
**All CE TSOs' proposal for additional properties of
FCR in accordance with Article 154(2) of the
Commission Regulation (EU) 2017/1485 of 2
August 2017 establishing a guideline on
electricity transmission system operation**

28.01.2019

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All Transmission System Operators of Synchronous Area Continental Europe are taking into account the following;

Whereas

- 7
8 (1) This document is a common proposal developed by all Transmission System Operators of
9 Synchronous Area CE (hereafter referred to as “TSOs”) regarding the development of the additional
10 properties of Frequency Containment Reserves (hereafter referred to as “FCR additional properties”)
11 in accordance with Article 154(2) of Commission Regulation (EU) 2017/1485 of 2 August 2017
12 establishing a guideline on electricity transmission system operation (hereafter referred to as “SO
13 GL”).
14
- 15 (2) The FCR additional properties proposal takes into account the general principles and goals set in the
16 Commission Regulation EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity
17 transmission system operation. The goal of the Commission Regulation (EU) 2017/1485 is to ensure
18 the operational security of the interconnected transmission system. It sets for this purpose
19 requirements for approval of terms and conditions or methodologies of TSOs, in particular
20 concerning additional properties of the FCR in accordance with Article 154(2).
21
- 22 (3) With respect to Article 154 of SO GL which determines only FCR technical minimum requirements,
23 all TSOs of a Synchronous Area have the right to specify, in the synchronous area operational
24 agreement, common additional properties of the FCR required to ensure operational security in the
25 Synchronous Area, by means of a set of technical parameters and within the ranges in Article 15(2)(d)
26 of Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on
27 requirements for grid connection of generators and Articles 27 and 28 of Commission Regulation
28 (EU) 2016/1388 of 17 August 2016 establishing a Network Code on demand connection. To reflect
29 the individual needs of the Synchronous Area CE, the TSOs of Synchronous Area CE propose
30 respective additional properties described below.
31
- 32 (4) The proposal specifies conditions for FCR providing units and/or FCR providing groups: with respect
33 to activation of FCR and in particular with respect to FCR availability also in stressed system status
34 with a view also to new technologies.
35
- 36 (5) Article 6(2)(d)(iii) of the SO GL requires all TSOs to develop methodologies, conditions and values
37 included in the synchronous area operational agreement in Article 118 concerning the additional
38 properties of the FCR in accordance with Article 154(2).
39
- 40 (6) According to Article 6 of SO GL the FCR additional properties proposal is expected to reduce the
41 risk of inappropriate activation of FCR and of unavailability of FCR in stressed system state. With
42 this in mind the proposed additional properties presented below will contribute to system stability
43 and therefore to the achievement of the objectives of Article 4 of the SO GL.
44
- 45 (7) Specification of activation of FCR has the goal to ensure fast response and therefore help to stabilize
46 the system. Specifications for FCR providing units and/or FCR providing groups with limited energy
47 reservoir aim at ensuring sufficient availability also in stressed system status. Specifications for
48 frequency measurement aim at ensuring availability of independent functionality of FCR providing
49 units and/or FCR providing groups in particular in case of system split or communication problems.

50 The transition period is defined to avoid too abrupt change of requirements for already existing FCR
51 providing units and/or FCR providing groups.
52

53 (8) In conclusion, the FCR additional properties proposal contributes to the general objectives of the
54 Commission Regulation (EU) 2017/1485 to the benefit of all market participants and electricity end
55 consumers.
56

57 **SUBMIT THE FOLLOWING FCR ADDITIONAL PROPERTIES PROPOSAL TO ALL REGULATORY**
58 **AUTHORITIES:**

59 **Article 1**
60 **Subject matter and scope**

61 The additional properties of FCR as determined in this proposal shall be considered as the common
62 proposal of all TSOs of CE in accordance with Article 154(2) of SO GL and shall cover the requirements in
63 addition to Article 154 for FCR providing units and/or FCR providing groups.

64 **Article 2**
65 **Definitions and interpretation**

- 66 1. For the purposes of the FCR additional properties proposal, terms used in this document shall have the
67 meaning of the definitions included in Article 3 of the SO GL, Article 2 of Regulation (EC) 714/2009,
68 Article 2 of Directive 2009/72/EC, Article 2 of Commission Regulation (EU) 543/2013 and Article 2 of
69 Commission Regulation (EU) 2016/631.
70
- 71 2. In this FCR additional properties proposal, unless the context requires otherwise:
72 a) the singular indicates the plural and vice versa;
73 b) the table of contents and headings are inserted for convenience only and do not affect the
74 interpretation of this FCR additional properties proposal; and
75 c) any reference to legislation, regulations, directive, order, instrument, code or any other enactment
76 shall include any modification, extension or re-enactment of it then in force.

