European Network of Transmission System Operators for Electricity

entsoe

RESPONSE TO THE COMMENTS RECEIVED DURING THE PUBLIC CONSULTATION OF THE METHODOLOGY FOR PERFORMING THE PROBABILISTIC DIMENSIONING OF FCR IN CE SYNCHRONOUS AREA

Period of consultation: 15/05/2023- 15/06/2023 (found here)

From: Project Team Probabilistic approach for FCR dimensioning

CONTENTS

1. Background of the consultation

The possibility for TSOs of Continental Europe (CE) synchronous area to adopt a probabilistic approach in the definition of the requirements of Frequency Containment Reserve (FCR) derives from the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (SO GL).

Art. 153 (2)(c) of SO GL states that "for the CE and Nordic synchronous areas, all TSOs of […] shall have the right to define a probabilistic dimensioning approach for FCR taking into account the pattern of load, generation and inertia, including synthetic inertia […]".

All CE TSOs have prepared a methodological approach for the FCR probabilistic dimensioning which is comprised of two documents:

- A proposal for assumptions and methodology (where the key features of the approach are defined).
- An Explanatory note, where a detailed explanation of the dimensioning process and its input is provided.

The plenary of the Regional Group Continental Europe (RG CE) approved for consultation the approach on 14th February 2023.

The approach has been then publicly consulted between 15/05/2023 and 15/06/2023 (the consulted documents can be found here).

Four stakeholders provided their feedback to the consultation:

- EDF (Électricité de France).
- UFE (Union Française de l'Electricité).
- A provider of energy control services which requested its feedback to remain anonymous. According to stakeholder's request, feedback and TSOs' replies are presented in this document keeping the stakeholder's name confidential.
- EPRI (Electric Power Research Institute) which requested its feedback not to be published. According to stakeholder's request, the feedback is not presented in this document.

EDF and UFE have separately provided the same feedback.

Furthermore, NRAs provided the TSOs with a shadow opinion in response to the consulted documentation.

2. Individual comments and replies

#	Commenter	Type of comment	Comment and proposal	TSOs Reply	Accepted/Rejected/Clarified
1	Confidential	Technical/ clarification	Have the TSOs modelled the effect of large-scale Batteries with limited capacity to FCR?	LER are considered as an aggregate. Given a certain amount of FCR provided by LER (e.g., 1500 MW), the effect of LER is modelled by a single unit providing that amount of regulation capacity with a reservoir derived from the TminLER. The modelling of a variety of units/groups wouldn't have added significant precision to the results. With this approach, the LER effects (in terms of potential depletion) are considered with performances exactly deriving from the requirement on TminLER. Should a frequency deviation lead to a reservoir depletion, the equivalent aggregate LER would cease to provide primary regulation. In reality, there would be LER unit/group which over performed on the TminLER (depleting later) while other would underperform (depleting earlier on). To use a single equivalent LER having TLER=TminLER is a conservative but appropriate way to model LER response.	Clarified
2	Confidential	Technical/ clarification	Are TSOs considering demand *just* for thermal units? What if all FCR is being auctioned off to batteries which are empty/full after a certain amount of time? What is the TSO solution or this problem?	In the model is considered the coexistence of conventional FCR providers (i.e., thermal and hydro) and of limited energy reservoir providers (LER, which can be battery or other technology such as run-of-river hydro). The level of penetration of LER in the FCR procurement is one of the inputs to be considered (i.e., LER share). Among other things, the model is aimed at assessing the impact of LER presence (and their potential energy depletion) on the system. The theoretical condition of 100% LER in the FCR procurement can therefore be modelled if needed.	Clarified
3	EDF, UFE	General/ Technical	EDF welcomes this ENTSO-E consultation on the methodology for performing the probabilistic dimensioning of FCR in the Continental Europe synchronous area. EDF understands that the **probabilistic approach is being mandated by ACER**, notably in its Request for Amendments relating to the decision on Tmin LER. *(1)* Regarding Article 1, EDF suggests reminding **the definition of the FCR dimensioning** for the CE synchronous area, which is **the maximum value between the 3000 MW of the reference**	(1) TSOs are developing the probabilistic approach for FCR according to their right provided by Art. 153(2) of SO GL. (2) Acknowledged. The methodology is updated accordingly. (3) The objective of the proposal is presented in the "Whereas" section of the proposal at point 1.	(1) Clarified (2) Accepted (3) Clarified

