Fingrid Oyj

The technical requirements and the prequalification process of Automatic Frequency Restoration Reserve (aFRR)

Valid from 13.2.2026

Unoffical translation
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1 Introduction

This document describes the prequalification process of Reserve Units offered for the maintaining of Automatic Frequency Restoration Reserve (aFRR) and the verification of compliance with the technical requirements concerning Reserve Units in accordance with article 159 of the Guideline on System Operation, Commission Regulation (EU) 2017/1485. The general requirements concerning Balancing Service Providers have been described in Fingrid's document "Terms and conditions for providers of Automatic Frequency Restoration Reserve (aFRR)."

2 Subjecting a Reserve Unit for prequalification

2.1 Prequalification process

The prequalification of the Reserve Unit follows the process shown in Figure 1. Balancing Service Provider is responsible for conducting the tests in accordance with this document and for providing the required information within the given time limits. Fingrid is responsible for verifying the data and measurement results according to the schedule specified in the process chart and for notifying the Balancing Service Provider of the result of the prequalification process.

Fingrid has the right to send its representative to the prequalification tests. Balancing Service Provider is responsible for the costs caused by the carrying out of the tests and Fingrid only for its own personnel costs.

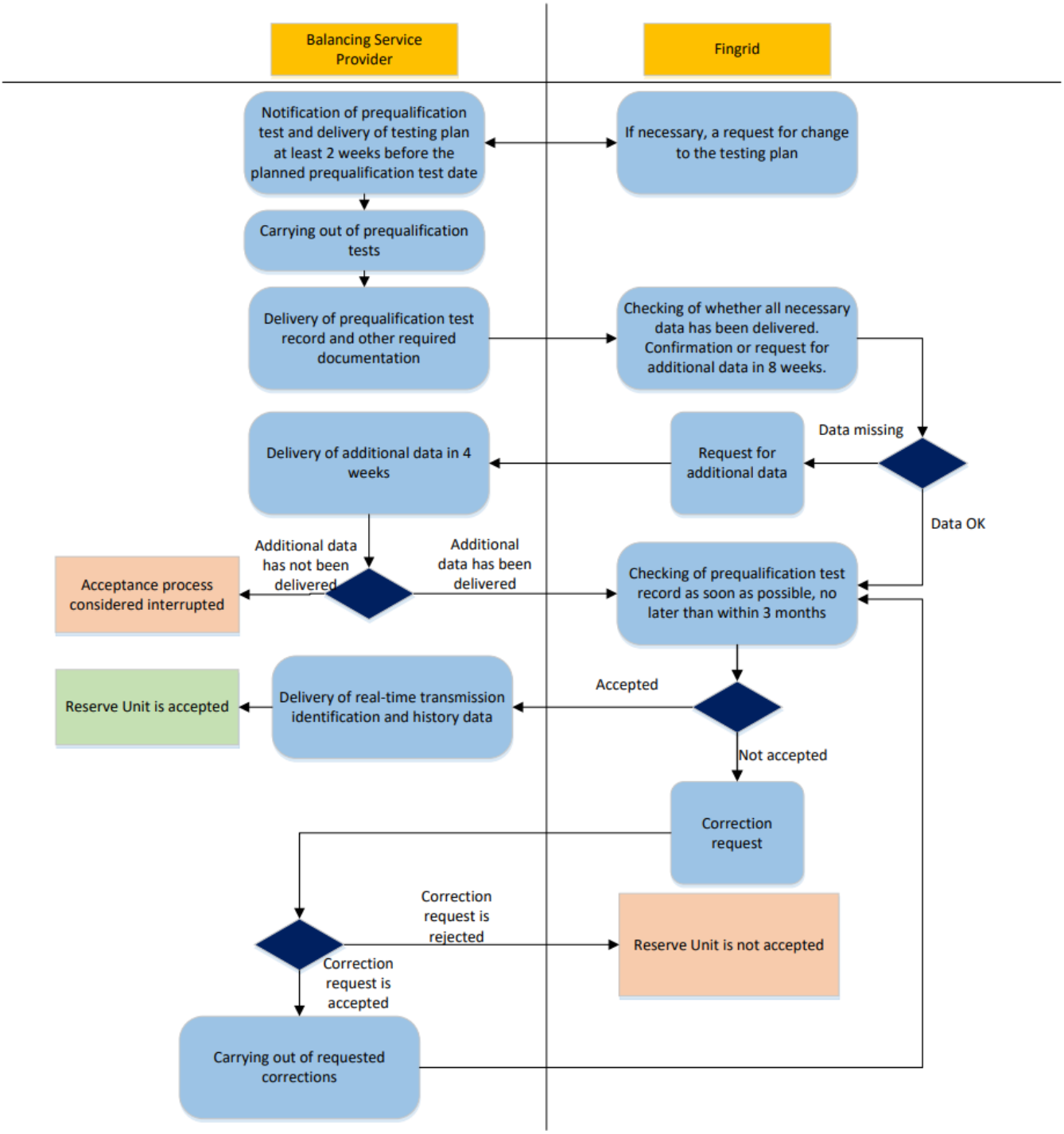

Figure 1 Progress of the prequalification process.

2.2 Necessary documentation

The requirements concerning the reporting and follow-up of the maintaining of the reserves have been described in Fingrid's document "Terms and conditions for providers of Automatic Frequency Restoration Reserve (aFRR)". The identifiers used in the sending of the real-time information shall be delivered in connection with the prequalification process of the Reserve Unit.

Only the prequalification test record and any changed information need to be delivered of a Reserve Unit whose prequalification test is renewed.

New Reserve Units shall indicate which type of technology the Unit represents and, depending on the type of Unit, provide the following information:

Power plants:

- maximum power (MW)
- nominal apparent power (MVA)
- technical description of the control system and signal processing

Consumption units:

- type of consumption, e.g., industrial process (what kind?), lighting, heating
