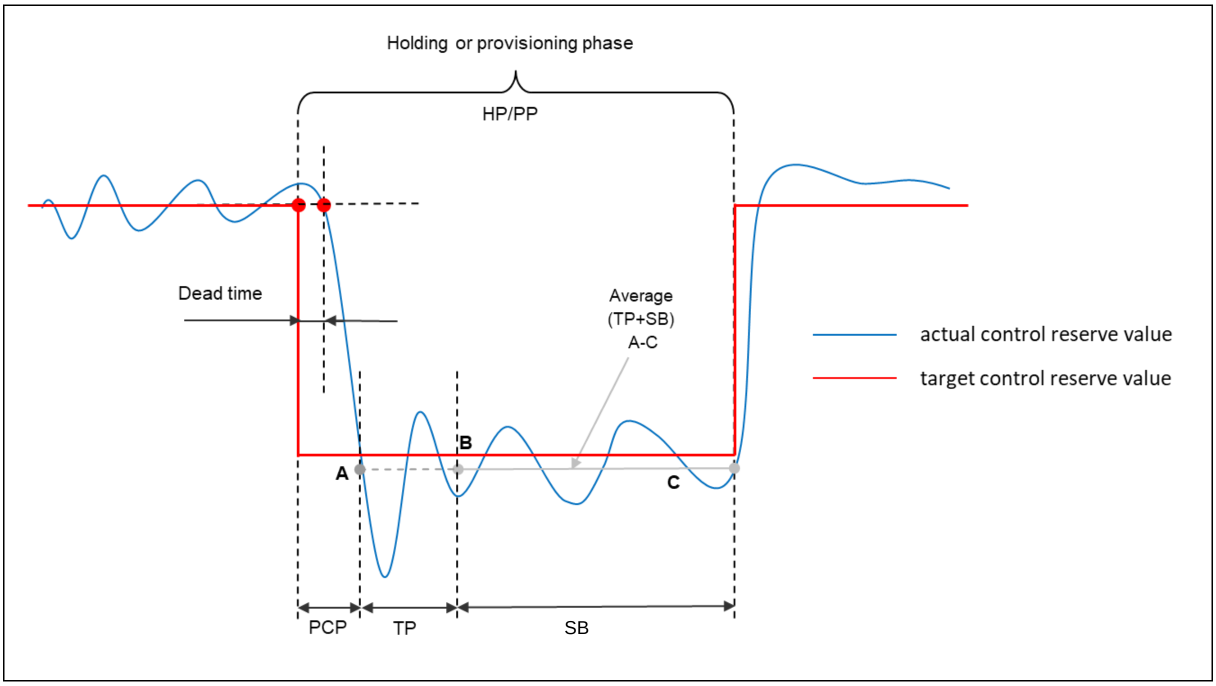

Figure 4: Schematic representation of an FCR operating test

To specify the ban on artificial delaying and the requirement to start the activation "as soon as possible" after the frequency deviation according to Article 154 paragraph 7 point a, additional FCR-specific requirements on the providing behaviour are formulated in Section 3.1.2 that are not taken into account in the description above.

FCR units and FCR groups that respond only within a specific frequency range or upon reaching of "trigger frequencies" must run through an additional activation profile during an operating test, which is also described in Section 3.1.2.

aFRR

The response time in the power change period can encompass up to 30 seconds during the activation of an aFRR unit or aFRR group. The possible reaction time starts with the setpoint shift and ends when the injection or withdrawal has left the average value of the previous

holding phase lastingly. The latter point in time is understood to be the point in time at which the actual value leaves the mean value for the last time. If the reaction time during activation exceeds 30 seconds, prequalification as an aFRR unit or aFRR group is not possible.
A verification of the reaction time during deactivation is not executed at the level of the aFRR unit or aFRR group. At pool level, a reaction time of up to 30 seconds has also to be realized in the context of deactivation.
The power change period begins overall with the setpoint shift and ends five minutes after the setpoint shift. The PQ-relevant average value is determined as the arithmetic mean of the actual balancing reserve value over the entire stationary period. As an additional requirement, the actual balancing reserve value, which corresponds to the prequalifiable power determined on the basis of the operating test, must be reached at least once within the power change period.

The stationary period starts five minutes after the setpoint change. It lasts at least 10 minutes.

Figure 5 schematically depicts the actual balancing reserve value (y axis) over time (x axis) and illustrates the different periods for an aFRR operating test:

If the same power is to be prequalified, the result of a successful aFRR operating test can be carried over 1:1 to the mFRR with regard to the verification of the dynamic behaviour. If a higher power is to be prequalified for the mFRR, another operating test is required.

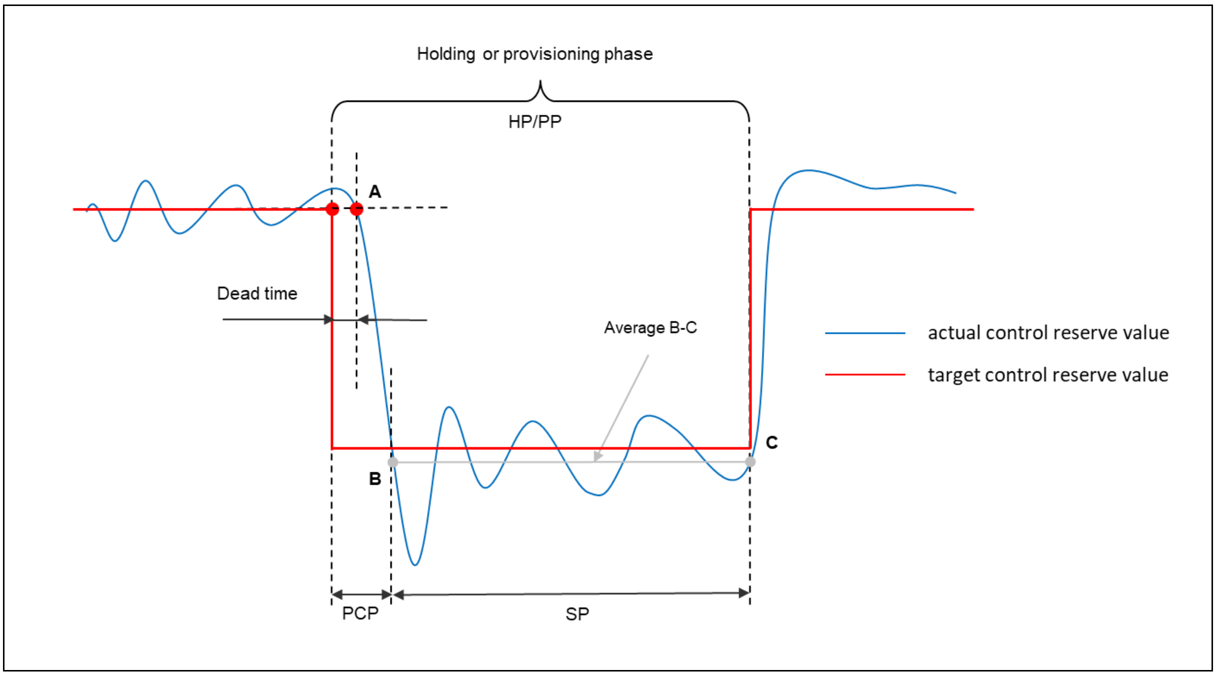

Figure 5: Schematic representation of an aFRR operating test

<u>mFRR</u>
In the case of mFRR, the power change period starts with the setpoint change and ends 12.5 minutes after the setpoint change. The target value (in other words the actual balancing

reserve value, which corresponds to the power to be prequalified) is determined as the arithmetic mean of the actual balancing reserve value over the entire stationary period. As an additional requirement, the actual balancing reserve value, which corresponds to the prequalifiable power determined on the basis of the operating test, must be reached at least once within the power change period.

The stationary period starts 12.5 minutes after the setpoint change. It lasts at least 10 minutes.

The schematic representation of an mFRR operating test corresponds to the schematic representation of an aFRR operating test in Figure 5.

2.3.3 Determining the prequalifiable power

For determination of the prequalifiable power, the mean value of the actual balancing reserve value of the stationary period (aFRR, mFRR) or the transient and stationary period (FCR) of each reservation and activation phase is determined. The actual balancing reserve values that fall within the power change period are not taken into account for the determination of the mean values.

Typically, three reservation and two activation phases are carried out during an operating test. The starting point for determination of the prequalifiable power in the positive (negative) direction is the minimum (maximum) mean value of the actual balancing reserve value in the activation phases. The maximum (minimum) mean value of the actual balancing reserve value in the reservation phases is subtracted from this. The (positive) prequalifiable power is therefore defined as

MIN {mean value of the actual balancing reserve value in activation phase 1; mean value of the actual balancing reserve value in activation phase 2}
MINUS
MAX {mean value of the actual balancing reserve value in reservation phase 1; mean value of the actual balancing reserve value in reservation phase 2; mean value of the actual balancing reserve value in reservation phase 3}

Example (positive balancing reserve):

Mean value of the actual balancing reserve value in reservation phase 1:	-1 MW
Mean value of the actual balancing reserve value in activation phase 1:	38 MW
Mean value of the actual balancing reserve value in reservation phase 2:	2 MW
Mean value of the actual balancing reserve value in activation phase 2:	39 MW
Mean value of the actual balancing reserve value in reservation phase 3:	0 MW

The prequalifiable power in the example is MIN {38 MW, 39 MW} - MAX {-1 MW, 2 MW, 0 MW} = 36 MW.

This calculation procedure applies accordingly for the negative balancing reserve, in which case the negative sign must be corrected.

The determination of the prequalifiable power is illustrated for the FCR case in Figure 6:

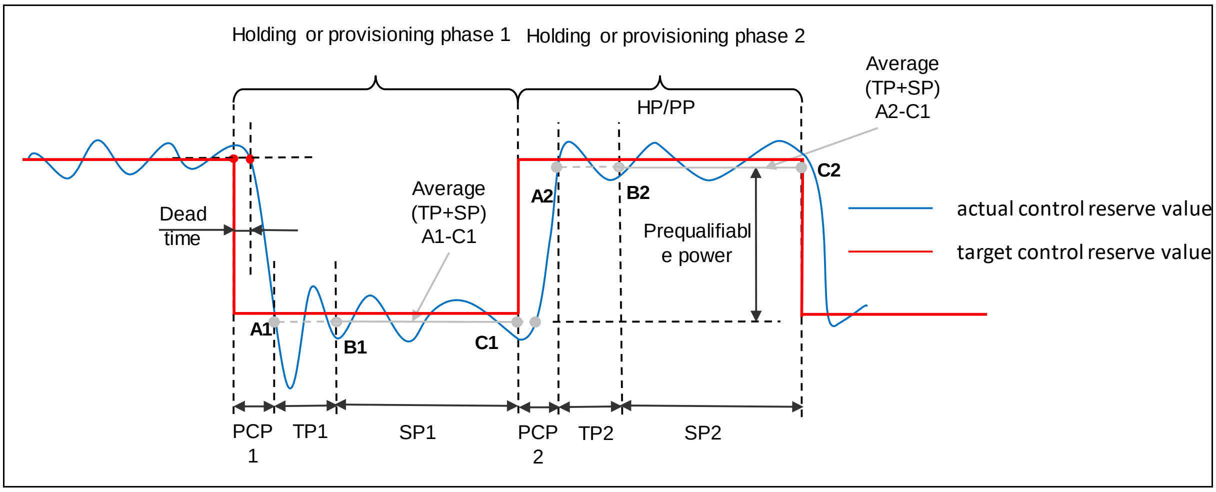

Figure 6: Schematic determination of the prequalifiable power

After completion of this evaluation, not only has it been determined whether the balancing reserve type-specific requirements with regard to response time and dynamic behaviour are complied with, the prequalifiable power has also been determined. The determination of the prequalifiable power is a prerequisite for the next part of the test, in which the activation behaviour of the RPU/RPG is checked with regard to whether the requirements concerning fluctuations of the injection or withdrawal are complied with and therefore whether the PQ power also truly corresponds to the prequalifiable power.

2.3.4 Permissible and acceptable fluctuations

Depending on the technology used by the respective power generating modules and/or demand units, the actual balancing reserve value fluctuates around the setpoint to a greater or lesser extent. Within the framework of the operating test, it is verified that the fluctuations of the balancing reserve activation do not exceed certain limits. In general, larger deviations are acceptable for the power change period than for the stationary (and in the case of FCR also the transient) period.

Permissible deviations are expressed in percent of the prequalifiable power. The deviation refers here to the deviation of the actual balancing reserve value from the mean value of the actual balancing reserve value during the reservation or activation phase. The principle used in determining the "acceptable" fluctuations can be most easily illustrated with an example:

- Prequalifiable power: 30 MW
- Mean value of the actual balancing reserve value of a reservation phase: -1 MW

- If a fluctuation of +/- 10% were deemed as "acceptable" ==> "acceptable" actual values in this example could lie in the interval [-1 MW - 10% * 30 MW, -1 MW + 10% * 30 MW] = [-4 MW, +2 MW]
- If a fluctuation of +/- 20% were deemed as "acceptable" ==> "acceptable" actual balancing reserve values in this example could lie in the interval [-1 MW - 20% * 30 MW, -1 MW + 20% * 30 MW] = [-7 MW, +5 MW]
- etc.

During the evaluation of the operating test, there is a differentiation between "allowed" and "acceptable" fluctuations. Every actual balancing reserve value measured within the framework of the operating test is evaluated as to whether the deviation from the setpoint

(i) lies within the interval of "allowed" fluctuations or
(ii) outside the interval of "allowed" fluctuations but still within the interval of "acceptable" fluctuations or
(iii) outside of the interval of "acceptable" fluctuations.

Values outside the interval of "acceptable" fluctuations are not permitted.

At least 95% of the actual balancing reserve values must lie within the interval of "allowed" fluctuations; a maximum of 5% of the measured values may lie in the "acceptable" interval. The definition of the intervals of "allowed" and "acceptable" fluctuations as well as the respective limits for the share of the measured values that must/may lie within these intervals depends on two factors:

- The balancing reserve type
- The period within the operating test in which the values are recorded.

In the case of FCR, the "allowed" or "acceptable" intervals can be illustrated in graph and table form as in Figure 7 and Table 1:

The requirements described in Section 3.1.2 also apply to the power change period (PCP).

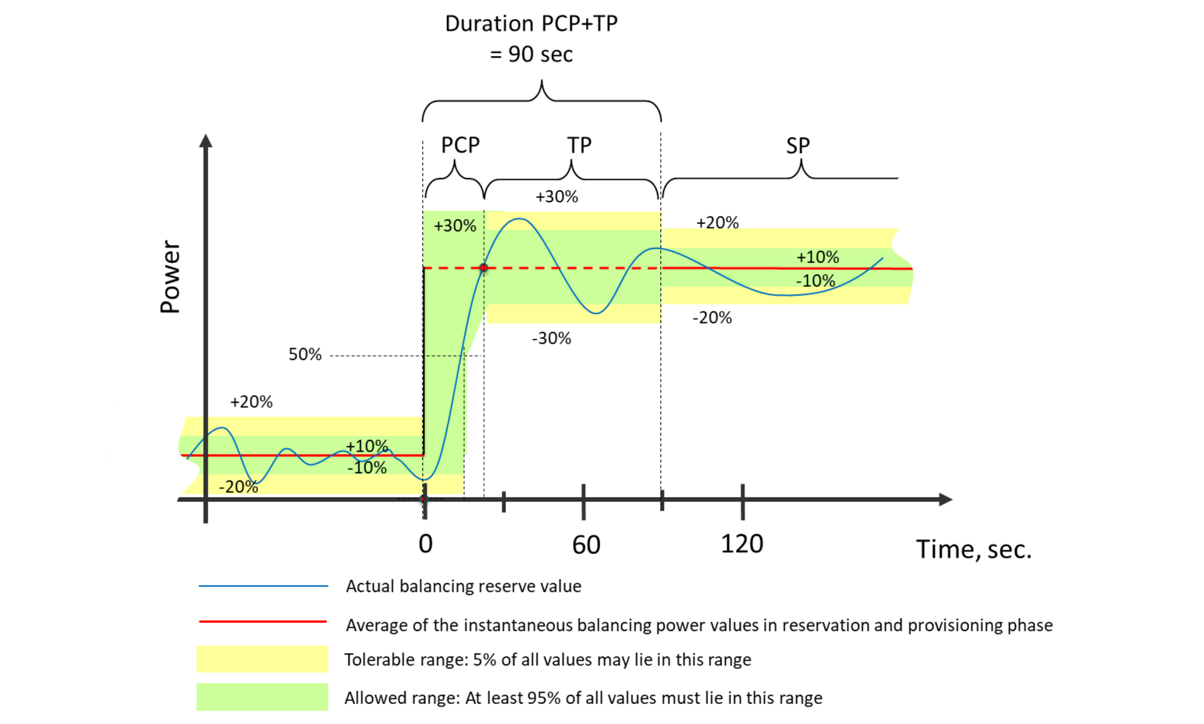

Figure 7: Schematic representation of the „allowed“ and “acceptable” intervals (FCR)

Table 1: Permissible fluctuations in the activation of FCR

Period within the reservation or activation phase	Duration of the period	"Allowed" interval (at least 95% of the values)	"Acceptable" interval (max. 5% of the values)
Power change period (PCP)	As of the setpoint change until reaching of the setpoint; maximum 30 seconds.	See additional requirements in Section 3.1.2; in addition, an over-fulfilment is limited to a deviation of no more than 30% of the prequalifiable power	
Transient period (TP)	End of the PCP up to 90 seconds after the setpoint change	+ / - 20%	+ / - 30%
Stationary period (SP)	90 seconds after the setpoint change until the next setpoint change (minimum duration 13 ½ minutes)	+ / - 10%	+ / - 20%

In the case of aFRR, the illustrations in Figure 8 and requirements according to Table 2 apply.

The maximum possible response time for aFRR of 30 seconds begins with the setpoint change and ends when the injection or withdrawal has continuously left the mean value of the preceding activation or reservation phase. The latter time is understood as the time at which the injection or withdrawal departs from the mean value for the last time.

In the time between the setpoint change and the end of the response time, a maximum of 5% of the measured values may lie in the interval [mean value of preceding reservation phase - 10% of the prequalifiable power, mean value of the preceding reservation phase - 5% of the prequalifiable power.