			incident and the results of the 4probabilistic dimensioning approach, in accordance with Article 153(2)(a). *(2)* EDF also suggests **introducing in Article 1 that the objective of the proposal is to provide a probabilistic FCR dimensioning using a Probabilistic Simulation Mode**l, to make a clear link with Article 4(1). *(3)*		
4	EDF, UFE	Definitions	The **"LER" definition given in Article 2(a) is not consistent with the definition given in the document "Additional properties of FCR"**. The proposal states "time frame contracted by the TSO" whereas the currently existing definition in Article 3(5) states "FCR providing units or FCR providing groups are deemed as LER FCR Providing Units or LER FCR Providing Groups in case a full continuous activation for a period of 2 hours in either positive or negative direction". For instance, the provision timeframe is 4 hours for the FCR Cooperation. In addition, in the proposal the "LER" definition is used for units/groups and not only stock as stated in the current definition. *(1)* The "Market induced imbalances" term, defined in Article 2(c), is used only once in the proposal in Article 4 so EDF suggests removing the definition from Article 2 and including it directly in Article 4. *(2)* The **"Equivalent reservoir energy capacity" definition** given in Article 2(k) **needs to be clarified**. There is **no explanation regarding the factor 2 mentioned in the proposal** "[…] shall amount to twice the energy […]". EDF understands that the implied requirement to have twice the energy provided by the full activation of LER for the Time Period is related to a FCR provision both in positive and negative directions simultaneously. **This hypothesis should be reminded in Article 7.6**, as the FCR could also be provided in one direction only by the FCR providing units/groups. *(3)*	(1) The proposal has been amended with the same definition of Art. 3(5) of SAOA A2. (2) TSOs deem the current formulation the formally clearest. (3) The "Equivalent reservoir energy capacity" is the minimum capacity required for a LER to fulfill the requirement on the minimum activation time period (TminLER). To fulfill the requirements the reservoir shall have the energy capacity to provide full activation for TminLER minutes in both directions. E.g., if TminLER=15', a 1MW bidirectional LER shall have a reservoir with 0.5 MWh (0.25 MWh upward energy reserve and 0.25 MWh downward energy reserve). Such approach doesn't affect uni-directional LER. A LER providing only downward reserve will be required to have half the reservoir of a bi-directional LER. Such LER can deplete only in terms of a reservoir totally full. (4) The definition of RoCoF has been modified for clarity.	(1) Accepted (2) Rejected (3) Clarified (4) Accepted

			The **"Initial RoCoF" definition** given in Article 2(n) **is not precise** as it does not mention the need for measurement windows to be calculated. *(4)*		
5	EDF, UFE	Technical	EDF regrets the lack of explanation associated with the **choice to define a symmetrical value in MW as outcome** of the probabilistic methodology for FCR dimensioning. *(1)* For example, the proposal and the explanatory document **do not consider the possibility of a grid split** that could explain the definition of a symmetrical value, as it would lead to an excess of generation in one split area and a symmetrical lack of generation in another split area. EDF considers such an event as significant as the loss of the 2 most powerful units in the CE area, but it is not mentioned in the examples of imbalances. *(2)*	(1) TSOs' intent is to keep a symmetrical dimensioning for FCR, in line with the current deterministic approach. It is important to know that a change towards non symmetrical values would implicate major changes in all frequency control processes, market rules and IT tools. In any case, the methodology is flexible and can be used to find non symmetrical values. (2) The whole probabilistic approach excludes analyses regarding extreme events such as a system split. Furthermore, all data regarding such events occurred in the past are not considered (i.e., the df during split system are removed from the input dataset). The whole approach is based on a system in normal state or in alert state. The emergency state pertains to system defence plan. Furthermore, a split has always a local component, which cannot be predicted in advance and effects more the geographical distribution of FCR than the overall amount in CE SA.	(1) Rejected (2) Rejected
6	EDF, UFE	Technical	As a preliminary statement, EDF notes that the **proposal does not give much detail on the modelling compared to the explanatory document**. Perhaps some choices should be detailed in the proposal. For instance, it should at least be **clarified that the generated imbalances of DFD, LLFD or outage types can be additive**. *(1)* EDF reminds the improvement of the frequency stability since 2008. **EDF therefore supports** the information given in the explanatory document regarding **the increased weight given** in the model **to the most recent years**. However, EDF regrets that **there is no complete explanation available for the selection of the years**. *(2)* EDF reminds the TSOs position already expressed in the 2020 ENTSO-E report on deterministic frequency deviations (DFD). In the chapter 4.4.1 related to additional FCR as a solution to improve the frequency quality, it is clearly stated that the	(1) The level of detail of the proposal is chosen to fulfill the formal requirements of a legal document to be approved by NRAs. The three sources of power imbalance are added each other with the caveat that DFDs and LLFD are mutually exclusive: a DFD cannot be extracted in a minute where a LL is present. TSOs deem as appropriate to provide such level of detail in the explanatory document. (2) The selection of the years is biased towards the most recent ones by means of the exponential function: $p_y = \frac{1}{N_{years}} e^{-\frac{y - y\_current}{N_{years}}}$ (3) DFDs evolution in recent years is considered with the bias towards most recent years in the Monte Carlo selections. The possible further evolutions of DFDs in the next years will be considered by TSOs in the selection of the input to be used. TSOs remark that the consideration of DFDs in the FCR dimensioning is not aimed at tackling them by means of FCR but rather to take into account FCR activated during DFDs and the consequent reduction of available reserve to deal with other imbalances (e.g., due to outages). (4) The level of detail of the proposal is chosen to fulfill the formal requirements of legal a document to be approved by NRAs. In particular, the values of the parameters are voluntarily absent from the proposal in order to avoid the	(1) Clarified (2) Clarified (3) Clarified (4) Rejected (5) Clarified (6) Rejected (7) Rejected (8) Rejected

