All Continental Europe TSOs' proposal for the definition of a minimum activation time period required for LER to remain available during alert state in accordance with Article 156(11) of the SO GL

xx xxxx 2021

1. Contents

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2. Reference and Acronyms

CBA	Cost Benefit Analysis compliant with the requirements contained in Article 156(11) of Commission Regulation (EU) 2017/1485 of 2 August 2017
SA	Synchronous Area
CE	Continental Europe Synchronous Area
FCR	Frequency Containment Reserve
FRR	Frequency Restoration Reserve
LER	FCR providing unit or group with Limited Energy Reservoir
Non-LER	FCR providing unit or group without Limited Energy Reservoir
TminLER	As of triggering the alert state and during the alert state, minimum time for which each FCR provider shall ensure that its FCR providing units with limited energy reservoirs are able to fully activate FCR continuously
TLER	As of triggering the alert state and during the alert state, time for which a specific FCR provider is prequalified to ensure that its FCR providing units with limited energy reservoirs are able to fully activate FCR continuously. TLER shall be not shorter than TminLER.
LER15	LER having TLER = 15 minutes
LER30	LER having TLER = 30 minutes
SOC	State of Charge of LER
MaxSSdf	Maximum Steady State frequency deviation (0.2 Hz in CE)
LER depletion	Condition in which the energy reservoir of LER is not able to regulate because it's completely full or completely empty
LL	Long-lasting frequency deviation

[1] All Continental Europe and Nordic TSOs' proposal for assumptions and a Cost Benefit Analysis methodology in accordance with Article 156(11) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation.

[2] Explanatory document of the proposal for assumptions and methodology for a Cost Benefit Analysis (CBA) compliant with the requirements contained in Article 156(11) of Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation (System Operation Guideline Regulation – SOGR)

[3] COMMISSION REGULATION (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation.

[4] FCR provision by Limited Energy Reservoirs - Focus on approach and collection of inputs – Updated version (https://www.entsoe.eu/events/2019/11/15/webinar-on-cba-to-assess-the-time-period-required-for-fcr-with-limited-energy-reservoirs-lers/)

[5] All CE and Nordic TSOs' results of CBA in accordance with Art.156(11) of the Commission Regulation (EU) 2017/1485 of 2 August 2017

[6] All Continental Europe TSOs' proposal for the definition of a minimum activation time period required for FCR providing units or groups with limited energy reservoirs to remain available during alert state in accordance with Article 156(11) of the Commission Regulation (EU) 2017/1485 of 2 August 2017

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3. Background and introduction

This document is aiming at providing the technical background regarding the proposal all CE TSOs proposal for a minimum activation time period ([6]) in accordance with Article 156(11) of Commission Regulation 2017/1485 of 2 august 2017 establishing a guideline on electricity transmission system operation amended by Commission Implementing Regulation (EU) 2021/280 of 22 February 2021. The purpose of this document is therefore to explain all the analyses and considerations forming the rationale behind the proposal.

In March 2019 all TSOs of the CE and Nordic synchronous areas have submitted for regulatory approval assumptions and methodology for the CBA to be conducted, in order to assess the time period required for FCR providing units or groups with limited energy reservoirs to remain available during alert state.

All Nordic NRAs have approved the assumptions and methodology for the CBA on 16th April 2019, whereas all CE NRAs have given their approval on 7th October 2020.

The results of the CBA performed by TSOs according to the approved methodology have been publicly presented to all stakeholders through a public consultation.

Considering the results of the CBA and in order to address all comments received by stakeholders from the public consultation, the TSOs have decided to perform further analyses aiming at defining a minimum activation period (Time Period) and reviewing of the FCR procurement. The results of these analyses are presented in Section 4.

These analyses, together with the results of the CBA [5], are the rationale of the definition for TminLER. All these results are also the reason why TSOs are proposing the TminLER together with a review of the current way the FCR volume dimensioning is defined at synchronous are level. All these considerations are explained in 5.

According to the results of CBA and of the following further analyses, the presence of LER in the FCR provision lead to an increase in the cost that TSOs (and hence consumers) are expected to bear for FCR. Starting from this consideration, TSOs investigated also a possible model (Derating Factors) to partially charge LER of these costs with the aim of sharing the increased costs amongst all the involved parts. Such model is meant to be as fair as possible and to be based on numerical evidences of the different contribution that LER provide to system safety. The model is not part of the proposal presented in [6] and. for the different proposals that are presented in this explanatory document, it's meant to be adopted by each TSO on a voluntary basis, on a mandatory basis or to be not applicable. All the details about it are presented in Section 6.

4. Analyses of the effect of LER presence to the system safety

Model to assess the LER impact

The model proposed in the approved CBA methodology in accordance with Article 156(11) of SOGL assesses, through a Monte Carlo simulation, the contribution of LER in the provision of FCR. When a LER is not able to regulate anymore (because it is either full or empty), the FCR provided by LER is lost and the power imbalance previously covered by LER must be counteracted by non LER providers. The consequence is that – given the same power imbalance – the frequency deviation worsens (get farthest from 50 Hz).

Events of Long-Lasting unidirectional frequency deviation characterized by considerable frequency deviation (average frequency deviation equal or higher to 50 mHz) (LLs), such as the ones considered in the CBA, are the most impacting elements leading to the possibility of LER exhaustion. Subgroup System Frequency (SG SF) and Sub-Group Coordinated System Operation (CSO SG) have studied and proposed a set of measures aiming at:

- reducing the occurrence of LLs;
- identifying the presence of LLs;
- handling identified LLs to resolve them.

The purpose of these measures is to reduces the number of LLs and, when a LL nevertheless happens, to minimize its duration.
The measures that are already in place tend to be still not effective enough in the intervals at which LER exhaustion could take place.
For this reason, such measures have not been considered in the following analyses. If in the future these measures will show to be effective also on a shorter timeframe, their effects will be considered in the model, potentially resulting in a reduction of the addition FCR needed to deal with LER presence.

The worsening of the frequency deviation if the LER are depleted is a direct consequence of the possibility of LER depletion and cannot be avoided[1].
This worsening can be limited by an increase of the FCR above the standard dimensioned value (which is currently 3000 MW[2]). The FCR increase allows to reduce the FCR worsening thanks to the fact that:

- The regulating power of the system is increased: the same power imbalance gives place to a lower frequency deviation as FCR is fully deployed;
- The resulting smaller frequency deviation reduce the use of the energy reservoir of LER, thus delaying or even avoiding a depletion.

TSOs are then requested to define the maximum acceptable worsening of frequency deviation due to LER presence.

Several solutions are possible for this definition. TSOs will perform a more detailed analysis on this topic in a following implementation phase. It's worth highlighting that the specific selected criterion is not important

[1] The so called "Reserve mode" foreseen in SAFA A.2 Additional properties of FCR is not considered in these analyses because of the fact that they are not yet in place, also considering the fact that they are meant to be applied to new LER only. Furthermore, the "Reserve mode" does not prevent the LER to stop providing the bulk amount of FCR it's expected from them; it only foresees the LERs to keep a limited regulating capacity on the "fast" components of frequency deviation. The loss of the mean value should be taken over by FRR and such swap of regulation is not yet put in place.

[2] The FCR dimensioning is currently undergoing a probabilistic recalculation (according to Article 153(2)(c)).

for the following analyses and for the proposal itself. Different criteria would give place to safe curves which are quantitively different, but the qualitative considerations around these curves are nonetheless relevant.

Regardless of the criterion chosen to define the acceptability level of frequency worsening, the developed model would provide the minimum FCR required to fulfill such criterion. The amount of FCR required is provided for each:

- TLER: longer TLER are obtained with larger reservoir and hence with less probability that a depletion occurs;
- Specific share [MW] of LER in the FCR provision: the more LER are present in the provision, the higher is their effect as they deplete.

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LER impact assessment results

Assuming that only LER with a single specific TLER are present in the FCR provision (e.g., 15'), it's possible to calculate the required FCR with increasing amounts of LER. The resulting values can be mapped on a chart with share of LER on the y-axis and share of non-LER on x-axis[3] (Figure 1).

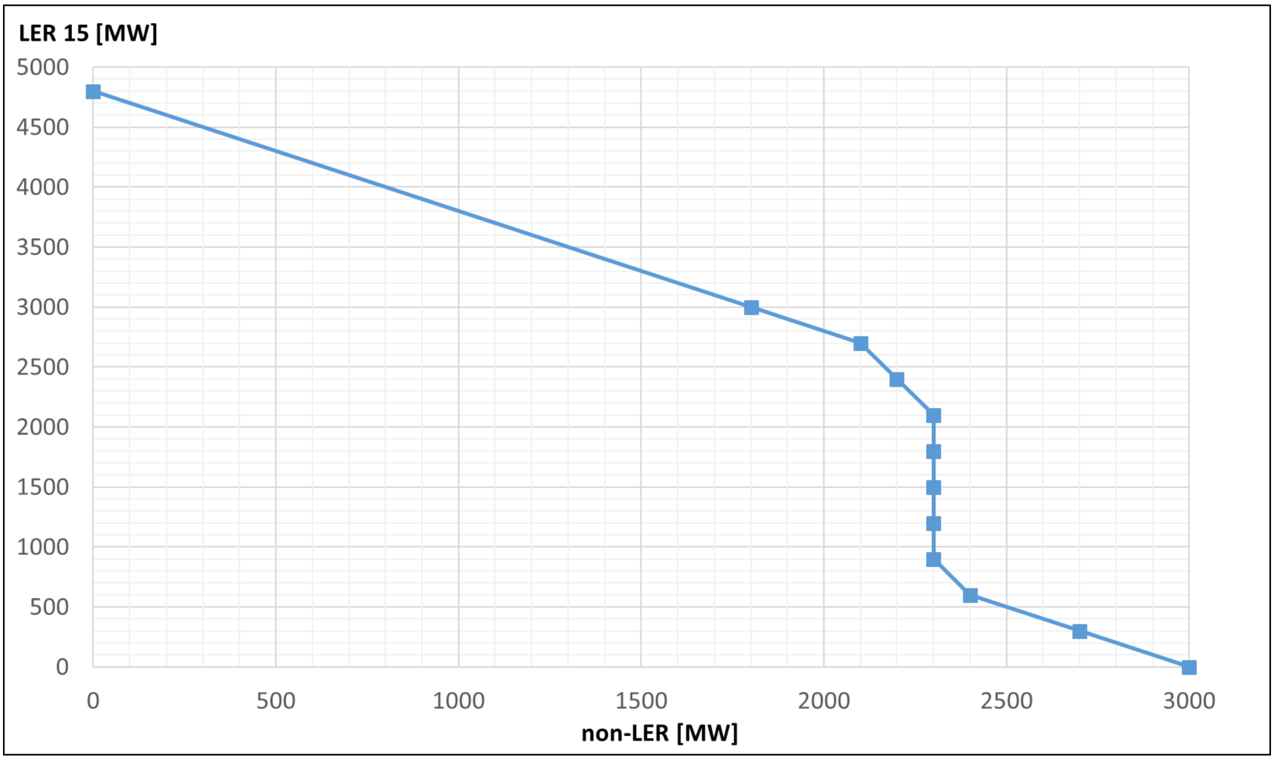

Figure 1: Example of a curve on non-LER vs LER15 plane.[4]

The non-LER vs LER15 plane shown in Figure 2 is a pure example of all the possible combinations of LER15 and non-LER share in the FCR provision. The curve defined with the model divides the combinations which fulfil the criterion on the maximum acceptable worsening of Δf due to LER (hereinafter referred to as "safe combinations") from the combinations not fulfilling the criterion (hereinafter referred to as "unsafe combinations").
Figure 2 (considering only LER having TLER = 15') and Figure 3 (considering only LER having TLER = 30') provide a visual clarification.

[3] The increased FCR dimensioning is meant to be provided by non-LER. Give a specific amount of LER in the provision, the non-LER amount is simply calculated as: increased FCR– LER amount.
[4] The presented curve (as well as the curves in the following figures) is calculated adopting an example criterion to define the acceptability of a LER/non-LER combinations. Such criterion is: "A combination is deemed as safe if the simulated frequency deviation calculated by the Monte Carlo model are always within a 40 mHz threshold with respect to the reference frequency deviation. The reference frequency deviation is the frequency deviation simulated by the model if no LER would be in the provision". In other words, this criterion defines as acceptable a worsening of frequency deviation due to LER presence up to 40 mHz.

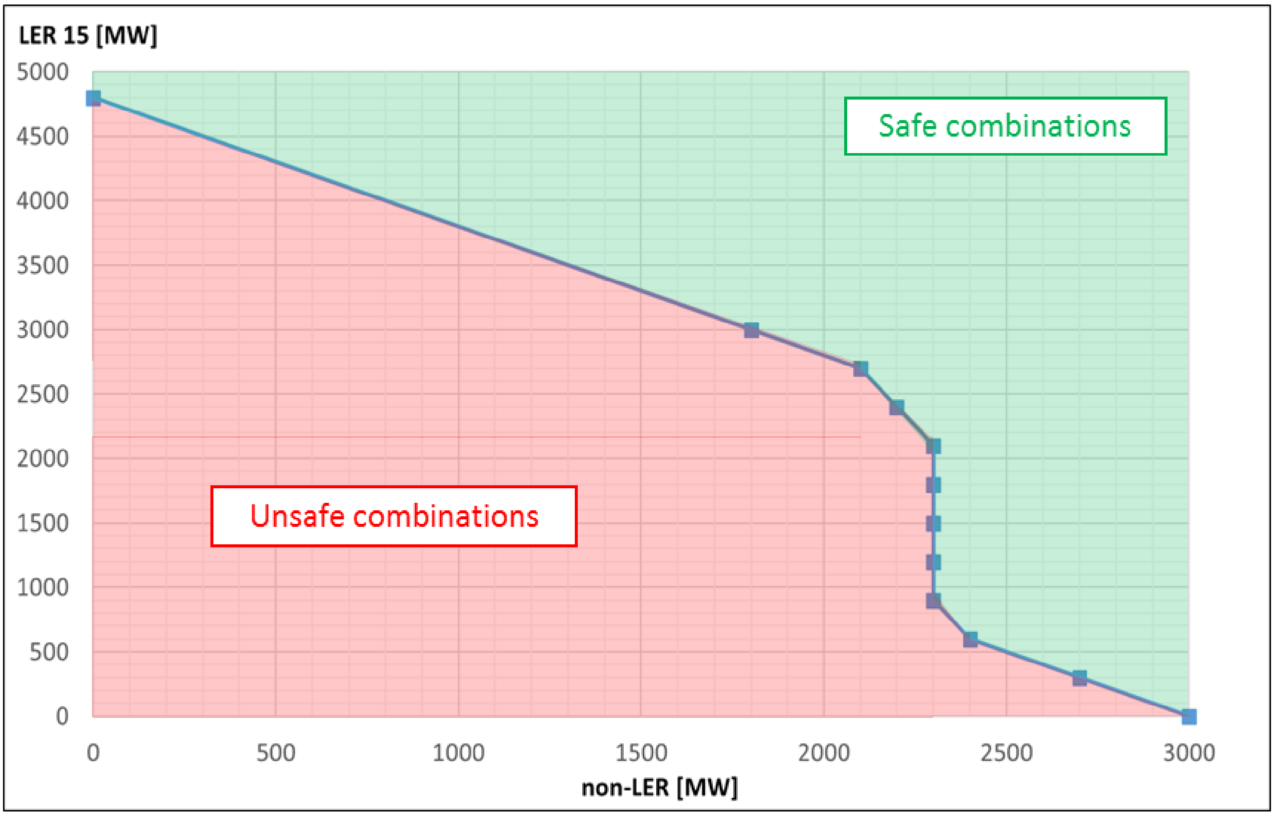

*Figure 2: Safe and unsafe combinations with TLER = 15' – **values are reported only as example***

