MEMORANDUM

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| **TO** | Potential suppliers of FCR | **DATE** | November 3, 2015 |
| | | **REFERENCE** | SON-SY 15-013 |
| | | **FROM** | SON-SY |

**SUBJECT** Productspecificatie FCR

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This document is a draft version. This document has been written on the basis of the European (concept) codes as currently known.
Elements of the European (concept) codes could possibly still change and have an impact on these product specifications.

## 1 General

The purpose of primary reserve is to limit and stabilise frequency disruptions in the entire (internationally) synchronously connected high-voltage grid, irrespective of the cause and location of the imbalance that has caused the frequency disruption. Without adequate intervention, frequency disruptions may lead to automatic load shedding and even cause a black-out in the worst case scenario.

The minimum size required for primary contributions from each control area is agreed annually within ENTSO-E Regional Group Continental Europe. The individual values are determined in proportion to the total electricity production in the control area of each connected TSO.

## 2 Requirements

In order to offer primary reserve, a technical unit must be prequalified in accordance with the prequalification requirements set out in the annexes of the framework agreement that is concluded following the successful prequalification of the unit. The framework agreement along with the annexes is on the TenneT website. Part of the prequalification is a test of whether the technical unit is in a position to supply primary reserve in accordance with the specifications. A test protocol is included for this in annex 1 of these product specifications.
Following prequalification and the signing of the framework agreement, the signatory party gains access to the auction platform. The requirements for the auction are also shown in the annexes to the framework agreement.

Ensuing from the European Codes, and in particular the 'Network Code on Load Frequency Control & Reserves' (NC LFCR) and the Dutch System Code, specifications that the primary reserve product must meet have been drawn up:

| | |
|---|---|
| Minimum Bidsize | 1 MW (upward and downward) |
| Accuracy of the frequency measurement of frequency control | 10 mHz or better |
| Insensitivity range of the frequency control | Max 10 mHz |
| FCR Full Activation Time | 30 s for the complete bid |
| Full Activation Frequency Deviation. | ±200 mHz |
| Real-time operating measurement of power | In MW with a resolution of no more than 4-10 seconds |

A technical unit or pool where the energy supply is not limited must supply primary reserve for as long as the deviation in frequency persists.

A supplier has the right to combine the measurement data of units, under condition that the maximum power of the combined units is lower than 1.5 MW and an objective check on the activation of the primary reaction is possible.

## 3 Target frequency

A supplier with a contract/permit for primary reserve must, for a 24-hour period with a different target frequency, determine a setpoint correction on the basis of the contractual commitment. A correction is preferably applied to each unit with an allocation. If a correction to the unit is not possible in practice, the supplier must include the correction in his central energy/power regulation in order to support the frequency correctly and to limit his imbalance.
Example: a contractual commitment of 30 MW (at 200 mHz) requires a correction to the setpoints of -1.5 MW at 49.99 Hz or +1.5 MW at 50.01 Hz target frequency.

## 4 Limited sources

The requirements for supplying the primary reserve for limited[1] and unlimited[2] sources are the same with a single exception. Specific requirements for limited sources are discussed below.
The specific requirements are based on the draft version of the European Network Code LFC&R.

[1] Batteries, Flywheels, Water reservoirs etc.
[2] Conventional units

### 4.1 30-minute requirement

Technical units or pool units with limited energy must be able - in the event of a deviation in frequency of 200 mHz - to continuously supply the full quantity of primary reserve awarded/contracted for a period of not less than 30 minutes, or to supply partial delivery for a proportionately longer period in the event of frequency deviations lower than 200 mHz.
After this half hour (or proportionately longer period), the limited unit must have the energy fully available again as soon as possible, but at the most within 2 hours.
This requirement is set out in greater detail in the latest version of the Guide Line System Operations.

A unit or pool with limited energy must be in a position to provide constant support to the frequency within the "standard frequency range"[3] (49.95-50.05 Hz).
If, in the event of a larger deviation in frequency, the "alert state" (Δf > +/-100 mHz for 5 min or Δf > +/- 50 mHz for 15 min) is reached, a unit must be able to continuously supply the full quantity of primary reserve awarded/contracted for a period of not less than 30 minutes, or to supply partial delivery for a proportionately longer period in the event of frequency deviations lower than 200 mHz.

### 4.2 Battery

A battery or a pool of batteries has specific characteristics (charging limits, self-discharge, ageing, unacceptable operating conditions etc.). These must be documented and submitted with the other prequalification documents.

#### 4.2.1 Charging management

The frequency within the synchronous system of continental Europe has a nominal setpoint of 50 Hz. Deviations from the setpoint are normal and are part of standard operation. The aim of the balancing is to maintain the frequency at an average of 50 Hz. After periods with an average frequency deviation in one direction, a temporary setpoint correction is used to restore the average to 50 Hz (see point 3 under Target Frequency).