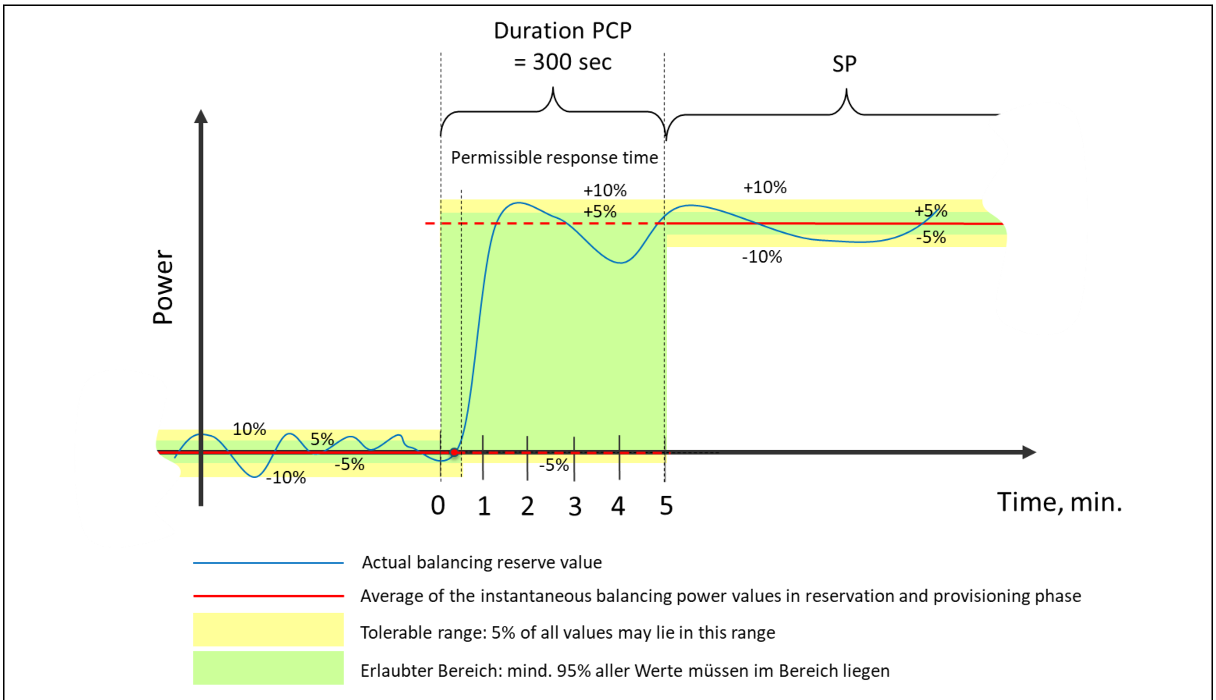

Figure 8: Schematic representation of the "allowed" and "acceptable" intervals (aFRR)

Table 2: Permissible fluctuations in the activation of aFRR

Period within the reservation or activation phase	Duration of the period	"Allowed" interval (at least 95% of the values)	"Acceptable" interval (max. 5% of the values)
Power change period (PCP)	Maximum permissible response time of 30 seconds from the setpoint change	+ / - 5%	+ / - 10%[1]

[1]In the time between the setpoint change and the end of the response time, a maximum of 5% of the measured values may lie in the interval [mean value of preceding reserve phase - 10% of the prequalifiable power, mean value of the preceding reserve phase - 5% of the prequalifiable power]. In the time between the end of the response time and 5 minutes after the setpoint change, a maximum of 5% of the measured values may lie in the interval [mean value of preceding reserve phase - 5% of the

Period within the reservation or activation phase	Duration of the period	"Allowed" interval (at least 95% of the values)	"Acceptable" interval (max. 5% of the values)
	End of the response time (max. 30 seconds) until five minutes after the setpoint change		
Stationary period (SP)	End of the PCP until the next setpoint change (≥10 minutes)	+ / - 5%	+ / - 10%

In the time between the end of the response time and 5 minutes after the setpoint change, a maximum of 5% of the measured values may be located in the interval [mean value of preceding reservation phase - 5% of the prequalifiable power, mean value of the preceding reservation phase.

The settlement rules applied in the framework of the aFRR accounting (i.e. in or for the real operation following the prequalification) do not correspond to the tolerance bands described above; rather, they imply stricter requirements with regard to the quality of the provision. In the PQ process, however, only compliance with the tolerance bands described above is intentionally evaluated.

In the case of mFRR, the illustrations in Figure 9 and requirements according to Table 3 apply.

prequalifiable power, mean value of the preceding reserve phase.

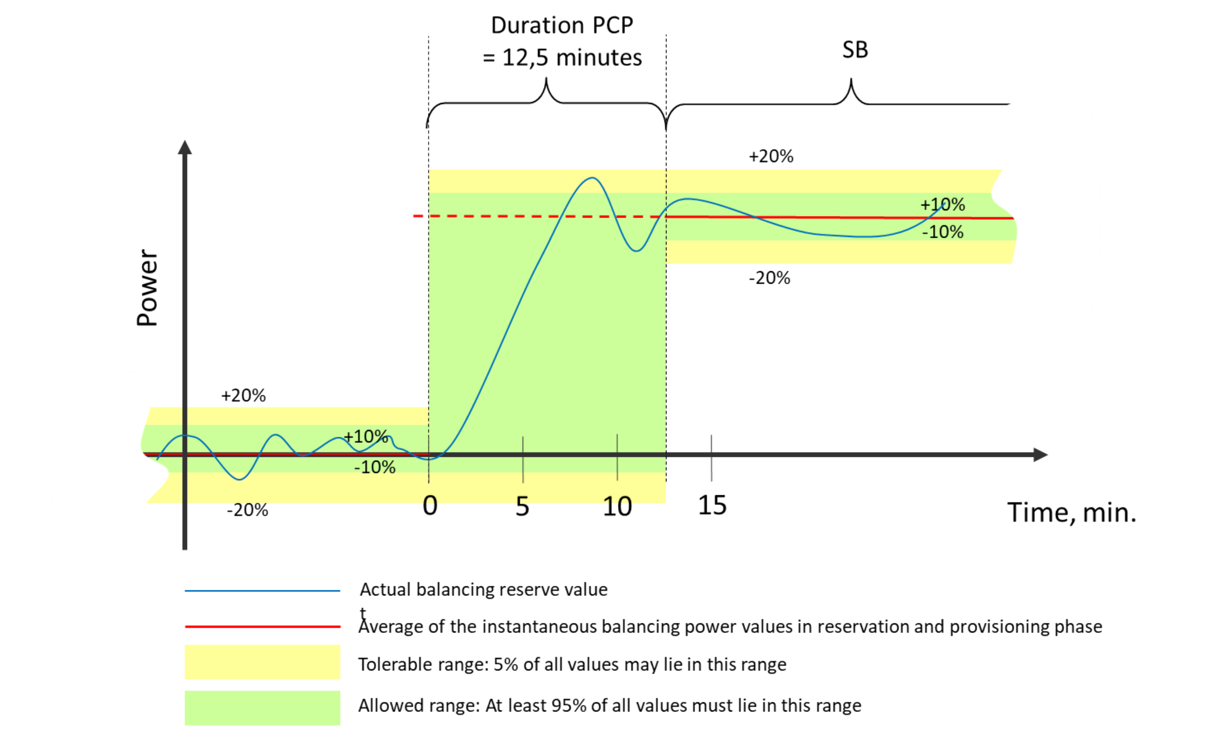

Figure 9: Schematic representation of the "allowed" and "acceptable" intervals (mFRR)

Table 3: Permissible fluctuations in the activation of mFRR

Period within the reservation or activation phase	Duration of the period	"Allowed" interval (at least 95% of the values)	"Acceptable" interval (max. 5% of the values)
Power change period (PCP)	12.5 minutes from setpoint change	+ / - 10%	+ / - 20%
Stationary period (SP)	End of the PCP until the next setpoint change (≥10 minutes)	+ / - 10%	+ / - 20%

If the above requirements regarding the permissible fluctuations are complied with, the prequalifiable power can be established as prequalified power or PQ power. The fulfilment of all other requirements is also a prerequisite for this.

2.3.5 Evaluation of additional requirements

Additional requirements may be evaluated within the framework of the operating test or in connection with this. A part of the additional rules for RPUs/RPGs with limited energy storage are very similar for the three balancing reserve types; these additional provisions are therefore addressed in the following Section 2.7.

The additional requirements specific to the balancing reserve type are described in Section 3.

At the time of publication of the present PQ conditions in autumn 2018, this applied only to FCR. For the sake of completeness, these additional requirements are summarised below; they consist of:

1) Test activation under operating conditions as well as local data saving in the event of communication disruptions

2) Evaluation of the compliance with the statutory requirements as well as the supplemental requirements formulated by the German TSOs (for specification of the requirement in Article 154 paragraph 7 point a) on the providing behaviour of an FCR unit or FCR group.

The compliance with the specially defined lower limit for the required energy capacity of an RPU/RPG with limited energy storage for the case of FCR must indeed be subjected to an evaluation; however, this evaluation does not take place within the framework of the operating test or the control system test and is described in Section 3.1.5.

2.4 Proof of suitability and PQ power from actual provision

For the repeated proof (repeat PQ) of prequalification for providing balancing power (no later than 5 years after the previous PQ), the process for proving prequalification based on actual provision data can also be used. This process is only permissible as an alternative to a new operating test for a renewed prequalification and to provide renewed evidence of product-specific suitability and PQ capacity. The process is not suitable for providing proof of storage capacity.
For renewing prequalification of an RPU/RPG involving several TUs, the process using proof from actual provision at some TUs can be combined with documentation of a new operating test at other TUs.

2.4.1 Overview of the process

The process for providing renewed evidence of technical feasibility and confirmation of PQ capacity requires a time sequence with data from actual provision, calculates the changes of power provided therein (increase or reduction), deems them to be valid or invalid according to a number of criteria and lists them in ascending or descending order (separately for power increases and reductions).
One time sequence can be used for several products for renewing the PQ, i.e. positive and negative balancing reserve with frequency containment reserve (FCR), automatic frequency restoration reserve (aFRR) and manual frequency restoration reserve (mFRR). The product-specific requirements (see below) must be fulfilled to renew the proof of suitability.
The respective highest applicable increase or reduction in capacity corresponds to the power value for which the plant has provided the renewed proof of prequalification. If none of the changes in output contained in the time sequence are recognised as valid, the provider cannot prequalify the facility again based on the submitted provision data.

With the process of actual provision, renewed prequalification is limited to a power value equal to the PQ power up to that point. This process is thus only suited to confirming the PQ power to date. If the provider wants to prequalify the plant for a higher value than the PQ power up to that point, an operating test will be required. The previous PQ power of the plant is considered confirmed if a change in power to the same extent and in the same direction is observed and deemed valid. If the changes in power are lower, the PQ power is confirmed on a pro rata basis accordingly.[2]

2.4.2 Formal requirements for using this procedure

A time sequence with data from actual provision must fulfil the following formal criteria.

Origin and structure

- The data from actual provision are not bound to the reservation and activation of balancing reserve and may contain changes in power for any reason, e.g. for schedule changes.
- The time sequence may contain several changes in the operating point.
- Target values may be set as a one-time change or as a series of incremental changes.

Age

The actual provision may not be longer than a year in the past.

Duration and granularity

The time sequence must cover a period of at least 4 hours without gaps.

For prequalification for FCR, aFRR and mFRR, time sequences with the following granularity are sufficient:

- FCR: up to 4 seconds
- aFRR: up to 4 seconds
- mFRR: up to 60 seconds

Format

Measurement time sequences in XLSX format (MS Excel) in line with the specifications from the PQ portal are expected.

2.4.3 Requirements for the testing procedure in terms of content

The requirements for the procedure are based on the requirements for the operating test as outlined in Section 0. However, they provide for the dynamic requirements for injection/withdrawal by the plants under real-life operating conditions.

The requirements can be divided roughly into changes of power and periods of constant provision. To this end, the value “signal” is determined as the sum from target value and

[2] In order to confirm the PQ power up to that point, it is sufficient to provide evidence of at least 98% of this power value via data form actual provision.

operating point for aFRR and mFRR. For FCR, the signal value is equal to the operating point. The signal value is compared to the actual power value for each point in time.

Changes in power

All changes in power, regardless of their value, are identified, measured and deemed to be valid or invalid according to the following criteria:

- The duration of the change in power between two power levels may not be longer than permitted for the relevant balancing energy type (FCR/aFRR/mFRR: 30, 300 and 750 seconds respectively) until the new level is reached.
- Before the start of the change in power, there must be at least 30 seconds of constant signal phase (reservation phase).
- Response time: The response time for the proof from actual provision data is evaluated in the same way as for the operating test, in connection with the highest change in power that has been deemed valid.
- The (duration of) change in power is considered complete once it enters the channel of +/-5% around the power level after the change in power (i.e. channel between 95-105%).
- After the end of the change in power, there must be at least 90 seconds of constant signal phase (activation phase).
- There are no requirements in terms of permitted fluctuations of the actual values relative to the signal for the duration of the change in power.

Permitted fluctuations in the reservation and constant provision of balancing energy (stationary periods)

Outside of periods that actually represent changes in power, further periods of time with a constant joint signal from operating point and target value must be recorded.

- Each change in power must show a time period with a constant signal of 600 seconds before and after the change.
- The lead-in and follow-up times may be present immediately before and after the change in power as one uninterrupted period or be made up of several segments with a duration of at least 30 seconds at any given point in time.
- In the 600 seconds with constant signal, the 30 seconds lead-in and 90 seconds follow-up time that must follow immediately after the power change are included.
- Only phases with a constant signal (i.e. target value and operating value must not change in it) will be eligible to be included.
- The (constant) operating point may differ from phase to phase.
- The lead-in and follow-up phases with constant signal do not need to be on the same power level as the power levels recorded before the power change. However, the power levels of suitable periods may only deviate up to +/-50% of determined PQ power from the level of the phase they are extending

For the duration of a constant signal (stationary period) the actual values must be distributed around the signal as follows, and thus remain within permissible fluctuations.

Table 1: Demands on the transient period (FCR) and stationary period

		"Permitted" interval (at least 95% of values)	"Acceptable" interval (max. 5% of values)
FCR	Transient period (end of PCP up to 90 seconds after change in target value)	+ / - 20%	+ / - 30%
	(Other) stationary period	+ / - 10%	+ / - 20%
aFRR	Stationary period	+ / - 5%	+ / - 10%
mFRR	Stationary period	+ / - 10%	+ / - 20%

These requirements for fluctuations during reservation or activation phases apply for aFRR and mFRR for the obligatory lead-in and follow-up phases of 30 or 90 seconds before or after the change in power respectively, as well as for further stationary periods of at least 540 seconds before and after the power change that do not need to follow immediately after the 30 seconds or 90 seconds respectively.

Other periods
All other periods in the time sequence that show strong or not so strong fluctuations and do not fulfil the requirements for power changes or stationary periods, including deviation tolerances, will not be considered any further.

2.5 Technical concept

In addition to the operating measure protocol described above and other specifications in the PQ portal, the BSP must submit a technical concept for each TU, RPU/RPG and the pool along with its PQ application. The technical concept encompasses the description of the issues that are not yet suitably depicted in the PQ portal. This includes, for instance, the documentation of the technical realisation of the respective balancing reserve type. The content of the technical concept should be derived from the PQ conditions. The reserve connecting TSO can establish additional requirements with regard to the creation of the technical concept, in particular with regard to the file formats to be used.

The requirements mentioned above with regard to the creation of the technical concept are primarily intended to permit the standardisation of the software tools, etc., used in the evaluation. If this results in implications for the PQ portal, the TSOs will take this into account in the release planning for the PQ portal.

2.6 Time availability

As far as this Section speaks of the time of activation of a backup, this always refers to the time at which the replacement injection becomes physically active in the public grid.

2.6.1 Time availability - FCR

The BSP must ensure the continuous availability of FCR over the entire product period.

Upon the occurrence of disruptions that result in the unavailability of FCR providing units or FCR providing groups, an appropriate backup must be activated immediately.
The provider must ensure that FCR is provided correctly, even in the event of failure of the communication line.

Article 156 paragraph 4 obliges an FCR provider to " guarantee the continuous availability of FCR, with the exception of a forced outage of a FCR providing unit, during the period of time in which it is obliged to provide FCR." Article 156 paragraph 6 point c clarifies that "the FCR which is made unavailable due to a forced outage or the unavailability of an FCR providing unit or FCR providing group [must be replaced] as soon as technically possible and in accordance with the conditions that shall be defined by the reserve connecting TSO." As reserve connecting TSO, the German TSO is free to require the FCR provider to ensure 100% time availability, e.g. by means of appropriate backup contracts.

The statutory obligation from Article 156 paragraph 5 SOGL applies: "An FCR provider shall guarantee the continuous availability of FCR, with the exception of a forced outage of a FCR providing unit, during the period of time in which it is obliged to provide FCR."

2.6.2 Availability of FRR providing units and FRR providing groups

At the pool level, the FRR provider must guarantee a time availability of 100%. Upon the occurrence of disruptions that result in the unavailability of FRR providing units or FRR providing groups, an appropriate backup must be activated immediately.
In the case of FRR, the statutory obligation from Article 158 paragraph 4 SOGL applies: "Each FRR provider shall [...] inform its reserve instructing TSO about a reduction of the actual availability of its FRR providing unit or its FRR providing group or a part of its FRR providing group as soon as possible."

2.7 Special requirements for reserve providing units or groups with limited energy storage

RPUs/RPGs with limited energy storage are RPUs/RPGs that cannot reliably provide the marketable PQ power **continuously in positive or negative direction over two hours for FCR and over four hours for FRR** without additional measures (such as the use of storage management measures).
In the case of RPUs/RPGs that do not own limited energy storage as per above definition, confirmation from the balancing service provider is sufficient proof. Confirmation is usually given by entering the maximum activation time (without additional measures, i.e. the pure physical energy capacity) in the PQ portal for TU/RPU/RPG.

A combination of TUs with limited energy capacity and TUs with unlimited energy capacity does not automatically result in an RPU/RPG with limited energy capacity, as long as the ability for provision is not curtailed by the TU with limited energy capacity.

2.7.1 Determining the minimum energy capacity for FRR

For RPUs/RPGs that satisfy the definition of an RPU/RPG with limited energy storage, the following additional requirements apply:

- The minimum energy capacity of the energy storage must meet or exceed two different lower limits.
- The value of minimum energy capacity depends on PQ power and marketable power. In the standard case of reservation and activation without activation of recharge management of FRR that value must be reached
- In the case of a combined reservation of positive and negative FRR, operating ranges must be reserved in both directions accordingly.
- No additional measures may be taken into account for determining the minimum energy capacity for FRR.

The lower limits described above are explained below; the maximum of both lower limits is the decisive factor for determining the minimum energy capacity.

Lower limit of the energy capacity relative to the marketable power
The minimum energy capacity of the energy storage relative to the marketable power is defined in Section 3.1.5. in the case of FCR.
In the case of FRR, the minimum energy capacity of the energy storage relative to the marketable power is 60 minutes. This requirement does not apply for exclusive participation in the balancing energy market. In that case, the actual marketing time periods at the balancing energy market must be taken into account. An energy reserve must be kept available for possible start-up and shut-down periods before and after the relevant product time slice.

Lower limit of the energy capacity relative to the PQ power

The minimum energy capacity of the energy storage relative to PQ power is 15 minutes for both FCR and FRR

2.7.2 Operating modes/activation of recharge management for FRR

There are two operating modes for FRR (see Figure 10)

- Standard case: The BSP decides on a recharge measure at an early stage. This means that the recharge measure takes effect before the minimum energy capacity of 60 minutes is used and the RPU/RPG is therefore still within the permitted operating range.
- Proof of the recharge measure by means of ERRP message: In this context, trading transactions already executed and shifts in the own generation and consumption portfolio, which are shown in the schedule of the relevant technical unit, are to be credited to the minimum energy capacity of 60 minutes. This is only permissible if the decision to trade and postpone the transactions in the own power plant portfolio was made in time before the energy capacity fell below 60 minutes. The ERRP message serves as proof that the trading transaction was executed. As proof, power plant operation plans for the affected TU, RPU or RPG are to be made available continuously throughout the entire period of balancing reserve reservation and updated in a timely manner. The transmission is file-based in ERRP format via the interface specified by the reserve connecting TSO. The BSP is held to return the charge level into the operating range as soon as possible, e.g. in order to be able to meet his delivery obligation in case of interruptions of trading possibilities.