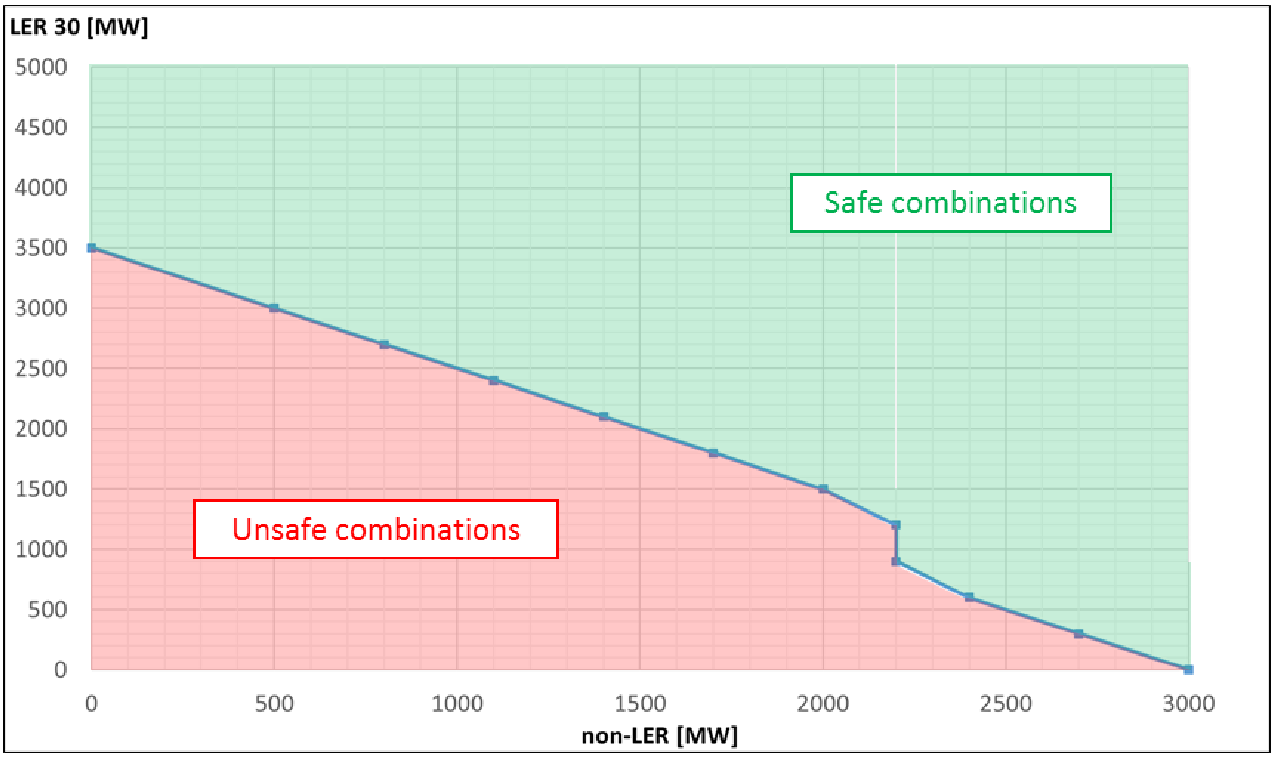

*Figure 3: Safe and unsafe combinations with TLER = 30' – **values are reported only as example***

The previous figures show how the presence of LER has a non-linear impact on the system safety.

Without any LER being present, the FCR required is obviously equal to the current requirement for FCR (3000 MW).
The LER penetration in the FCR provision doesn't impact the safety of the system as long as they remain below a certain threshold. In that interval the dimensioned FCR (3000 MW) is still sufficient to ensure system safety. It means that a MW of LER can equivalently substitute a MW of non-LER.

When LER penetration exceeds a specific threshold (which depends on the TLER of present LER and on the adopted criterion for the definition of the Δf worsening acceptability), the current FCR requirement of 3000 MW is not sufficient anymore to ensure the fulfillment of the adopted safety criterion on frequency deviation. To ensure that such criterion is fulfilled an additional amount of non-LER is required. The overall required FCR is indeed increased above 3000 MW. As shown under both examples presented in Figure 2 and Figure 3, when LER share is above 600 MW it is necessary to increase the overall FCR procurement. In fact, as LER share increases beyond 600 MW, the contribution of LER to system safety is very limited: a MW of LER substitutes only a small fraction of non-LER.

As LER penetration increases even more, the curves reach a value of FCR which is enough to ensure the safety regardless of how much LER is present in the FCR provision. With such FCR, the system can deal with any share of LER in the system (even 100% LER is sustainable).
For both the examples presented in Figure 2 and Figure 3, these FCR amounts are respectively 4800 MW (for TLER = 15') and 3500 MW (for TLER = 30').

A case in which LER having different TLER are simultaneously present has also been investigated. For the sake of simplicity only two different TLER are considered: 15 minutes and 30 minutes.
The analysis to assess the impact of LER in these conditions is similar to what is described in the single-product description. The main difference is that the combinations which can fulfill the FCR required amount are made of three products: non-LER, LER15 and LER30. Since the behavior of LER15 and LER30 are different when it comes to their depletion, a dedicated simulation is needed for all the possible combinations.

When only two products are considered (non-LER and LER), the possible combinations are mapped on a plane and the simulation model is able to draw the line separating the safe combinations from the unsafe ones. When three products are considered, the possible combinations need to be mapped on a 3-dimensional space. The simulation model is thus requested to draw the surface separating safe and unsafe combinations (hereinafter referred to as "safe surface"). An example of such 3-dimensional space of combination and of the calculated surface identifying the safe combinations is provided in Figure 4.

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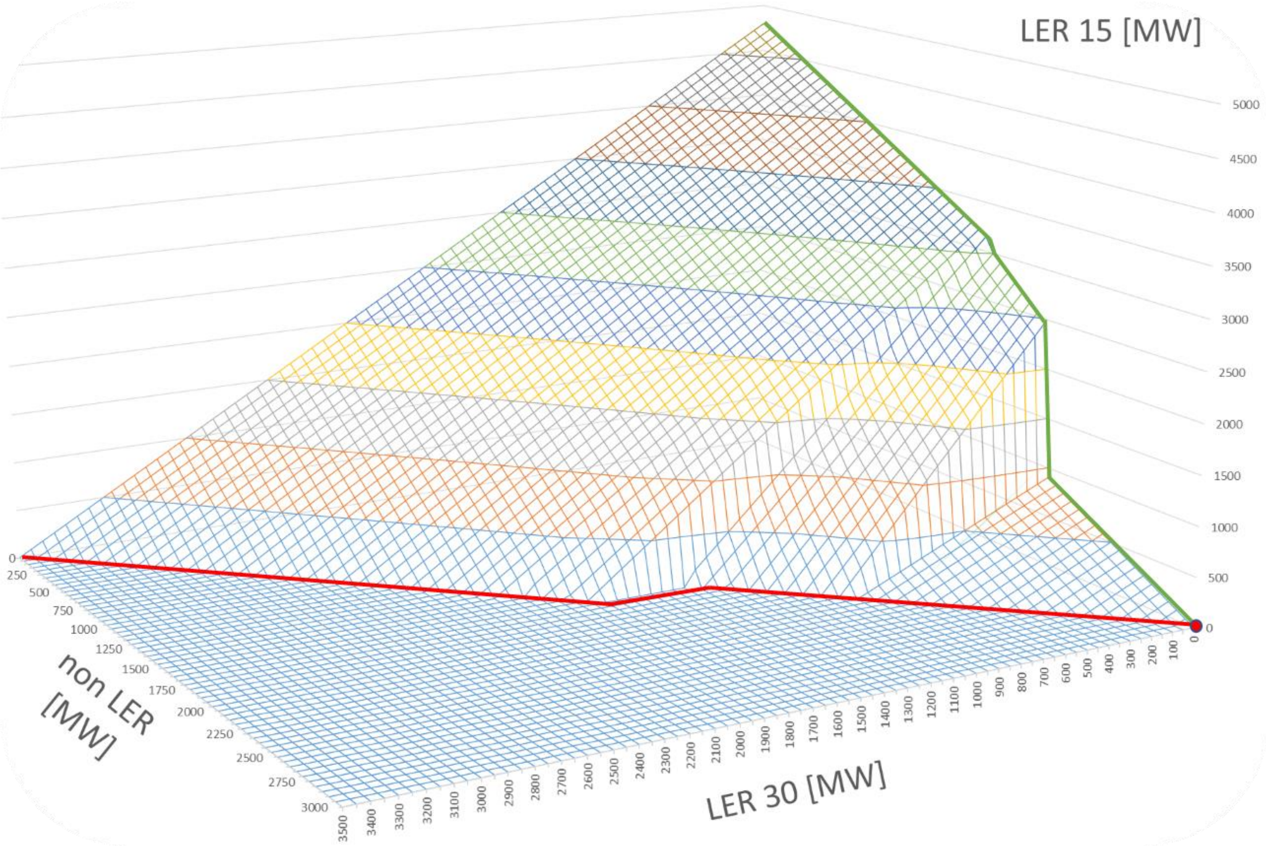

Figure 4:Example of safe surface in 3-dimensional space of products combinations (non-LER, LER15 and LER30)

The methodology for the calculation of the safe surface is similar to the methodology for the calculation of the safe curve with just two products: the possible combinations of LER15 and LER 30 are mapped with a specific granularity (e.g., 10 MW); for each of these mapped points the amount of FCR required to ensure the system safety (and thus the amount of requested non-LER) is calculated.
The safe surface in the Figure 4 is provided merely as an example of the general shape that such surface could have. Its points are indeed calculated with a simplified methodology: with a linear interpolation of correspondent points of the two safe curves (non-LER vs LER15 and non-LER vs LER30).

Current situation with prequalified LER

It can be useful to compare the presented example of safe curves with the current prequalified LER in CE. In 2020 a survey was carried out amongst all TSOs in order to provide a picture of how many LER are present in the system. According to the survey's results, the overall prequalified LER in CE are around 1126 MW.
Almost all the LER currently installed in CE are located in areas where the FCR is provided through the FCR Cooperation (Germany, France, Netherlands, Belgium, Switzerland, Denmark). It means that all of them participate in a single integrated market.

Not all prequalified LER are indeed expected to simultaneously provide FCR; their actual participation in the market depends on several factors such as:

- Opportunity-cost to provide FCR instead of other services (e.g., aFRR), if they are prequalified for them and in the specific areas where this is allowed;
- Non availability due to maintenance, out of services, etc.;

- For the hydro run-of-river, the availability of the primary energy source and the cost-opportunity to reduce energy production in order to sell FCR.

A preliminary survey amongst the TSOs where LER are installed has shown that the level of participation of LER in the FCR market is quite high for batteries (with electrochemical storage). A very rough indication could be that around 80% of prequalified LER are offered (and accepted) in the market. This participation is probably due to the high number of stand-alone batteries LER; such installations have the FCR provision as their main purpose. The provision of other services is thus limited and rarely more convenient than participation in FCR market.

Each TSO currently sets its own TminLER to the LER of its LFC Area/Block. For a majority of TSOs the current requirement is TminLER = 15'. Since TminLER = 30' used to be applied locally in Germany, many LER there are capable of meeting TminLER = 30'. To keep the analysis on the safe side, all the current prequalified LER are considered with TLER = 15'.

In case all these prequalified LER would enter in the provision of FCR, the current dimensioned value of FCR could not be sufficient to avoid the worsening of the frequency beyond the level deemed as acceptable because of LER depletion.

The actual risk – as well as the additional FCR required to mitigate such risk – is up to several factors such as the specific criterion for acceptability of frequency worsening and the actual amount of LER in the FCR provision.
However, taking into account all the previous considerations, TSOs deem the current situation to be relevant for the FCR dimensioning.

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5. Review of the FCR dimensioning

The results of the analyses presented in Section 4, show the challenges of integrating high share of LER in the FCR provision, keeping the current FCR dimensioning. Even the LER with longest possible duration (30 minutes, as provided in Art.156(11) of the SO Regulation) could pose a risk if their share is high enough.
The risk represented by LER could be however mitigated with an FCR volume increase above the current 3000 MW value.

As described in Section 4, the required FCR increase depends on the actual amount of LER in the FCR provision. The opportunity to require an FCR amount which could deal with any LER share is not applicable since it would entail an over dimensioning and an unacceptable cost increase for TSOs.
The FCR to be required at CE synchronous area level must therefore be dependent on the level of LER actually expected in the provision.
This means that a periodical update of the FCR dimensioning may be needed in order to recalculate the FCR volume required to ensure the safety of the system under a certain assumption of LER share in the FCR provision.

The details of such FCR dimensioning update mechanism will be defined at a later stage (according to Art.153(2) of the SO Regulation).
The key inputs of such mechanism will be:

- The criterion of acceptability of frequency worsening caused by LER;
- The expected amount of LER in the provision.

The first point will be the object of further studies and will be agreed by all the involved TSOs in the context of FCR dimensioning. The second point is the most challenging. The prequalified LER amount is a figure which could be easily considered as a first approximation of LER present in the provision of FCR. The real presence of LER in the market where LER is procured could however be less than the maximum theoretical value. This difference merits further investigations. The TSOs agree that a methodology to evaluate LER penetration in FCR provision will be identified. The methodology will take into account:

- The typical market behavior of LER;
- A reasonable safety margin (to consider also conditions with an unusual but possible participation of LER).

The recalculation of required FCR shall take place on a periodical basis. In defining the best interval between recalculations, several contrasting aspects need to be considered:

- A stable procurement mechanism is a goal for both FCR providers and TSOs. For each TSO, the recalculation of required FCR means to review all the internal procurement procedure. It has an impact on both TSOs providing FCR through a market mechanism and TSOs applying a mandatory scheme. Moreover, an increase in FCR implies the need to define the allocation of the increase on each LFC Block, with the consequent potential impact on the k-factors.

  The FCR recalculation should therefore take place as seldom as possible.
- On the other hand, the presence of LER in the provision could change quite rapidly due to technological progress and as a consequence of the FCR price evolution (for areas where FCR is procured through a market-based scheme).

The best solution in terms of update frequency of the FCR dimensioning will be defined in a subsequent implementation phase. It can however be already excluded the possibility of an update taking place at every market auction.