			significant increase of the FCR to limit DFD occurrence is not a sufficient mitigation and that the root cause of the problem is not properly addressed. **FCR increase cannot be the main driver to tackle the DFDs**. EDF believes that the introduction of 15 minutes dispatch will have a visible effect on the reduction of DFDs. Moreover, TSOs have identified several levers to mitigate the occurrences of DFD, so one can expect **the situation to be improved in the coming years. Therefore, the role of the simulated market induced imbalances in the dimensioning should be carefully assessed**. *(3)* In any case, **some precisions given in the explanatory document should be included in the proposal** as they are impactful, such as the choice to consider only the minutes [55, 05] in the historic data and the generation of imbalances considering only the similar days/hours patterns. *(4)* Concerning the proposal in Article 4(7), EDF requests additional details regarding the model defined to simulate the different LER units/groups. For example**, is every LER unit simulated or is an aggregated approach used?** This should be at least detailed in the explanatory document. EDF had expressed the same concern previously in the public consultation regarding the cost-benefit analysis of the Tmin, where the **hypothesis** taken by ENTSO-E **for the stock management led to a faster exhaustion in the model than in real conditions**. *(5)* EDF suggests to **consider as an additional imbalance the possibility of a reverse flow in HVDC line**, having in mind the recent Nordlink incident currently under investigation, where the active power flow reversed from 1.4 GW to -0.3 GW. A repeat event cannot be excluded with the on-going development of HVDC lines. For example, the Gascogne project between France and Spain, with two 1 GW cables in parallel, if an incident was to occur on one cable, it could lead to a reverse	need for the proposal to be approved again, should TSOs choose to change the parameterization in the future (e.g., for the DFDs minutes). (5) LER are considered as an aggregate. Given a certain amount of FCR provided by LER (e.g., 1500 MW), the effect of LER is modelled by a single unit providing that amount of regulation capacity with a reservoir derived from the TminLER. The modelling of a variety of units/groups wouldn't have added significant precision to the results. With this approach, the LER effects (in terms of potential depletion) are considered with performances exactly deriving from the requirement on TminLER. Should a frequency deviation lead to a reservoir depletion, the equivalent aggregate LER would cease to provide primary regulation. In reality, there would be LER unit/group which over performed on the TminLER (depleting later) while other would underperform (depleting earlier on). To use a single equivalent LER having TLER=TminLER is a conservative but appropriate way to model LER response. To consider that the majority of LER would over perform on TminLER requirement would be unrealistic and wouldn't be based on solid regulatory reasons. (6) Sudden loss of power on HVDC connections is considered as input of the Monte Carlo model. The power loss is calculated considering the power rating of the connection and estimating the actual flow from TYNDP data. The probability of occurrence of a failure on an HVDC connections is based on ENTSO-e statistics. The assumption is that an outage on an HVDC entails a power imbalance equal to the power flowing in the interconnection. The possibility of revers flow is not considered. TSOs remark that only HVDC connections connecting CE SA with other synchronous areas are considered. HVDC internal to CE SA (e.g., HVDC Italy-Greece) are not considered since their failure would lead to an imbalance between blocks but not a net power imbalance in the area. The effect on frequency is therefore neglected. (7) In TSOs view, the current high-level formulation presented in the proposal already allows to update the input dataset, should it be needed in the next years to model unforeseen events or situations. TSOs also remark that a major update of the hypotheses of the model would need to be approved by NRAs and that it would be impractical to include in the current proposal a clause covering generic future updates on the hypotheses. (8) Losses of lines internal to CE SA are not considered since their effects wouldn't be a net power imbalance on the whole SA but only a local imbalance. The effects on frequency deviation at SA level are negligible.	