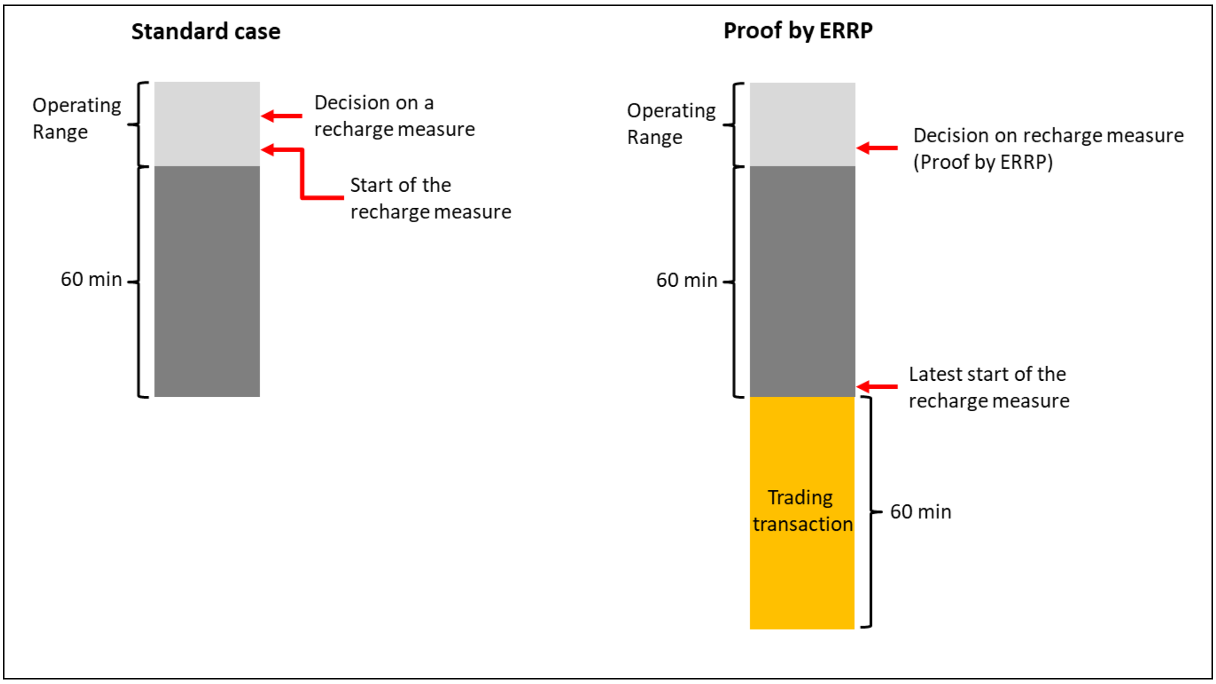

Figure 10: Operating modes of charging management

Before the end of the marketing window, the energy capacity must only be provided on a pro rata period basis.
In addition, the BSP must verify that it has developed storage management measures that permit a continuous, secured providing over 4 hours. The product structure and lead times of the intraday trading, system processing times of the BSP, the possible unavailability of a trading platform and liquidity bottlenecks in ¼-h intraday trading, among other factors, must be taken into account here.

2.7.3 Requirements on the storage management

The use of storage management must permit the RPU/RPG to provide the held balancing reserve over the duration of the reference value of four hours by means of operating point shifts in connection with compensating energy transactions[3]. In the case of FCR, this applies to the normal state according to Article 18 SOGL; in the case of FRR, this applies regardless of the system state.
The power balance between the operating point shift and the charging/discharging measure must be guaranteed.

Exogenously caused changes to the storage level (e.g. natural inflows) do not represent storage management here. The BSP is responsible for ensuring that exogenously caused changes to the storage level do not endanger the PQ conditions or the reservation and activation in the case of marketing.
Upon request of the TSO, any compensation measures utilised in the framework of storage management (market transactions, compensation measures in one's own balancing group, etc.) must be documented in suitable form. The recharge strategy must not be reliant upon a potential overfulfilment of the FCR.

Possible elements of storage management could be:

Charging/discharging processes via schedule transactions: The restoration of the optimal charge state is possible via charging/discharging processes via the market by means of schedule transactions carried out in advance (exchange or OTC transactions). In this case, the operating point shift equals the amount of the compensating schedule transaction that is carried out.

Charging/discharging processes by means of other units: The restoration of the optimal charge state is possible via charging/discharging processes by means of adaptation of the injection or withdrawal of other TUs. It is a prerequisite here that the TUs in question belong to the same balancing group and that it has been verified in a technical concept and via operating curves how the temporal interaction of the charging or discharging process and the compensating unit

[3] If the anticipated operating point is transmitted and/or archived, the operating point shift must be appropriately taken into account in the anticipated operating point.

is ensured. The data delivery obligations described in Section 5.1 additionally also apply for the compensating unit. In principle, the substitution must be oriented around the quarter hour interval framework.

Non-use of a permissible response time: In accordance with the requirements, the balancing reserve must be provided continuously. For an activation of the entire balancing reserve, this must be completely activated within 30 seconds (FCR), 5 minutes (aFRR) or 12.5 minutes (mFRR). Technical units that are capable of providing the balancing reserve more quickly can make use of this property as a measure of freedom.

Overfulfilment: Within the limits established in the framework agreement, an overfulfilment of FCR is permitted. FCR must be provided at least according to the requirements of the P(f) characteristic curve; an activation of up to 120% of the requirement according to the P(f) characteristic curve is permitted (in contrast to underfulfilment). This measure of freedom can be used for storage management in order to charge or discharge the storage as needed. It must be observed here that the maximum combined effect of the inherent frequency response insensitivity and a possible intended frequency response deadband of the governor of the FCR providing units or groups is 10 mHz.

2.7.4 Determination of the usable energy capacity for FCR and FRR

The verification of the usable energy capacity is mandatory for RPUs/RPGs with limited energy storage and can take place within the framework of the operating test according to one of the two variants described below (see Figure 11 and Figure 12).
In variant 1, another cycle is added after the second cycle and the power is provided until the minimum required energy capacity has been verified. Figure 11 illustrates this first variant for the case of FCR.

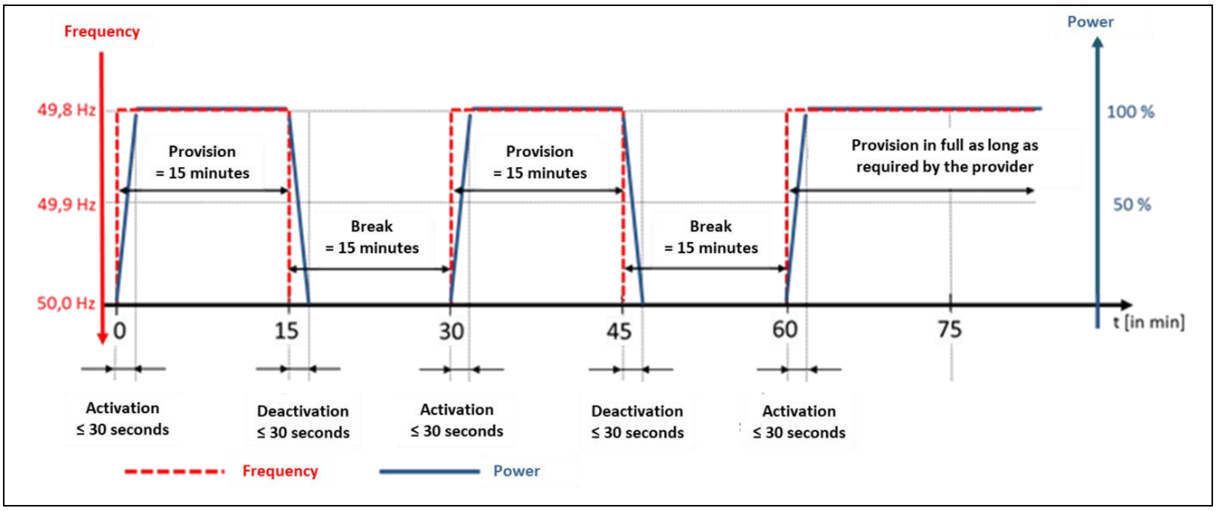

Figure 11: Variant 1 of the verification of the usable energy capacity (FCR)

Alternatively, the BSP can repeat the cycles enough times to verify the minimum required energy capacity. This second variant is illustrated in Figure 12 (also for the case of FCR).

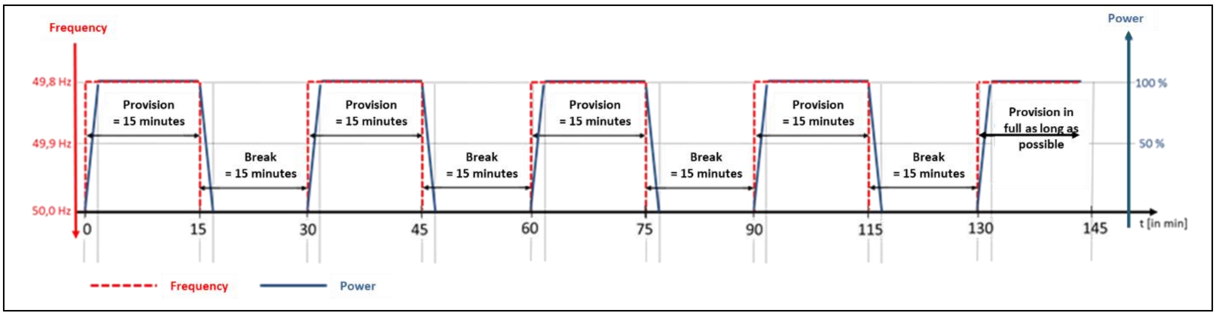

Figure 12: Variant 2 of the verification of the usable energy capacity (FCR)

The verification of the usable energy capacity must take place with at least the desired marketable power. The energy capacity extending beyond the minimum required energy capacity can be verified by operating logs or similar documents. The use of storage management measures is not permitted during the determination of the usable energy capacity.

2.8 Consideration of catch-up effects

A catch-up effect exists if a balancing reserve activation or the resulting providing of balancing reserve impacts the injection or withdrawal behaviour of the pool such that it changes independently of the balancing reserve activation; in other words, the deviation of the actual power supply or consumption from the planned injection or withdrawal is not limited to the power- and operating-related consequences of the balancing reserve activation. It does not matter here whether the additional deviation arises before, during or after the balancing reserve activation.

The BSP must either confirm that such catch-up effects can be ruled out or he must describe the effects in the technical concept and explain the reasons for them as well as ensure that they are fully taken into account within the framework of the balancing group management. The procedure for taking account of these effects in the balancing group management must also be described.

2.9 Requirements for wind turbines

To determine the operating point, the method of nominal injection can be used for wind turbines. It is the responsibility of the BSP to use this or an equivalent method for determining the operating point.

2.9.1 Permitted methods for determining the operating point

In case the BSP uses the method of nominal injection, the determination of the nominal injection has to be explained qualitatively to the reserve connecting TSO in the technical concept.

- The nominal injection is the power value determined by the BSP, which the wind turbines can currently feed-in at the maximum level on the basis of the available wind generation injection and the technical conditions.
- The datapoint "Setpoint for supply-dependent units" is used to record power-reducing measures, e.g. night-time sound insulation, balancing reserve activation or curtailment. If no power-reducing measures are available, the nominal injection must best reflect the measured injection of the wind park.
- The operating point is derived from the minimum of the data points " nominal injection and "setpoint for supply-dependent units".

The data points are described in detail in Section 5.1.

When using the method, the BSP has to take into account the specific constellation of TUs/RPUs/RPGs, i.e. the BSP shall explain how the nominal injection of the wind turbines or the share of the RPU/RPG consisting of wind turbines is determined and how this is taken into account in the operating point of the entire RPU/RPG.

2.9.2 Nominal injection in case of mFRR

The "nominal injection" procedure is shown in Figure 13 using the example of the mFRR. The phases of reservation, activation, provision and deactivation of balancing reserve are explained by way of example.

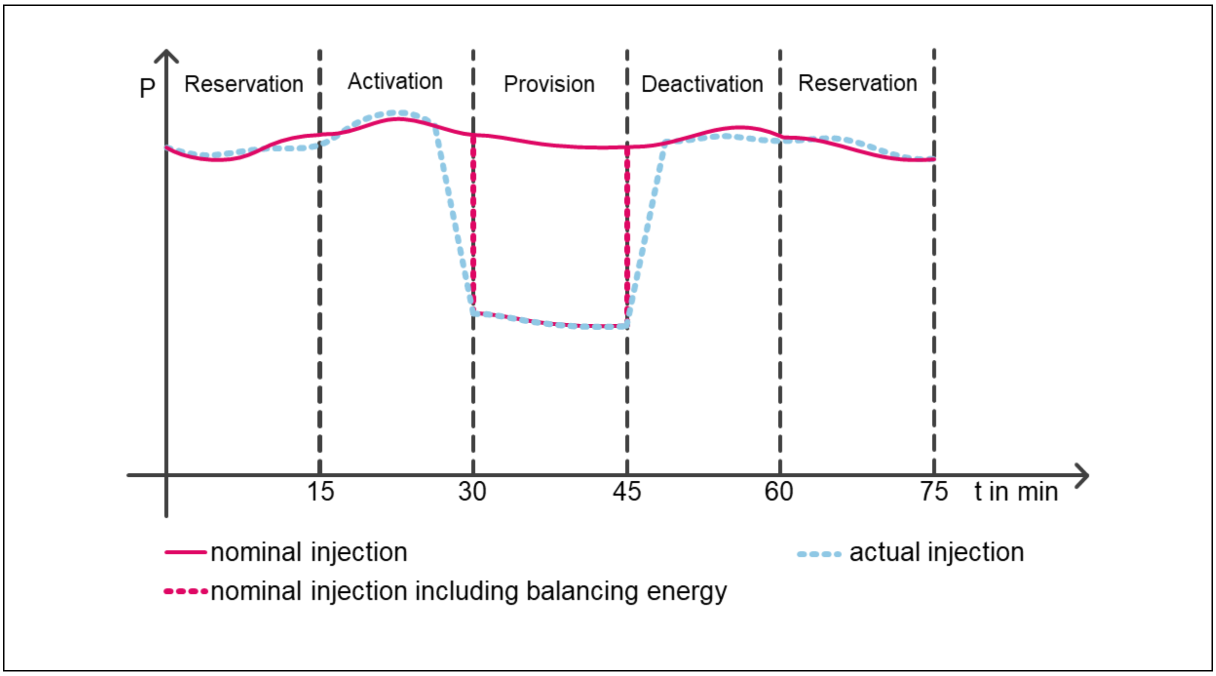

Figure 13: Verification procedure of the "nominal injection" method using the example of mFRR

In the reservation phase, measured and possible feed-in must correspond according to the rules in Section 2.9.4.

In the activation phase, the injection power of the wind park is reduced by the requested balancing reserve power. During the activation phase, the nominal injection must be determined with sufficient accuracy, as this serves as a reference value for determining the balancing reserve power.

During the provisioning phase, the nominal power is permanently reduced by the requested balancing reserve power. The nominal power serves as a reference value. It is expected that the curves of the nominal and the actual injection are approximately parallel (see Figure 13).

In the following phase the balancing reserve provision is deactivated. At the time of complete deactivation, the nominal and actual injection should match sufficiently precise. The difference at this time serves as an indicator for the accuracy of the nominal injection during the balancing reserve provision.

The procedure for determining the nominal injection must not differ in the various phases of balancing reserve provision.
In case of a power reduction (e.g. within the scope of curtailment according to § 13 (2) EnWG or for economic reasons), the reference value can be derived from the minimum of the nominal injection and the setpoint of the power reduction, if the method for nominal injection is used.

2.9.3 Nominal injection for FCR and aFRR

In case of FCR and aFRR, the specifications specific to the balancing reserve type must be taken into account. For aFRR this means the operating point 5 minutes ahead must be determined.

2.9.4 Accuracy requirements to determine the possible feed-in capacity

In order to verify the accuracy of the determination of the nominal injection, the BSP shall take into account the following points in his evaluations and submit them to the reserve connecting TSO, taking into account the data points listed in Section 5.1:

- The period under consideration for the evaluation must be coherent and include the period during which the operational test (double cycle curve) was recorded.
- Values with an injection power of less than 10 % of the installed capacity shall not be considered.
- Data recorded in the context of a power reduction (e.g. curtailment measures) are not taken into account.
- At least 10,000 values within the period of observation must meet the requirements.

- In the period of observation, the difference between nominal injection deducting the balancing power setpoint and the actual injection resp. the balancing reserve provision errors are determined. The absolute value of the mean value of the provision errors must not be greater than ±1 % of the power to be prequalified.
- The requirements for the operating test according to Section 0 must be fulfilled

2.9.5 Shading effects

By reducing the power of wind turbines, the injection of the remaining turbines of a wind park or of the turbines in neighbouring wind parks can increase. Likewise, by deactivating negative balancing reserve, the injection of the remaining turbines of a wind park or the turbines in neighbouring wind parks can be reduced. This results in the obligation for the BSP to list all wind turbines within a radius of 5 km (ideally in the form of a map) in his technical concept.

If shading effects occur and have a non-negligible impact on the injection power within the wind park or the neighbouring wind park, it is the responsibility of the BSP to consider and compensate for these effects. In doing so, it must be ensured that there is no systematic underfulfilment, but also no serious overfulfilment. If a compensation factor is used to avoid systematic underfulfilment, the level of the factor for the reserve connecting TSO must be shown in the technical concept.

Following the provision of balancing reserves, the participating wind turbines must return to the reference value as soon as possible.

2.10 Control system test

Every pool must complete a control system test and verify that it complies with the requirements formulated for this.

In contrast to the operating test, which the BSP carries out without the participation of the reserve connecting TSO, the control system test is carried out in close coordination with the TSO. The control system test is required for all three balancing reserve types, however, it is structured somewhat differently in each case. The uniform requirements of the four German TSOs are described below.

The control system test has two primary elements for all three balancing reserve types:

- The BSP must show that its pool is connected correctly to the control system of the TSO. This includes the correct recording and transmission of the measurement values required as real-time data (see Section 5.1) and the unproblematic receipt and implementation of setpoint assignments / activations. In the case of aFRR, this includes an evaluation of the reliable integration into the control network of the TSO.
- The BSP must verify the robustness of the providing by the pool. This includes, firstly, a regular function test (setpoint assignment) under operational conditions; secondly, the BSP must show that the pool can also handle technical/operational challenges,

such as faults. The conceivable faults that could be simulated in the control system test include, for instance, the failure of a TU of the pool.

The control system test must be carried out

- during the first prequalification of a pool or
- upon fundamental changes to the pool composition or pool control or
- upon regular expiration of the validity of an issued prequalification after no later than five years or
- upon justified request by the reserve connecting TSO.

In analogy with the TSO understanding of Article 155 paragraph 6 and Article 159 paragraph 6 laid out in Section 0, fundamental changes to the pool composition or pool control should be understood to include such changes that could result in the pool no longer satisfying the requirements.
Upon the regular expiration of the validity of a prequalification, it is possible, in analogy with Section 2.3, to use real activation or providing data of the respective pool. The condition for this is that the data are no older than 12 months. In addition, it must be clear from these data that the requirements of the control system test are fulfilled.

The main requirements with regard to the control system test are shown in Table 5.