77 **Article 3**
78 **Additional properties of Frequency Containment Reserves**

- 79 1. Each TSO shall ensure that either each FCR providing unit and FCR providing group or – in case a TSO
80 utilizes combined responses to fulfil its FCR delivery – the activation of all FCR providing units and
81 FCR providing groups are not artificially delayed, begin as soon as possible but no later than 2 s after a
82 Frequency Deviation, and the activation shall rise at least linearly or quicker. If the delay in initial
83 activation of active power frequency response is greater than two seconds and/or the activation of active
84 power frequency response cannot be linearly or quicker, the power generating facility owner shall provide
85 technical evidence to the respective TSO demonstrating why a longer time is needed. These requirements
86 should be checked during prequalification according to Article 155 in the SO GL.
87
- 88 2. Each FCR providing unit or group shall be capable to stay connected to the grid within the frequency
89 range of 47,5 to 51,5 Hz for time periods specified by the TSO taking into account the technical boundary
90 conditions of the respective FCR providing units or FCR providing groups in accordance with Article
91 154(6) of the SO GL. Each TSO shall in dialog with the DSOs ensure that distributed FCR is not
92 significantly reduced by load shedding actions.

93 3. FCR providing units or FCR providing groups are deemed to have limited energy reservoirs (LER) in
94 case a full continuous activation for a period of 2 hours in either positive or negative direction might,
95 without consideration of the effect of an active energy reservoir management, lead to a limitation of its
96 capability to provide the full FCR activation in accordance with Article 156(8) of the SO GL, due to the
97 depletion of its energy reservoir(s) taking into account the effective energy reservoir(s). FCR providing
98 units or groups not deemed as LER that contain technical entities with limited energy reservoirs shall
99 ensure to be able to fully activate their FCR provision in accordance with Article 156(7) of the SO GL.
100 For the avoidance of doubt FCR providing units or groups that contain technical entities with unlimited
101 energy reservoirs and technical entities with limited energy reservoirs shall not be considered LER in
102 case their energy reservoir does not limit the capability to provide FCR according to Article 156(7) of
103 the SO GL.

104 In case FCR providing units or FCR providing groups containing technical entities with limited energy
105 reservoirs have to compensate a possible lack of energy and hence a lack of FCR, they shall be able to
106 shift FCR activation to technical entities available in order to ensure FCR provision. In any case the
107 shifting of FCR activation shall guarantee continuity of the FCR provision. FCR providing units or FCR
108 providing groups considered as LER shall respect the minimum time period of FCR full activation
109 according to Article 156(9), 156(10) and 156(11) of the SO GL. Technical entities with unlimited energy
110 reservoir of FCR providing units or FCR providing groups must not limit their FCR provision in case
111 technical entities with limited energy reservoir (of that FCR providing group/unit) are already exhausted
112 in either the positive or negative direction according to Article 156(8) of SO GL.
113

114 For prequalification, the TSOs shall require that FCR providing units or FCR providing groups respect
115 the following:

116 • FCR providing units or FCR providing groups using technical entities with limited energy reservoir
117 shall have an active energy reservoir management. The active energy reservoir management shall
118 ensure a continuous physical activation of FCR in normal state according to Article 156(9) of the SO
119 GL. Following Article 156(9) of the SO GL, the FCR provider shall ensure that FCR providing units
120 or FCR providing groups considered as LER have an energy reservoir dimensioning sufficient to
121 cover a Frequency Deviation of 200 mHz for at least [15-30] minutes in positive and negative
122 direction by additionally taking into account possible frequency deviations that might happen before
123 entering into Alert State. To enable the active energy reservoir management, such FCR providing
124 units or FCR providing groups considered as LER shall have a ratio of rated power to prequalified
125 power of at least 1.25:1 or an alternative solution with equivalent effect. Any lead time for the
126 charging process needs to be considered for the energy reservoir management. The value in brackets
127 given in this paragraph is depending on the minimum activation period to be ensured by FCR
128 providers according Article 156 (9),(10) and (11) of the SO GL.

129 • The energy reservoir management of FCR providing units and FCR providing group shall not rely
130 on over fulfilment of activation.