A peculiar challenge associated with the need of FCR dimensioning update is related to how the additional FCR due to LER presence is distributed amongst TSOs. This distribution criteria are important to define the share of economic burden to be borne by each TSO as a consequence of LER presence. However, it also impacts other aspects of the load frequency control scheme at synchronous area level. The k-factors assigned to each LFC Block are indeed derived from the FCR contribution which each TSO is requested to provide. As this contribution distribution changes, the k-factors need to be updated as well.

The distribution criteria for the additional FCR will be agreed by TSOs in a following implementation phase.

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6. Costs analysis and proposal for a LER remuneration reduction mechanism

Costs assumptions

The methodology to perform the CBA according to Art. 156(11) of SOGL [1] foresees a set of assumptions for the FCR cost evaluation. The actual application of such assumptions to perform the CBA itself has been described in [4].

The same assumptions and input information have been adopted to assess the impact of LER in the FCR provision according to the revision of the FCR dimensioning (5).

These costs assumptions can be summarized as follows:

- newly installed LER are considered with their long-run marginal costs.

  Even if LER are usually considered as price takers in the FCR market (thanks to their limited variable costs), considering their long run-marginal costs allows to identify the real market signals which incentivize/disincentivize the future installation of new LER;
- existing LER are considered with their short-run marginal costs (their investment costs are thus considered as sunk costs);
- Non-LER costs are based on their opportunity costs. Their FCR costs derive thus from the interaction between the energy marginal prices and their variable costs;
- A whole CE synchronous area single pool market is considered (no FCR import/export limitations are simulated).
- A yearly average market is considered (no hourly/seasonal differentiation);

For the newly installed LER, three costs scenarios have been investigated considering different evolution of investment costs (only for stand-alone batteries):

- Base scenario: based on long term marginal cost for benchmark units (technology/size/duration) which include all CAPEX and operative expenses over the lifetime of the investment, with 2020 as reference year and data from different sources (EASE; IRENA; LAZARD; U.S. EIA; U.S. DoE; ESG - PoliMI; Press releases…);
- Scenario A, based on average CAPEX projections to 2025 considering yearly average reference annual capital cost reduction rate from IRENA's "Electricity Storage and Renewables: Costs and Markets to 2030" (October 2017);
- Scenario B, based on Low (optimistic) CAPEX projections to 2025 calculated applying a cost reduction factor to the average CAPEX projections of around 30%, coming from the expected CAPEX range reported in different studies (IRENA, LAZARD, US DOE).

The resulting newly installed LER long-run marginal costs are shown in the following Table 1.

	Long-run marginal costs for TLER = 15 minutes	Long-run marginal costs for TLER = 30 minutes
Base scenario	7.86 €/MW(h)	9.39 €/MW(h)
Scenario A	6.05 €/MW(h)	7.25 €/MW(h)
Scenario B	4.58 €/MW(h)	5.52 €/MW(h)

Table 1: Assumptions on LER costs

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For all the costs assumptions regarding non-LER please refer to [4].

It is important to highlight that the results presented in the following are not intended to be considered as real simulations of any FCR market (e.g., on the FCR cooperation). Above all, not all the FCR in CE synchronous area is provided via market mechanisms (albeit LER are almost entirely located in areas with FCR markets). The assumptions previously described are then quite strong: while the real FCR markets see some hourly/daily/weekly/seasonal changes, the presented results refer to average yearly values.
Furthermore, in a real market the LER would be FCR price takers, since their variable costs are usually very low.

The purpose of the presented results is instead to provide possible scenarios about the evolution of LER presence in CE. Investors would be incentivized to install new LER as long as their investment could be paid off by the FCR price. The comparison between FCR marginal price and LER long-run marginal costs represents the main indicator of the potential viability of new LER installation. From this comparison it's possible to get an insight of the equilibrium in terms of installed LER and needed FCR increase towards which the system is going.
As further information, the TSOs costs are provided as well. This information is also intended as an indicative figure.

Costs assessment

The cost assessment has been performed considering the existing LER according to the survey performed amongst TSOs. In the same survey TSOs have also been asked to estimate the possible prequalified LER amount in their system if the existing plants changed their TLER (e.g., from the current 15 minutes to 30 minutes). In this estimate TSOs usually assume that the providers have to change the prequalified FCR to fulfil a different time period with same physical energy reservoir.

Based on the replies received from the TSOs it is possible to estimate the current maximum FCR which can be provided by LER with TLER = 15 minutes and TLER = 30 minutes. The results are roughly 1126 MW with 15 minutes and roughly 796 MW with 30 minutes.

Starting from these values of existing LER, it's possible to evaluate how the average costs of FCR would evolve if new LER were installed in the future. In this assessment, it shall be kept in mind that the introduction of new LER has a double effect: it can modify the FCR cost (becoming marginal or intramarginal), but it also forces TSOs to increase the required FCR amount.

The assessment is performed considering two distinct scenarios: a first one in which all existing and new LER have TLER = 15 minutes, and a second one where existing and new LER have TLER = 30 minutes.
The analysis has been carried out simulating different scenarios with a progressive installation of more and more LER. The results are summarised in Table 2.

	TLER [minutes]	New LER long-run marginal costs [€/MW(h)]	LER in FCR provision at the expected equilibrium [MW]	FCR required at the expected equilibrium [MW]	Costs for TSOs at the expected equilibrium [€/h]
Base scenario	15	7.86	1127 (Current value)	3500	23300

Scenario A	15	6.05	2700	4800	31900
Scenario B	15	4.58	2700	4800	31900
Base scenario	30	9.39	796 (Current value)	3100	20600
Scenario A	30	7.25	796 (Current value)	3100	20600
Scenario B	30	5.52	1500	3500	23300

Table 2: Results of costs assessment

Simulation with all LER having TLER = 15 minutes

The simulated increasing amount of LER and consequent increased need for FCR[5] are shown in Table 3.

Total LER15 [MW]	Newly installed LER15 [MW]	Existing LER15 [MW]	Required FCR [MW]
1200	73	1127	3500
1500	373	1127	3800
1800	673	1127	4100
2100	973	1127	4400
2400	1273	1127	4600
2700	1573	1127	4800

Table 3: Costs assessment - Simulated increased amounts of LER15

Figure 5 shows the results with the base scenario for LER long-run marginal cost (see Table 1). The figure is a composition of two charts: in the bottom chart the FCR marginal price are presented together with the LER marginal costs (long-run for new LER, short-run for the existing ones). In the top chart are shown the installed LER15, the existing LER15, the LER15 amount entering in the market (on price basis) and the total cost for TSOs (FCR marginal price * total required FCR).

[5] The criterion for defining the acceptability of a Δf worsening due to LER presence is the same used for Figure 1.

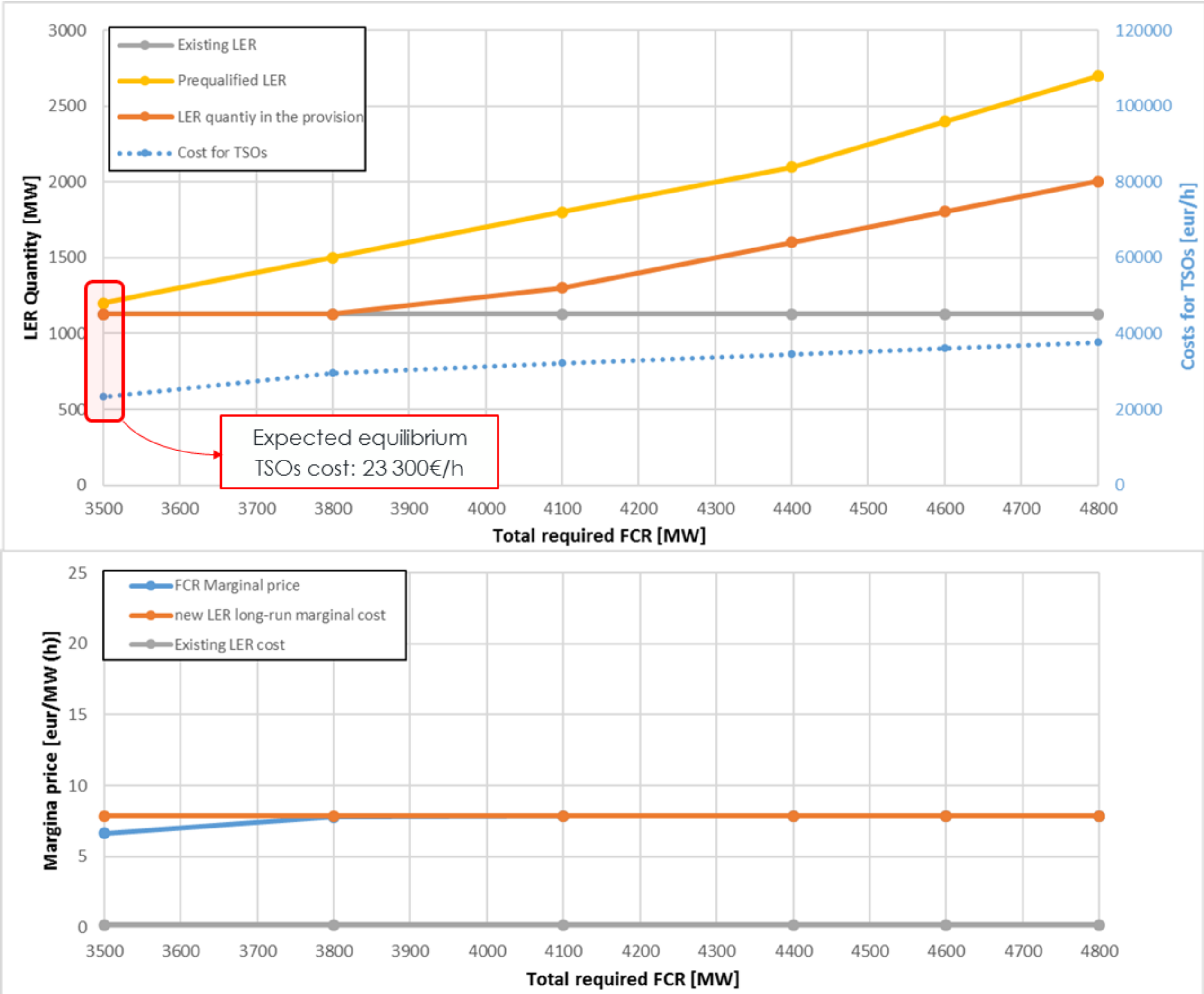

Figure 5: Example of possible expected LER penetration in the FCR provision in base scenario

In the upper chart it is possible to understand what happens when prequalified LER increase (yellow one). As they increase, it is necessary to also increase the total required FCR to be procured, in order to ensure the safety of the system.
However, the long-run marginal cost of LER is typically equal to or higher than the FCR marginal price (bottom chart), therefore only a small portion of prequalified LER enters the FCR market, and only when prequalified LER is higher than 1800 MW (well beyond today's numbers).

In the point closest to the current situation (1200 MW of LER15, 3500 MW of required FCR) the LER15 have a long-run marginal cost higher than the FCR marginal price. The total average costs for TSOs in that point would be around 23300 €/h.

The LER15 would become marginal only with further 300 MW of new installations, which would force TSOs to require a total amount of FCR equal to 3800 MW.
In such condition, the current situation is deemed as stable. Actual further LER investment in new LER15 are hindered by an FCR marginal price lower than LER15 long-run marginal cost.

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If the 3000 MW requirement is kept (implicitly accepting the reduced safety condition for the power system) the total costs for TSOs would be around 20000 €/h[6].

[6] The total TSOs' costs difference between the case with 3000 MW and the case with 3500 MW represents the increased cost associated with the restoration of the safe conditions if 1200 MW LER15 would be in the provision.

Figure 6 shows the results under scenario A (see Table 1) for LER long-run marginal cost.

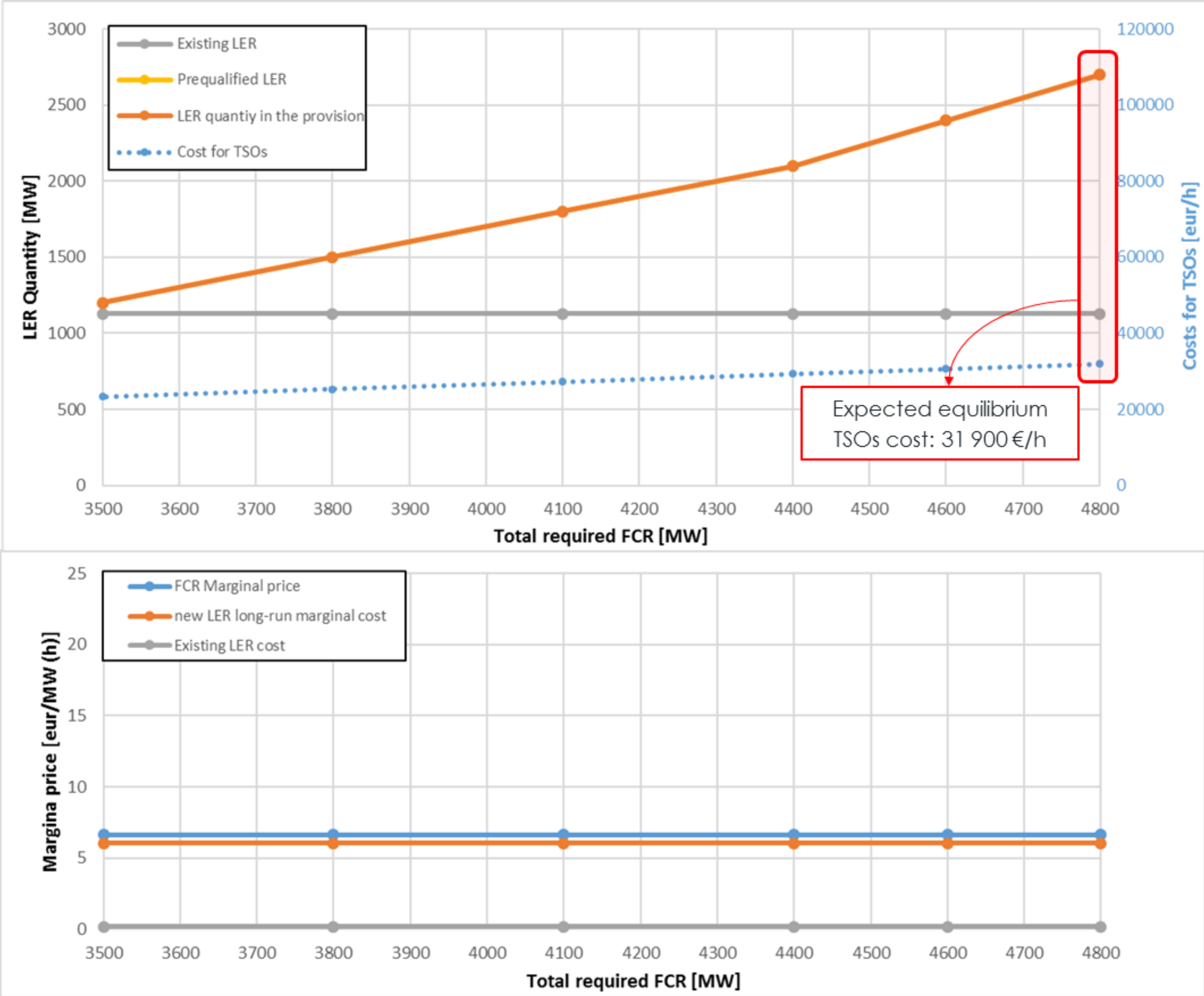

Figure 6: Example of possible expected LER penetration in the FCR provision in scenario A

The LER15 long-run marginal costs are below the FCR marginal price already in the point closest to the current situation (1200 MW of LER15, 3500 MW of required FCR). This would result in an incentive to investors to install new LER15. All the new installed LER15 would be accepted in the market thanks to their competitive cost. The continuous increase of LER15 in the provision of FCR would however force TSOs to gradually increase the required FCR up to its maximum value (4800 MW, where any amount of LER15 are acceptable). The latter condition can be considered as the final equilibrium.