			flow from +1 GW to −1 GW, so a 2 GW incident. *(6)* The likelihood of imbalances due to unforeseen events or situations encourages EDF to suggest including **a review clause in the proposal, to ensure an improvement of the hypothesis considered in the model if needed**. *(7)* Finally, **EDF regrets that the losses of "local" lines** within the area and the local consequences on the frequency **are not taken into account** by the model. *(8)*		
7	EDF, UFE	Technical	**EDF does not understand the definition of the critical condition given in Article 5(2)(b)**, which compares a frequency value (zenith or nadir) with a difference between 2 frequency values (Maximum transient frequency deviation), according to the definitions given in Article 2(l), (m) and (o). *(1)* EDF supports the **introduction of the precision** in the article **that the simulation is based on a calculation for every minute**. *(2)* It should also be **clarified that the "once in 20 years" criterion considers the notion of an event**, which is also to be defined in the proposal. In addition, the notion of an event is not clearly defined in the explanatory document, as it leaves room for interpretation regarding the meaning of "series" in "series of not acceptable minutes spaced each other not more than 15 minutes". *(3)* **EDF does not support critical condition** c) **on the topic of RoCof** as **increasing the FCR will have no direct impact on the inertia** of the system, except if it implies increasing the total amount of started synchronous machines. In that case, EDF reminds its position on the topic, if the grid requires more inertia, it should be provided via a remunerated product. *(4)*	(1) In the model, a module is dedicated to the calculation of the frequency peak (nadir/zenith) reached during the transient. Such calculation is performed for every minute, and it's based on a simplified algebraic approach. For every minute, the model check whether the nadir/zenith value exceeds a predefined threshold. If the zenith/nadir exceeds the threshold in the minute n, then a critical condition is detected in the minute n. Further details on this topic are added in the explanatory document. (2) The 1-minute discretization is already declared in Article 4(6): "*The time discretization adopted by the Probabilistic Simulation Process shall be 1-minute. Each variable shall thus be calculated on 1-minute basis*". (3) TSOs deem as appropriate to keep in the explanatory note the level of detail related to the notion of "event". (4) Article 153(2)(c) of SO GL explicitly provides that the probabilistic dimensioning approach can take into account inertia. An increase of FCR doesn't impact the amount of inertia but limits the zenith/nadir in a low inertia scenario. The frequency peak depends indeed on the inertia as well as on the available FCR and its deployment dynamics. To consider the inertia in the FCR dimensioning doesn't preclude the possibility to define a dedicated remunerated product. Such decision is however out of scope of the mandate of Article 153(2) SO GL.	(1) Clarified (2) Clarified (3) Rejected (4) Rejected