- maximum power (MW)
- technical description of the control system and signal processing

Energy storages:

- rated power (MW)
- energy capacity (MWh)
- upper and lower limit of the charge level (MWh or %)
- a technical description of the control system, including charge level control and signal handling;

The calculation method of maintained reserve capacity and the possible calculation of reference power shall be described for all types of Reserve units. The baseline power refers to the power of a Reserve Unit if the reserve had not been activated. An inaccurate calculation can cause lacking or excessive activations, distort the monitoring of the available reserves and lead to incorrect payments and penalties.

In addition, Balancing Service Providers that are obliged to send the delivered balancing energy message shall describe how the delivered balancing energy is calculated and how the balance responsibility information of the Reserve Resources is maintained.

2.3 Validity period of prequalification test

The validity period of prequalification tests is 5 years. A prequalification test shall be renewed before the ending of the validity period. A prequalification test shall also be renewed whenever changes influencing reserve operation are carried out on the Reserve Unit.

3 Activation signal

Fingrid sends activation signals to the Balancing Service Providers every 4 seconds. One activation signal is sent to the Provider regardless of how many Reserve Units participate in the balancing. ICCP data exchange is used for data transfer. The sign of the signal sent is negative if the activation request is downregulation or positive if the activation request is upregulation. The unit of activation signal is MW.

The activation can vary between zero and the accepted aFRR capacity. For example, if a 10 MW upregulating offer has been accepted, then the signal can vary between 0 and 10 MW. Since the activation signal is constantly changing, the activation of aFRR is about tracking the control signal rather than activating individual “step like” power requests.

4 Requirements for reserve activation

4.1 Activation speed

A Reserve Unit contributing to the maintaining of the Automatic Frequency Restoration Reserve shall activate the reserve capacity in its entirety within 5 minutes from the sending of the activation signal. Activation must be started no later than 30 seconds after the activation signal is sent (the activation shall not be intentionally delayed). Figure 2 shows the minimum activation speed without delay and with the longest allowed delay.