For a battery that supplies primary reserve, this means that, despite the fact that the frequency is in the normal state, alongside a changing charging and discharging load, there is in an absolute sense a constant impact on the battery's charging process. For a battery that supplies primary reserve, this means that active charging management is necessary to facilitate constant support for the frequency within the "standard frequency range".
The charging management must be designed in such a way that, with a transition from "normal" to "alert state", full activation of the contracted primary reserve for 30 minutes is possible or for as much longer as the deviation is lower than 200 mHz. The charging management must be documented in the prequalification documents.

#### 4.2.2 Power

[3] Is the "normal state"

The dimensioned power is related to the offered power desired. No further requirements are set here.

#### 4.2.3 Charging and discharging capacity

The charging and/or discharging capacity of the battery is related to the charging management and the energy content of the battery. No further requirements are set here.

#### 4.2.4 Energy content

The energy content of the battery is related to the power and the charging management. No further requirements are set here.

ANNEX 1

# 1. Testing protocol



## 1.1 Introduction

For a Technical unit to prequalify for the supply of Primary Reserve, it must be tested on technical requirements as described below. The prequalification tests must take place under normal operational settings of the Technical unit.



## 1.2 Simulation of frequency deviations

Frequency deviations are simulated during the tests. A stepwise frequency increase and decrease of 100 mHz and 200 mHz is simulated and also an even frequency increase and decrease of 200 mHz.



## 1.3 Requirements



Accuracy of measurement of the writers: < 0.5% (of the nominal value, Class 0.1)
Time scale: 100 ms
Accuracy of the desired frequency value: < 5 mHz
The different measurements must have an unambiguous time stamp and be synchronous.



## 1.4 Recommendations

The tests are performed under the responsibility of Supplier by qualified technicians.
The measurement results are the basis of the prequalification. The Technical unit must remain connected to the grid during the tests.



## 1.5 Description of tests to be performed



The tests to be performed test the power to be prequalified; the droop is set such that the expected power changes are realised. The tests described below must be performed. In the description of the tests, ‘power’ means that power that is to be prequalified. It is noted that with batteries a charging state can be agreed instead of a power setting. Apart from frequency and power, batteries should also include the charging state as a measurement:



a) For a power setting established in consultation with TenneT[4] between minimum net power and maximum net power, the full power decrease must be realised within 30 seconds at a simulated frequency deviation of +200 mHz.
b) For the power setting stated under a), the full power increase must be realised within 30 seconds at a simulated frequency deviation of -200 mHz.
c) For the power setting stated under a), half of the power decrease must be realised within 15 seconds at



[4] For batteries a certain charging state can be agreed on

a simulated frequency deviation of +100 mHz.

d) For the power setting stated under a), half of the power increase must be realised within 15 seconds at a simulated frequency deviation of -100 mHz.

e) For the power setting stated under a), an evenly progressing power decrease of the full power must be realised in 2 minutes at a simulated evenly increasing frequency deviation of 0 mHz to +200 mHz. The power decrease must have an even course and be fully realised within 2.5 minutes (max. 30 seconds lag on simulated frequency change).

f) For the power setting stated under a), an evenly progressing power increase to the full power must be realised in 2 minutes at a simulated evenly decreasing frequency deviation of 0 mHz to -200 mHz. The power increase must have a linear course and be fully realised within 2.5 minutes (max. 30 seconds lag on simulated frequency change).

g) The adjusted power achieved during the test must be delivered for at least 30 minutes.
It must be noted that a certain droop value belongs to a particular percentage of the rated power which will be prequalified.

h) Once the above tests have been satisfactorily completed, the technical unit should track the frequency for 8 hours and submit the corresponding measurement strips. These last test results are needed to be able to pass judgment on the quality that the unit supplies to the frequency support.

## 1.6 Reporting and evaluation

In order to fulfil the prequalification requirement, Supplier must provide the results of the tests. This concerns at least:

- Measurement protocol including the relevant measurement results
- Test structure, precise specification of the measurement points
- Test time, list of tests performed
- Description of the way the tests have been done
- Persons involved in the test (including the contact person for the test)

The results are checked by TenneT, or by an independent third party appointed by TenneT.

ANNEX 2

## Explanation Droop

The droop is related to the volume that is to be prequalified. The droop is defined as follows:

$$\frac{\Delta P}{P_{nom}} = \frac{100}{x} \frac{|\Delta f|}{f_{nom}}$$

Where:
Δf = frequency change in Hz
fnom = nominal frequency (= 50 Hz)
ΔP = difference in power in MW
Pnom = nominal power in MW
x = droop in %

The full primary reserve must be activated if the (quasi-stationary) frequency deviation is 200 mHz. This forms the basis, together with Pnom and the offered bid size, for calculating the droop for the Technical unit concerned. The table below gives an example:

| | Value |
|---|---|
| Δf = frequency change in Hz | -0.2 |
| fnom = nominal frequency in Hz | 50 |
| Bid (ΔP = difference in power in MW) bv | 20 |
| Unit (Pnom = nominal power in MW) bv | 500 |
| x = droop in % | x=100*Δf* Pnom/ΔP/ fnom<br>x=100 *0.2*500/20/50<br>x=10 |