Table 5: Summary of the main content of the control system test

<table>
<tr><th>FCR</th><th>aFRR</th><th>mFRR</th></tr>
<tr><td colspan="3">Checking of the correct integration into the control system of the TSO
• Correct recording and transmission of the measurement values required as real-time data (see Section 5.1)
• Unproblematic receipt and implementation of setpoint requirements and activations
• Simulation of the failure of the data connection between the TSO and the BSP for checking of the redundancy</td></tr>
<tr><td></td><td>Reliable integration into the control network of the TSO</td><td>Functioning integration into the MOLS</td></tr>
<tr><td colspan="3">Simulation of the failure/disruption of a TU/RPU/RPG in order to check the robustness and the stability of the providing quality; checking of the smooth functioning of the backup by another TU/RPU/RPG of the pool</td></tr>
</table>

FCR	aFRR	mFRR
The power to be utilised in the control system test should be representative for the pool and will be agreed upon between the BSP and the TSO. A duration of one to two hours can be assumed for the test providing.		
Test providing under realistic conditions on the basis of actual frequency deviations; evaluation with regard to the product requirements for FCR	Test providing under realistic conditions on the basis of a non-standardised setpoint to be specified by the TSO with a time resolution between 1 and 4 seconds; Quickly changing activations with different setpoint and direction changes Evaluation with regard to the product requirements for aFRR. The providing behaviour is oriented around the tolerance/acceptance channels of the currently valid billing logic.	Test providing under realistic conditions on the basis of an activation via MOLS in quarter-hour intervals; evaluation with regard to the product requirements for mFRR
The BSP must itself ensure that its balancing group is appropriately managed for the period of the test.		

No compensation is provided for the participation in the control system test; the BSP must itself bear any costs that arise. If the test isn’t passed, a repetition is required in coordination with the TSO.

The above description of the control system test is not conclusive, rather, the test can be expanded appropriately on the basis of justified requests by the reserve connecting TSO.

2.11 Identification and rectification of faults

The BSP must ensure through suitable measures that faults in the reservation and/or activation are identified and rectified immediately. No later than 15 minutes after the end of the quarter hour in which the fault occurred, the correct reservation and/or activation must be once again restored. Faults must be suitably documented and explained to the reserve connecting TSO upon request.

After the development and publishing of requirements for the structured and standardised recording of faults by the TSOs, the documentation of the faults must take place in accordance with these requirements.

2.12 Special requirements with regard to the simultaneous or sequential provision of various types of balancing reserve by the same Technical Unit

One TU can be prequalified per LFC area via allocation to RPUs/RPGs as follows:

- For different balancing reserve types for one or more BSPs
- Per balancing reserve type by only one BSP.

A BSP can market, reserve and activate, at the same time, all three balancing reserve types (FCR, aFRR, mFRR) from a single TU per LFC area via allocation to RPUs/RPGs insofar as a separate power band is maintained for each balancing reserve type and the requirements specific to the balancing reserve types are complied with overall.

One TU can be part of different RPUs/RPGs per balancing power type at one balancing service provider. During operation, this TU may be allocated to only one RPU/RPG, i.e. during reservation and activation of balancing power in 15-minute slots. Allocation of the TU to the respective RPU/RPG must be archived and be made available upon request from the connecting TSO (e.g. as part of an ex-post proof of provision). This ensures that one TU cannot be assigned to more than one RPU/RPG at any one time. This situation is also taken into account when determining marketable power, by taking the contribution of the TU to the marketable power of the overall pool into account only once (see example in the explanation box below). In addition, this construct must be described in the provision statement and approved by the TSO.

The following example is intended to illustrate how the contribution of one battery impacts the marketable power of the respective power plants and how this impact in turn effects the contribution to the pool.

	Generator 1	Generator 2	Generator 3	Pool contribution
Prequalified as RPU	7	8	5	20
Prequalified as RPG, in combination with the same battery respectively	8	9	7	22

The different power plants prequalified as RPUs feature a marketable power of 7 MW, 8 MW and 5 MW. The contribution to the pool thus amounts to 20 MW in total.
When the power plants are being prequalified with the battery that only exists once in the pool, the marketable power for power plant 1 increases by 1 MW, for power plant 2 by 1 MW

and for power plant 3 by 2 MW. For determining the contribution to the pool, the group is taken into account for which the battery results in the highest increase in marketable power. In the present example this would be the group with power plant 3. The contribution to the pool is thus the sum of the capacity of power plant 1, power plant 2, and the group consisting of power plant 3 and battery, which is 22 MW in total.

The determination of the deviation of the actual balancing reserve value from the setpoint, in each case per balancing reserve type, is referred to as error attribution. For simultaneous reservation and activation by the same BSP, the error attribution for the levels TU/RPU/RPG takes place based on the combination of the held or provided balancing reserve types as follows:

- If only one balancing reserve type is held and provided, then the error is to be entirely attributed to this balancing reserve type
- If FCR and mFRR, but not aFRR, are held or provided, the error is attributed to the FCR
- If in addition to FCR and/or mFRR, aFRR is also held or provided, the error is attributed to the aFRR.

Table 6 below shows the currently applicable error attribution.

A simultaneous (i.e. temporally overlapping) marketing, reservation and activation by more than one BSP is not permitted.

Marketing, reservation and activation by more than one BSP in succession is permitted if each balancing reserve type is marketed, held and provisioned by no more than one BSP. If marketing of different balancing reserve types is planned from one TU/RPU/RPG by more than one BSP, appropriate measures must be in place to prevent the simultaneous marketing by more than one BSP, and these measures must be described in the technical concept. Each of the BSPs in question must fulfil the prequalification requirements.

The table shown below illustrates all seven possible marketing combinations. A blue background in one of the cells in the three columns on the far left means that the balancing reserve type in question is marketed, held and provisioned by the TU/RPU/RPG. For the sake of simplicity, only the positive balancing direction is considered and no units are specified; for the purpose of the description the unit "MW" is assumed below. Also for simplification, it is assumed below that the operating point in all combinations shown is 0 MW. The numerical values in the table follow the generally applied leading sign convention: The injection has a positive sign; the same is true of a request (TARGET) for positive balancing reserve and overfulfilment of an activation for positive balancing reserve as well as underfulfilment of an activation for negative balancing reserve. Correspondingly, power consumption has a negative sign; the same also applies to a request (TARGET) for negative balancing reserve and underfulfilment of an activation for positive balancing reserve as well as overfulfilment of an activation for negative balancing reserve.

Table 6: Illustration of the error allocation in the providing of balancing reserve

FCR POS	aFRR POS	mFRR POS		IST	FCR POS Target	aFRR POS Target	mFRR POS Target	FCR POS Actual	aFRR POS Actual	mFRR POS Actual	FCR POS Error	aFRR POS Error	mFRR POS Error		FCR POS	aFRR POS	mFRR POS
			1	+5	+10			+5			-5			1			
			2	+5		+10			+5			-5		2			
			3	+5			+10			+5			-5	3			
			4	+10	+10	+10		+10	0		0	-10		4			
			5	+10	+10		+10	0		+10	-10			5			
			6	+10		+10	+10		0	+10		-10	0	6			
			7	+15	+10	+10	+10	+10	-5	+10	0	-15	0	7			

In the case of combination 1, the TU/RPU/RPG only provides FCR_POS (blue designation on left). The actual injection is assumed as +5 MW. Because the actual balancing reserve value essentially corresponds to the actual injection minus the operating point, the FCR actual value in this example is +5 MW. For the sake of assumption, this actual value stands in relation to a setpoint of +10 MW. Because the activation error is fundamentally determined as the difference between the actual balancing reserve value and the setpoint, this results in an activation error (under-provision) of five MW, which is displayed according to the leading sign convention as -5 MW. The attribution of the error to a specific balancing reserve type is indicated in the three columns on the far right of the table with a red background colour. (Also on the far right, an activation considered to be "correct" - for the sake of assumption - is indicated with a green background colour.) In the case of combination 1, the entire error is attributed to the FCR (FCR_POS). In this case, combinations 2 and 3 each illustrate the sole activation of aFRR (aFRR_POS) and mFRR (mFRR_POS) respectively.

In combination 4, the TU/RPU/RPG simultaneously provides FCR (FCR_POS) and aFRR (aFRR_POS). In this case, there is no division of the error; rather, the entire error is attributed to the aFRR (aFRR_POS) (red indication on right), while the requested FCR (FCR_POS) is considered to be correctly provided for the sake of assumption (green indication on right). Also in the cases of combinations 6 and 7, the entire activation error is attributed to aFRR (aFRR_POS).

In the case of combination 5, the TU/RPU/RPG is used for the simultaneous providing of FCR (FCR_POS) and mFRR (mFRR_POS). The example illustrates that in this case, the entire activation error is attributed to the FCR (FCR_POS) and the mFRR (mFRR_POS) is considered to be provided correctly.

2.13 Contact for communication with TSOs regarding operational issues

The BSP is obliged to establish a point of contact for operational issues that is available around the clock and to provide the reserve connecting TSO with all information necessary for reaching this contact. In times during which the BSP has received an engagement and is reserving balancing reserve, the point of contact specified by the BSP must be staffed by a trained, German or English-speaking employee with the necessary knowledge and skills who is able to implement the instructions of the TSO and independently intervene in the control systems of the BSP (e.g. manual activation of balancing reserve).

Changes to the contact information must be reported to the TSO via the PQ portal. It will take no longer than ten business days for them to become effective. If such notification of changes is not provided, the prequalification of all RPUs and RPGs belonging to the respective pool will be suspended.

2.14 Connection system operator (CSO) confirmation

The BSP – if applicable, together with the system operator – must coordinate with the reserve connecting distribution system operator (DSO) and take all measures necessary for the correct reservation and activation of balancing reserve. As verification of this, the BSP must submit to the reserve connecting DSO a signed CSO confirmation (see Section 0).

With regard to the practical implementation, it is established that the reserve connecting DSO issues the confirmation and coordinates as necessary with the next adjacent DSO.

For the case that a reserve connecting DSO or an intermediate DSO situated between the reserve connecting TSO and the reserve connecting DSO must temporarily limit a TU on the basis of grid restrictions, the BSP must ensure via suitable measures and potentially via agreements with the system operator that the provider immediately receives the information concerning the limitations placed on the TU from the plant operator and makes use of this information for upholding the obligation of continuous reservation and activation of balancing reserve.

2.15 Balance responsible party (BRP) confirmation

Every TU that is allocated to an RPU/RPG must be allocated to a balancing group via a metering point, and the BRP of the balancing group must be informed of the balancing reserve marketing (and any reservation and provision). The BSP must confirm this in a declaration of its own.

2.16 Supplier confirmation

For every TU that is allocated to an RPU/RPG and is to be used for the reservation or activation of balancing reserve, a supplier confirmation according to Section 5.3 must be submitted and updated in the event of a supplier change. An existing prequalification will be suspended upon a supplier change until the updated supplier confirmation is received.

2.17 Confirmation of the operator/owner of the TU

For every TU that is allocated to an RPU/RPG and is to be used for reservation or activation of balancing reserve, the BSP must confirm the following, insofar as it is not also the system operator and owner of the TU:

a) The owner of the TU is informed of the prequalification application and has agreed to the reservation and activation of balancing reserve from its TU.
b) The system operator has received all of the relevant prequalification documents and has declared its full agreement with the procedure described therein.
c) The system operator agrees to the use of the TU for reservation and activation of balancing reserve by the BSP in accordance with the instructions of the reserve connecting TSO.

The BSP must confirm that it has concluded agreements with every relevant system operator and/or owner that ensure the following:

a) The requirements described in the PQ conditions will be completely complied with for as long as the BSP is obliged to reserve or activate balancing reserve or for as long as marketing takes place.
b) The BSP will be immediately informed if the requirements described in the PQ conditions are no longer fulfilled or no longer completely fulfilled.
c) Significant changes to the company or performance data on which the prequalification is based will be reported to the BSP immediately.
d) The system operator will only operate the TU used for the reservation or activation of balancing reserve in a way that does not impede the proper reservation and activation of the balancing reserve.
e) The reserve connecting TSO is indemnified against all liability claims from damages that could arise in connection with the reservation or activation of balancing reserve.

2.18 Technical Backup

A technical backup can be organized pool-internally or pool-externally. In case of using a pool-external backup, this is referred to as third-party backup[4].

A pool of technical units may be backed up by a third party to protect against technical faults, but not for economic optimization. As a backup for its RPUs or RPGs providing FCR, aFRR or mFRR, a provider is permitted to use prequalified RPUs or RPGs located in the same LFC area. As long as a failure cannot be compensated within a provider's pool of technical units in one LFC area, a backup for aFRR and mFRR is also permissible by prequalified RPUs or RPGs in another LFC area.

In order to setup a backup via a third party, the following may be done:

- For a backup within the same control area or across LFC areas, bids can be submitted in the balancing energy market or
- Within the borders of one LFC area, a solution based on control technology can be implemented. The successful implementation of such a solution has to be proven to the connecting TSO via a control test before utilization. Additionally, it has to be described by means of a technical concept.

Activation of a backup must not result in any violation of the pool held by the third party. The portions of power used for backup must be provided exclusively and may not be contracted from another source.

If errors occur that lead to non-availability, a backup must be activated immediately.

An agreement on the backup must be made on time between the provider and the third party and prepared for operation. Also, the TSO must be informed about the agreements. The proof shall be provided ex ante by the securing third party in form of a signed confirmation (cf. Section 5.4).

2.19 Deleted

2.20 Avoidance of disturbances of the pool performance due to prequalification process

The balancing service provider shall ensure that the execution of the pre-qualification process does not have any negative impact on contractual obligations with respect to provision and injection of balancing reserves. In particular, operational tests, control tests and other tests should be planned sufficiently and taken into account during marketing of balancing reserves.

[4] For backup of the provision of aFRR or mFRR, the available options are described in the TSOs' guidelines “Leitfaden zur Besicherung von Regelleistung für den Fall von technischen Ausfällen von a/mFRR-Anlagen des Regelleistungsanbieters - Anzuwenden ab Einführung des Europäischen Zielmarktdesigns in 2022 –“ (available in German only).

Actual values resulting from tests and examinations usually have to be viewed in isolation. They do not have any negative influence on the performance quality of the pool which is actively used for provision and injection.

3 Requirements specific to balancing reserve types

3.1 FCR

The FCR-specific requirements can be broken down into requirements on:

1. The providing behaviour
2. The frequency measurement
3. FCR units and FCR groups with limited energy storage
4. The trial provision under operational conditions
5. Other characteristics based on statutory or regulatory requirements

3.1.1 FCR-specific requirements on the providing behaviour

Each FCR providing unit and each FCR providing group must verify that the following requirements are fulfilled (see SOGL Article 154 paragraph 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)."

The above requirements are formulated in Article 154 paragraph 7 as requirements for "the combined reaction of FCR of a LFC area". If each individual FCR providing unit and each individual FCR providing group complies with these requirements, compliance with the requirements at the level of the LFC area is also ensured. Because this requirement is not explicitly formulated as a requirement for each individual FCR providing unit or FCR providing group, the above passage is not marked in green. The TSOs nevertheless consider it necessary to require the compliance with the requirements at the level of the individual FCR providing unit or FCR providing group and have therefore also included this as a basis for the operating measure protocol to be created during the operating test and provided within the framework of the PQ process.

The activation of FCR providing units and groups must take place no later than two seconds after a frequency deviation. This can be deviated from in those cases in which the activation does **not** take place within two seconds and the BSP can prove that this is due to technical reasons.

For avoidance of an artificial delay, the requirement of at least linear provision as defined below additionally applies for the providing behaviour of FCR providing units and groups.

A (at least) linear provision is defined such that the actual FCR power at every point in time after the frequency deviation (sudden deviation) is not less than a specific value, which is described by a series of inequalities.

Notation on the behaviour of a TU/RPU/RPG (including explanation of the symbols used)

$$\Delta f = f_{target} - f_{actual} \qquad (3.1)$$

Δf Frequency deviation [mHz] (grid frequency = nominal frequency - frequency deviation)

f_{target} Target frequency (generally 50 Hertz)

f_{actual} Actual frequency: Frequency measured by the TU/RPU/RPG

The following generally applies:

$$0 \leq |\Delta f| \leq 200\,mHz \qquad (3.2)$$

Given a response time (RT) of the RPU/RPG of T_{RT} seconds, the minimum actual FCR power $P(t)_{FCR}$ at the time t seconds after the frequency deviation is:

$$P(t)_{FCR} = 0 \text{ for } t \text{ in the period } 0 \leq t \leq T_{RT} \qquad (3.3)$$

$$P(t)_{FCR} = P_{PQ} \cdot \frac{\Delta f}{200\,mHz} \cdot \frac{t - T_{RT}}{2 \cdot (15\,s - T_{RT})} \text{ for } t \text{ in the period } T_{RT} \leq t \leq 15s \qquad (3.4)$$

$$P(t)_{FCR} = P_{PQ} \cdot \frac{\Delta f}{200\,mHz} \cdot \frac{t}{30\,s} \text{ for } t \text{ in the period } 15s \leq t \leq 30s \qquad (3.5)$$

$$P(t)_{FCR} = P_{PQ} \cdot \frac{\Delta f}{200\,mHz} \text{ for } t \text{ in the period } t > 30s \qquad (3.6)$$

In the cases in which the requirement of linearity is not complied with but the BSP can verify that this was unavoidable for technical reasons, the non-fulfilment of the requirement shall not prevent a prequalification of the RPU/RPG. The requirements are shown in the following figure to visualize the artificial delay:

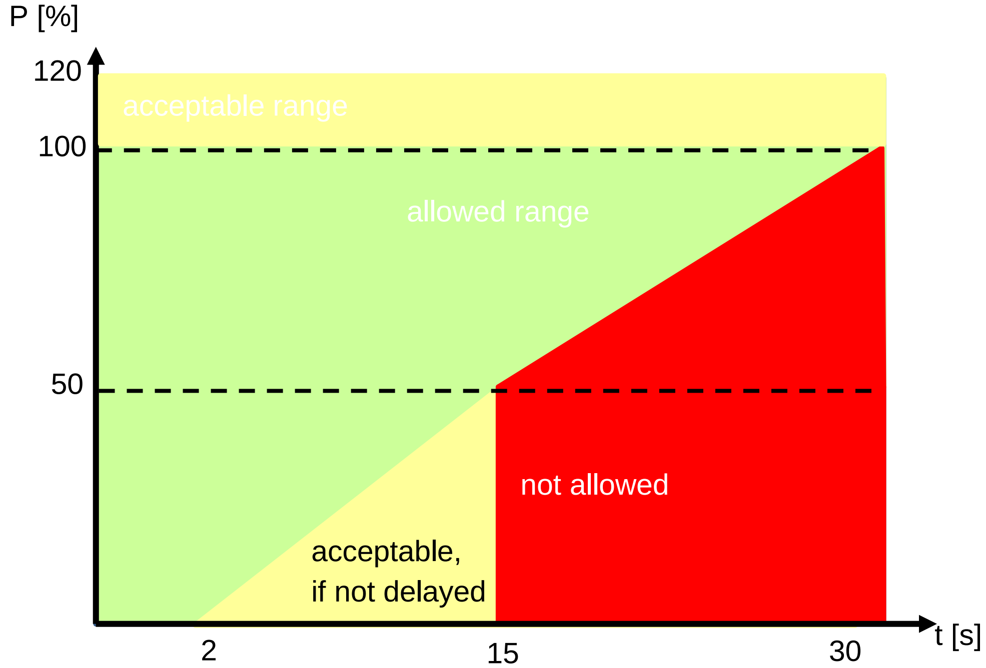

Figure 14: Artificial deceleration FCR (visualization without consideration of fluctuation tolerances)

Every FCR providing unit and group must provide FCR for the maximum time period for which they are capable within the respective frequency ranges. The time period is therefore determined according to the technical performance capability of the respective FCR providing unit or group. Article 156(7) of the SOGL regulates that an FCR unit or an FCR group with an energy storage device that does not limit the FCR provisioning capability needs to activate its FCR as long as the frequency deviation persists.