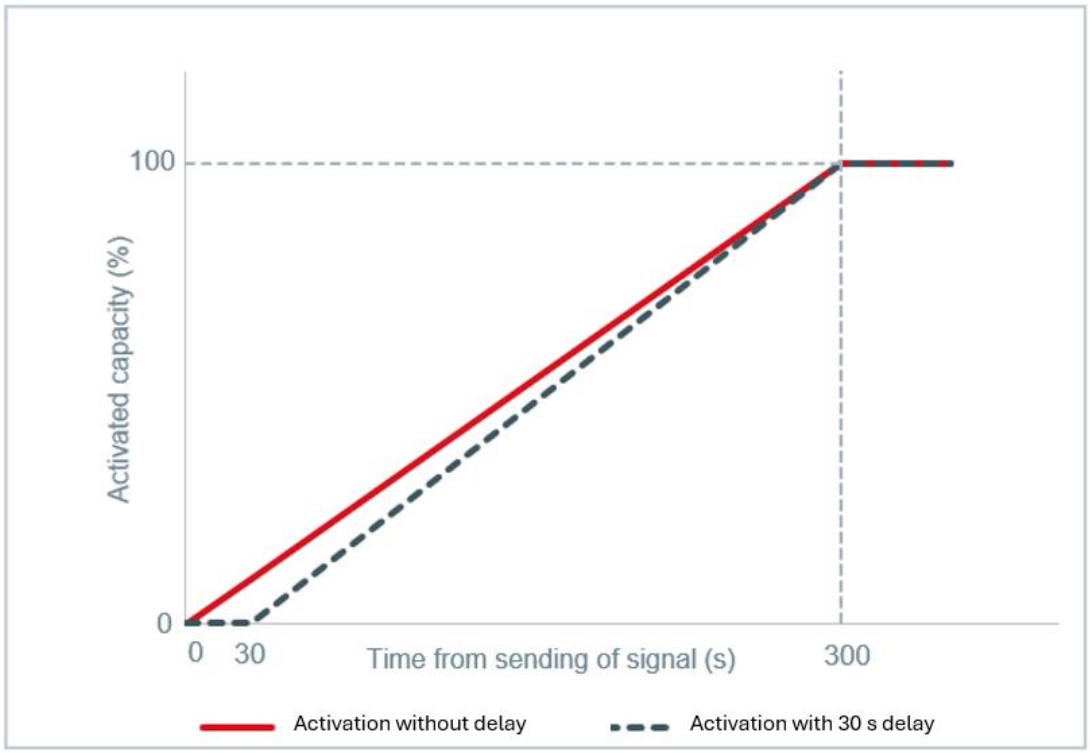

Figure 2 Minimum activation speed

4.2 Accuracy of activation

The volume of activated reserve shall be $90 - 110$ % of the power request.

4.3 Requirements for electricity storages

The Reserve Unit must be able to provide balancing energy to all the sold hours. In the case of electricity storage, the successful delivery of the reserve is ensured by sufficient energy capacity and an energy management method approved by Fingrid. The Balancing Service Provider is responsible for the dimensioning and management of the reserve to ensure a successful delivery.

The minimum energy capacity required from the reserve is an energy capacity corresponding to 1 hour of full activation per direction. aFRR capacity must be fully reserved for the delivery of aFRR and the same capacity cannot be used for energy management. The activation of the reserve is not sufficient to be an approved energy management method. The energy management method of the reserve must be described in the prequalification test report. Balancing power shall not be used for reserve management, but the required power must be bought or sold for example on the intra-day market or it may be compensated in the portfolio, excluding independent aggregation.

5 Execution of prequalification tests

Balancing Service Provider shall make sure that a Reserve Unit that contributes to the maintaining of the Automatic Frequency Restoration Reserve fulfils the requirements laid down in this document. The fulfilment of the requirements shall be verified by means of prequalification tests that shall be carried out in a normal operating condition of the Reserve Unit. The requirements and guidelines given in this document shall be followed in the execution of the prequalification tests.

Fingrid sends a test sequence shown in Figure 3 to a Reserve Unit tested. The sequence is used for testing the greatest (ΔPmax) and smallest (ΔPmin) power change that the Reserve Unit should carry out. If it is not possible to feed the sequence as such, the power change can be carried out manually in accordance with Table 1. The Reserve Unit tested during the sequence shall fulfil the requirements described under item 4.