The TSOs would therefore face a partial reduction of FCR marginal price[7] thanks to the presence of LER15, at the same time they have to increase the required FCR. The net impact of these two factors is an increase of costs for TSOs. The total costs at the final equilibrium is indeed 31900 €/h.

If the 3000 MW requirement is kept (implicitly accepting the reduced safety condition for the power system), the total costs for TSOs would be around 18150 €/h.

[7] In the simulation the FCR marginal price reduction is not present because of the fact that the non-LER marginal provider is the same.

Figure 7 shows the results under scenario B (see Table 1) for LER long-run marginal cost.

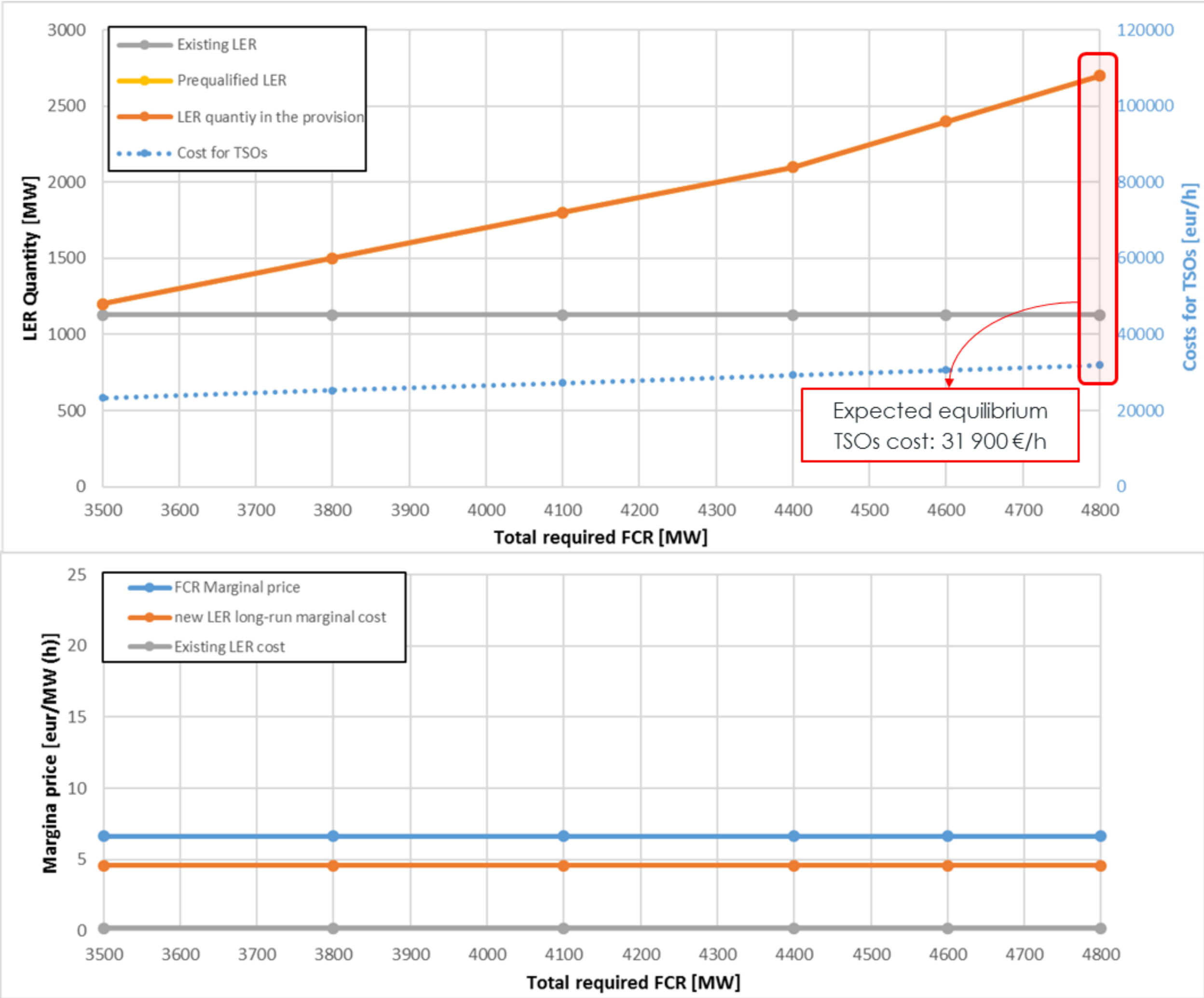

Figure 7: Example of possible expected LER penetration in the FCR provision in scenario B

The results are qualitatively the same as in scenario A.

If the 3000 MW requirement is kept, the total costs for TSOs would be around 13740 €/h.

Simulation with all LER having TLER = 30 minutes

The simulated increasing amount of LER and the consequent increased need for FCR are shown in Table 4.

Total LER30 [MW]	Newly installed LER30 [MW]	Existing LER30 [MW]	Required FCR [MW]
900	104	796	3100
1200	404	796	3400
1500	704	796	3500

Table 4: Costs assessment - Simulated increased amounts of LER30

Figure 5 shows the results under the base scenario for LER long-run marginal cost.

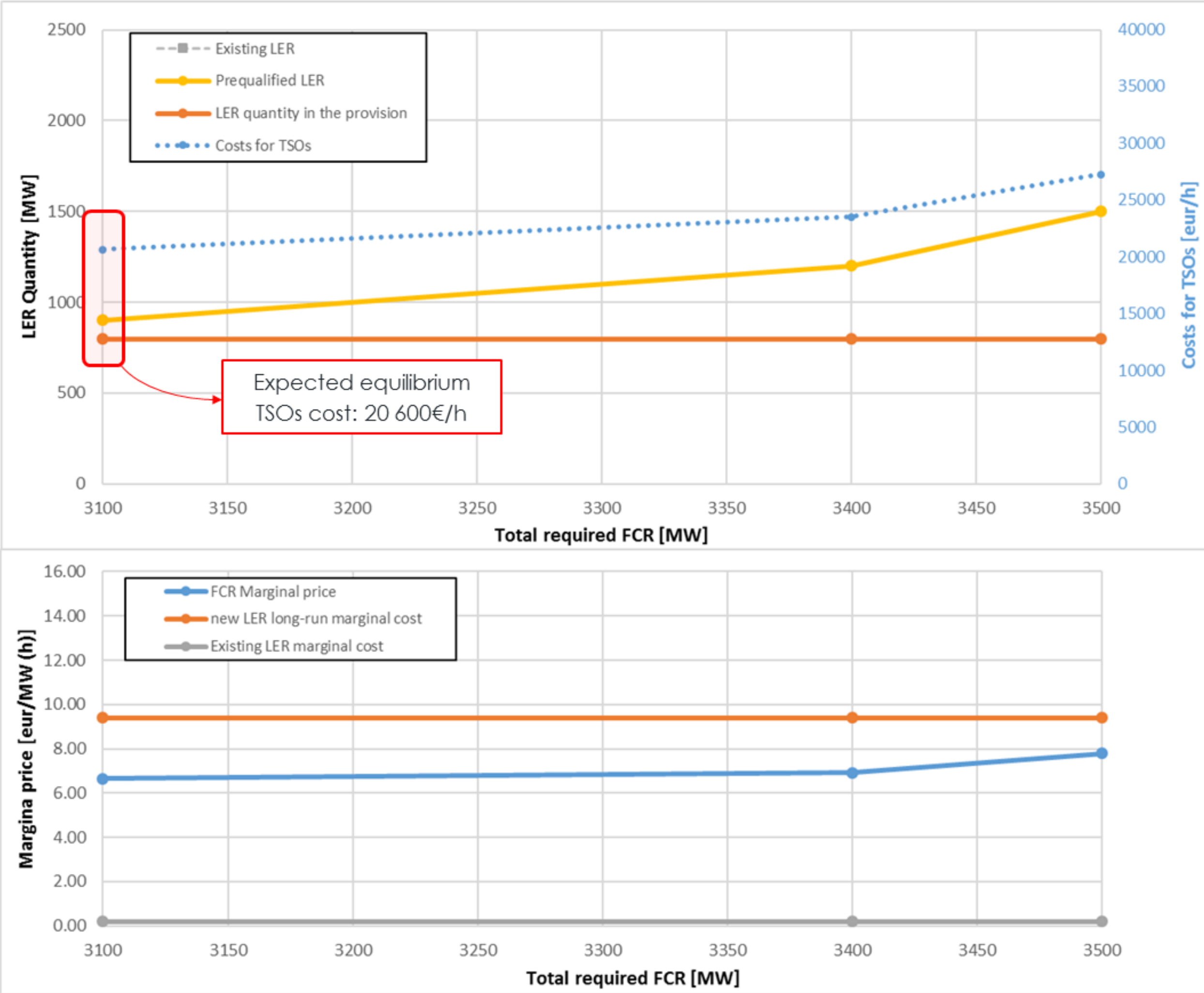

Figure 8: Example of possible expected LER penetration in the FCR provision in base scenario

In the point closest to the current situation (900 MW of LER30, 3100 MW of required FCR) the LER30 have a long-run marginal cost higher than the FCR marginal price. The total average costs for TSOs in that point would be around 20600 €/h. This situation is deemed as stable since further LER investment in new LER30 are hindered by a FCR marginal price lower than LER30 long-run marginal cost.

If the 3000 MW requirement is kept the total costs for TSOs would be around 20000 €/h

Figure 9 show the results under scenario A for LER long-run marginal cost.

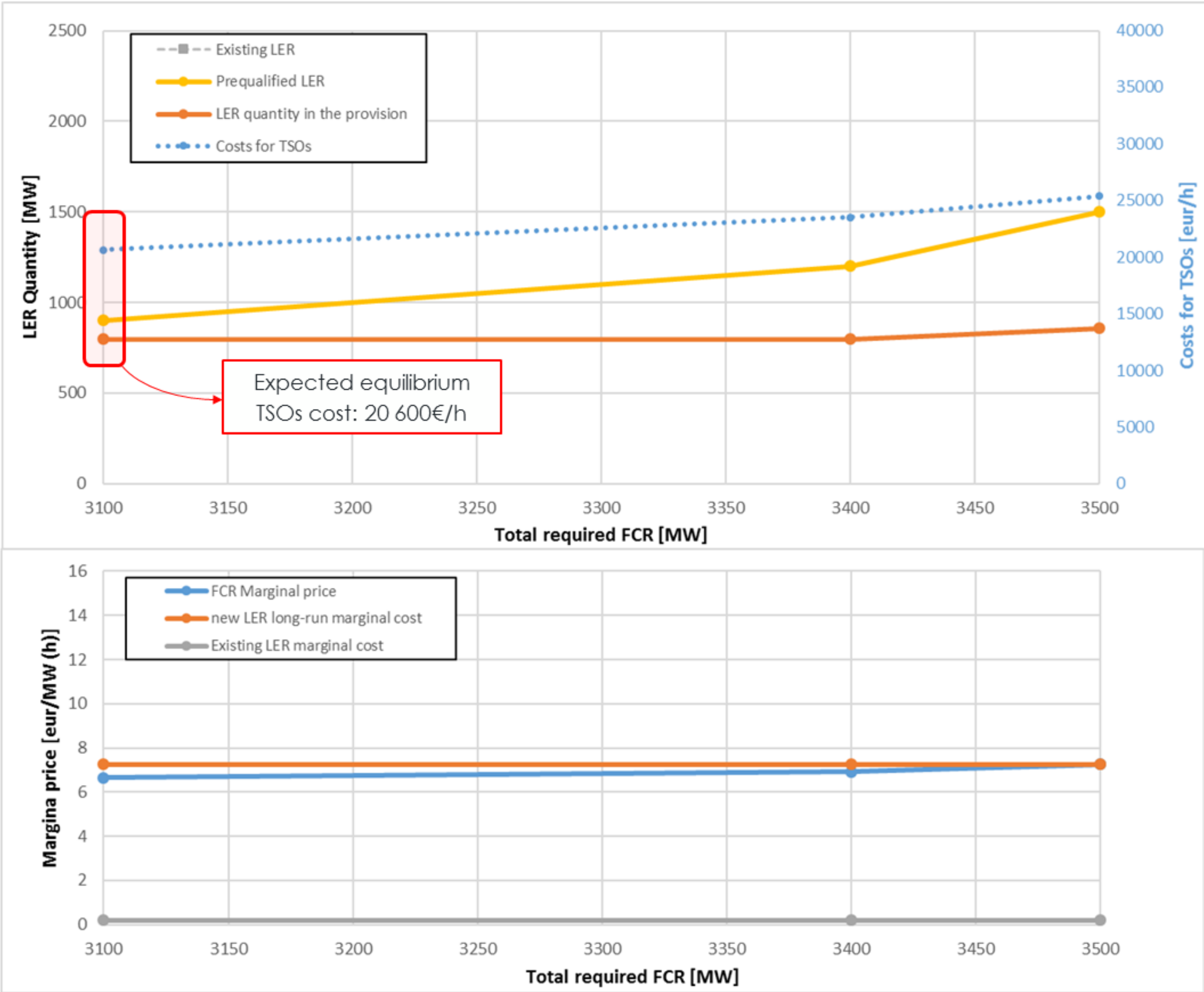

Figure 9: Example of possible expected LER penetration in the FCR provision in scenario A

In the point closest to the current situation (900 MW of LER15, 3100 MW of required FCR) the LER30 have a long-run marginal cost higher than the FCR marginal price. The total average costs for TSOs in that point would be around 20600 €/h.

The LER30 would become marginal only with further 400 MW of new installation, which would force TSOs to require a total amount of FCR equal to 3500 MW (at which level any amount of new LER30 would be acceptable).
The current situation is deemed as stable. Further investments in new LER30 are hindered by an FCR marginal price lower than LER30 long-run marginal cost.
If the 3000 MW requirement is kept the total costs for TSOs would be around 20000 €/h.
Figure 10 shows the results under scenario B for LER long-run marginal cost.