The inclusion of an FCR providing unit or group in a process for load shedding, such as the five-stage plan, can in fact result in a situation in which the described minimum requirements can no longer be complied with. However, if only a corresponding requirement of the grid operator results in a failure to comply with the minimum requirements, this is unobjectionable with regard to the prequalification and the participation in tenders and does not lead to disqualification.
Of course, this applies all the more so if the inclusion in a process for shedding of load or power generation is not known ex ante and is attributable, for example, to the fact that the entire grid region in which the unit or group in question is located is shut down. Even in the latter case therefore, a failure to meet the minimum requirement is not a violation of the requirements assessed in the PQ process. [Article 154 paragraph 6 in connection with Annex V]

3.1.2 Specification of requirements for the provision in the event of frequency deviations greater than +/-200 mHz

According to paragraph C-4-2 of the Synchronous Area Framework Agreement (SAFA) for Regional Group Continental Europe, for frequency deviations greater than +/-200 mHz and up to the frequency ranges defined in Article 154(6) of SOGL, FCR activation shall not be limited up to the technical performance limit of the FCR units and FCR groups, provided that no technical restrictions exist.

Regardless of this, the provisions according to Article 154 paragraph 7 SOGL apply: Article 154 paragraph 6 SOGL states that "[each FCR providing unit and each FCR providing group (...) [must] activate the agreed FCR by means of a proportional governor reacting to frequency deviations or alternatively based on a monotonic piecewise linear power-frequency characteristic in case of relay activated FCR. They shall be capable of activating FCR within the frequency ranges specified in Article 13(1) of Regulation (EU) 2016/631."

In addition, a requirement on the providing behaviour arises in connection with the robustness versus frequency deviations. Specifically, FCR providing units or FCR providing groups must be capable of activating FCR in the frequency range of 47.5 Hz to 51.5 Hz for at least the following periods of time:

- 47.5 Hz - 49.0 Hz: 30 minutes
- 49.0 Hz - 51.0 Hz: Unlimited
- 51.0 Hz - 51.5 Hz: 30 minutes

Article 154 paragraph 6 refers to the frequency ranges established in Article 13 paragraph 1 of Regulation (EU) 2016/631 of the Commission of 14 April 2016 establishing a network code on requirements for grid connection of generators (NC RfG). Because Article 154 paragraph 6 does not explicitly mention the minimum time periods in which a power generating module must be capable of operating in the event of deviations from the nominal frequency without disconnecting from the grid, which are also defined in Article 13 paragraph 1, the consultation draft of the present PQ conditions from April 2018 required that FCR providing units and FCR providing groups be fundamentally capable of activating FCR within the frequency range of 47.5 Hz to 51.5 Hz without any time restrictions. During the revision, these minimum time periods were adapted to the minimum time periods specified in Article 13 paragraph 1 NC RfG.

In the case of frequency deviations greater than +/- 200 mHz but within the frequency range of 47.5 Hz to 51.5 Hz, the FCR providing unit or group must provide the full FCR power for as long as it is capable of providing FCR at all.

3.1.3 FCR unit and group with trigger frequencies

Another FCR-specific requirement on the providing behaviour concerns RPUs/RPGs that respond only within a specific frequency range or upon the reaching of "trigger frequencies". These are not excluded from the reservation and activation of FCR. To qualitatively test the behaviour of these FCR providing units and groups, they must run additionally through the provision profile according to Figure 15 and Figure 16, depending on the balancing direction, within the framework of the operating test.

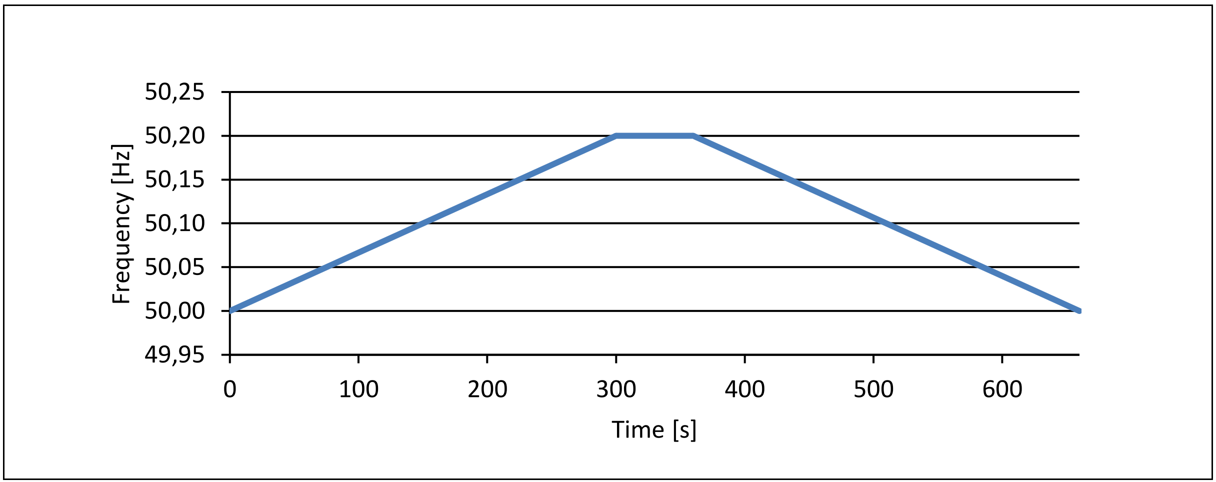

Figure 15: Additional provision profile for FCR providing units/groups that provide FCR on a non-proportional basis; positive balancing direction

It is the responsibility of the BSP to only market as much FCR as it is also capable of providing – in compliance with the requirements on the product.

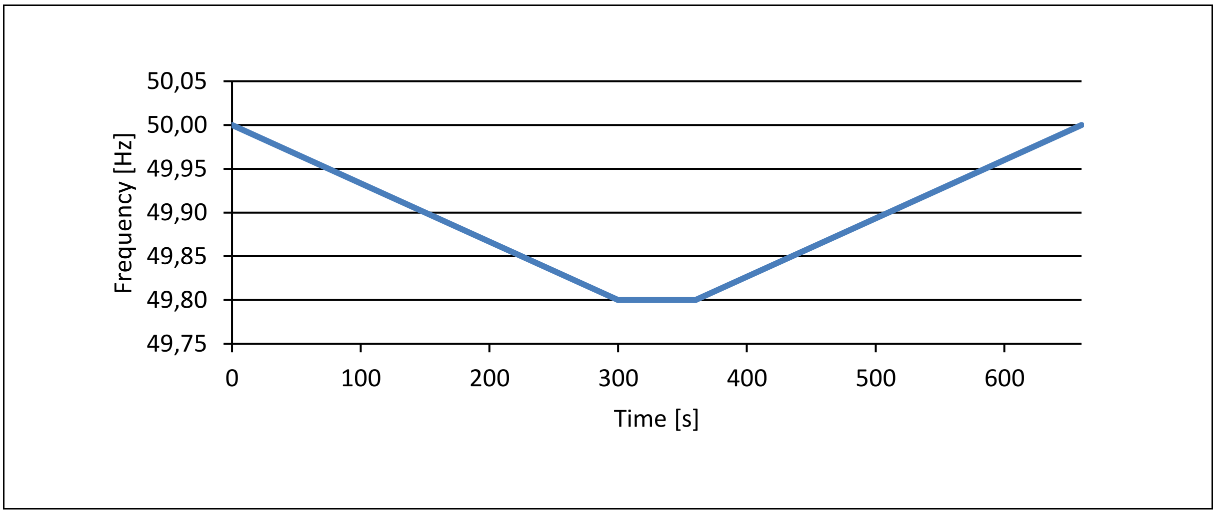

Figure 16: Additional provision profile for FCR providing units/groups that provide FCR on a non-proportional basis; negative balancing direction

3.1.4 Frequency measurement

The BSP must verify for every TU that the requirements from Annex V of the SOGL with regard to the precision of the frequency measurement are complied with: *"The precision of the frequency measurement must correspond to the state of the art and at least the industry standard. The maximum permissible deviation of the measured frequency from the actual frequency is 10 mHz. The maximum combined effect of the inherent frequency response insensitivity and a possible intended frequency response deadband of the governor of the FCR providing units or FCR providing groups is 10 mHz."*

With regard to the frequency measurement, the following requirements apply in addition to the above provisions:

- The frequency measurement must fundamentally take place in a decentralised fashion in order that FCR providing units and FCR providing groups can autonomously provide FCR.
- Per grid connection point, at least one frequency measurement must take place at an arbitrary location between one TU and the grid connection point. If a TU has multiple grid connection points or multiple TUs have a shared grid connection point, a single frequency measurement is sufficient. If multiple TUs have multiple grid connection points and the TUs are part of one or more closed distribution grids, at least one frequency measurement is required within the closed distribution grid.
- In addition to decentralised frequency measurement, the balancing service provider may use a central control point for FCR provision. In the case of faults, for example of the central control point, IT communications, or in case of a system split of the interconnected system, the provider must detect the fault automatically and automatically fall back on a decentralised frequency measurement per TU or per grid connection point without breaching their contractual obligations. The data exchange between the equipment participating in the provision of FCR (e.g. frequency measurement equipment, control equipment, the TU itself) must take place over a physical local network.
- The correct provision of the FCR must still be ensured even if the connection of a TU or RPU or RPG to the corresponding pool is interrupted.

3.1.5 FCR-specific provisions in the case of limited energy capacity

The FCR-specific provisions described in this section apply in addition to the statutory requirements of Article 156; in particular, its paragraph 12:
"The FCR provider shall specify the limitations of the energy reservoir of its FCR providing units or FCR providing groups in the prequalification process in accordance with Article 155."

The FCR-specific provisions for RPUs/RPGs with limited energy storage encompass the following elements:

- Compliance with the rules on storage dimensioning must be verified.

- The BSP must show that it has implemented appropriate storage management measures.
- The maximum injection or withdrawal must be dimensioned such that no relevant restrictions arise with regard to the storage management measures.

Storage dimensioning

Within the framework of the PQ process, it must be verified that the FCR providing unit or FCR providing group fulfils the requirements with regard to the minimum activation period to be ensured by the FCR providers according to 156 paragraph 9, if a minimum activation period is not defined according to Article 156 paragraph 10 SOGL.

The requirements of the German TSOs for the storage dimensioning consist of the following four components:

1. Dimensioning of the energy capacity for the alert state
2. Consideration of the energy capacity due to a previous activation
3. Consideration of a delayed effect of the storage management measures
4. Consideration of the energy capacity for activating reserve operation

   The necessary storage dimensioning arises overall from the sum of the following values:

- the energy capacity required for the alert state;
- the maximum of
    - energy capacity required for consideration of a previous activation
    - energy capacity required for consideration of a delayed effect of the storage management measures};
- energy capacity for activating reserve operation.

> The definition of the alert state according to Article 3 paragraph 2 number 17 SOGL and the definition in Article 18 paragraph 2 SOGL encompass different criteria for the existence of the alert state. The conditions formulated in Article 18 paragraph 2 point c are relevant in connection with the prequalification of RPUs/RPGs with limited energy storage for the providing of FCR. According to this, the alert state exists when, firstly, the frequency deviation is ± 200 mHz or, secondly, either the frequency deviation was previously ± 100 mHz continuously for at least five minutes or more than ± 50 mHz continuously for at least fifteen minutes.

1. Dimensioning of the energy capacity for the alert state

For a minimum activation period according Article 156 paragraph 10 or paragraph 9 SOGL of 15 minutes, an RPU or RPG with a marketable power of 1 MW would need an energy capacity of at least 0.5 MWh (symmetrical case) or 0.25 MWh (as asymmetrical case) in order to fulfil a full activation of 15 minutes or, in the case of frequency deviations that are less than the

frequency deviation for which a full FCR activation is required, would need to activate this over a correspondingly longer time period. However, the latter requirement is not sufficient because, on the one hand, the energy capacity may have been reduced by a previous activation, on the other hand, storage management measures may only take effect after a delay. The last two effects are each quantified separately on the basis of specific assumptions. The effect that gives rise to the higher requirements on the energy capacity is additionally taken into account in the determination of the total required energy capacity and increases the required energy capacity accordingly.
The FCR provider shall ensure the recovery of the energy reservoirs as soon as possible, but latest within 2 hours after the end of the alert state.

Note: After carrying out the cost-benefit analysis in accordance with Article 156 (11) SOGL, the sizing requirements concerning energy capacity for the alert state can change again to a value between 15 and 30 minutes.

In the example of assumed marketable power of 1 MW, the required energy capacity is calculated as follows:

- Symmetrically prequalified RPU or RPG: 2 * 1 MW * ¼ h = 0.5 MWh
- Asymmetrically prequalified RPU or RPG: 1 MW * ¼ h = 0.25 MWh

2. Consideration of the energy capacity due to a previous activation

On the basis of the definition of the alert state, for the consideration of the effect the assumption is made that a frequency deviation of (just below) ± 100 mHz arises for the duration of 15 minutes. For a prequalified power of 1 MW, the latter frequency deviation requires an energy capacity as follows:

- Symmetrically prequalified RPU or RPG: 2 * 0.5 MW * ¼ h = 0.25 MWh
- Asymmetrically prequalified RPU or RPG: 0.5 MW * ¼ h = 0.125 MWh

3. Consideration of a delayed effect of the storage management measures

The second effect to be taken into consideration arises from to the fact that an operating point shift in the framework of the storage management is always associated with a delayed effect (lag), which delays the restoration of the storage contents. This lag must be bridged by additional energy capacity, for which an FCR activation at a frequency deviation of ± 50 mHz is assumed. The lag is defined by the strategy of the storage management measures. In particular, for storage management measures with quarter hour intervals, the product structure and the lead times of the intraday trading as well as the system processing times of the BSP must be taken into account for determining the lag. An assumed lag of 30 minutes results in the following requirements on the storage dimensioning:

- Symmetrically prequalified RPU or RPG: 2 * 0.25 MW * 0.5 h = 0.25 MWh
- Asymmetrically prequalified RPU or RPG: 0.25 MW * 0.5 h = 0.125 MWh

4. Consideration of energy capacity for activating reserve operation

For FCR units with limited energy storage not to cease FCR provision at the same time and to their full capacity, they must switch to reserve operation just before energy storage is exhausted. In order to ensure complete activation of reserve operation, additional energy capacity is required to bridge the gap of 5 minutes[5] and needs to be reserved for this purpose as well.

In the example of 1 MW of marketable power, this results in a required energy capacity of:

- Symmetrically prequalified RPU: $2 * 1\ \mathrm{MW} * \frac{1}{12}\mathrm{h} = 0.16\ \mathrm{MWh}$
- Asymmetrically prequalified RPU: $1\ \mathrm{MW} * \frac{1}{12}\mathrm{h} = 0.08\ \mathrm{MWh}$

From 30 June 2023, prequalified reserve provision units that have been deemed to be of limited energy capacity must change from normal operation to reserve operation shortly before energy storage is exhausted according to the additional FCR features [6] (see decision BK6-19-069). In this context the objective is to maintain the existing ability to respond to a frequency deviation despite the existing limitations. This arrangement also applies to reserve provision units that seek renewed prequalification from 30 June 2023. Reserve provision groups are exempt from this rule.

In the above example, the total required energy capacity is determined as follows:

Symmetrically prequalified RPU or RPG (1 MW):
0.5 MWh + max {0.25 MWh; 0.25 MWh} $+ 0.16\ \mathrm{MWh} = 0.91\ \mathrm{MWh}$

Asymmetrically prequalified RPU or RPG (1 MW):
0.25 MWh + max {0.125 MWh; 0.125MWh} + $0.08\ \mathrm{MWh} = 0.455\ \mathrm{MWh}$

Use of storage management measures and allowed operating range

In order to always have sufficient energy capacity to be able to provide the entire marketable power for at least 30 minutes in the alert state, it must be ensured via suitable storage management measures that the energy capacity is always within the allowed operating range described below, in other words always between the lower and upper charging state limits described here. (The marketable power in Figure 17 refers to symmetrical power). Only if the frequency deviation satisfies the criteria described above for the existence of the alert state, is it permitted to depart from the allowed operating range. The ratio of the usable storage capacity to the marketable power is used for determination of the permitted operating range. The upper (C_{UL}) and lower (C_{LL}) limits of the operating range are determined as follows:

[5] Time for full activation of aFRR: 5 minutes

[6] see Article 154 paragraph 2 of Commission Regulation (EU) 2017/1485 from 2 August 2017 establishing a guideline on electricity transmission system operation (SO-VO)

$$C_{UL} = \frac{E_{usable} - 1/3h \times P_{MP}}{E_{usable}} \quad (3.7)$$

$$C_{LL} = \frac{1/3h \times P_{MP}}{E_{usable}} \quad (3.8)$$

where: E_{usable}: Usable storage capacity
P_{MP}: Marketable power

The BSP must verify that it has identified suitable storage management measures that can be employed to ensure compliance with the above requirements. These storage management measures reduce the operating range because a BSP must activate compensating energy transactions already before it reaches the limit of the operating range. The larger the ratio of usable storage capacity to marketable power, the larger the possible operating range.
The verification is provided in that the BSP shows that – given a historical frequency time series specified by the TSO – the algorithm that controls the storage management would always have held the charge state within the allowed operating range. In addition to the exemplary frequency profile, the storage management must also function in regular operation and constantly meet the requirements. In addition to a general description of the algorithm and the simulation procedure by the BSP, this requires a practical test, meaning a simulation on the basis of the frequency data provided by the TSO.

For this purpose, the TSOs are providing the frequency profile for January 2019 for download at regelleistung.net.