Table 1 Test sequence in tabular form.

Time [min]	Change in setpoint [MW]	Comment
0	0	
5	50% ΔPmax	upregulation
10	ΔPmax	upregulation
20	0	
25	50% ΔPmin	downregulation
30	ΔPmin	downregulation
40	0	

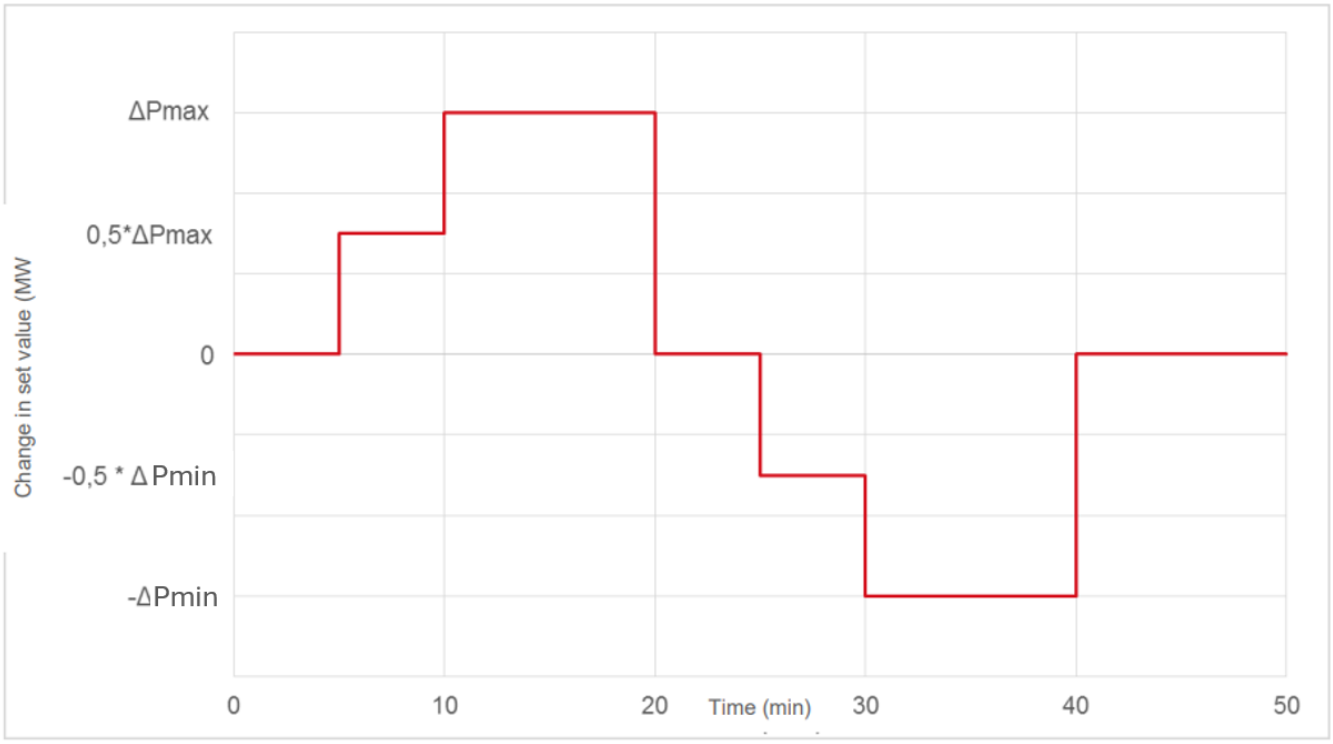

Figure 3 Test sequence.

5.1 Prequalification tests of aggregated Reserve Units

Individual reserve resources can be used to form an aggregated Reserve Unit. Fingrid has the right to request real-time and historical data separately for the individual resources of an aggregated Unit. The rules for participation in the market for aggregated reserve assets are described in the document "Terms and conditions for providers of automatic Frequency Restoration Reserves (aFRR) ".

There are three different ways to perform prequalification tests of aggregated Reserve units. The method of performing the prequalification test must be agreed in advance with Fingrid.

