

# 2023 Annual Load-Frequency Control Report

25 September 2024

From: System Operations Committee

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## Executive Summary

According to Article 16 of the Commission Regulation (EU) 2017/1485 of 2 August 2017, which establishes a guideline on electricity transmission system operation, the transmission system operators (TSOs) of each European Union Member State are obliged to provide ENTSO-E with the necessary data and information for the preparation and creation of the annual LFC report (ALFC Report). Subsequently, ENTSO-E is obligated to publish the annual report.

The LFC report aims to present the results of the frequency quality evaluation criteria for each synchronous area and LFC block, and the FCR obligations and the initial FCR obligations of each TSO for each month of the preceding two years. Additional details include a description and the date of implementation of any mitigation measures and ramping requirements to alleviate deterministic frequency deviations in which TSOs were involved during the last preceding year.

The main conclusion of the 2023 ALFC report is that Continental Europe (CE) did not reach their frequency quality target in 2023. The reason is due to long-lasting frequency deviations (LLFD) during the first half of 2023 in CE, mostly in direction of over-frequency. The largest impact came from the control blocks of Bulgaria and France, but other control blocks contributed as well. Whereas in the other Synchronous Areas the frequency quality fit within the defined levels for the reported data. All LFC blocks and TSOs provided their data and have explained any mitigation measures where applicable.

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## Introduction

The load-frequency control (LFC) annual report is a requirement of the Commission Regulation (EU) 2017/1485 of 2 August 2017, which established a guideline on electricity transmission system operation (SOGL).

Article 16 of SOGL requires transmission system operators (TSOs) of each European Union Member State to provide ENTSO-E with the necessary data and information for the preparation and creation of the LFC annual report. ENTSO-E is required to publish the annual report. On the grounds of SOGL Article 2(2), the synchronous areas of Cyprus and Iceland are excluded in this report as islands of Member States not operated synchronously with CE, GB, Nordic, IE/NI and Baltic are excepted from the annual LFC reporting requirement.

All ENTSO-E member TSOs agreed to provide the necessary data and information for the preparation and publication of the annual LFC report. Subsequently, each annual report is separately approved for publication by the ENTSO-E System Operations Committee.

The objectives of the report include:

- a) the identification, graphical representation, and associated monitors for each synchronous area, LFC block, and TSO of the five synchronous areas (Ireland/Northern Ireland, Great Britain, Nordic, Continental Europe, and Baltic). Details are presented in Chapter 2.
- b) the frequency quality evaluation criteria results for each synchronous area and LFC block. Details are presented in Chapter 3.
- c) the description and date of implementation of any mitigation measures and ramping requirements to alleviate deterministic frequency deviations in which TSOs were involved during the preceding year. Details are presented in Chapter 3.
- d) the FCR obligation and the initial FCR obligation of each TSO for each month of the preceding two years. Details are presented in Chapter 4.

## Synchronous areas, LFC blocks and TSO identification

In this section, the requirements of SOGL Article 16(2)(a), (b) and (c) are reported with the goal of identifying the LFC blocks, LFC areas, and monitoring areas in the ENTSO-E. The location of each member state in relation to the European synchronous areas and LFC blocks is also reported.

The five synchronous areas included in this document are Continental Europe, Nordic, Great Britain, Ireland and Northern Ireland and Baltic, as shown in Tables 1–5 and graphically in Figure 1 below. All LFC blocks and LFC block monitors are reported in Tables 1-5. For the Baltic Synchronous Area, the data collection process is not performed. The Baltic States power system is currently asynchronously connected to Continental Europe through the LitPol Link between Lithuania and Poland and to the Nordic Synchronous Area through the NordBalt link between Lithuania and Sweden and Estlink 1 and 2 between Estonia and Finland. The Baltic synchronisation with Continental Europe is part of the EU Energy Union strategy and will enable the Baltic TSOs to operate their systems under the frequency of the Continental European System and under the EU rules.