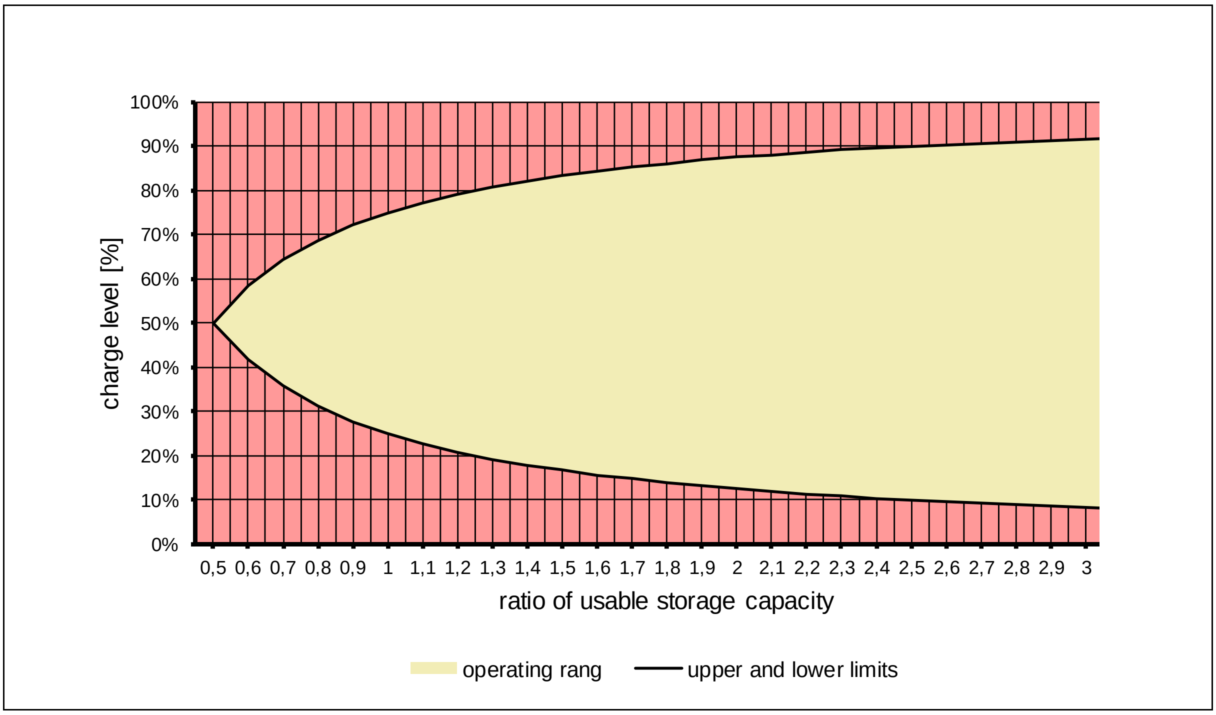

Figure 17: Permissible operating range for FCR units and FCR groups with limited energy storage

Dimensioning of the maximum injection and maximum withdrawal

In addition to the minimum energy capacity and the implementation of suitable storage management measures, another requirement on RPUs/RPGs with limited energy storage is sufficient dimensioning of the maximum injection or withdrawal. A continuous provision at a frequency deviation of just under ± 50 mHz requires that compensating energy transactions of a quarter of the marketable power have to be possible without impairing the FCR activation for a full activation. The maximum injection or withdrawal must therefore exceed the marketable power by at least one quarter, so that the providing of FCR in the full amount is possible despite simultaneous storage management measures.

$$P_{max} \geq 1{,}25 \times P_{VL} \quad (3.9)$$

By a higher dimensioning of the maximum injection resp. the maximum withdrawal the storage management capacity can be increased accordingly.

Reserve operation

Scope and evidence of reserve operation

Reserve provision units (not reserve provision groups) with limited energy capacity must switch over from normal operation to reserve operation shortly before their energy storage becomes depleted. From 30 June 2023, existing reserve provision units with limited energy capacity that have already been prequalified and reserve provision units with limited energy capacity that are due to be prequalified for the first time must prove as part of their first prequalification or first renewal of prequalification that they are capable of reserve operation. Reserve provision units for whom it is impossible or unreasonable to implement reserve operation and who have provided evidence to this effect are exempt from this rule.

Activation and deactivation of reserve operation

Reserve operation is activated at the point in time $t\ start$ when the following upper limit is exceeded ($C \geq C_{oG}$) or the lower limit is no longer reached ($C \leq C_{uG}$):

$$C_{uG} = \frac{P_{VL} * \Delta tFAT}{E_{usable}} \quad (3.10)$$

$$C_{oG} = 1 - C_{uG} \quad (3.11)$$

- E_{usable}: usable energy capacity in MWh
- P_{VL}: power available for FCR provision in MW
- $\Delta tFAT$: full activation time (FAT) of aFRR in hours (h).

Therefore, the following illustration applies to $C_{uG} = 2\% \; and \; C_{oG} = 98\%$:

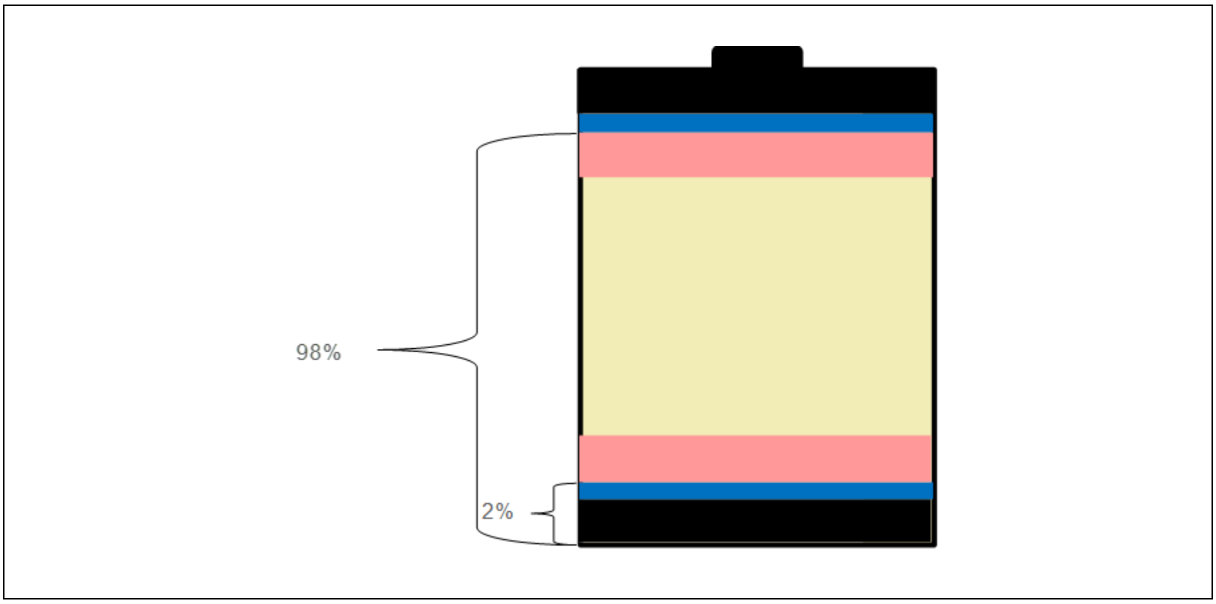

Figure 18: Illustration of the different ranges of the required energy capacity

Table 7: Overview of the required ranges of energy capacity

Allowed operating range		The storage level may vary in this range. Storage management measures are permitted.
Energy capacity in alert state		When a frequency deviation occurs that meets the criteria for the alert state, the allowed operating range may be left and the operating range that has been reserved for the alert state may be used.

Energy capacity for activating reserve operation		Once the SOC limiting values as defined above are exceeded, the reserved range for activating reserve operation is used.
Energy capacity for reserve operation		The remaining energy capacity is used to activate FCR in reserve operation. In this state the unit may discharge.

The transition from normal operation to reserve operation takes $\Delta tFAT$ = 5 min. During the transition time $\Delta tFAT$ the unit must not fully discharge. During the transition from normal operation to reserve operation as well as vice versa, the reserve provision unit with limited energy capacity must react to frequency deviations from the normal frequency of 50 Hertz according to the following term $\mathrm{Df_{reaction}(t)}$ during the transition period ∆tFAT:

$$\mathrm{Df_{reaction}(t) = DF_{zero-mean}(t) \cdot T + (1 - T) \cdot Df(t)} \qquad (3.12)$$

With the weighting function T:

- during the transition from normal operation to reserve operation

$$T = \begin{cases} 0 & t < t_{start} \\ \frac{t - t_{start}}{t_{\Delta FAT}} & t_{start} \leq t < t_{start} + t_{\Delta FAT} \\ 1 & t \geq t_{start} + t_{\Delta FAT} \end{cases} \qquad (3.13)$$

$t\ start$: time of exceeding the upper or lower threshold value

- Transition from reserve operation to normal operation

$$T = \begin{cases} 1 & t < t_{restore} \\ \frac{t_{restore-t}}{t_{\Delta FAT}} + 1 & t_{restore} \leq t < t_{restore} + t_{\Delta FAT} \\ 0 & t \geq t_{restore} + t_{\Delta FAT} \end{cases} \qquad (3.14)$$

$t\ restore$: time of the upper or lower threshold value being restored

For T=0 the combined frequency deviation remains unchanged compared to the normal frequency deviation and for T=1 the combined frequency deviation is unchanged compared to the short-term frequency deviation with the mean value of 0 $Df_{zero-mean}(t)$ (see Figure 19). From the mean value of the frequency values from the past 5 minutes, a new optimised frequency line is derived, upon deviation of which FCR activation is to take place.

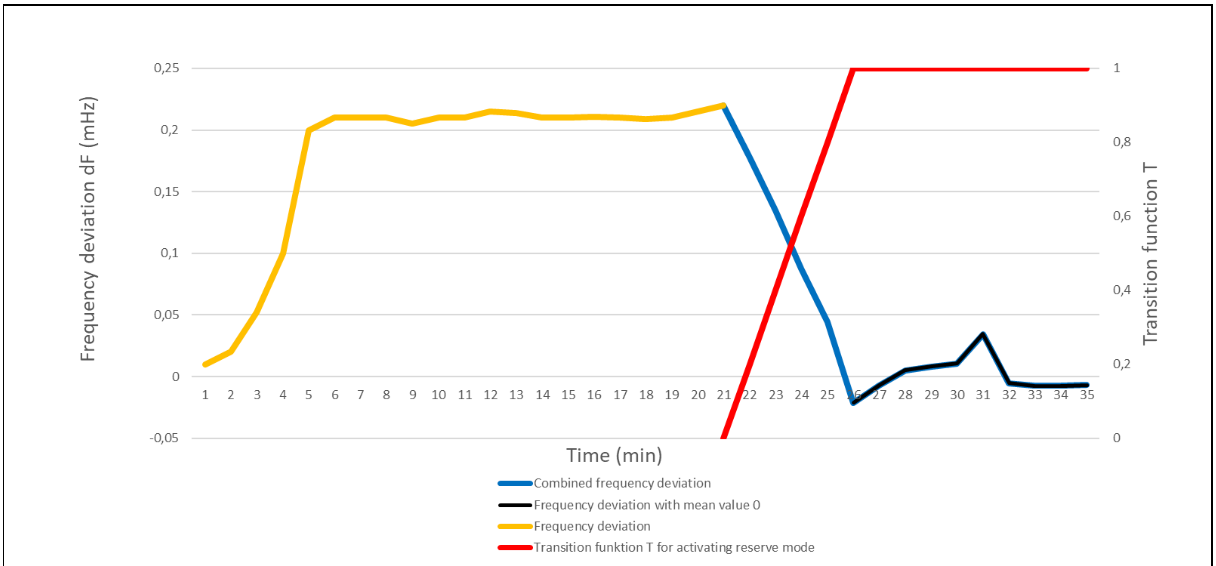

Figure 19: Frequency deviation during normal and reserve operation

Behaviour during reserve operation
After the activation period of $\Delta tFAT$= 5 minutes the unit with limited energy capacity in reserve operation must react to frequency deviations from the normal frequency according to the following term $DF_{zero-mean}(t)$:

$$DF_{zero-mean}(t) = Df(t) - \frac{1}{t_{FAT}} \sum_{i=0}^{t_{FAT}-1} Df(t-i) \qquad (3.15)$$

During reserve operation, storage management must ensure that the storage level is returned to the normal operation range according to Figure 17. Once this has occurred, the reserve provision unit must leave reserve operation and return to normal operation as per above specifications for deactivating reserve operation.

Providing evidence of reserve operation for prequalification
To prove the correct functioning of reserve operation, the balancing service provider must simulate the alert state and demonstrate that the implemented storage management measures respond to the frequency deviation dynamically and reserve operation is fully activated and then deactivated. The TSOs provide suitable frequency data for this purpose.

3.1.6 FCR trial provision under operational conditions

As part of the process for initial and renewed prequalification, every RPU/RPG is required to carry out a test under operating conditions. In practical terms, this means that the RPU/RPG must reserve and provide FCR for an uninterrupted period of four hours. Should it not be possible to fulfil the requirement with regard to the uninterrupted time period during the trial, the supplier will be asked for technical reasons to justify this. If a TU is added to or removed from an RPU/RPG, this generally does not require the provision of another trial. If the composition of an RPU/RPG changes significantly, the TSOs reserve the right to demand another trial provision.
The balancing service provider is wholly responsible for carrying out the FCR trial.
The power reserved for the trial must be equivalent to a significant part of the marketable power of the RPU/RPG. The provider must record the following data points and submits them to the TSO in line with the data requirements from 5.1:

- Actual injection
- Measured frequency
- Target value
- Operating point
- Positive and negative reservation power
- Positive and negative energy capacity (for RPUs/RPGs with limited storage capacities according to the definition under 2.7

Also within the framework of the FCR trial provision, a failure of the connection of the RPU/RPG to the central control unit (e.g. the control system of the BSP or the central control box of an RPG) may also be simulated and correct reconnection checked upon request from the TSO.

3.1.7 Other explicit requirements of the SOGL with regard to FCR

Within the framework of the PQ process, the compliance with the following provisions is also evaluated:

- FCR providing units and FCR providing groups must fulfil the additional properties of FCR according to Article 154 paragraph 2 and Article 118 paragraph 1 point b.
- The marketable and the PQ power of an FCR providing unit are limited according to Article 156 paragraph 6 point a to five percent of the total FCR required for the Continental Europe synchronous area.

3.2 FRR (aFRR and mFRR)

There are common product-specific requirements applying to both FRR products (aFRR and mFRR). These are FRR-specific requirements on the providing behaviour as well as FRR-specific provisions for FRR units and FRR groups with limited energy storage.

3.2.1 FRR-specific requirements on the providing behaviour

A BSP must be capable of manually specifying a setpoint for FRR providing units and FRR providing groups given a telephone instruction by the TSO. In this case, the requirements specific to the balancing reserve type must be complied with (e.g., in the case of aFRR, complete activation within five minutes). The manual specification of a setpoint based on telephone instruction is intended as a fallback measure.

3.2.2 Electronic communication process (MOLS)

The BSP is obliged to configure, test and keep operational (using a valid certificate, among other things) the communication connection to the electronic communication process of the Merit-Order-List-Server (MOLS). The BSP must also show in the framework of a practical test that it has implemented a provider client for the MOLS and can operate this correctly. (The description of the MOLS communication process is not available online; it is provided to the BSP individually in the course of the PQ process.)

4 IT-Requirements for providing balancing reserves

The main document contains the minimum requirements on the information technology of the BSP (Attachment 1), which is provided in a separate file. This document describes the technical and organisational measures expected by the TSO for connecting the system landscape of the BSP to the system landscape of the TSO. If specific measures apply only for individual balancing reserve types, this is indicated accordingly.

The BSP must document the solution approach specifically selected on the basis of the minimum requirements of the information technology in a separate IT concept, including checklist. The following additional requirements must be taken into account within the framework of the PQ process and the ongoing providing of balancing reserve:

- Minimum requirements for the reserve provider's information technology
- Checklist for the minimum requirements for the reserve provider’s information technology for the provision of active power reserve
- Report on the information technology of the provider (German language)
- BSI – Notes on the spatial distance between redundant data centres (German language)
- Requirement of closed user groups

The above documents are made available here as separate files.

5 Attachments relevant to all balancing reserve types

5.1 Data to be recorded or transmitted in real-time to the reserve connecting TSO at the level of TUs, RPUs/RPGs and the pool

The requirements on data exchange described in this section apply to the exchange of variable data (offline data and real-time data) between the BSP and the reserve connecting TSO and further specify the general requirements outlined in Section 1.2. The variable data encompasses the data types "Message" and "Measurement Value", whereby only one data point with the data type "Message" (the data point "Status") is listed in Table 9 with the description of the data points.

The list of data to be provided in Table 9 is preceded by a description of general requirements regulating, for example, the time of transmission and/or the time resolution of the data, rounding and leading sign conventions, etc.

Requirements regarding the time of transmission and/or the time resolution
Messages are generally transmitted spontaneously. A renewal of the message takes place at a required interval, even if no change occurs. For transmission from the TU to the control system of the BSP, the required interval is a maximum of 60 seconds; for transmission from the control system of the BSP to the control system of the reserve connecting TSO, the interval is a maximum of 30 seconds. In contrast to the communication between the BSP control system and the TSO control system, the mandatory cycle for the communication between the TU and the BSP is not mandatory but recommended.

Measurement values transmitted from the TU to the control system of the BSP can be transmitted spontaneously or cyclically. For spontaneous transmission, the threshold value (for a change) corresponds to the measurement precision. A renewal of the value takes place at a required interval, even if no change occurs. The required interval is a maximum of 60 seconds. Also here, the mandatory cycle is not binding for communication between TU and BSP control system, but is recommended. For cyclical transmission, the requirements described below apply.

Measurement values transmitted from the control system of the BSP to the control system of the reserve connecting TSO are recorded and archived cyclically according to the requirements in Table 8 or transmitted in real time.

Table 8: Time resolution of real-time data

Aggregation level	Data type (offline or real-time)	Required time resolution
Pool	Real-time FCR/aFRR	1 to 4 seconds in coordination with the reserve connecting TSO
	Real-time mFRR	One minute
RPU/RPG TU	Real-time	In coordination with the reserve connecting TSO
Pool RPU/RPG TU	Offline	The value for every second in the data transmitted from the archiving to the TSO must contain an entry. It is acceptable to the TSO here if an unchanged value is copied forward without change in the transmitted data. In other words, if the recording takes place with a time resolution of two seconds, each measurement value can be reused for the immediately following second. A time resolution of one second is to be striven for; however, this recommendation is not binding. If no one-second values can be supplied, the BSP provides values – in coordination with the reserve connecting TSO – in a time resolution that is compatible with the time resolution of the real-time values. In this context, "compatible" means that for every second for which the BSP transmits a real-time value, the corresponding value is also recorded offline. Specifically, this means, for example, that for a time resolution of the real-time values between 1 and 4 seconds, the following combinations of transmitted real-time values and recorded offline values are permissible. For the sake of assumption, the first transmission of a real-time value takes place at time T.
		Resolution of the real-time values of 1 second Real-time values are transmitted at: T, T+1s, T+2s ... Offline values are recorded at: T, T+1s, T+2s ... ==> Time resolution of the offline values of 1 second is required

Aggregation level	Data type (offline or real-time)	Required time resolution
		Resolution of the real-time values of 2 seconds Real-time values are transmitted at: T, T+2s, T+4s ... Recording of the offline values as follows is permitted: T, T+1s, T+2s ... (time resolution of the offline values of 1 second) T, T+2s, T+4s ... (time resolution of the offline values of 2 seconds)
		Resolution of the real-time values of 3 seconds Real-time values are transmitted at: T, T+3s, T+6s ... Recording of the offline values as follows is permitted: T, T+1s, T+2s ... (time resolution of the offline values of 1 second) T, T+3s, T+6s ... (time resolution of the offline values of 3 seconds) A time resolution of 2 seconds is not permitted in this example because this would result in a situation in which a corresponding offline value is not available for all transmitted real-time values.
		Resolution of the real-time values of 4 seconds Real-time values are transmitted at: T, T+4s, T+8s ... Recording of the offline values as follows is permitted: T, T+1s, T+2s ... (time resolution of the offline values of 1 second) T, T+2s, T+4s ... (time resolution of the offline values of 2 seconds) T, T+4s, T+8s ... (time resolution of the offline values of 4 seconds) A time resolution of 3 seconds is not permitted in this example because this would result in a situation in which a corresponding offline value is not available for all transmitted real-time values.