5.1.1 Aggregated Unit as a whole

The activation signal is fed into the top-level control system (Figure 4) and the activated power is calculated as the sum of the power outputs of all resources. The Balancing Service Provider demonstrates that the aggregated object as a whole meets the technical requirements. All reserve resources must contribute to the delivery of the reserve. Adding or removing new resources requires repeating the prequalification tests, either for new resources or again for the whole portfolio.

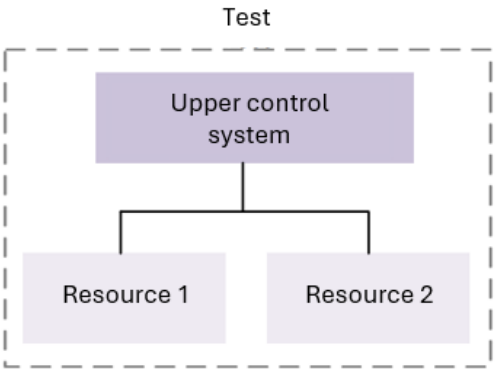

Figure 4 Testing of the aggregated Reserve Unit as a whole.

5.1.2 Resources separately

Each resource is tested separately (Figure 5). The Balancing Service Provider demonstrates that each resource to be aggregated meets the technical requirements independently. A resource can be either a single device or a larger group within a portfolio. The reserve resources involved in the delivery of the reserve may vary because their operation has been verified individually. If a subset of the portfolio was tested as one reserve resource, then this set cannot be divided into smaller units without new tests. The Balancing Service Provider must also demonstrate that the operation of the top-level system meets the requirements (e.g., of data transfer delays). In addition to the measurement data for the entire portfolio, measurement data is provided separately for each tested resource.

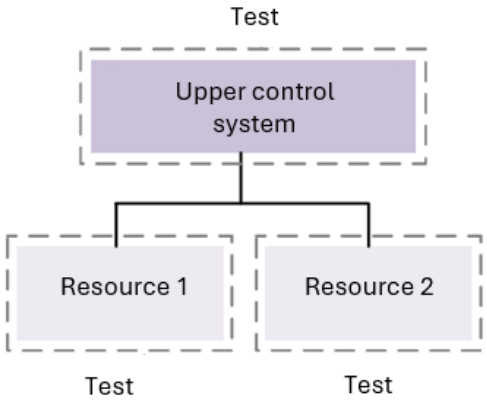

Figure 5 Testing individual resources

5.1.3 Type approval

Identical resources may be subject to type approval. The Balancing Service Provider must demonstrate that the resources work in the same way with each other. After this, new similar resources can be added to the aggregated Reserve Unit without new prequalification tests. However, increasing the capacity of a Reserve Unit requires notification to Fingrid according to the practice agreed with the Balancing Service Provider.

If the capacity of the Automatic Frequency Restoration Reserve has increased by more than 5 MW since the previous prequalification test, the test must be repeated.

If the type approval has been granted for reserve resources as an Independent Aggregator or as a Contractual Balancing Service Provider that aggregates reserve resources from several different balances, the Balancing Service Provider may add similar new resources to the Reserve Unit in question without performing prequalification tests. This requires that the method of calculating the delivered balancing energy and baseline power per balance responsibility and the method of maintaining the balance responsibility information of the reserve resources remains unchanged. However, for new Contractual reserve resources the Balancing Service Provider must submit a completed Notification of agreed Reserve Resource's reserve use to Fingrid.

5.2 Documentation of prequalification test results

The results of the prequalification test are provided in a fully completed aFRR application form that acts as a test report.

The measurement results are plotted in a graph showing the instantaneous active power, reference power, activated aFRR and activation signal over time. In addition, the measurement results are delivered in accordance with Table 2 using a standard CSV format, where the values are delimited by comma (,), decimal separator is point (.) and record delimiter is carriage return. The timestamp format is ISO 8601.

The sampling interval shall be 1 second or more accurate. The power measurement resolution shall be 0.01 MW or more accurate.