8	EDF, UFE	Technical	It is the understanding of EDF that **no imbalance due to forecast errors of the demand or renewable generation is used by the model**. However, it is expected that they will also have a large impact on the balance of the system in the mid to long term. Even though they are not considered in the coming years, the proposal should anticipate the opportunity to include them in the model. This could be done via a reference scenario or also via a random generation. *(1)* In addition, EDF suggests including precise requirements for the information shared by the CE TSOs as inputs to the probabilistic simulation model and the envisioned fallbacks if one or more TSOs does not share the needed data. *(2)*	(1) Errors in the forecasts of demand or renewables are imbalance to be managed by FRP/RRP, due to their typical timeframe. According to the LFC, the imbalance due to such forecast errors are expected to be covered by activation of FRR/RR. Nonetheless, it's possible that the FRP/RRP would partially fail in effectively compensate for these imbalances. In these conditions, the frequency deviation wouldn't be fully restored and a LLFD would be present. In this sense, the effects of forecast errors not correctly managed by FRP/RRP are indirectly covered by the use of historical LLFD as an input of the model. FCR would be admittedly involved as a response to sudden variations in the production of renewables (namely off-shore wind PPMs). Such variations are however mitigated at SA level by the wide geographic distribution of these plants. The effects of these variations on frequency are therefore considered in terms of outages of off-shore PPMs rather than in terms of forecasts error. (2) Please refer to the reply to comment #10.	(1) Rejected (2) Clarified
9	EDF, UFE	Technical	The approach taken in the explanatory document for the **dynamic simulation, based on an aggregated single-busbar model, is simplified. EDF promotes an approach with several areas** (for example considering Spain and Portugal as a peninsula, but also Italy or Turkey). EDF understands it would require additional input data but it could also allow to model local phenomena for the frequency and the ability to represent grid splits. *(1)* Regarding the item developed in **Article 7(6)**, EDF seeks for some **clarification of the definition of the stock**, to better understand its use in the model. *(2)*	(1) The approach on the dynamic calculations is simplified and based on an algebraic model. The need for this simplification is related to the very large number of simulations to be performed (one every minute of the year, for 200 simulated years) and to the consequent computational effort. The choice to adopt a single-busbar model is instead independent from the need for a simplified approach. Such model is adopted because the dynamic simulations are aimed at calculating the peak/nadir and the RoCoF at synchronous area level during frequency transient. The assumption is that the frequency is always the same all over the SA. To introduce a geographical differentiation of frequency (by considering a multi busbar model) would add a layer of complexity without adding a significant value to the results. The model is indeed not about inter-area oscillations or other local phenomena. Such phenomena could impact the security of the system (e.g., system split) but they're outside the scope of the FCR dimensioning (which is not about the system in emergency state). (2) Please refer to the reply on comment #4.	(1) Clarified (2) Clarified
10	EDF, UFE	General	EDF seeks some clarification for Article 8(2) to understand the governance considered here. **What is the organization chosen by the TSOs to perform the FCR calculation?** Who decides that	(1) TSOs will collectively perform the dimensioning following the agreed schedule. A permanent working group of the TSOs will have the mandate to perform the activities on behalf of all CE TSOs. Such working group will also have the mandate to monitor whether a re-run of the methodology is needed	(1) Clarified (2) Clarified/

			a recalculation is needed: at least one TSO, a majority of TSOs, NRAs? Who is responsible for collecting all useful data and running the model? If the operational procedures are to be detailed in SAFA, then it should be mentioned. *(1)* **What is the frequency of this calculation or what should trigger it?** The explanatory document is vague "The periodical re-calculation will take place depending on scenarios variability (e.g., every 1-2 years), and the input to be used will be updated accordingly." and the proposal does not tackle this subject. EDF supports a pre-established frequency of the calculation, as well as the possibility to run the calculation depending on the context. For instance, a mandatory recalculation after the shift to 15 minutes ISP, market time unit, etc should be scheduled. Additionally, it would be beneficial to clarify. *(2)* Finally, **EDF suggests including in Article 8(3) the possibility for a review clause** as previously mentioned. Which actors can trigger a review clause and initiate a new calculation with the model also needs to be clearly identified. *(3)*	outside the schedule because of significant change in the input (e.g., change in the frequency quality). Formal decision on a new dimensioned FCR will then be taken by plenary of RG CE. (2) The periodicity of the recalculation is two years. TSOs have also the right to re-run the methodology also outside of the scheduled 2-years periodicity, should they consider that the input data are significant changed since the last run. Clarifications on this topic are added in Article 8 of the proposal. (3) A permanent working group of TSOs will have the mandate to monitor whether a re-run of the methodology is needed outside the schedule because of significant change in the input. A clarification is now included in Article 8 of the proposal.	Accepted (3) Accepted
11	EDF, UFE	Technical	Regarding the model to calculate the dynamics of the frequency deviation in each minute presented in the explanatory document, EDF would like to be confirmed that the input data will be modified in the future iterations of the model, such as the self-regulation of the load D.	TSOs remark that all input are subject to be updated at each re-run of the methodology. The model is always based on the newest data from the TYNDP and takes future developments into account TSOs confirm that in the actual implementation of the simplified dynamic model the self-regulation of the load (D) is already present.	Clarified