<u>Rounding convention</u>

During the recording / archiving / transmission (in the case of offline data) or the transmission (in the case of real-time data) of the data point in question, values that refer to a quantity of electrical power are to be rounded so that the greatest possible rounding error does not exceed one percent of the PQ power. In no case may the values have a resolution larger than one MW.

- Example 1: A power station with 1000 MW nominal power has a symmetrical PQ power of + 50 MW and - 50 MW. The total PQ power amounts to 100 MW; one percent of this is one MW ==> Depiction in whole MW values is sufficient. The largest possible rounding error is 0.5 MW and arises from the rounding from 0.5 MW to 1 MW.
- Example 2: 100 MW nominal power, symmetrical PQ power of + 5 MW and - 5 MW. One percent of the total PQ power of 10 MW amounts to a 0.1 MW. A depiction in whole MW values is no longer sufficient because the largest possible rounding error of 0.5 MW exceeds one percent of the PQ power. For this reason, MW values must be supplied with at least one decimal place.

If the data point in question indicates electrical work, the same principles are applied as in the case of electrical power. However, the reference value is not the PQ power but rather the relevant energy capacity.

If the data point in question indicates a frequency, the values must be given in Hz with three decimal places.

<u>Leading sign convention</u>
A flow to the busbars of the TSO has a positive sign. For this reason, the values shown in the following table have a positive sign:

- Values that indicate an injection (==> A negative sign indicates withdrawal.)
- Values that indicate a balancing reserve (i.e. a power) in the case of the positive balancing direction (==> A negative sign indicates that the stated power is a withdrawal.)

Pool designations are always positive.

The message "Status" can only have the values "ON" and "OFF"; therefore, negative values also do not occur here.

<u>Direction of the data transmission</u>
With the exception of the data point "aFRR TARGET", which is transmitted from the reserve connecting TSO to the BSP, all data points in the table are transmitted from the BSP to the reserve connecting TSO.

<u>Provisions concerning the transmission of real-time data in engagement-free times and in periods of engagement</u>
Once a TU, RPU/RPG or a pool is prequalified, the corresponding real-time data must be <u>continuously</u> transmitted to the reserve connecting TSO as follows:

- In principle, every engaged offer must be allocated to exactly one pool of the BSP. In other words, if a pool is engaged, real-time data must be transmitted according to the following provisions for this pool as well as all RPUs/RPGs and TUs that are allocated to the pool, regardless of the engaged power.

- In times during which an engagement is applied, the physically correct values must be transmitted.
- Likewise, physically correct values must be transmitted for the quarter hour preceding the start of the engagement period and the first quarter hour following the period of engagement.
- In all other times during which no engagement is awarded, the transmission of zero values in place of the physically correct values is desired.
- During engagement-free times, including the last quarter hour preceding the period of engagement and including the first quarter hour following the period of engagement, the status "OFF" must be transmitted for a pool.
- During times of engagement, the status "ON" must be transmitted for the corresponding pool.

Provisions concerning the recording of offline data during engagement-free times and in periods of engagement

- In principle, every engaged offer must be allocated to exactly one pool of the BSP. In other words, if a pool is engaged, offline data must be recorded according to the following provisions for this pool as well as all RPUs/RPGs and TUs that are allocated to the pool, regardless of the engaged power:
- The obligation to record data is linked to the allocation to a pool. A TU, RPU/RPG or pool must record offline data, archive the data and transmit the data at the given time to the reserve connecting TSO during the quarter hours in which the TU or RPU/RPG is assigned to the pool and the pool is engaged. In addition, the data must be recorded, archived and transmitted at the given time to the reserve connecting TSO during the quarter hour preceding the allocation to the pool and the quarter hour following the allocation to the pool.

  The pool itself must record, archive and transmit offline data at the given time to the reserve connecting TSO for the entire period of the engagement plus the preceding quarter hour and the following quarter hour.

Provisions concerning the recording of offline data and the transmission of real-time data in cases of backup utilisation

The external backup solution may require additional data exchange.

Rules of a general nature (such as requirements for the use of the status provided in the measurement value telegrams)

A TU must be allocated to a total of two (three) different pools if the same provider would like to reserve and activate two (three) different balancing reserve types from this TU.

The status indications provided in the measurement telegrams according to the IEC standard are to be set according to the operational situation.

Offline data must be archived at least for the period specified in Section 2.2.2.

If a specific data point is not required by the reserve connecting TSO, this data point cannot be transmitted even if the BSP wishes to do so voluntarily.

Provisions concerning the exceptional cases in which values for the aggregation levels RPU/RPG or pool are not determined according to the calculation procedure described in Section 1.5

For most of the data points described in Table 9, transmission or recording of the data point is possible at the three aggregation levels TU, RPU/RPG and pool described in Section 1.2. The cases in which the RPU/RPG or pool values cannot be determined on the basis of the calculation procedure described in Section 1.5 are described in the explanations following the table.

Requirements concerning the aggregation levels for which collection and (i) recording/archiving as well as transmission or (ii) transmission in real-time of the respective data point to the reserve connecting TSO must take place (depending on the balancing reserve type and depending on whether the data is provided as offline data or real-time data)

The recording/archiving/transmission (in the case of offline data) or the transmission (in the case of real-time data) takes place according to the requirements in the table below.

The entries in the cells of the table have the following meaning:

- X: The recording/archiving/transmission (in the case of offline data) or the transmission (in the case of real-time data) of the respective data point for the respective aggregation level (i.e. the level of TU or RPU/RPG or pool) is mandatory.
- (X): The recording/archiving/transmission (in the case of offline data) or the transmission (in the case of real-time data) of the respective data point for the respective aggregation level (i.e. the level of TU or RPU/RPG or pool) is mandatory if requested by the reserve connecting TSO.

Table 9: Data points (variable data)

Definition of the data point	Unit	FCR[3]			aFRR			mFRR		
		TU	RPU/RPG	Pool	TU	RPU/RPG	Pool	TU	RPU/RPG	Pool
Injection (or withdrawal)	MW	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X
Operating point	MW	Offline:X[1] Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X	Offline:X[1] Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X	Offline:X[1] Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X
Anticipated operating point	MW				Offline:(X) Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X			
Actual balancing reserve value	MW	Offline: X[2] Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X	Offline: X[2] Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X	Offline: X[2] Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X
Pool allocation	(Pool ID)	Offline: X Real-time: (X)	Offline: X Real-time: (X)		Offline: X Real-time: (X)	Offline: X Real-time: (X)		Offline: X Real-time: (X)	Offline: X Real-time: (X)	

Definition of the data point	Unit	FCR[3)]			aFRR			mFRR		
		TU	RPU/RPG	Pool	TU	RPU/RPG	Pool	TU	RPU/RPG	Pool
Status	("ON" / "OFF")	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: X
(Measured) frequency	Hz	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: (X) Real-time: (X)						
aFRR target (from TSO to BSP)	MW						Real-time: X			
aFRR target echo (from BSP to TSO)	MW						Offline: X Real-time: X			
Balancing power target	MW	Offline: (X) Real-time: (X)	Offline: (X) Real-time: (X)	Offline: (X) Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)
aFRR gradient POS	MW / min						Offline: (X) Real-time: (X)			

Definition of the data point	Unit	FCR[3)]			aFRR			mFRR		
		TU	RPU/RPG	Pool	TU	RPU/RPG	Pool	TU	RPU/RPG	Pool
aFRR gradient NEG	MW / min						Offline: (X) Real-time: (X)			
Current reservation power POS	MW	Offline: (X) Real-time: (X)	Offline: (X) Real-time: (X)	Offline: (X) Real-time: X	Offline: (X) Real-time: (X)	Offline: (X) Real-time: (X)	Offline: (X) Real-time: X	Offline: (X) Real-time: (X)	Offline: (X) Real-time: (X)	Offline: (X) Real-time: X
Current reservation power NEG	MW	Offline: (X) Real-time: (X)	Offline: (X) Real-time: (X)	Offline: (X) Real-time: X	Offline: (X) Real-time: (X)	Offline: (X) Real-time: (X)	Offline: (X) Real-time: X	Offline: (X) Real-time: (X)	Offline: (X) Real-time: (X)	Offline: (X) Real-time: X
Balancing band POS	MW	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)
Balancing band NEG	MW	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)

Definition of the data point	Unit	FCR3)			aFRR			mFRR		
		TU	RPU/RPG	Pool	TU	RPU/RPG	Pool	TU	RPU/RPG	Pool
Nominal injection (supply-dependent units)	MW	Offline: (X) Real-time: (X)	Offline: X Real-time: X		Offline: (X) Real-time: (X)	Offline: X Real-time: X		Offline: (X) Real-time: (X)	Offline: X Real-time: X	
Setpoint specification (supply-dependent units)	MW	Offline: (X) Real-time: (X)	Offline: X Real-time: X		Offline: (X) Real-time: (X)	Offline: X Real-time: X		Offline: (X) Real-time: (X)	Offline: X Real-time: X	
Status figure (supply-dependent units)	Code Number	Offline: (X) Real-time: (X)	Offline: X Real-time: X		Offline: (X) Real-time: (X)	Offline: X Real-time: X		Offline: (X) Real-time: (X)	Offline: X Real-time: X	
Status curtailment (supply-dependent units)	("ON" / "OFF")	Offline: (X) Real-time: (X)	Offline: X Real-time: X		Offline: (X) Real-time: (X)	Offline: X Real-time: X		Offline: (X) Real-time: (X)	Offline: X Real-time: X	
Energy capacity (for limited energy storage - POS)	MWh	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: (X) Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: (X) Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: (X) Real-time: (X)

Definition of the data point	Unit	FCR[3)]			aFRR			mFRR		
		TU	RPU/RPG	Pool	TU	RPU/RPG	Pool	TU	RPU/RPG	Pool
Energy capacity (for limited energy storage - NEG)	MWh	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: (X) Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: (X) Real-time: (X)	Offline: X Real-time: (X)	Offline: X Real-time: (X)	Offline: (X) Real-time: (X)

*The data points highlighted in grey are to be recorded and transmitted additionally for special technologies such as offer-dependent or energy capacity-limited systems

1) See definition of data point below

2) See definition of actual balancing reserve value below

3) Each FCR provider shall have the right to aggregate the respective data for more than one FCR providing unit if the maximum power of the aggregated units is below 1,5 MW and a clear verification of activation of FCR is possible.

Injection (or withdrawal)
Measurement value of the injection or withdrawal active in the public grid. In the case of a power generating module, a correction must therefore be made for the own consumption, transformer losses and any further reductions to the power active in the public grid; in the case of demand units, a correction must be made for transformer losses and any other increases of the power active in the public grid. The injection of an RPU (or RPG) is determined – as described in Section 1.5 – as the sum of the injection values of the TU (or TU and RPU) in the RPU (or RPG). The injection of a pool is the sum of the injection values of the RPUs/RPGs allocated to the pool:

At the level of TU, RPU/RPG, transmission in real-time takes place at the request of the reserve connecting TSO.

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Operating point
The operating point is the planned injection or the planned withdrawal of a TU, RPU/RPG or a pool at a specific point in time without consideration of a possible providing of balancing reserve and must be determinable and be determined by the BSP (for the TU, RPU/RPG or pool). The operating point of an RPU (or RPG) is determined – as described in Section 1.5 – as the sum of the operating point values of the TU (or TU and RPU) in the RPU (or RPG).

If the BSP can credibly show that the determination of the operating point of one or more TUs of an RPU (or RPG) is not possible and an RPU (or RPG) consists of TUs that are connected to the same grid segment (i.e. electrically active at the same or multiple adjacent grid nodes of the transmission grid) and the balancing reserve is provisioned via TUs of the same technology, the determination of the operating point may – in coordination with and according to the requirements of the connecting TSO – take place at the next higher aggregation level (RPU or RPG).

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Anticipated operating point
The anticipated operating point is the planned injection or the planned withdrawal of a TU, RPU/RPG or a pool at time T for time T+X without consideration of a possible providing of balancing reserve. The value is currently only defined for aFRR: X (aFRR) = 5 minutes.

The TSOs explicitly reserve the right to generally require at a later time the transmission of the anticipated operating point for the case of FCR and mFRR as well, in analogy to the procedure for aFRR, and to define specific lead times for this [X(FCR), X(mFRR)]. In the case of FCR, independent of a general rule, the anticipated operating point is also to be determined with a lead time specified by the reserve connecting TSO at the request of the TSO and to be recorded, archived and transmitted or transmitted in real-time to the reserve connecting TSO in exceptional cases in which the reservation and providing of FCR is based on a new type of technology or new type of technical concept with which the TSO does not yet have sufficient operational experience.

The anticipated operating point of an RPU (or RPG) is determined – as described in Section 1.5 – as the sum of the anticipated operating point values of the TU (or TU and RPU) in the RPU (or RPG). The anticipated operating point of a pool is the sum of the anticipated operating point values of the RPUs/RPGs allocated to the pool. At the TU level, the collection and recording/archiving as well as the offline transmission or real-time transmission takes place at the request of the reserve connecting TSO.

If necessary, the operating point may deviate from the transmitted anticipated operating point for a maximum of the duration of the balancing reserve type-specific lead time (for aFRR 5 minutes) in the case of technical faults or mFRR activation. Incidents of this type must be documented by the balancing service provider and submitted upon request to the balancing reserve connecting TSO.

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Actual balancing reserve value

The fundamental calculation procedure for the actual balancing reserve value is described in Section 1.4. The actual balancing reserve value of an RPU (or RPG) is determined – as described in Section 1.5 – as the sum of the actual balancing reserve values of the TU (or TU and RPU) in the RPU (or RPG). The actual balancing reserve value of a pool is the sum of the actual balancing reserve values of the RPUs/RPGs allocated to the pool.

If the BSP can credibly show that the determination of the actual balancing reserve value of one or more TUs of an RPU (or RPG) is not possible and an RPU (or RPG) consists of TUs that are connected to the same grid segment (i.e. electrically active at the same or multiple adjacent grid nodes of the transmission grid) and the balancing reserve is provisioned via TUs of the same technology, the determination of the actual balancing reserve value may – in coordination with and according to the requirements of the connecting TSO – take place at the next higher aggregation level (RPU or RPG).

A separate actual balancing reserve value must be determined for every balancing reserve type that is held and provided.

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Pool allocation

In the pool allocation, it is necessary to differentiate between the pool allocation (of TUs or RPUs/RPGs) and the status (of the pool), which will be explained below. The pool allocation – in other words, the addition of TUs, RPUs/RPGs to the respective pool or the removal of these from the pool – can only be changed at the quarter hour boundary. It remains applicable here – initially only in the case of aFRR – that the pool allocation must be established already five minutes before the quarter hour boundary because a change to the composition will typically result in a change to the operating point. In the case of aFRR, however, the anticipated operating point is to be reported with a lead time of five minutes. It is therefore not possible on the part of the system to change the pool allocation without a lead time of five minutes before the quarter hour boundary. However, the actual change to the pool allocation only takes place at the quarter hour boundary, even if the anticipated operating point already reflects the new composition of the pool five minutes before the quarter hour boundary.

A change to the pool status or a change to the pool allocation – such as from a pool A to a pool B – is possible instantaneously but only ever at the quarter hour boundary.

Exclusively in the case of technical faults is a change to the pool allocation also permitted at a time other than the quarter hour boundary. Technical faults must be documented. If a TU or RPU/RPG fails, it may no longer be allocated to any pool. The reported pool allocation must reflect that the failed TU or RPU/RPG is no longer allocated to the pool.

If a TU or RPU/RPG is allocated to a pool, the actual injection (or withdrawal), operating point, etc. of the TU or RPU/RPG in question is taken into consideration in the corresponding values at the pool level. It is irrelevant here whether or not the TU or RPU/RPG is actively participating in the reservation and activation of balancing reserve.

If an RPU/RPG is allocated to, for instance, pool 123, this RPU/RPG transmits "123" as pool allocation. The TUs that are allocated to pool 123 also transmit the pool allocation "123" in this case.

If a TU or RPU/RPG is not allocated to any pool, the pool allocation "99" is to be used.

The pool ID to be used per pool and balancing reserve type is specified by the reserve connecting TSO.

The pool allocation of TUs or RPU/RPGs is to be differentiated from the "Status" described below, which provides information on whether a pool is currently reserving or providing the respective balancing reserve type.

For example, a pool that is used for the reservation of 100 MW could be allocated RPUs/RPGs with a power of 200 MW. This gives the BSP the flexibility to flexibly change the reservation and activation of the balancing power within its pool. The reservation within a pool can also be changed at any time.

The values of the data point "Pool allocation" at the aggregation levels RPU/RPG and pool are not determined according to the principle described in Section 1.5. Rather, the value of the data point "Pool allocation" for all RPUs/RPGs allocated to a specific pool as well as for all TUs allocated to these RPUs/RPGs corresponds to the designation of the pool. The data point "Pool allocation" is not defined for a pool.

A separate "Pool allocation" value must be determined for every balancing reserve type that is held and provisioned.

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Status

The date point "Status" takes on one of two possible values: "ON" or "OFF".

- "ON" -
  - Pool: The reporting pool is reserving the balancing reserve type in question or providing the balancing reserve type in question
- "OFF" -
  - Pool: The reporting pool is not reserving the balancing reserve type in question or not providing the balancing reserve type in question

The values of the data point "Status" at the aggregation levels TU and RPU/RPG are not needed and are therefore not defined. TUs and RPUs/RPGs can only be allocated to a pool; they cannot independently transmit a status.

However, the status of a TU or an RPU/RPG can be determined indirectly by means of other data points. If a TU or RPU/RPG is allocated to a pool, the status of a TU or RPU/RPG is implicitly that of the pool. The value of the current reservation power also provides information on the status.

A separate "Status" value must be determined for every pool and for every balancing reserve type that is held and provisioned.

The status discussed here is to be differentiated from the status "FCR (PBP) Balancing ON / OFF", which may be depicted in grid control systems for large power plants. These are two different types of status. The data point "Status" described in this document is required in connection with the participation of the BSP in the market for balancing reserve and provides information on whether the reported pool is currently engaged for the corresponding balancing reserve type. FCR (formerly PBP) is one of the three balancing reserve types, meaning that a corresponding status message can also refer to this balancing reserve type.

The reporting of the second status described here, "FCR (PBP) Balancing ON / OFF" may be based on agreements, grid connection regulations or similar sources that have nothing to do with the balancing market.

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(Measured) frequency

(Measured) frequency = Nominal frequency + frequency deviation (in other words, a possible correction of the grid time deviation is not taken into account)

If agreed with the reserve connecting TSO, the frequency deviation can also be recorded in place of the frequency. If within a pool or an RPU/RPG more than one frequency measurement takes place, only the most precise value in the respective aggregation needs to be recorded.

The values of the data point "(Measured) frequency" at the aggregation levels RPU/RPG and pool are not determined according to the principle described in Section 1.5. Rather, the following applies in consideration of the previous paragraph:

- Pool value: Most precise value measured within an RPU/RPG of the pool
- RPU/RPG value: Most precise values measured within the RPU/RPG
- Also for the TU value, only the most precise value needs to be recorded in the case of multiple frequency measurements.

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aFRR target (from TSO to BSP)

A BSP that is engaged (awarded) for the reservation and activation of aFRR, receives from the reserve connecting TSO only one aFRR setpoint per pool, which the BSP must divide up among the RPUs/RPGs of the pool. This data point is only mentioned here for the sake of completeness; no obligations arise from this for the BSP to record data or transmit data in real-time to the TSO.