Table 2 Formatting of the measurement results

NAME	dateTime	instantaneous_power	reference_power	activated_afrr	activation_signal
FORMAT	YYYYMMDDThhmmss.nnn	double	double	double	double

The files are named in the format [unit name]_aFRR_[test direction]_[yyyymmdd].csv

In the case of a Contractual Balancing Service Provider or an Independent Aggregator, a column *delivered_energy* is added to Table 2 for the delivered balancing energy to check the energy calculation. The Contractual Balancing Service Provider reports the results per balance responsibility, and the Independent Aggregator reports the results per open supplier (RE, electricity retailer) and per metering grid area (MGA).

6 Calculation of the amount of maintained Automatic Frequency Restoration Reserve

The Balancing Service Provider must provide Fingrid real-time information on the amount of maintained Automatic Frequency Restoration Reserve. Reporting must comply with Fingrid's guidelines on reserve trading and information exchange.

Activation of aFRR should not reduce the amount of the maintained reserve. The amount of maintained aFRR is zero if the reserve providing functionality is switched off.

The Balancing Service Provider shall provide Fingrid with a description of the implementation of the calculation of the amount of maintained Automatic Frequency Restoration Reserve. If a more accurate calculation method is available to the BSP, it may be used with Fingrid's approval.

If there is not enough headroom for all the sold capacities, the maintained FCR-D capacity is limited first, then the FFR capacity, then FCR-N, then FRR. The reasoning behind this is that FRR and FCR-N can be fully activated when a disturbance that activates FCR-D and FFR occurs. When the disturbance occurs, FFR will activate faster than FCR-D, and therefore it is FCR-D that will not be delivered fully. With regards to FCR-N and FRR, any of these reserves can be activated before the other. This does not describe the priority order of the reserves for the power system, but a typical reserve activation order in a situation where the regulation of all sold reserves is online.

6.1 Production Units

The amount of maintained Automatic Frequency Restoration Reserve can be calculated for generation-based reserve Units using the equations:

$$C_{aFRR,up-GEN} = \max\left[\min\left(P_{max} - P_{baseline} - C_{other\ reserves}, C_{prequalified}\right), 0\right] \quad (1)$$

$$C_{aFRR,down-GEN} = \max\left[\min\left(P_{baseline} - P_{min} - C_{other\ reserves}, C_{prequalified}\right), 0\right] \quad (2)$$

where

$C_{aFRR,up-GEN}$ is the amount of the maintained upregulating automatic frequency restoration reserve,

$C_{aFRR,down-GEN}$ is the amount of the maintained downregulating automatic frequency restoration reserve,

P_{max} is the maximum active power of the Reserve Unit,

P_{min} is the minimum active power of the Reserve Unit,

$P_{baseline}$ is the active power setpoint of the Reserve Unit excluding any activated reserves,

$C_{other\ reserves}$ is the capacity of other reserves sold for the regulating direction in question, considering the priority order of the maintained capacities,

$C_{prequalified}$ is the amount of automatic frequency restoration reserve approved in the prequalification test.

6.2 Consumption Units

For Reserve Units based on electricity consumption, the amount of automatic frequency restoration reserve can be calculated using equations

$$C_{aFRR,up-Load} = \max[\min(P_{baseline} - P_{min} - C_{other\ reserves}, C_{prequalified}), 0] \quad (3)$$

$$C_{aFRR,down-Load} = \max[\min(P_{max} - P_{baseline} - C_{other\ reserves}, C_{prequalified}), 0] \quad (4)$$

where

$C_{aFRR,up-Load}$ is the amount of the maintained upregulating automatic frequency restoration reserve,

$C_{aFRR,down-Load}$ is the amount of the maintained downregulating automatic frequency restoration reserve,

P_{max} is the maximum active power of the Reserve Unit,

P_{min} is the minimum active power of the Reserve Unit,

$P_{baseline}$ is the power of the Reserve Unit, excluding any activated reserves,

$C_{other\ reserves}$ is the capacity of other reserves sold for the regulating direction in question considering the priority order of the maintained capacities.