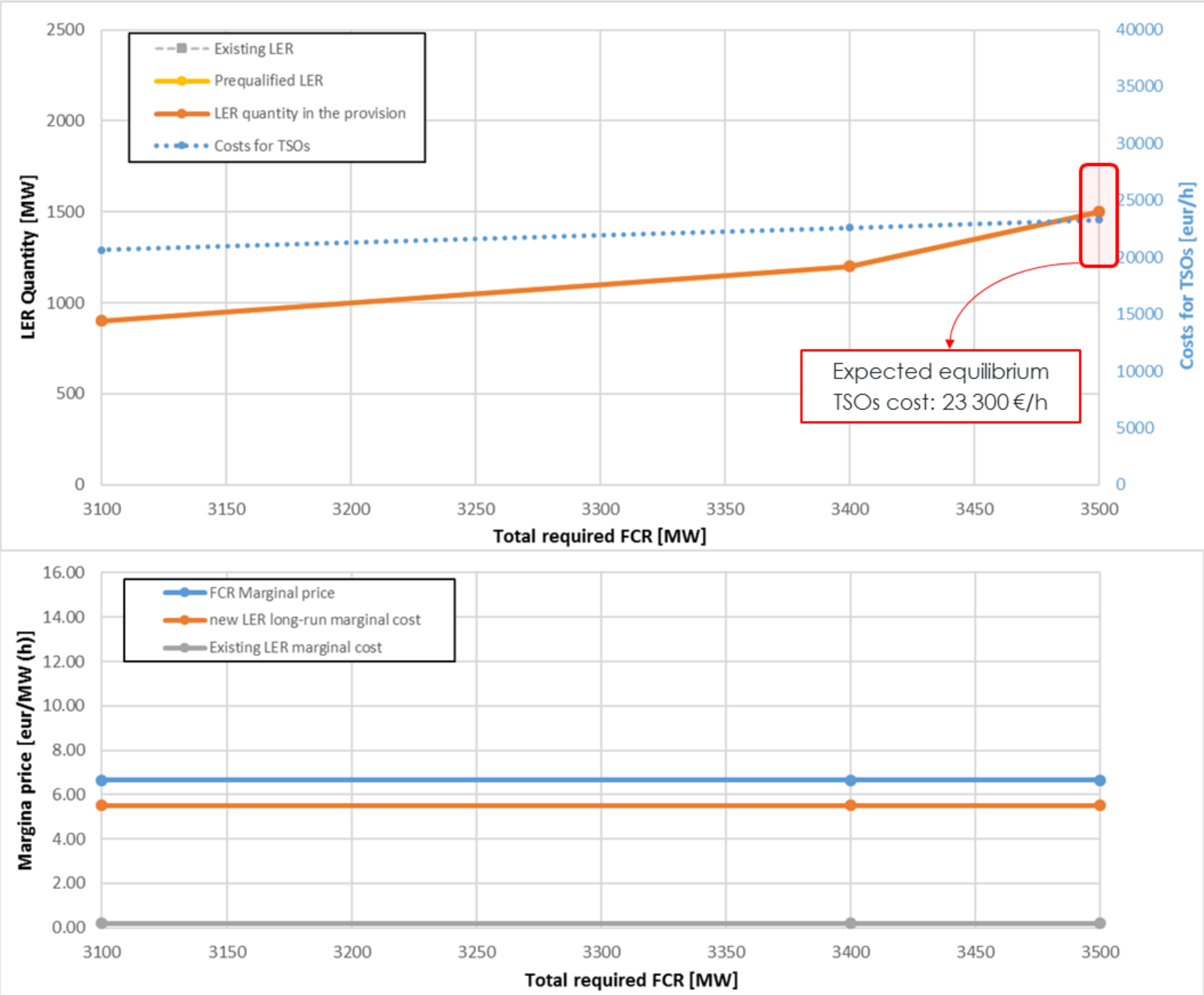

Figure 10: Example of possible expected LER penetration in the FCR provision in scenario B

The LER30 long-run marginal costs are already below the FCR marginal price in the point closest to the current situation (900 MW of LER30, 3100 MW of required FCR). This would result in an incentive to investors to install new LER30. All the new installed LER30 would be accepted in the market thanks to their competitive cost. The continuous increase of LER30 in the provision of FCR would however force TSOs to gradually increase the required FCR up to its maximum value (3500 MW, where any amount of LER30 are acceptable). The latter condition can be considered as the final equilibrium.

TSOs would therefore face a partial reduction of FCR marginal price thanks to the presence of LER30, at the same time they would have to increase the required FCR. The net impact of these two factors is an increase of costs for TSOs. The total costs at the final equilibrium is indeed 23300 €/h.

If the 3000 MW requirement is kept, the total costs for TSOs would be around 16560 €/h.

Explored proposal for a LER remuneration reduction

The cost assessment presented in Section 6, shows that the LER presence in the FCR provision can vary depending on the assumptions of the future evolution of LER investment costs. If these costs face a reduction, it is likely that LER will be widely installed in the system and that TSOs will have to cope with such installations, gradually increasing the required FCR. If this situation came true, the total costs for the procurement of FCR that TSOs had to pay would likely increase. In fact, new LER have a downward impact on FCR prices, however this is more than offset by higher volumes of FCR to be procured.

Even the current LER presence can cause an increase in FCR costs if all the prequalified LER were providing FCR. The TSOs would have to increase FCR dimensioning above the 3000 MW in order to deal with such level of LER.

While acknowledging the importance of the LER as a technology capable of providing FCR, the TSOs highlight how LER presence is substantially changing the way TSOs have to procure FCR. This change is associated with an increased cost to keep the system safety at the same level as it would be without the presence of LER.

TSOs explored the way how increase in costs could be shared by all involved parts: TSOs (on behalf of consumers) and LER owners. It must be also stressed that LER are not providing the power system with the same contribution as non-LER. While in normal condition their contribution is equal, LER performances in degraded frequency conditions is fundamentally different.

Events of frequency deviations lasting far more than the *time to restore frequency* are however possible. The experience has shown that - in an extremely complex system as CE - it is impossible to exclude a chain of events leading to long-lasting frequency deviations.

The main contributing factors to such events are usually related to malfunctioning of the aFRR mechanisms. The TSOs are putting in place several countermeasures to quickly identify, react to and solve problems related to FRR misbehaviour. In the short term however, these countermeasures are still not effective enough in the intervals at which LER exhaustion could take place.

It should also be underlined how, in extremely degraded grid conditions (e.g., system separation), a high share of FCR provided by LER is a potential source of further risk since it imposes stricter time constraints to TSOs to react in order to be able to restore the frequency. The loss of the LER contribution as a consequence of energy depletion could substantially worsen the already degraded system conditions. This further problem is not present under a scenario in which FCR is provided by non-LER alone, as in this case the TSOs could rely on a time-unlimited FCR provision.

For all these reasons, TSOs investigated a mechanism for introducing a differentiation in how LER are remunerated with respect to non-LER. The proposal only makes sense if applied to LER procured via remunerated schemes. TSOs adopting a mandatory FCR procurement without remuneration can't be affected by the proposed mechanism.

The LER remuneration reduction mechanism is based on the application of a Derating Factor (DF) to the paid FCR quantity. For LER, the mechanism introduces a differentiation between the FCR which is accepted on the market and that must be provided to the system ($FCR_{physical}$) and the FCR the LER are paid for ($FCR_{financial}$). The ratio between them is the derating factor:

$$FCR_{financial} = FCR_{physical} \cdot DF$$

$FCR_{physical}$ is the amount of FCR which is accepted by the market. The LER has to physically provide this FCR (at ±200 mHz, a LER shall thus provide $FCR_{physical}$). $FCR_{physical}$ is also the value considered by TSOs in fulfilling the required FCR.

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$FCR_{financial}$ is the amount of FCR actually paid to LER.

A DF is therefore a factor (≤ 1) reducing the remuneration of the LER. DFs need to reflect the different contribution to system safety which LER provide depending on their associated TLER when compared to non-LER (whose remuneration is not reduced). DFs calculation shall be as fair as possible, it needs therefore to properly consider:

- The different contribution provided by LER having TLER longer than TminLER (15 minutes): the longer the TLER, the higher the DF.
- The DFs shall reflect the increased costs borne by TSOs (and thus by consumers) as a consequence of the increased required FCR caused by LER. DFs shall be thus proportional to such increase. DFs will be therefore dependent on the amount of LER expected in the FCR provision. The more LER are in the FCR provision, the higher FCR must be required, causing different DFs.

TSOs stress that the intention behind the suggestion of exploring DFs' approach for LER technologies is not to hinder the further installation of LER nor to create a disguised limitation of the FCR share provided by LER.

The rationale behind exploring DFs is instead to check possible approaches to create a fairer competition between different FCR technologies (either LER or non-LER) and thus achieving the objective of system safety in an economically efficient way. This aim is pursued by introducing an objective criterion which reflects the actual different contribution that LER and non-LER provide to the system safety. Moreover, the economic burden related to FCR increase due to LER could be shared fairly between consumers and BSPs thanks to a well-defined DF.

The hypothesis is that DFs should be calculated using the same safe curves (Figure 2, Figure 3) and/or safe surface (Figure 4) used to calculate the FCR increase. The recalculation of the required FCR needed to deal with the expected LER amount in the provision and the calculation of the DFs should take place together.

An important input for the calculation of DFs is the evaluation of the expected LER in the FCR provision. The prequalified amount of LER represents an upper bound to the possible share of LER in the FCR provision.

Given a certain amount of LER in the FCR provision, the DF should be determined based on the maximum replacement ratio between LER and non-LER which would ensure the system safety, regardless of the LER penetration in FCR provision within the expected range.

A replacement ratio between LER and non-LER is the ratio at which LER should replace non-LER in the FCR provision in order to have LER/non-LER combinations keeping the system in safe conditions (i.e., resulting above the safe curve/surface).

Figure 11 provides a numerical example. Let's consider an expected amount of LER15 in the provision within the range 800-1100 MW (close to the current prequalified value) and a specific criterion for the acceptability level of frequency worsening[4].

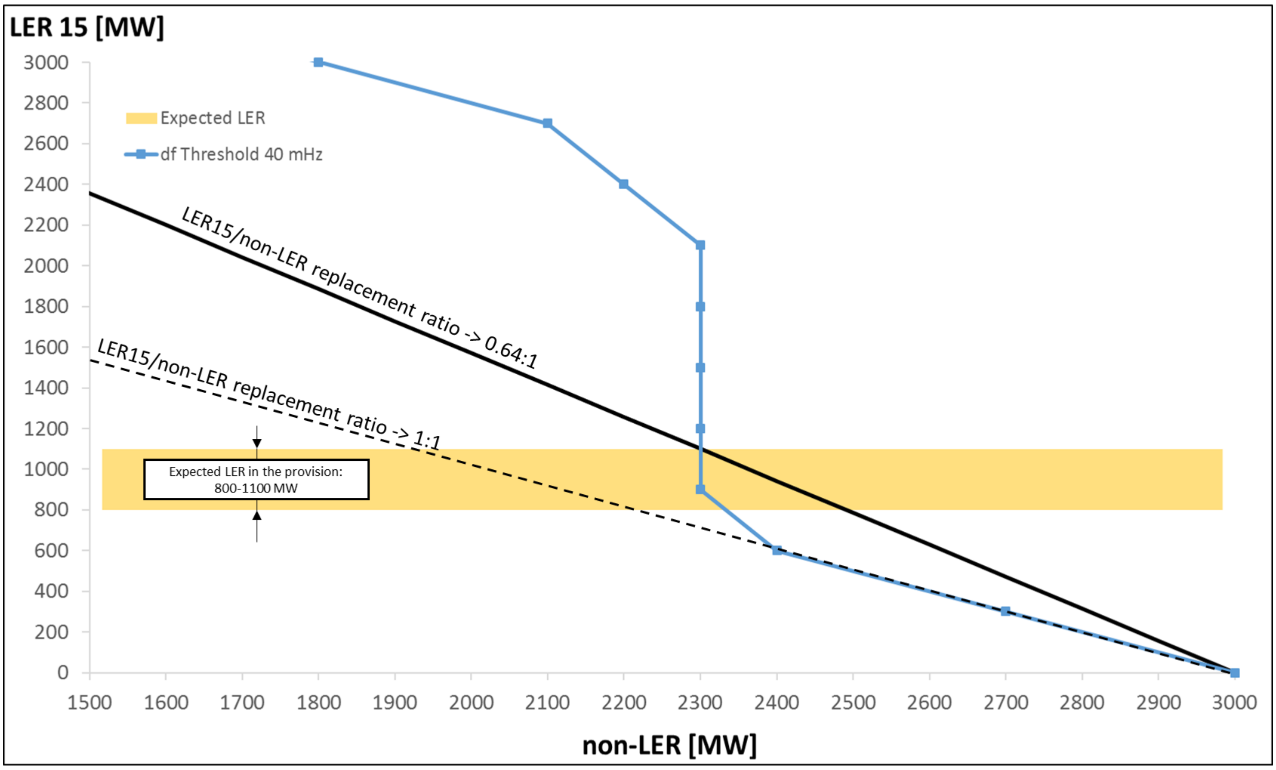

Figure 11: Numerical example of the application of replacement ratio

A hypothetical 1:1 replacement ratio between LER15 and non-LER (with a steady dimensioning of 3000 MW of FCR), would result in infinite combinations of LER15 and non-LER lying on the dotted line. As can be seen, it would entail the fact that some combinations would result to be unsafe (those below the blue safe curve).

Adopting a 0.64:1 replacement ratio, each MW of LER15 entering in the provision substitutes only 0.64 MW of non-LER. This replacement ratio is the maximum allowing all the possible combinations (up to the expected LER in the provision) to be safe, that is to lie above the safe curve.

The DFs calculated as LER/non-LER maximum replacement ratio represents therefore a proxy of the overall impact that a specific amount of LER could have on the provision in terms of increased need of FCR. For this reason, TSOs suggest that such criterion is suitable to be adopted for the LER remuneration reduction.

As the expected LER in the provision increases, the replacement ratio decreases, with consequent reduced remuneration for LER. Figure 12 and Figure 13 provide an example of trend for the DFs as expected LER15 increases.