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aFRR target echo (from BSP to TSO)

To ensure the correct receipt of the correct aFRR setpoint, a BSP that has been engaged for the reservation and activation of aFRR must reflect the aFRR setpoint received from the reserve connecting TSO for the entire aFRR pool back to the TSO and also record, archive and transmit this offline to the TSO at the given time.

The data point is not defined at the levels of RPU/RPG and TU.

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Balancing power target

The values of the data point balancing power target refer to the setpoint sent by the BSP to the TUs, RPUs/RPGs. The balancing power target of a pool is the sum of the balancing power target values of the RPUs/RPGs allocated to the pool.

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aFRR gradient (POS and NEG)

This data point describes an aFRR activation gradient (separate gradient per balancing direction in each case) agreed upon with the reserve connecting TSO for the aFRR pool of the BSP. The value is not defined for the aggregation levels RPU/RPG or TU.

To clarify, this means that the positive gradient applies to periods of positive balancing reserve provision, the negative gradient to the provision of negative balancing reserve.

Should this not be transmitted correctly, the balancing reserve connecting TSO must use the product-specific minimum gradient for aFRR.

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Nominal injection (supply-dependent units)

Nominal injection in MW at TU/RPU/RPG level. The nominal injection can be used to determine the operating point and, in case of aFRR, also to determine the anticipated operating point.

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Setpoint specification (supply-dependent units)

Setpoint specification for power reduction in MW. The setpoint takes into account power reductions due to e.g. curtailment measures or negative stock exchange prices, but does not include the provision of balancing reserves.

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Status figure (supply-dependent units)

It must be possible to transmit the following statuses as key figures: 0...fault / 1...regular operation / 2...reservation / 3...ramp / 4...activation --> current status or the minimum within the past minute, if minute values are transmitted and several statuses occur within the relevant minute.

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Status curtailment (supply-dependent units)

ON if the unit is/was currently or last minute affected. Example: If, for example, the curtailment measure lasted until 14:10:10, the value for the time interval 14:10 - 14:11 is ON.

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Energy capacity (for limited energy storage)

If and only if an RPU/RPG meets the definition of an RPU/RPG with limited energy storage in Section 2.7, the following additional data delivery obligations apply:

- If individual TUs of an RPU/RPG have limited energy storage according to the definition but the RPU/RPG as a whole is not subject to a limitation of the energy capacity, no energy capacity has to be recorded or transmitted at the level of the TU with potentially limited energy capacity.
- The energy capacity must be recorded and transmitted for all TUs that are allocated to an RPU/RPG that is overall subject to an energy capacity limitation.
- If individual RPUs/RPGs of a pool have limited energy storage according to the definition but the pool as a whole is not subject to any limitation of the energy capacity, the energy capacity must be recorded and transmitted at the level of all RPUs/RPGs with limited energy capacity. For the pool as a whole as well as for the RPUs/RPGs of the pool whose energy storage is not limited according to the definition, no energy capacity has to be recorded or transmitted.
- The determination of the energy capacity at the aggregation levels RPU/RPG and pool takes place according to the method described in Section 1.5. An unlimited energy capacity corresponds to a value of + ∞ or - ∞. In the summation across the TUs of the RPU/RPG or across the RPUs/RPGs of the pool, the application of this convention results in the next higher aggregation level being identified as "not limited in energy capacity".

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Current reservation power

The current reservation power is the respective power held in reserve by the BSP for each respective balancing reserve type. For the pool, the current reservation power corresponds to the minimum of the engaged power and the available balancing band (see below). In contrast to the balancing band, the "current reservation power" describes the share of the balancing band currently available for a balancing power activation.

It may not be possible to fully utilise the balancing band due to agreements with the respective system operators, due to the simultaneous reservation of multiple balancing reserve types or due to temporary technical restrictions. The current reservation power is always less than or equal to the balancing band (see below).

The determination of the values at the aggregation levels RPU/RPG and pool takes place according to the method described in Section 1.5. There are three requirements that apply to the recording of the current reservation power at the level of the TUs, which is then aggregated into values for RPUs/RPGs and the pool:
1. The TU in question must be allocated to the corresponding pool.
2. The corresponding pool must have the status "ON".
3. A specific power value is reported for the TU in question as "current reservation power".

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Balancing band
The balancing band of a TU, RPU/RPG or a pool corresponds to the technically available power of a given balancing reserve type arising from the current operating point. The balancing band is determined at every aggregation level and for every balancing reserve type (BR type) according to the following formula:

- Balancing band (BR type) POS = Min {upper power limit (BR type) - operating point, PQ power (BR type) POS}
- Balancing band (BR type) NEG = Max {lower power limit (BR type) - operating point, PQ power (BR type) NEG}

In other words, the balancing band takes no account of the engaged power. The values used in the formula
- Upper power limit (BR type)
- Lower power limit (BR type)

are to be determined within the framework of the PQ process and are defined as follows:
- Upper power limit (BR type): Absolute value in MW up to which the power of the TU, RPU/RPG or pool can be ramped in compliance with the product definition for the corresponding BR type
- Lower power limit (BR type): Absolute value in MW down to which the power of the TU, RPU/RPG or pool can be ramped in compliance with the product definition for the corresponding BR type

The determination of the values at the aggregation levels RPU/RPG and pool takes place according to the method described in Section 1.5.

The availability of the data point "Balancing band" is limited by the availability of the data point "Operating point". The requirements described above for the data point "Operating point" ensure that the balancing band is always available at the level of RPU/RPG and pool.

A separate value must be determined for every balancing reserve type that is held and provisioned.

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If requested by the TSO, further data points (e.g. wind direction and wind intensity for wind parks) must be transmitted online.

5.2 Confirmation declaration of the reserve connecting system operator (SO) for the reservation and activation of reserve (and associated explanations)

Note: The TSOs request processing and, if applicable, issuing of the following confirmation declaration within four weeks of receipt.

Confirmation declaration of the reserve connecting SO and the intermediate SO(s) for the reservation and activation of reserve

The technical units listed in the table of Balancing Service Provider

Name Balancing Service Provider
Street, number
Postcode, place

- hereafter "BSP" –

are entitled to the reservation and activation of balancing reserves by the German Transmission System Operators

- 50Hertz Transmission GmbH, Heidestrasse 2, 10557 Berlin,
- Amprion GmbH, Von-Werth-Strasse 274, 50259 Pulheim,
- TenneT TSO GmbH, Bernecker Strasse 70, 95448 Bayreuth and
- TransnetBW GmbH, Pariser Platz, Osloer Strasse. 15-17, 70173 Stuttgart

- hereafter "TSOs" -
and, in case of an activation, deliver the balancing reserve requested by the TSOs.

This delivery involves the grid

Name Grid Operator
Street, number
Postcode, place

- hereafter "CSO" (connecting DSO) and

the grid of

Name Grid Operator
Street, number
Postcode, place

- hereafter "ISO" (intermediate DSO).

[Other intermediate SOs to be added as necessary.]

With the signature below, the CSO confirms that the listed measurement locations (meter point designations) of the grid connection, the use of the connection and the technical regulations of the grid connection (e.g. within the framework of grid connection regulations) have been regulated. From our perspective, nothing stands in the way of the providing of balancing reserve in consideration of the required limitations, if applicable, from the technical units at the measurement locations (meter points) according to the following table and the transport of the balancing reserve through our grid and through the grid of the intermediate DSO(s). Corresponding coordination has also taken place with the intermediate DSO(s).

Between the operator and the CSO as well as the CSO and the ISO(s), the required technical and organisational regulations were coordinated as are necessary for the operation of the technical units listed in the table for the delivery of balancing reserve at the grid connection through the grid of the CSO and of the ISO(s) to the TSO. In particular, we confirm that all relevant grid security aspects that concern the grid of the CSO and the ISO(s) have been considered.

We agree to immediately inform the operator in the event of grid restrictions (e.g. due to load or feed-in management) that could restrict or prevent the proper transport of balancing reserve.

To be filled out by:																		
BSP / Operator										CSO								
Designation of the reserve providing unit or group	Des-igna-tion of tech-nical unit	Volt-age level	Meas. location (meter point des-ignation) of the grid conn. point[1]	Market location (MaLo-ID)	Type of balancing reserve	Maximum reserve capacity of the TU positive (+) / negative (-) in MW				Grid connection power in MW (Injection (+) / withdrawal-power (-))				Balancing power that can be physically provided without limitation positive (+) / negative (-) in MW				Maximum rate of change of active power for the TU
						+		-		+		-		+		-		
						+		-		+		-		+		-		
						+		-		+		-		+		-		
						+		-		+		-		+		-		
						+		-		+		-		+		-		

This confirmation declaration is valid from DD.MM.YYYY and can be terminated at any time with notice of five business days. Changes will be announced immediately.

The contractual agreements established between the CSO and the operator (grid connection contract, etc.) remain unaffected by this confirmation declaration.

___________________________________, on _______________

____

Signature of the connection system operator (CSO)

The data in the table must always match the data of the equipment data sheet.

Explanations of the confirmation declaration of the reserve connecting DSO

The System Operation guideline which went into force on 14. September 2017 ("Regulation (EU) 2017/1485 of the Commission of 2. August 2017 establishing a guideline for transmission system operation"; hereafter "SOGL") contains, among other things, requirements for the cooperation between transmission system operators (TSOs) and distribution system operators (DSOs) in the implementation of prequalification processes for BSPs. In particular, Article 182 paragraph 2 of the SOGL is pertinent here.

This paragraph obliges each TSO to "develop and specify, in an agreement with its reserve connecting DSOs and intermediate DSOs, the terms of the exchange of information required for these prequalification processes for reserve providing units or groups located in the distribution systems and for the delivery of active power reserves." The paragraph further states that the prequalification process "shall specify the information to be provided by the potential reserve providing units or groups, which shall include:

a) voltage levels and connection points of the reserve providing units or groups;
b) the type of active power reserves;
c) the maximum reserve capacity provided by the reserve providing units or groups at each connection point; and
d) the maximum rate of change of active power for the reserve providing units or groups."

The TSOs intend to implement these requirements as follows: The CSO confirmation ("Confirmation declaration of the connection system operator for the reservation and activation of balancing reserve") has previously been part of the prequalification documents. In the perspective of the TSOs this has been effective and should – with explicit specification of all information required by the SOGL – continue to be used in the future.

Special case of "blanket approval"

The special case of blanket approval concerns the grid area of a CSO that, firstly, can assure without inspection of the individual case that the reservation and activation of balancing reserve in the full amount of the capacity specified in the grid connection contract is possible and, secondly, has ensured that all intermediate DSOs also consider no restrictions to be necessary in this regard. Such a blanket approval can be issued by the CSO in question to the reserve connecting TSO(s). The TSOs in turn will load this blanket approval onto the PQ portal so that a BSP can see that an explicit coordination with the CSO is not required.

In this case, the BSP can proceed as follows:

- The BSP fills out the CSO confirmation itself and adds a reference to the existing blanket approval.
- The BSP encloses with the CSO confirmation a copy of its grid connection contract, which attests to the agreed connection capacity.

5.3 Supplier confirmation

Supplier confirmation within the framework of the balancing reserve marketing

The supplier Name, Anschrift des Unternehmens hereby confirms that it has knowledge of the balancing reserve marketing, reservation and activation for the technical units (TUs) listed in the table by the BSP Name, Anschrift des Unternehmens and has informed the balance responsible parties accordingly. In the context of its forecasting, the supplier will take into consideration the changed operating characteristics of the TUs resulting from the reservation of balancing reserve. The supplier shall ensure, insofar as online measurement data of the respective TUs or the corresponding measurement location (meter point) are used for management (online management), that no regulation (power station or load adaptations or trading transactions) will be intentionally carried out by the supplier itself or the balancing responsible party in the supplier's balancing group to compensate for the providing of balancing reserve during the provision by the BSP. The supplier indicates below per TU whether online management exists; the supplier will immediately announce changes to the form of management.

Date:

Signature of provider: ______________________________

Date:

Signature of BSP: ______________________________

Table of technical units:

Name of the TU	Measurement location / metering point	Balancing group in which the TU is balanced	Positive BP (Check cells that apply)			Negative BP (Check cells that apply)			Online management (yes/no)
			FCR	aFRR	mFRR	FCR	aFRR	mFRR	

5.4 Confirmation of the backup provider within the context of the backup by a third party

Confirmation of the backup provider within the context of the backup for the reservation and activation of balancing power by a third party

The reserve provider Name reserve provider
Adress

- hereafter „backup provider“ -

informs within the context of the tendering process of the German Transmission System Operators

- 50Hertz Transmission GmbH, Heidestrasse 2, 10557 Berlin,
- Amprion GmbH, Von-Werth-Strasse 274, 50259 Pulheim,
- TenneT TSO GmbH, Bernecker Strasse 70, 95448 Bayreuth and
- TransnetBW GmbH, Pariser Platz, Osloer Strasse. 15-17, 70173 Stuttgart

- hereafter „TSO“ -
about its valid contracts in its role of a backup provider:

Backup provider	
EIC of the backup provider	
Connection TSO of the backup provider	

Backup BSP	
Connection TSO of the backup BSP	
EIC of the backup BSP	

Backup power (MW)	Type of balancing reserve (FCR, aFRR, mFRR)	Effective from (DD.MM.YYYY)	Valid by (DD.MM.YYYY)

The statements of this confirmation will be stored in the master file data of the backup provider (pq-portal/regelleistung.net).

This confirmation can always be modified with a lead time of at least 14 working days. In the case of any changes of the backup relations the reserve control provider in its role of a backup provider as well as of the backup BSP is obliged to timely inform its connection TSO.

___________________________________, _______________

Location, date

____

Signature of the backup provider

5.5 Deleted

6 Glossary

The table below contains explanations and definitions of the most important terms used.

Term	Explanation
aFRR	'aFRR' means FRR that can be activated by an automatic control device [see SOGL, Article 3 paragraph 3 number 99].
Provider	Previously used term equivalent to "balancing service provider"
Connection TSO	Previously used term equivalent to "reserve connecting TSO"
Operating test	Test operation carried out by the BSP via its control system according to the standardised requirements of a double peak curve.
FCR	'frequency containment reserves' or 'FCR' means the active power reserves available to contain system frequency after the occurrence of an imbalance [see SOGL, Article 3 paragraph 2 number 6].
FRR	'frequency restoration reserves' or 'FRR' means the active power reserves available to restore system frequency to the nominal frequency and, for a synchronous area consisting of more than one LFC area, to restore power balance to the scheduled value [see SOGL, Article 3 paragraph 2 number 7]. There are two types of FRR: • aFRR (automatic FRR) • mFRR (manual FRR)
Actual value	Actually measured or determined value
LFC Block	'load-frequency control block' or 'LFC block' means a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC blocks, consisting of one or more LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control [see SOGL, Article 3 paragraph 2 number 18]
LFC area	'load-frequency control area' or 'LFC area' means a part of a synchronous area or an entire synchronous area, physically demarcated by points of measurement at interconnectors to other LFC areas, operated by one or more TSOs fulfilling the obligations of load-frequency control [see SOGL, Article 3 paragraph 2 number 12].

Term	Explanation
MOLS	Abbreviation for Merit-Order-List-Server. Shared IT tool of the four German TSOs with which mFRR is called off automatically by a Germany-wide merit order (taking into consideration bids from pools and plants with a physical connection within the Creos grid area). The use of the MOLS replaces the previous telephone activation; integration into the MOLS is mandatory for all mFRR providers.
MRP	Minutes reserve power; previously used term equivalent to "mFRR"
Grid connection point	NC RfG Article 2 number 15 defines a connection point as follows: 'connection point' means the interface at which the power-generating module, demand facility, distribution system or HVDC system is connected to a transmission system, offshore network, distribution system, including closed distribution systems, or HVDC system, as identified in the connection agreement;
Pool	A pool refers to a single or multiple aggregated RPUs and/or RPGs that fulfil(s) the requirements described in this document with regard to the provision of FCR, aFRR or mFRR.
Prequalification	'prequalification' means the process to verify the compliance of a reserve providing unit or a reserve providing group with the requirements set by the TSO [see SOGL, Article 3 paragraph 2 number 146]
PBP	Primary balancing power; previously used term equivalent to "FCR"
Automatic FRR activation delay (or response time)	'automatic FRR activation delay' means the period of time between the setting of a new setpoint value by the frequency restoration controller and the start of physical automatic FRR delivery [SOGL, Article 3 paragraph 2 number 100]
Reference incident	'reference incident' means the maximum positive or negative power deviation occurring instantaneously between generation and demand in a synchronous area, considered in the FCR dimensioning [see SOGL Article 3 paragraph 2 number 58]
Balancing block	Previously used term equivalent to "LFC block"
Balancing service provider / BSP	'balancing service provider' means a market participant with reserve-providing units or reserve-providing groups able to provide balancing services to TSOs [see EB GL Article 2 paragraph 6] The term corresponds largely to the SOGL term "reserve provider".
Control area	Previously used term equivalent to "LFC area"

Term	Explanation
Reserve connecting TSO	'reserve connecting TSO' means the TSO responsible for the monitoring area to which a reserve providing unit or reserve providing group is connected [see SOGL, Article 3 paragraph 2 number 150]. For technical units that are connected to the Creos Luxembourg S. A. grid, regardless of their connection grid or voltage level, Amprion GmbH assumes the role of Creos Luxembourg S. A. as reserves connecting TSO in terms of this document.
Reserve provider	'reserve provider' means a legal entity with a legal or contractual obligation to supply FCR, FRR or RR from at least one reserve providing unit or reserve providing group [see SOGL, Article 3 paragraph 2 number 9]. The term corresponds largely to the EB GL term "BSP".
Reserve providing unit	'reserve providing unit' means a single or an aggregation of power generating modules and/or demand units connected to a common connection point fulfilling the requirements to provide FCR, FRR or RR [see SOGL, Article 3 paragraph 2 number 10].
Reserve providing group	'reserve providing group' means an aggregation of power generating modules, demand units and/or reserve providing units connected to more than one connection point fulfilling the requirements to provide FCR, FRR or RR [see SOGL Article 3 paragraph 2 number 11].
Setpoint (in the context of the PQ conditions)	Balancing reserve to be provided by the BSP
SCP	Secondary balancing power; previously used term equivalent to "aFRR"
Synthetic test	An overlaying of TU double peak curves of a reserve providing unit or group. By adding or removing a TU, it is possible to synthetically generate new PQ values for the RPU/RPG without all TUs of the RPU/RPG having to simultaneously complete an operating test.
Technical unit	A technical unit ("TU") is a power generating module or demand unit or electricity storage unit (as a combination of a production and consumption unit) whose injection or withdrawal is measured and that fulfils the requirements described in these PQ conditions.
Dead time	Previously used term equivalent to response time / delay
Automatic FRR full activation time	'automatic FRR full activation time' means the time period between the setting of a new setpoint value by the frequency restoration controller and the corresponding activation or deactivation of automatic FRR [see SOGL Article 3 paragraph 2 number 101].

Term	Explanation
FCR full activation time	'FCR full activation time' means the time period between the occurrence of the reference incident and the corresponding full activation of the FCR [see SOGL, Article 3 paragraph 2 number 112].
Manual FRR full activation time	'manual FRR full activation time' means the time period between the setpoint change and the corresponding activation or deactivation of manual FRR [see SOGL, Article 3 paragraph 2 number 143].
Time availability	Quotient of (availability in the relevant time period - unavailability in the relevant time period) / relevant time period