Figure 1 European Synchronous Areas and LFC Blocks

According to Article 133 of the SOGL, all TSOs of a synchronous area shall, in the synchronous area operational agreement, appoint one TSO of that synchronous area as the synchronous area monitor. The synchronous area monitor shall implement the data collection and delivery process of the synchronous area referred to in Article 132 of the SOGL and implement the criteria application process referred to in Article 129 of the SOGL.

Furthermore, the synchronous area monitor shall collect the frequency quality evaluation data of its synchronous area and perform the criteria application process, including the calculation of the frequency quality evaluation criteria, once every three months and within three months after the end of the analysed period.

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According to Article 118 of the SOGL, there exist the following synchronous areas and associated monitors:

- Swissgrid (south CE), Amprion (north CE),
- EirGrid (Ireland and Northern Ireland),
- Statnett SF-SN (Nordic),
- National Grid ESO or NGENSO (Great Britain).

LFC Block	LFC Area	LFC Block Monitor	Country
AK	OST, KOSTT	OST	Albania, Kosovo
APG	APG	APG	Austria
CEPS	CEPS	CEPS	Czech Republic
ELIA	ELIA	ELIA	Belgium
ESO	ESO	ESO	Bulgaria
Germany	TNG, TTG, AMP, 50HZT, EN, CREOS	AMP	Germany, Denmark-West, Luxembourg
IPTO	IPTO	IPTO	Greece
MAVIR	MAVIR	MAVIR	Hungary
PSE	PSE	PSE	Poland
REE	REE	REE	Spain
REN	REN	REN	Portugal
RTE	RTE	RTE	France
SEPS	SEPS	SEPS	Slovak Republic
SG	SG	SG	Switzerland
SHB	NOS BiH, HOPS, ELES	ELES	Bosnia and Herzegovina, Croatia, Slovenia
SMM	EMS, MEPSO, CGES	EMS	Serbia, North Macedonia, Montenegro
TEIAS	TEIAS	TEIAS	Turkey
TEL	TEL	TEL	Romania
TERNA	TERNA	TERNA	Italy
TTB	TTB	TTB	Netherlands
UAMD	Ukrenergo, Moldelectrica	Ukrenergo	Ukraine, Moldova

Table 1 Continental Europe SA identification of LFC blocks

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LFC Block	LFC Area	LFC Block Monitor	Country
<b>EirGrid+SONI</b>	EirGrid, SONI	EirGrid	Ireland, Northern Ireland

Table 2 IE/Ni SA identification of LFC blocks

LFC Block	LFC Area	LFC Block Monitor	Country
<b>Nordic</b>	FG, SN, SvK, DK-E	SN	Finland, Norway, Sweden, Denmark-East

Table 3 Nordic identification of LFC blocks

LFC Block	LFC Area	LFC Block Monitor	Country
<b>Baltic</b>	Baltic	Baltic	Estonia, Latvia, Lithuania

Table 4 Baltic identification of LFC blocks

LFC Block	LFC Area	LFC Block Monitor	Country
<b>GB</b>	NGESO	NGESO	Great Britain

Table 5 GB SA identification of LFC blocks

## Frequency quality evaluation

### Introduction and target parameters

To maintain the power system frequency within secure limits, TSOs shall maintain the balance between load and generation on a short-term basis. The first step of balancing actions is the application of Frequency Containment Reserves (FCR). These reserves are activated quickly (typically within 30 s), stabilising the power system frequency and ensuring that the frequency deviation will not further increase. The Frequency Containment Process (FCP) will stabilise the frequency with an offset from 50 Hz, but it is the change of speed of the rotating masses, inertia, that ensures the frequency change is damped so that FCR is able to contain and stabilise the frequency at a value close to 50 Hz.

The second step is assigned to Frequency Restoration Reserves (FRR) which replace FCR and restore the frequency to the target frequency. SOGL defines two types of FRR: automatic (aFRR) and manual (mFRR). FRR is activated by an automatic control device or by manual activation, which reduces the Frequency Restoration Control Error (FRCE) to zero. For aFRR, this control device usually is called a Load-Frequency Controller (LF-Controller). The LF-Controller is physically a process computer that is implemented in the TSOs' control centre systems (SCADA/EMS/AGC) and collects FRCE measurements every 4–10s, thus providing—in the same time cycle—automated instructions to balancing service providers that are connected by data communication links.