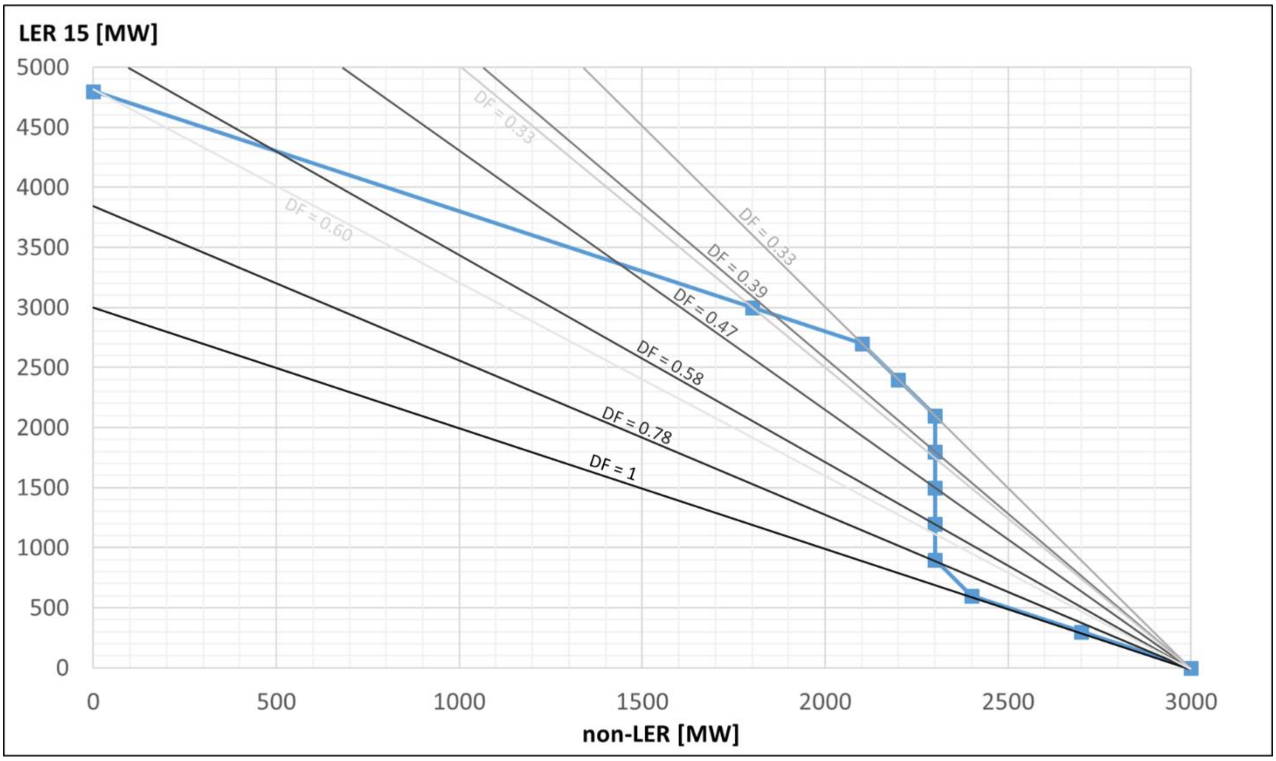

Figure 12: Example of LER15/non-LER replacement ratio applied to increasing amount of expected LER15 in the FCR provision

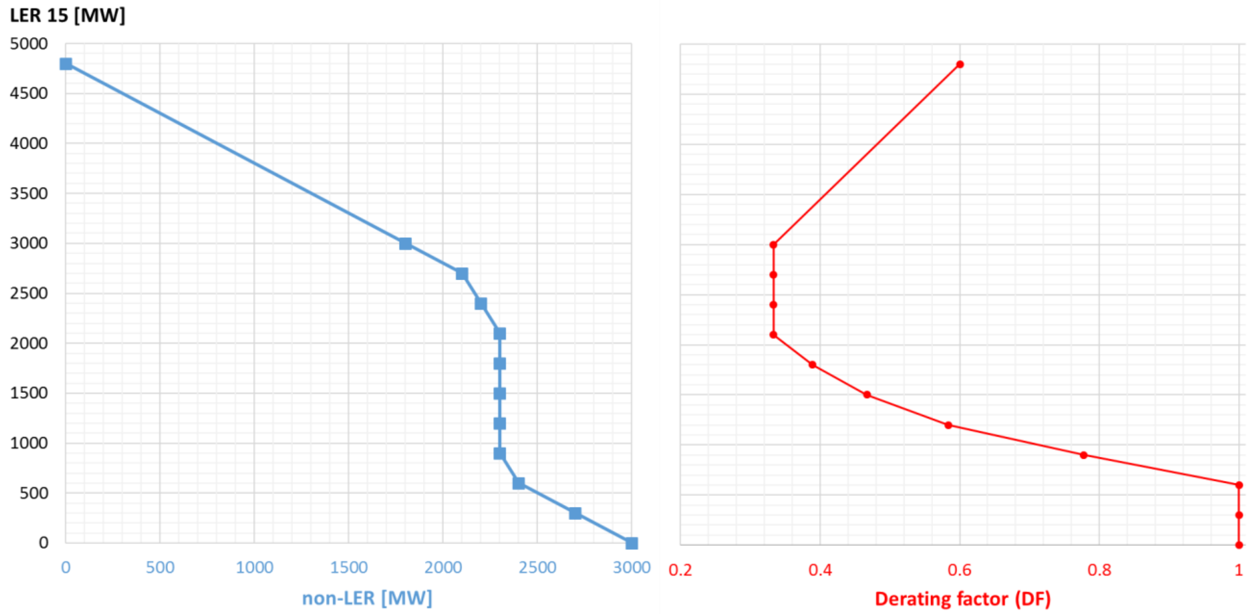

Figure 13: Example of DFs trend (LER15)

The DFs decrease is clearly nonlinear with the LER increase in the FCR provision.

In Figure 14 the trend of DF against different LER amount is depicted also for LER30.

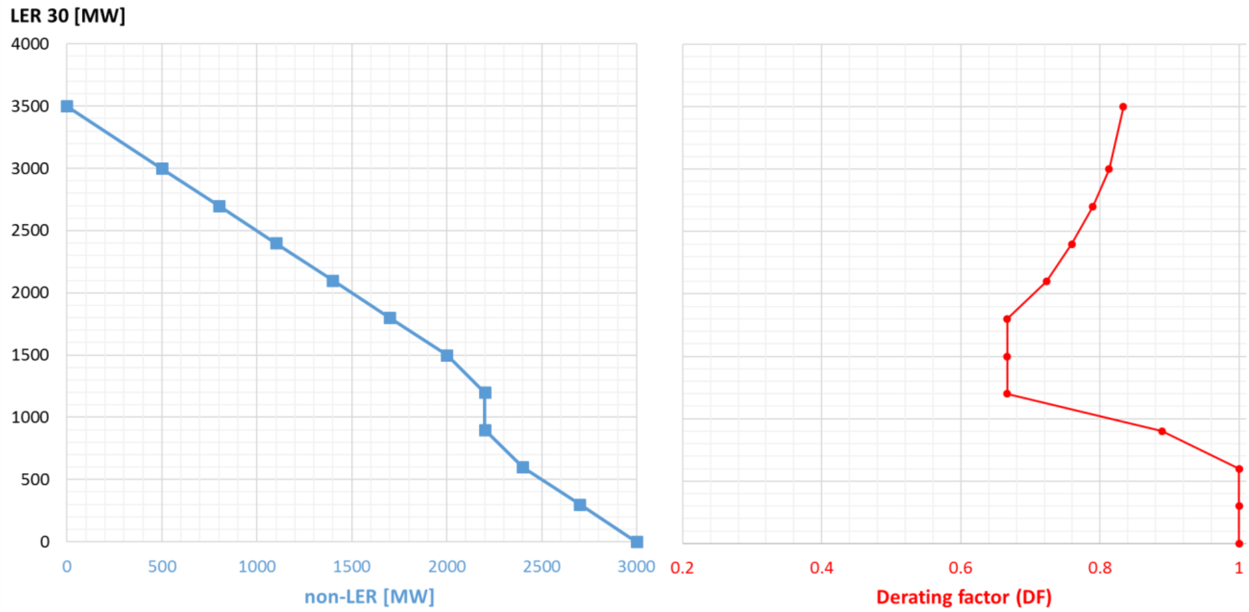

Figure 14: Example of DFs trend (LER30)

It is important to highlight that the previous figures are provided merely as an example. The shown DFs are indicative since their correct calculation would be further investigated, with a focus on the criterion chosen as the most suitable to represent the maximum frequency worsening which TSOs could accept because of LER presence.

Cost analysis results considering the DFs

The introduction of DFs on LER remuneration would have an impact on the costs associated to LER. If DFs were adopted for LER remuneration, they would be paid for an FCR quantity reduced with respect to the FCR they physically provide. In DFs presence, the FCR sold in the market is less than the physically available FCR. An investor would thus have to install more FCR for being remunerated for the same FCR capacity it would have been without DFs. **The investment cost is therefore higher per remunerated MW of FCR**.

TSOs have performed a cost assessment considering different scenarios of LER penetration (and consequent FCR costs). Two distinct scenarios are considered: a first one in which all existing and new LER have TLER = 15 minutes, and a second one where existing and new LER have TLER = 30 minutes.
The analysis has been carried out simulating different scenarios with a progressive installation of additional LER.
The assumptions of the assessment are the same as described for the previous cost assessment (without any DF). As more LER penetrate the FCR provision, the only further assumption is related to the increased LER investment cost per remunerated MW of FCR. It's assumed a linear effect of DF on LER investment cost:

$$long\ run\ marginal\ cost_{LER,DF} = \frac{long\ run\ marginal\ cost_{LER}}{Derating\ Factor}$$

As more LER are considered in the FCR provision, the DFs decrease and the potential LER remuneration is reduced. This has an effect of the incentive for investors in installing new LER and consequently to the foreseeable equilibrium point.

The analyses are performed considering the LER cost scenarios described in Table 1; the results are summarized in the following.

	TLER [minutes]	New LER long-run marginal costs [€/MW(h)]	LER in FCR provision at the expected equilibrium [MW]	FCR required at the expected equilibrium [MW]	Costs for TSOs at the expected equilibrium [€/h]
Base scenario	15	7.86	1126 (Current value)	3500	23300
Scenario A	15	6.05	1126 (Current value)	3500	23300
Scenario B	15	4.58	1126 (Current value)	3500	23300
Base scenario	30	9.39	796 (Current value)	3100	20600
Scenario A	30	7.25	796 (Current value)	3100	20600
Scenario B	30	5.52	≈1000	≈3175	≈22000

Table 5: Results of costs assessment with DFs

In what follows, the detailed results are explained.

Simulation with all LER having TLER = 15 minutes

The simulated increasing amount of LER and consequent increased need for FCR are presented in Table 3.

Figure 15 shows the results under the base scenario for LER long-run marginal cost (Table 1) and the application of the DFs as shown in Figure 13.

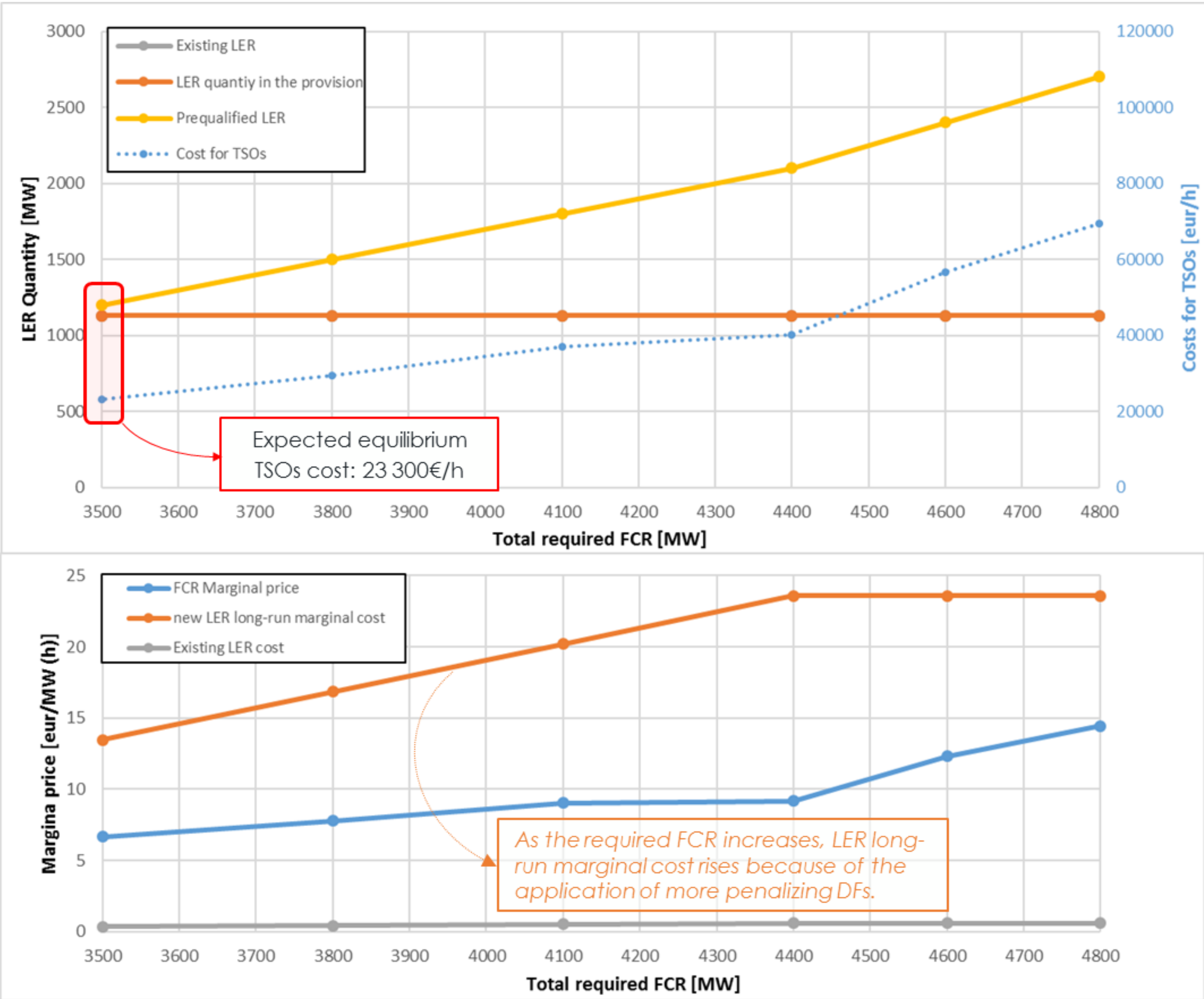

Figure 15: Example of possible expected LER penetration in the FCR provision in base scenario with DFs

The main difference compared with the scenario without DFs is that the long-run marginal cost of LER increases as the DF decreases.

The result is that the LER15 long-run marginal costs would remain above the FCR marginal prices in all possible scenarios of increased LER15 penetration and FCR increase. It represents a strong disincentive for investors in new LER15. The expected equilibrium is therefore the situation with only the current LER15 without any new installation. The total average costs for TSOs in that point would be around 23300 €/h.

Figure 16 shows the results under scenario A (see Table 1) for LER long-run marginal cost.