131 • FCR providing units or FCR providing groups with limited energy reservoirs which are connected
132 to the grid by means of inverters shall ensure that close to the limit of its energy reservoir the
133 remaining capacity is sufficient for keeping its reactivity on short-term frequency deviations.
134 Therefore, the unit shall switch from normal mode into reserve mode at t_{FAT} (full activation time of
135 aFRR according to Article 158(1)(f) of the SO GL) before exhaustion of the energy reservoir due to
136 maximum FCR provision in one direction. During the reserve mode the unit shall only react on
137 short-term frequency deviations by following the zero-mean frequency:

138 •
$$\overline{\Delta f_{zero-mean}(t)} = \Delta f(t) - \frac{1}{n(t-t_{FAT})} \sum_{i=0}^{n(t-t_{FAT})} \Delta f(t-t_i) \text{ (reserve mode)}$$

139 • For transition from normal mode into reserve mode a linear transition function T should be applied
140 within the transition period of $t_{\text{exhaustion}} - t_{\text{FAT}}$ to $t_{\text{exhaustion}}$:

141 • $f_{\text{reaction}}(t) = \overline{\Delta f_{\text{zero-mean}}(t)} \cdot T + (1 - T) \cdot \Delta f(t)$
142

143 The fulfilment of requirements stated above and in Article 156(9), (10) and (11) of the SO GL shall be
144 subject of the prequalification process specified by TSO.

145 4. FCR providing units and groups shall be based on local frequency measurement at least per connection
146 point or below at side of generating units when it is feasible from technical solution at the power
147 generating module or demand unit.

148 5. FCR providing groups shall have decentralized frequency measurements per connection point (based on
149 local frequency measurement) that can be used either by default or as a fallback solution to ensure an
150 autonomous function and a proper activation in case of errors of the central control (e.g. outage of
151 SCADA, faults of communication lines) or system split of the electrical grid. In case of central control,
152 additional requirements are the following:

153 i. An observation function shall detect any kind of errors of the central control or frequency deviations
154 among the technical entities. The FCR provider shall initiate appropriate counter-measures
155 immediately to ensure the FCR provision is not significantly negatively impacted.

156 ii. The minimum accuracy of the local frequency measurement used for the fully decentralized
157 fallback can be reduced if accepted by the reserve connecting TSO .

158 6. For a time period of 4 years after the entry into force of this proposal and in case no decentralized fallback
159 procedure according to 5. can be implemented within a FCR providing group or in case the fallback
160 procedure cannot fulfill the reserve connecting TSO's requirements (e.g. accuracy or reliability of local
161 frequency measurements) an implementation of a centralized control of FCR providing groups is
162 temporary allowed under the following conditions:

163 i. To mitigate the risk of misbehavior of technical entities in case of errors of the central control (e.g.
164 outage of SCADA, faults of communication lines) and to limit the impact on frequency, a single
165 centralized FCR controller shall not control more than 30 MW of FCR.

166 ii. In line with Article 156(6a) of the SOGL the reserve connecting TSOs shall observe the share of
167 FCR provided in this central control way within the procurement process and shall implement a limit
168 of total amount of procured volume per LFC block to 75 MW, pursuant to Article 154(4) of the
169 SOGL.

170 7. Each TSO shall require that FCR providing units and FCR providing groups continue providing FCR and
171 are not allowed to reduce activation in case of a frequency deviation outside the frequency range of +/-
172 200 mHz up to the frequency ranges as defined in Article 3.2.

173 **Article 4**

174 **Publication and implementation of the FCR additional properties proposal**

175 1. The TSOs shall publish the FCR additional properties proposal without undue delay after all NRAs have
176 approved the proposal or a decision has been taken by the Agency for the Cooperation of Energy
177 Regulators in accordance with Article 8(1) and Article 11 of the SO GL.
178

179 2. The TSOs shall start to implement the FCR additional properties as specified in this proposal immediately
180 after the NRAs have approved the proposal in accordance with Article 6(3) SO GL or a decision has been
181 taken by the Agency in accordance with Article 6(8) SO GL. The transitional period for the
182 implementation of additional properties of FCR by the affected FCR providers shall be two years: one

183 year for TSOs to adapt their Terms & Conditions and one additional year for FCR providers to implement
184 the additional properties on FCR.

185 **Article 5**
186 **Language**

187 The reference language for this FCR additional properties proposal shall be English. For the avoidance of
188 doubt, where TSOs need to translate this FCR additional properties proposal into their national language(s),
189 in the event of inconsistencies between the English version published by TSOs in accordance with Article 8
190 of the SO GL Regulation and any version in another language, the relevant TSOs shall, in accordance with
191 national legislation, provide the relevant national regulatory authorities with an updated translation of the
192 FCR additional properties proposal.