6.3 Energy Storage Systems

For Reserve Units that are energy storages, the amount of automatic frequency restoration reserve can be calculated using equations

$$C_{aFRR,up-BESS} = \max[\min(P_{max} - P_{baseline} - C_{other\ reserves}, C_{prequalified}), 0] \quad (5)$$

$$C_{aFRR,down-BESS} = \max[\min(P_{baseline} - P_{min} - C_{other\ reserves}, C_{prequalified}), 0] \quad (6)$$

where

$C_{aFRR,up-BESS}$ is the amount of the maintained upregulating automatic frequency restoration reserve (Battery Energy Storage System, BESS),

$C_{aFRR,down-BESS}$ is the amount of the maintained downregulating automatic frequency restoration reserve (Battery Energy Storage System, BESS).

7 Requirements for a Balancing Service Provider acting as an Independent Aggregator or aggregating reserve resources from several different balances

The prequalification tests for an Independent Aggregator or a Balancing Service Provider aggregating reserve resources from several different balances are carried out in the same

way as the prequalification tests for aggregated Reserve Units. In addition, the calculation of the reference power (baseline) of the Balancing Service Provider and the delivered balancing energy is verified per balance responsibility, in the case of independent aggregation per open supplier (RE, electricity retailer) and metering grid area (MGA). Variable production refers to, for example, weather-dependent production such as wind and solar power. Variable consumption refers to, for example, electric car charging systems, where the baseline power depends on the number of users, or electric boilers, whose operating power depends on the demand of the district heating network.

The reference power is validated using one month of data including a timestamp, calculated reference power, and active power measurement. The data must be broken down by balance responsibility into independent aggregation, contractual balancing service provision, and reserve resources from own balance. The review period does not have to be a continuous period. There shall be no activation of reserves from the Units concerned or power curtailments during the reference period. The quality of the calculation of the reference power is assessed in accordance with Fingrid's document "Guideline for variable production and consumption in automatic reserves". The reference power is only validated for the new reserve resources of the Balancing Service Provider, i.e., no re-validation of the reference power is required for the reserve resources already participating in the market if the Balancing Service Provider adds new reserve resources to its portfolio.

The calculation of the delivered balancing energy of the Balancing Service Provider is ensured per balance responsibility, in the case of independent aggregation per open supplier (RE, electricity retailer) and metering grid area (MGA). The description of the calculation of the reference power and delivered balancing energy must also be specified separately by aggregation method (independent aggregation, contractual reserve provision, own balance reserve resources), if the new reserve resources to be accepted include more than one aggregation method.

A description of how the Balancing Service Provider maintains up-to-date balance responsibility information of its reserve resources must be provided to Fingrid. In the case of independent aggregation, the balance responsibility information for the reserve resource must be maintained per open supplier (RE, electricity retailer) and metering area (MGA). The prequalification test results shall be documented similarly as in Chapter 5.2 but the results are provided per balance responsibility. In addition, the delivered balancing energy $E_{\text{delivered}}$ during the prequalification test is delivered in the same resolution as the other prequalification test data. Fingrid checks the delivered balancing energy based on active power measurement and reference power per balance responsibility ($E_{\text{calculcated}}$), after which the difference between the delivered and calculated balancing energy is calculated by

$$\text{difference} = \frac{E_{\text{delivered}} - E_{\text{calculated}}}{E_{\text{delivered}}} \quad (7)$$

The difference between the delivered balancing energy reported by the Balancing Service Provider and the balancing energy calculated by Fingrid for each imbalance settlement period shall not exceed $\pm 10\ \%$.

If the Balancing Service Provider wishes to make changes to the method of maintaining balance responsibility data for previously approved reserve resources or to the method of calculating the delivered balancing energy or reference power, a notification to Fingrid is required. The Balancing Service Provider must then submit to Fingrid for approval a description of the new method of calculating the delivered balancing energy or reference power or the method of maintaining balance responsibility data, before the Balancing Service Provider can implement the changes. If Fingrid evaluates the changes in the calculation of the delivered balancing energy or reference power to be significant, Fingrid may, in addition to the descriptions, also require a repeat of the prequalification test.