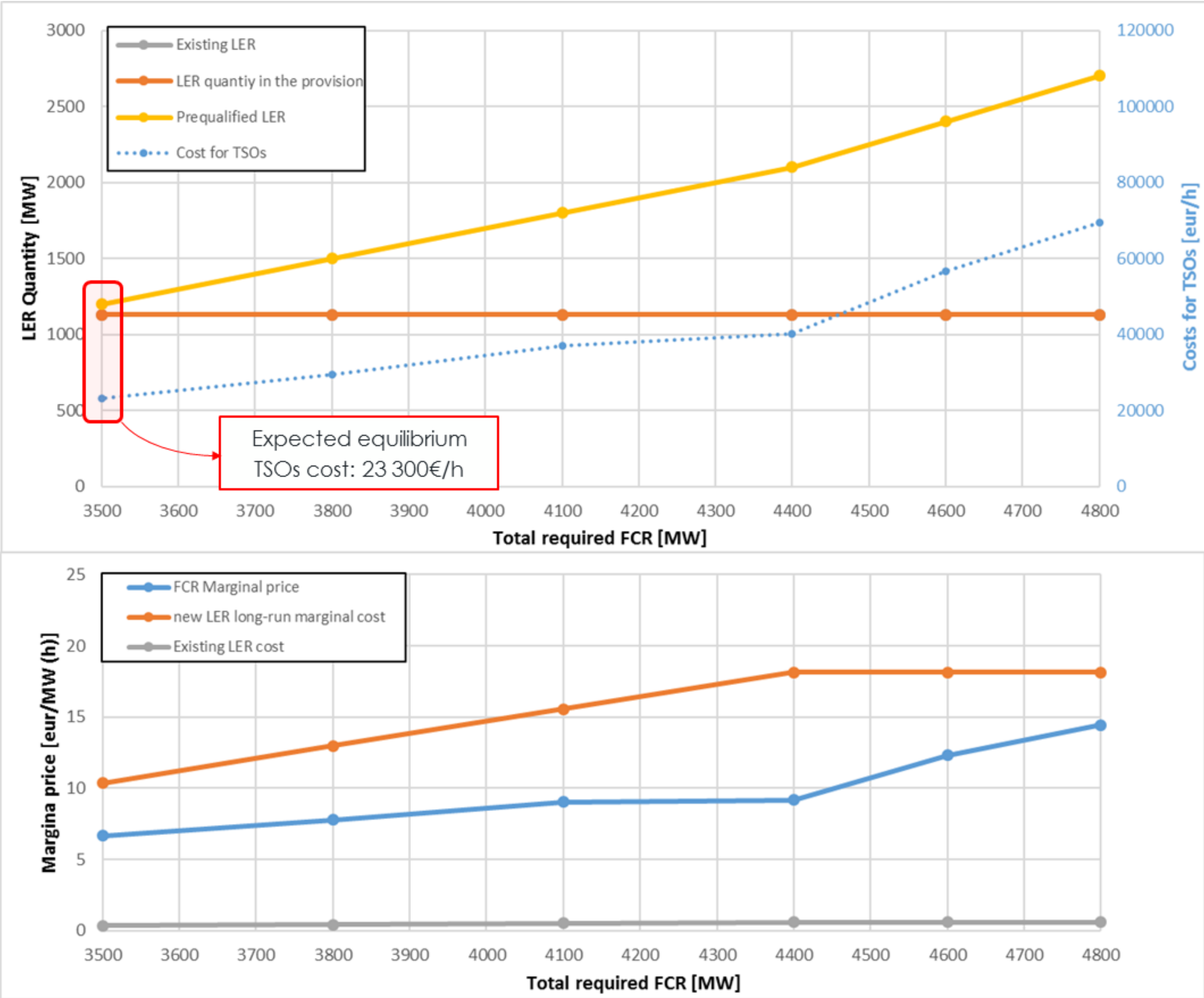

Figure 16: Example of possible expected LER penetration in the FCR provision in scenario A with DFs

Despite the reduced LER investment cost, the situation is the same as for the base scenario: LER15 investment costs are not competitive considering FCR marginal prices: the current situation is foreseen to remain stable as an equilibrium point.

Figure 17 shows the results under scenario A (see Table 1) for LER long-run marginal cost.

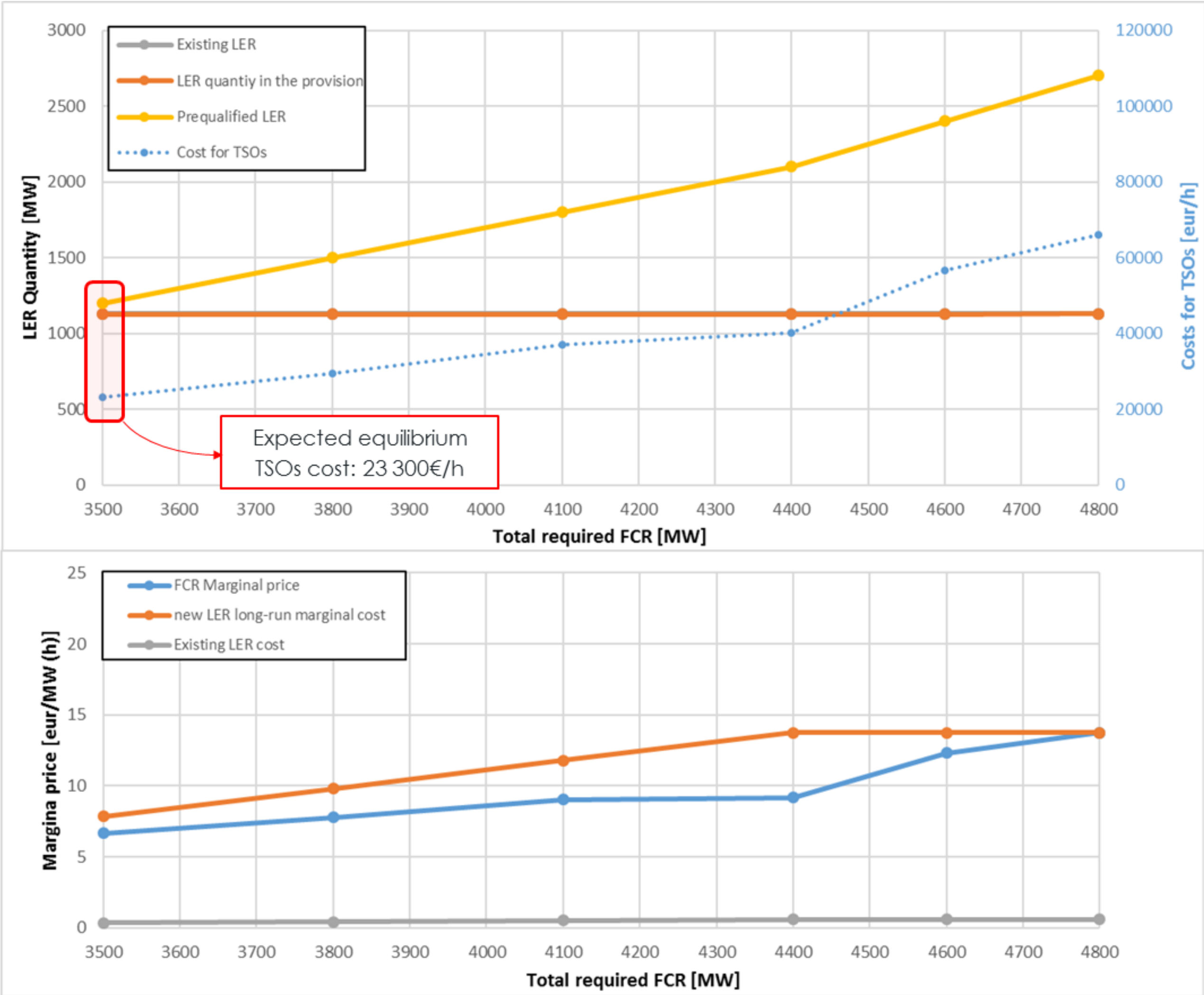

Figure 17: Example of possible expected LER penetration in the FCR provision in scenario B with DFs

Despite the reduced LER investment cost, the situation is the same as for the base scenario: LER15 investment costs are not competitive considering FCR marginal prices: the current situation is foreseen to remain stable as an equilibrium point.

Simulation with all LER having TLER = 30 minutes

The simulated increasing amount of LER and consequent increased need for FCR are presented in Table 4. Figure 18 shows the results under the base scenario for LER long-run marginal cost.

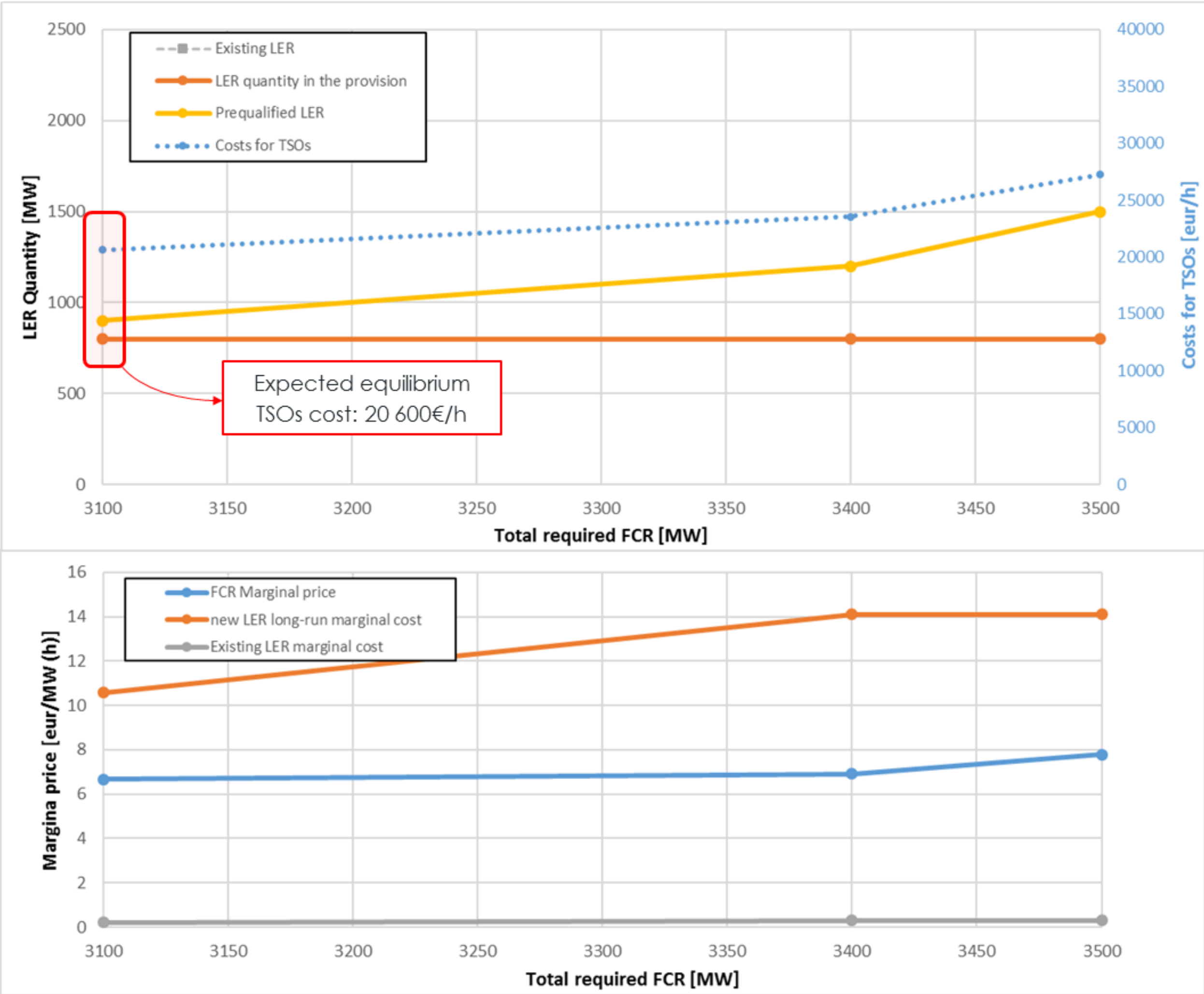

Figure 18: Example of possible expected LER penetration in the FCR provision in base scenario with DFs

LER30 long-run marginal costs would remain above the FCR marginal prices in all possible scenarios of increased LER penetration and FCR increase. It is a strong disincentive against investing in new LER30. The expected equilibrium is therefore the situation with only the current LER30 without any new installation. The total average costs for TSOs in that point would be around 20600 €/h.

Figure 19 shows the results under scenario A (see Table 1) for LER long-run marginal cost.

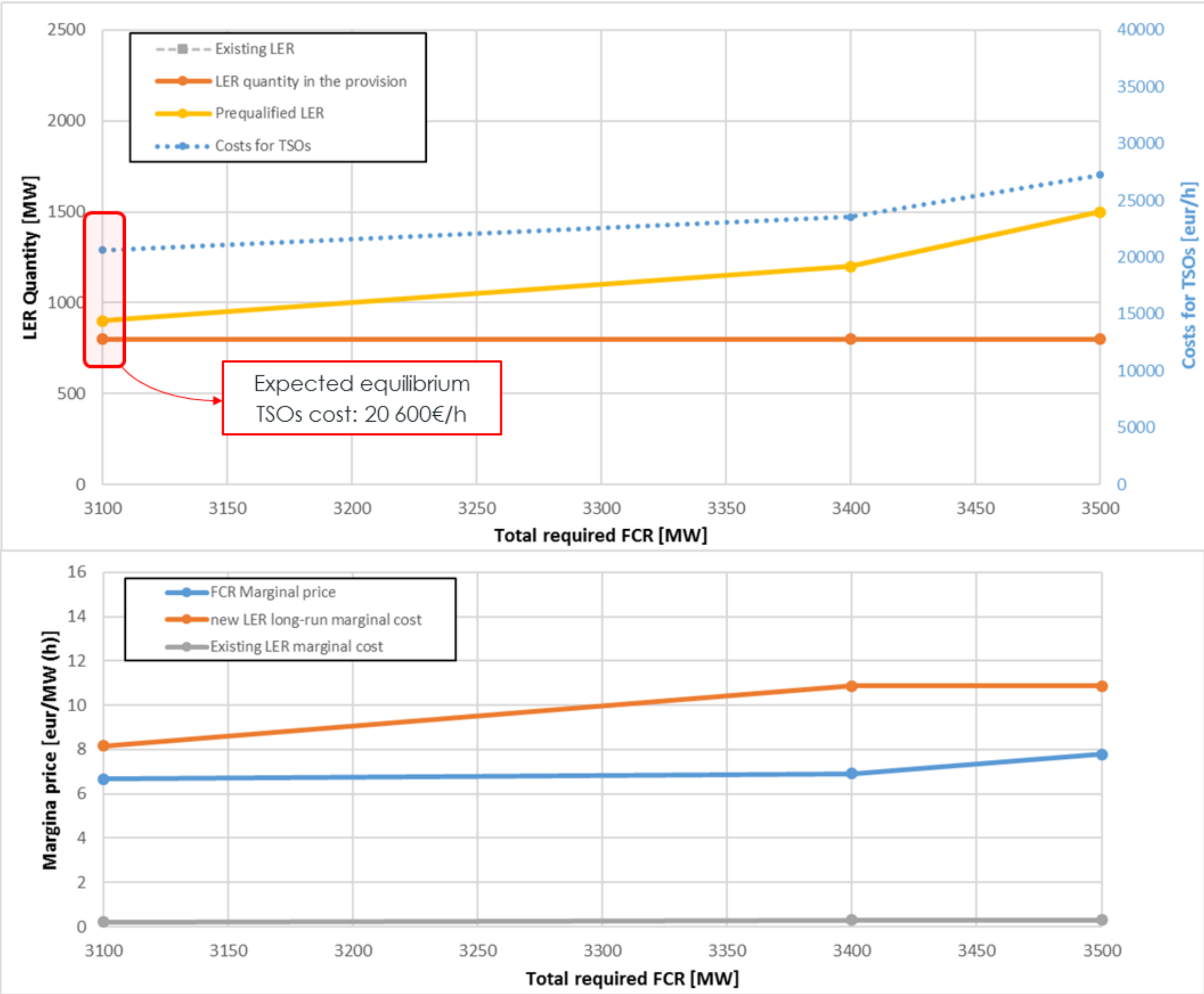

Figure 19: Example of possible expected LER penetration in the FCR provision in scenario A with DFs

Despite the reduced LER investment cost, the situation is the same as for the base scenario: LER30 investment costs are not competitive considering FCR marginal prices: the current situation is foreseen to remain stable as an equilibrium point.