Explanatory note for Additional Properties of Frequency Containment Reserves

20.02.2019

Explanatory note

Regarding Article 3.1:

In case of system imbalances and resulting deviations of system frequency, FCR are activated to stabilize the system. For an effective stabilization, FCR needs to be quick enough to avoid unacceptable (dynamic) deviations of system frequency. Thus, activation has to start as soon as possible after occurrence of the deviation. Nevertheless, depending on the used technology of FCR providing units, some delay of physical activation is unavoidable. To ensure that this time delay remains within acceptable limits, a maximum delay shall not be exceeded. Exemptions can be granted by the TSO in case the delay is only insignificantly exceeded because of the used technology. Nevertheless, if quicker response is possible based on the applied technology, it should not be artificially delayed in order to contribute as effectively as possible to stabilize the system.

Regarding Article 3.2:

Since FCR is the fundamental component for stabilizing system frequency, it is of utmost importance that FCR providers ensure the capability of connection of their FCR providing units and groups over the whole permitted range of system frequency in which the system can be operated. Nevertheless, TSOs can require disconnection of FCR providing units or groups if they are part of the automatic over-frequency control scheme in the respective LFC area in accordance with Commission Regulation (EU) 2017/2196 Article 16 (3). Due to the different technologies of FCR providing units and different possible voltage levels of connection of these units, it is very important to, on one hand, require respective parameter settings of the FCR providing units and, on the other hand, consider possible shedding concepts of DSOs. Even if these DSO shedding concepts usually strive for shedding only load branches in case of low frequency, FCR providing units might also be affected, resulting in a loss of FCR capacity. Thus, close cooperation with respective DSOs will be needed.

Regarding Article 3.3:

Categorization into LER or non-LER:

The SO GL introduces the categorization of FCR providing groups or units in “LER” (for Limited Energy Reservoir) and “Non-LER”;

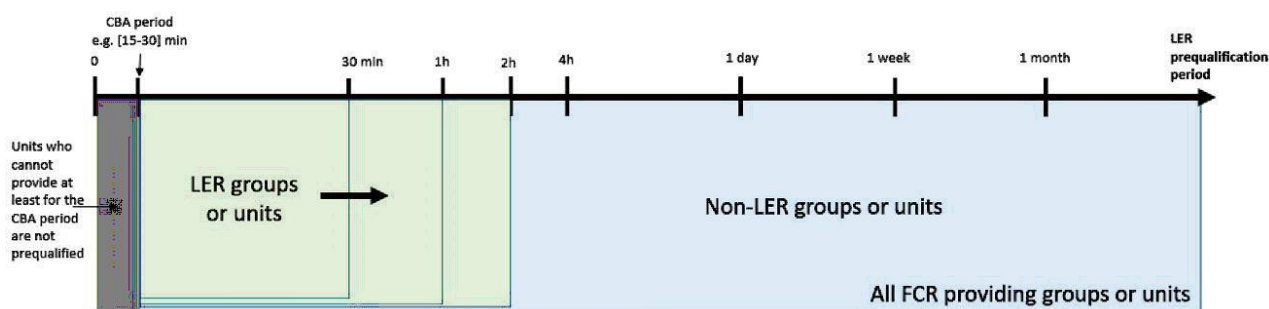
For LER providing units or groups **only**, when the reservoir is exhausted, it is admitted by SO GL to stop FCR provision after entering into alert state but not before a certain period of time between 15 minutes and 30 minutes has passed. The minimum period of time will be determined according to the CBA methodology pursuant to article 156(6) of the SO GL.

On the contrary, the “non-LER” FCR providing units or groups shall always be capable of providing FCR continuously (meaning for an indefinite period of time), regardless of the system state in respect to article 156(7) of the SO GL.

From a technical point of view, even e.g. big hydro storage power plants have a “limited” energy reservoir and, although they could continuously provide FCR for days or months, they might not necessarily be treated as LER.

TSOs, therefore, decided to differentiate between “LER” and “non-LER”, based on the definition of a minimum period of full continuous FCR provision to be applied for the categorization between “LER” and “non-LER” FCR providing groups or units. This minimum period is called “LER prequalification period”.

As illustrated in the following figure, depending on the LER prequalification period definition, it is well understood that the amount of FCR providing groups or units categorized as LER units will differ:



46

47 The longer the LER prequalification period, the higher the share of LER groups or units TSOs will have to
48 satisfy the FCR dimensioning volume.

49 Since the obligation for LER groups or units to provide full FCR in alert state is weaker compared to non-
50 LER groups or units, there is a risk for the system of providing a LER definition which would imply a
51 higher share of LER groups or units. To cover this risk, TSOs consider that the LER prequalification period
52 should be defined as the shortest period possible.

53 On the other hand, it is acknowledged by the TSOs that, in order to guarantee full activation of FCR
54 regardless to the system state, the LER prequalification period shall be long enough to cover the lead time
55 needed for the BSP to perform an energy reservoir management according to its local terms and conditions.
56 By local terms and conditions, TSOs refer to any local process which might play a role in the energy
57 reservoir management strategy of the BSP, such as local market rules, local scheduling rules, local FCR
58 obligations transfer rules and/or local compensation and back-up rules. Indeed, the LER prequalification
59 period shall be long enough to cover the time period (including any lead time) for which a BSP no longer
60 has the capability to perform any energy reservoir management action (e.g. time period for which a loss of
61 FCR provision cannot be compensated by the BSP).

62 Considering all local conditions in the Synchronous Area of Continental Europe, the maximum time period
63 for which a BSP cannot compensate its FCR exhaustion by means of the energy market or shift FCR in
64 accordance to article 156(6) of SO GL is **2 hours** (e.g. in case of 1-hour market period with 1-hour lead
65 time).

66 This **2-hour period** is based on the same considerations as the **2-hour period** in article 156(13) of SO GL as
67 the maximum admitted time period (for Synchronous Area Continental Europe) for reservoir recovery in case
68 of exhaustion after an alert state for an LER FCR providing group or unit.

69 By setting a LER prequalification period, TSOs consider all BSPs in Synchronous Area Continental Europe,
70 based on their local terms and conditions, shall always be capable of guaranteeing continuous FCR provision
71 for **non-LER** FCR providing groups or units, regardless of the system state.

72 This definition is fully in line with the CBA methodology assessment pursuant to article 156(11) of the SO
73 GL for which the risk of FCR exhaustion for the Synchronous Area is assessed, considering non-LER FCR
74 providing groups and units are always available, regardless of the system state.

75 For the sake of clarity, a conventional unit without any specific constraint of reservoir such as a thermal unit
76 shall never fail the 2 hours of full FCR provision prequalification criteria (because of depletion of reservoir).
77 Therefore, such conventional units shall never be categorized as LER under this definition.

78 The fulfilment of the time period of 2 hours is considered as a common prequalification requirement. It shall
79 be proven by the FCR providing unit or group that the capacity of its energy reservoir is sufficient to allow
80 the full activation of FCR in both positive and negative direction. The capability is only achieved if there is
81 at least one energy reservoir storage level where a full activation for the LER prequalification period is

82 possible in either positive or negative direction. The positive effect of an energy reservoir management shall
 83 not be considered during the classification of LER or non-LER.

84 The following figure illustrates two examples of the requirements applicable in case of a FCR providing unit
 85 or group composed of both limited and unlimited energy reservoir technical entities, alternatively deemed as
 86 non-LER or LER in accordance with Articles 156(7) and (8) of SO GL. Common assumptions for both
 87 configurations are (top vs. bottom of the figure): same overall FCR provision volumes, rated
 88 power/technology of each technical entity and the state of charge of a limited energy reservoir technical entity
 89 at the beginning of the timeframe. The FCR provision splitting between technical entities and, subsequently,
 90 the minimum reserved FCR margin on the unlimited energy reservoir technical entity alter the classification
 91 of the FCR providing unit or group.

Examples of FCR provision splitting between technical entities

LER FCR dynamic support to conventional units	Total FCR provision	FCR provision distribution at steady state (e.g. >30seconds)	Technical entities duty	SOGL classification	Additional prescriptions to LER as a whole
	≥100%	100%	Full activation at steady state	Art.156(7) "unlimited"	<ul style="list-style-type: none"> •No normal state obligations •No time period
		0%	Compensating non LER dynamics only (no activation at steady state)		
Full FCR provision by LER	Total FCR provision	FCR provision distribution at steady state (e.g. >30seconds)	Technical entities duty	SOGL classification	Additional prescriptions to LER as a whole
	≥25%	0%	Continuous activation in normal state only	Art.156(8) "limited"	<ul style="list-style-type: none"> • shifting provision in normal state + "1,25:1,00" or equivalent solution •Time period
		100%	Full FCR activation at steady state		