Figure 20 shows the results under scenario A (see Table 1) for LER long-run marginal cost.

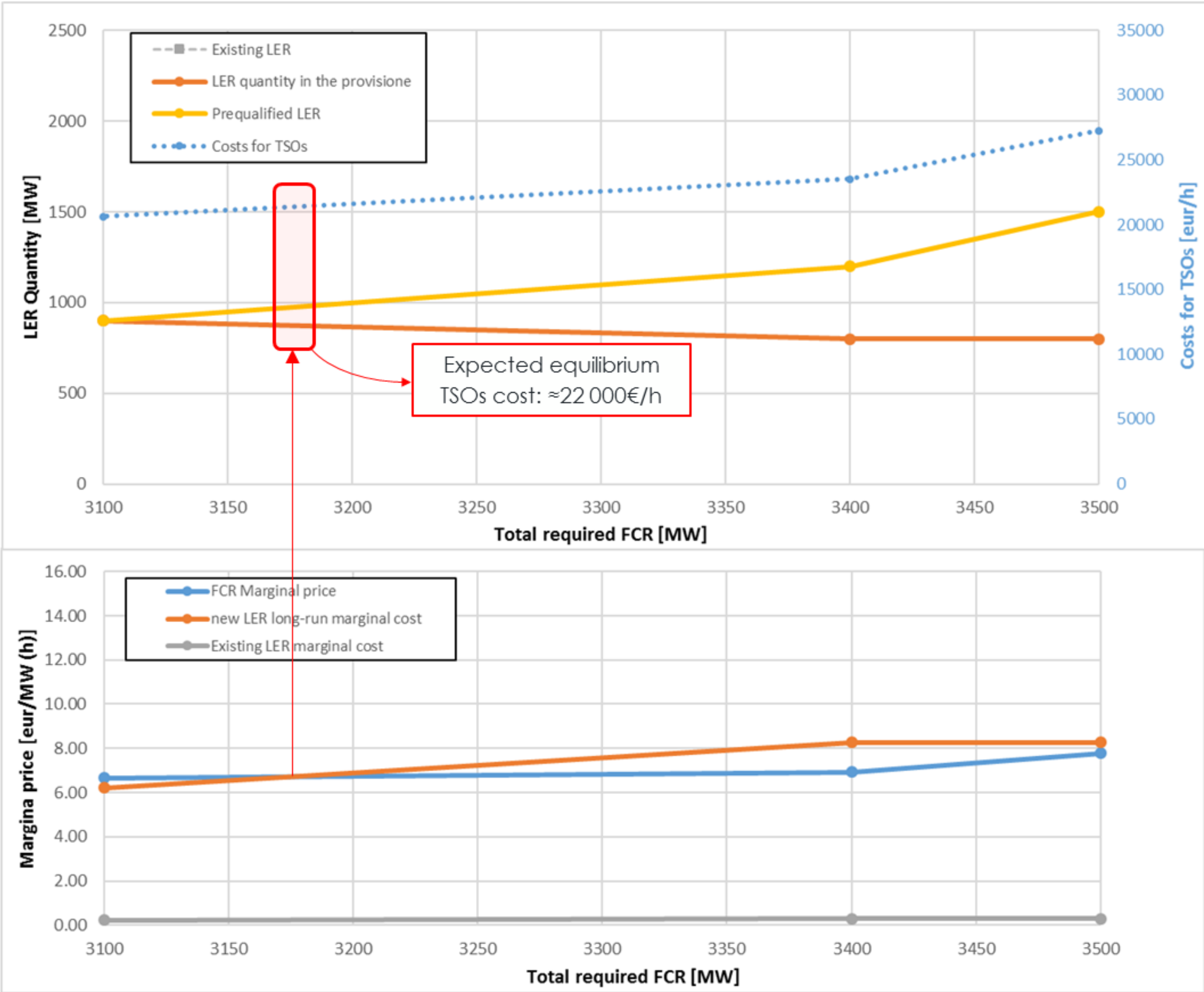

Figure 20: Example of possible expected LER penetration in the FCR provision in scenario B with DFs

In the current situation LER30 are inframarginal. It would theoretically incentivize investors to install new LER30. However, as LER30 in the provision increases, the presence of DFs leads LER30 to be less convenient. As DFs fall below a threshold around 0.85, LER30 are not convenient anymore.
The expected equilibrium is therefore slightly above the current situation in terms of LER30 installation, with an estimated cost for TSOs of around 22000 €/h.

7. General conclusions on the analyses results

The main result of the CBA performed in 2020 and of the following further investigations which TSOs have carried out is the fact the LER presence in the FCR provision represents an important aspect to be considered for ensuring the safety of the CE system.

In the real operation of CE power system, the FCR is of the utmost importance even beyond the Time to Restore Frequency[8]. In real operation there could be several factors which hinder the TSOs to restore system frequency at 50 Hz by a proper FRR activation. In such situations, the presence of LER in the FCR provision drastically changes the system behaviour: since the regulation provided by LER is provided only for a limited time, the TSOs must operate before the LER depletion to restore the system frequency. If this restoration is not achieved within the few minutes, the LER contribution is lost with a consequent further worsening of the system conditions.

It's important to highlight how these kind of situations with frequency deviation persisting for longer than Time To Restore frequency are not foreseeable and follow from technical problems which are inherent in a complex system such as the CE synchronous area. TSOs are working to reduce both the occurrence and the duration of such events, mitigating in this way their potential impact on FCR needs. However, the effects of the adopted measures still do not allow to neglect the importance of the FCR provided in the timeframe in which LER are expected to deplete.

Furthermore, TSOs need also to deal with potential really degraded system conditions (e.g., system separation) arising from incidents occurring on the grids. In such situations, the presence of FCR provision with a limited duration is a further challenge that the TSOs need to deal with in such a situation.

All things considered, LER cannot be considered as traditional (non-LER) FCR providers in terms of safety contribution provided to the power system. By the way, LER are already widely present in FCR provision, with both 15 minutes and 30 minutes minimum activation time period. Whatever proposal for a time period longer than 15 minutes would therefore have an impact on LER FCR providers business cases all over Europe.

A second important result of the analyses performed by TSOs is that the potential negative effects of LER can be addressed by an increase of the dimensioned FCR at synchronous area level. In LER presence, the system's safety conditions could be successfully restored increasing the procured FCR above the FCR dimensioned without LER. The required FCR increase depends on the amount of LER in the provision and on their activation time periods in alert state (15 minutes ÷ 30 minutes).

TSOs have also explored the impact on the FCR needed with a specific LER amount in the provision (with specific activation time periods).

An FCR increase would clearly cause a cost increase for FCR (and thus for consumer). The mitigation on cost increase provided by LER introduction appears to be limited.

TSOs have also explored a mechanism allowing the cost increase due to LER presence to be borne both by TSOs (on behalf of consumers) and LER.

These considerations lead TSOs to the conclusion that **<u>the proposal of a minimum activation time period required LER to remain available during alert state (according to Art.156(11) SO GL) shall be backed by a proposal for a way to deal with LER with the aim to keep the system at acceptable safety conditions</u>**.

[8] 15 minutes in CE.

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Starting from the previous considerations, TSOs have assessed several different solutions. In the following list these solutions are presented with their pros and cons.

a) To adopt a specific TminLER (either 15 or 30minutes) and to limit the maximum amount of LER in the FCR provision.

With this solution TSOs could avoid the need for FCR dimensioning increase by defining the maximum amount of LER the system could accommodate with the current FCR dimensioning. Such solution has been ruled out since it is not acceptable because it would unduly affect the competition between different alternative technologies

Furthermore, with TminLER = 15minutes, the LER limitation would already be reached by the prequalified amount of LER present today.

b) To adopt TminLER = 15 minutes while establishing a market mechanism where non-LER and LER having different TLER could compete on a level playing field.

With such solution, the LER reduced contribution to system safety would have been explicitly considered with a reduction of LER remuneration dependent on the actual LER share entering the market. LER with longer TLER would have been encouraged by positive market signals (less remuneration reduction). The LER share in the FCR provision and the share of LER with different TLER (15÷30 minutes) would have been the result of a market equilibrium.

Also the needed FCR increase above the starting dimensioned value would have arisen as a market results and would have been dependent on the amount of LER entered in the market.

Such solution has been ruled out due to its complexity. FCR procurement mechanism across CE varies greatly: some TSOs adopt mandatory mechanisms while others implement market-based procurement. Not even all the FCR markets are integrated each other; in addition, for some of them the proposed mechanism would be not appliable. Finally, the continuous update of k-factors would have been an important challenge.

This proposed mechanism would have been the most comprehensive, but its actual feasibility and transparency is questionable.

c) To adopt a specific TminLER (either 15 or 30minutes) and to review how the FCR is dimensioned at CE synchronous level in order to take into account the LER presence.

With this solution, the needed FCR increase do not arise from the market as in the previous solution. It is instead explicitly calculated on a regular basis by TSOs. TSOs evaluate the expected range of LER which are likely to be in the FCR provision at synchronous area level and calculate the corresponding need of FCR.

In this way the FCR procurement mechanisms adopted by each TSO are not impacted by LER presence; the only impact is the periodical update of the FCR required from each LFC Block. Such update occurs on regular basis, with the consequent reduced impact on k-factors. Moreover, the update take place only if a new amount of LER are really expected in the provision.

A possible way to mitigate the costs effects of LER could be the introduction of a Derating Factors scheme on LER remuneration.

The third solution is the one selected by TSOs as the most acceptable for all involved parts. Such solution could be suitable with the adoption of whatever TminLER between 15 and 30 minutes. The longer is TminLER, the less FCR increase is needed (all else being equal). A reduced FCR increase lead to reduced FCR costs increase.

In the following section is presented the specific proposed TminLER between 15 and 30 minutes, in the framework of the solutions "c)".

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8. Minimum activation time period proposal

Once selected the framework in which the proposed TminLER operates (Option "c)" in the previous section), the specific minimum activation time period between 15 and 30 minutes needs to be defined.

The aspects involved in the decision can be summarised as follows:

- The adoption of a longer TminLER (e.g., 30 minutes instead of 15 minutes) allows a limitation of FCR costs increase in most scenarios, thanks to the reduced need for FCR increase;
- A large share of the current prequalified LER have a time period of 15 minutes. A part of them can easily switch to a longer TminLER while others would face technical hurdles to perform such change;
- A possibility to reduce the TSOs' cost increase associated with LER presence is the introduction of a Derating Factors scheme in LER remuneration. Such scheme would be appliable only in Blocks where an FCR market-based procurement is in place. The introduction of a DFs mechanism could either be mandatory (for all eligible TSOs, i.e., with market procured FCR) or voluntary (decided at TSO level);

Starting from these considerations, TSOs have assessed four different options. Each option is presented in the following with its pros and cons.

Option A

With this proposal TminLER = 15 min. To mitigate the expected FCR costs increase the application of a DFs scheme is foreseen, albeit only on a voluntary base.

LER remuneration reduction could thus be applied only by each single TSOs (coordination between TSOs having a joined FCR procurement is however a desirable solution: i.e., FCR Cooperation).

Pros:

- It doesn't affect the existing LER installation being prequalified with 15 minutes;
- Not mandatory DFs application allows for more flexibility for TSOs with respect to Option B;

Cons:

- It has a higher cost for TSOs than defining TminLER = 30 min;
- If compared to option B, the DFs presence may have implications on the level playing field since its adoption is made at TSO level;

Option B

With this proposal TminLER = 15 min. To mitigate the expected FCR costs increase the application of a DFs scheme is mandatory. LER remuneration reduction must be applied by all the TSOs procuring FCR with a market-based mechanism.

Pros:

- It doesn't affect the existing LER installation being prequalified with 15 minutes;
- The cost increase due to LER is mitigated by the widest possible DFs application (if compared to Option A);

Cons:

- It has a higher cost for TSOs than defining TminLER = 30 min, although the cost is reduced when compared to Option A;
- If compared to Option A, the mandatory DFs adoption allows for less flexibility for TSOs;

Option C

With this proposal TminLER = 30 min for LER prequalified after a specific date, to be set, in the future. The requirement is not applied to LER prequalified before that date (including thus all the already prequalified LER).

The application of a DFs scheme to LER is not mandatory and the adoption decision is left to each single TSO (as in Option A).

Since the 30 min requirement will enter into force from a specific date, depending on the prequalification date LER will have to be compliant with different requirements.

Pros:

- It doesn't affect the existing LER installation;
- It has lower expected cost than options A and B;

Cons:

- Higher impact on new LER installation than options A and B;

Option D

With this proposal TminLER = 30 min for all LER. An interim period is foreseen to allow existing LER (with shorter time period) to comply with the new requirement. No DFs application is considered.

From the date in which the 30 minutes TminLER enters into force, all the newly prequalified LER must be compliant with such requirement.

The LER which are already prequalified as the 30 minutes TminLER enters into force, remain subject to their current requirement during the interim period. Once the interim period ends, all LER must be compliant with the 30 minutes requirement.

The duration of the interim period takes into account the need to allow all LER to operate the technical modifications needed to be compliant with TminLER = 30 minutes.

Pros:

- It entails the minimum expected cost increase for TSOs;
- Avoiding the use of DFs mechanism mitigates the impact on LER remuneration;

Cons:

- Impact the existing LER with a time period shorter than 30 minutes;

TSOs propose to adopt the Option D: TminLER = 30 minutes for all LER with an interim period to be applied on existing LER.

The main driver of the decision is to reduce the expected cost increase due to LER presence in the FCR procurement and its consequent increase in needed FCR, without addressing on the LER the burden of higher investment cost per remunerated MW of FCR thet is consequence of the DFs application..

In order to limit such cost increase, the solution of DFs application has been thoroughly assessed. It has been however deemed as difficult to be applied in the current framework of CE FCR procurement.

TSOs are aware of the technical and economic issues associated with the application of a TminLER = 30 minutes to the LER which are already prequalified with a shorter activation time period. TSOs are therefore committed to ensure a proper interim period for such providers to deal with the regulation change, both from the technical and financial point of view.

TSOs are however in charge of ensuring the power system safety while minimizing the costs. A large LER presence in the FCR provision has proven to be a challenging aspect for the system safety. The TSOs are working to reduce the causes which could potentially lead the LER to deplete (e.g., long-lasting frequency deviations). In the near future however, these causes remain not foreseeable and follow from technical problems which are inherent in a complex system such as the CE.

The system safety shall then duly take into consideration LER presence in FCR provision, and also the foreseeable need of FCR increase, with a consequent cost increase. To set TminLER = 30 minutes has been considered as the most suitable way to limit such cost increase and simultaneously support operational aspects.