Examples: FCR provision distribution supposed against a 200 mHz frequency deviation

5

92
 93 On the basis of the configuration shown at the top of the figure, the limited energy reservoir technical entity
 94 (Battery Energy Storage System, BESS) is in charge of compensating, fully or partially, the FCR dynamic
 95 activation of its coupled thermolectric generator. This activation is generally performed during frequency
 96 transients and it is completely substituted by the conventional generator full activation at regime. Since, e.g.
 97 for prolonged a frequency deviation, the entire FCR provision is reserved on the latter, the FCR providing
 98 unit or group is not classified as LER in accordance with Article 156(7) of SO GL. The BESS system shall
 99 only ensure its availability in order to uphold the dynamics of the provision, and not "the energy content" of
 100 the FCR provision.

101 According to the configuration shown at the bottom of the figure instead, the limited energy reservoir
 102 technical entity (BESS) supplies the entire FCR provision of the FCR providing unit. Since the conventional
 103 group reserves an FCR margin smaller than the total FCR provision (<100%), this configuration limits the
 104 FCR providing unit capability in case of a full activation for the adopted timeframe (under the assumption of
 105 a given state of charge).

106 The FCR providing unit is then classified as LER in accordance with Article 156(8) of SO GL.

107 Article 156 (9), (10) and (11) of SO GL apply to FCR providing units or groups and, in accordance with
 108 Article 156(8), the limited energy reservoir technical entity (BESS) shall activate its FCR for as long as the

109 frequency deviation persists, unless its energy reservoir is exhausted in either the positive or negative
 110 direction. In this example, an FCR margin, equal to or greater than 25% of the provision, shall be reserved
 111 on the conventional group so as to guarantee a continuous FCR providing unit activation in normal state and,
 112 in accordance with Article 156(8), as long as available.

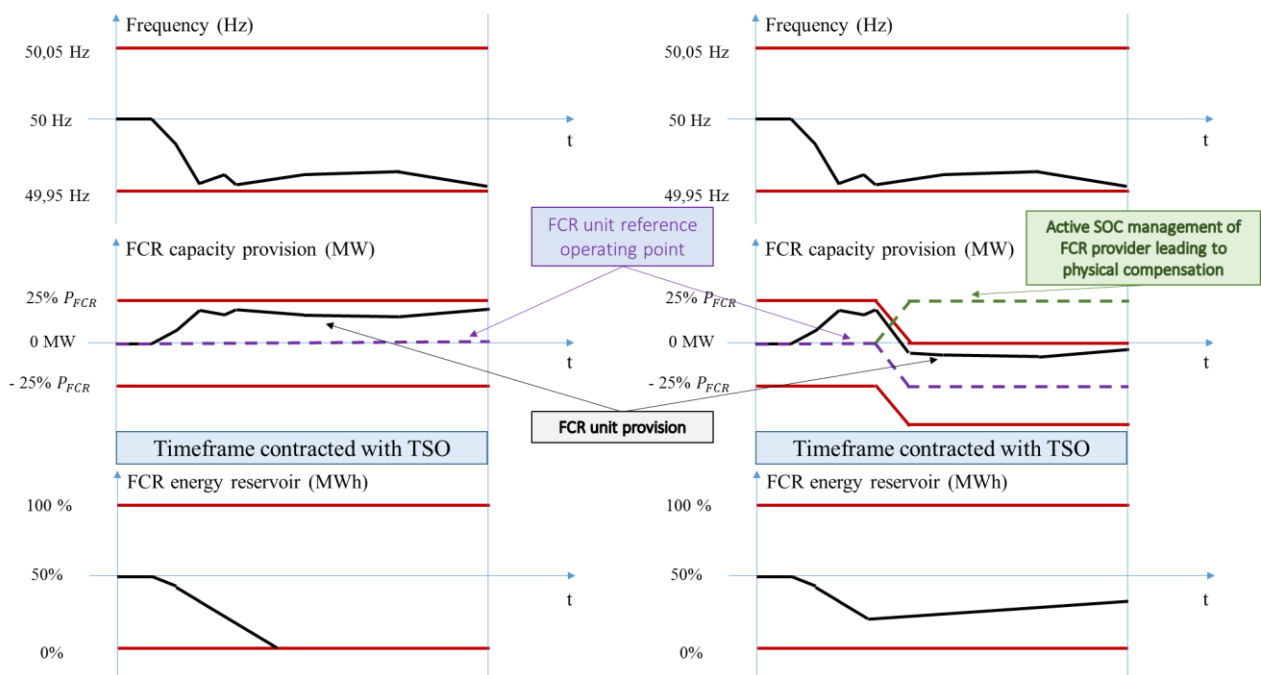
113 Further Prequalification Requirements for LER units:

114 FCR providing units with limited energy reservoir bear in general the risk of losing effective FCR capacity
 115 in case of longer lasting deviations of system frequency due to empty reservoirs. Thus, a charging concept
 116 based on a defined energy exchange with the grid (energy reservoir management) for such units is essential
 117 to guarantee an appropriate activation, particularly in stressed system states. In exceptional cases where a
 118 FCR providing unit or group is not technically able to implement energy reservoir management (e.g. hydro
 119 power plants), or a FCR provider chooses not to implement energy reservoir management, the respective
 120 FCR provider shall be able to compensate a possible lack of energy and, hence, a lack of FCR provision, by
 121 shifting FCR activation to available providing groups or units.

122 Normal state with frequency deviations larger than +/-50 mHz implies an energy depletion with a possible
 123 impact on the energy availability for the alert state. FCR providers shall consider these frequency deviations
 124 before entering into alert state to comply with the minimum activation period in accordance with Article
 125 156(9).

126 Since normal state includes a constant frequency deviation of a maximum of 49.99 mHz, the energy
 127 reservoir may be depleted. The energy reservoir management for FCR providing units or groups with
 128 limited energy reservoir takes into account this scenario in order to guarantee continuous activation of FCR.
 129 Hence, an additional power dimensioning of 25% (50 mHz divided by 200 mHz) is required to allow
 130 continuous FCR provision while applying energy reservoir management. Nevertheless, this requirement is
 131 determined only for standalone operation of FCR providing units with limited energy reservoir, which
 132 means that operation is completely separated from other units that may provide energy reservoir
 133 management for this unit. The following figure illustrates the requirement for additional power
 134 dimensioning of 25%:

135



136

137

138 The figure illustrates the relationship between frequency deviation, FCR power provision and energy
 139 reservoir usage.

140 On the left side of the figure, a theoretical case of reservoir exhaustion without active energy reservoir
 141 management is presented during the timeframe contracted with TSO. The FCR unit reference operating
 142 point is used to represent the energy reservoir management strategy.

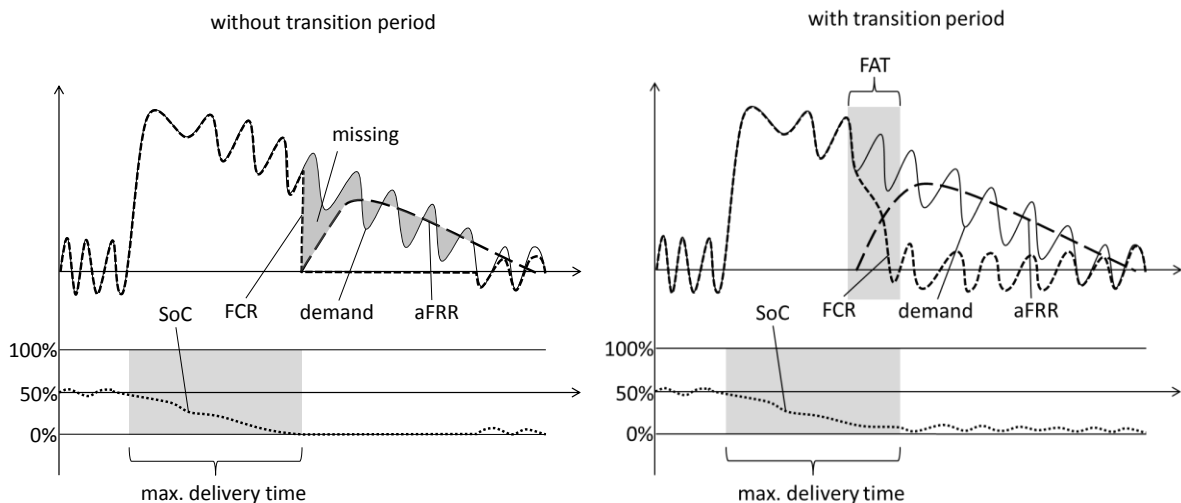
143 On the right side of the figure, the same case is presented applying a theoretical energy reservoir
 144 management strategy with physical compensation. It is shown that a shift of the reference operating point
 145 enables charging of the reservoir. After shifting the operating point to continue providing FCR up to
 146 200mHz frequency deviation, it can be understood that 125% (so additional 25%) of the FCR unit
 147 prequalified power might be reached.

148 If the energy reservoir management made use of over fulfilment of activation (e.g. when system frequency
 149 exceeds 50 Hz, energy intake is higher than required), possible negative impacts on system stability like
 150 power swings could occur. Thus, such an energy reservoir management is not allowed.

151 An energy reservoir management cannot prevent a full exhaustion of the energy reservoir in case of very
 152 long-lasting deviations in alert state. Therefore, the concept of the so called “Reserve Mode” has to be
 153 additionally adopted to achieve a deterministic and controllable behaviour of FCR providing groups and units,
 154 and to prevent them from provoking an arbitrary behaviour (e.g. sudden complete stop of activation) in such
 155 critical situations. Intention of the reserve mode is, therefore, the maximum possible prolongation of the
 156 stabilizing effect for the system, considering the existing limitations.

157 The idea of the Reserve Mode is to relieve FCR providing units with limited energy reservoir from the “mean
 158 deviation” of system frequency. By applying this approach, the availability of FCR providing units with
 159 limited energy reservoir can be prolonged (see also graph below) depending on the mean value of system
 160 frequency.

161



162

163

164 **Regarding Article 3.4:**

165

166 With respect to the particular importance of FCR for the system security, the appropriate activation of FCR,
 167 especially in extraordinary situations, (e.g. system split or outage of FCR components) are of utmost
 168 importance.

169 In the light of encouraged FCR market development, the needs of the respective market participants are taken
170 into account as far as possible. One of the requests of the market participants is the centralized control of
171 FCR, as well as centralized frequency measurement, in order to increase cost efficiency. Nevertheless,
172 compared to the current approach of on-site frequency measurement and fully autonomous activation of FCR,
173 central frequency measurement and central control bears the inherent risk of malfunction (in case of system
174 split) or loss of FCR capacity (outage of SCADA or communication). In general, a significant degradation of
175 system security compared to the current level of security is not acceptable.

176
177 Therefore, the respective requirements in this proposal take into account:

- 178 - The possibility of applying centralized frequency measurement and centralized operation of FCR, in
179 case the BSP can demonstrate that a complete decentralized solution or a decentralized fallback
180 procedure cannot be implemented with adequate efforts;
- 181 - The respective application of Article 154(4) of the SO GL, which includes requirements concerning
182 limitation of concentration of FCR with respect to single incidents.

183 In consequence, the total FCR operated by a single independent FCR controller is limited to 30 MW, in
184 particular with respect to incidents affecting e.g. the SCADA of the BSP. The BSP is allowed to operate
185 more than one independent FCR controller. In addition, and in order to prevent the effect of technical
186 malfunction of FCR provision by central control, the total FCR operated with central control and central
187 frequency measurement in a LFC block of a TSO is limited to 75 MW, so as to consider outages of a
188 telecommunication provider in the region of a TSO, which might offer its service to a number of BSPs.

189
190 FCR providing units and groups shall be based on local frequency measurement at least per connection
191 point, where the connection point is defined as the point of physical connection to the public grid. In special
192 cases where the FCR units or groups are connected in an industrial grid, the FCR units' local frequency
193 measurement shall be used. The justification for this requirement is the fact that FCR activation should be
194 based on the measurement of the local frequency to ensure proper activation, also in extraordinary
195 scenarios. From the technical side of the FCR providing unit, local frequency measurement is a natural
196 feature in most manufacturing technologies, both for synchronous units and for units with a non-
197 synchronous connection (through power electronics) to the system. This requirement has been already
198 applied in the past.

199
200 **Derogation and Development:**

201 Experiences with central frequency control will be shared during a period of 4 years after entry into force of
202 this Article by the reserve connecting TSO and evaluated by all TSOs. If the outcome proves that
203 centralized control of FCR providing groups can be as reliable and robust as a decentralized solution, the
204 joint TSOs may reconsider the preferred (decentralized) solution, either by extending the derogation period
205 or by allowing centralized control of FCR as an alternative solution under specific conditions. The
206 evolution and development of appliances controlled by BSPs on centralized principle might allow more
207 robust solutions during this derogation period.

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209 **Regarding Article 3.5:**

210 In emergency state, when the deviation of system frequency exceeds 200 mHz, the procured FCR are
211 exhausted by principle. To prevent a system collapse and a respective disconnection of all generating units
212 and demand facilities, the FCR providing units have to continue activation of the procured volume. This
213 concept has also been applied in the past.

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