The Frequency Restoration Process (FRP), aFRR and mFRR, restores frequency by replacing the power from the FCR. This principle is applicable for normal imbalances such as the activation of a light bulb, the start of a train, or the sudden outage of a large power plant. Market behaviour, such as the stop and start of production units at hour shift, will also create a power imbalance and result in frequency deviations.

All frequency deviations are recorded carefully for further analyses. SOGL defines processes for the calculation and the evaluation of frequency data, and the required parameters for each synchronous area and each LFC block (defined in SOGL in Articles 127–131 and in Annex III–V) are presented below in Tables 6 and 7.



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Data item	CE	GB	IE/NI	Nordic
Standard frequency range	± 50 mHz	± 200 mHz	± 200 mHz	± 100 mHz
Maximum instantaneous frequency deviation	800 mHz	800 mHz	1000 mHz	1000 mHz
Maximum steady-state frequency deviation	200 mHz	500 mHz	500 mHz	500 mHz
Time to recover frequency	Not used	1 minute	1 minute	Not used
Frequency recovery range	Not used	± 500 mHz	± 500 mHz	Not used
Time to restore frequency	15 minutes	15 minutes	15 minutes	15 minutes
Frequency restoration range	Not used	± 200 mHz	± 200 mHz	± 100 mHz
Alert state trigger time	5 minutes	10 minutes	10 minutes	5 minutes

Table 6 Frequency quality defining parameters of synchronous areas, as shown in Annex III Table 1 of the SOGL

Data item	CE	GB	IE/NI	Nordic
Maximum number of minutes outside the standard frequency range	15 000	15 000	15 000	15 000

Table 7 Frequency quality target parameters of synchronous areas, as shown in Annex III Table 2 of the SOGL

Considering the aforementioned information for each synchronous area during operation in a normal state or an alert state, the following values are reported on a monthly basis for the instantaneous frequency data:

- i. The mean value.
- ii. The standard deviation.
- iii. The 1<sup>st</sup>, 5<sup>th</sup>, 10<sup>th</sup>, 90<sup>th</sup>, 95<sup>th</sup> and 99<sup>th</sup> percentiles.
- iv. The total time during which the absolute value of the instantaneous frequency deviation was larger than the standard frequency deviation, distinguishing between positive and negative instantaneous frequency deviations.
- v. The total time during which the absolute value of the instantaneous frequency deviation was larger than the maximum instantaneous frequency deviation, distinguishing between positive and negative instantaneous frequency deviations.

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- vi. The number of events in which the absolute value of the instantaneous frequency deviation of the synchronous area exceeded 200% of the standard frequency deviation and the instantaneous frequency deviation was not returned to 50% of the standard frequency deviation for the CE synchronous area and to the frequency restoration range for the GB, IE/Nl and Nordic synchronous areas, within the time to restore frequency. The data distinguish between positive and negative frequency deviations.
- vii. For the GB and IE/Nl synchronous areas, the number of events for which the absolute value of the instantaneous frequency deviation was outside of the frequency recovery range and was not returned to the frequency recovery range within the time to restore frequency, distinguishing between positive and negative frequency deviations.

For LFC blocks from the CE and Nordic areas, the following data are reported:

- i. For a dataset containing the average values of the FRCE of the LFC block over time intervals equal to the frequency restoration time:
  - the mean value;
  - the standard deviation;
  - the 1<sup>st</sup>, 5<sup>th</sup>, 10<sup>th</sup>, 90<sup>th</sup>, 95<sup>th</sup> and 99<sup>th</sup> percentiles; and
  - the number of time intervals in which the average value of the FRCE was outside the Level 1 FRCE range, distinguishing between positive and negative FRCE, and the number of time intervals in which the average value of the FRCE was outside the Level 2 FRCE range, distinguishing between positive and negative FRCE.
- ii. For a dataset containing the average values of the FRCE of the LFC block over time intervals with a length of one minute, the number of events on a monthly basis for which the FRCE exceeded 60% of the reserve capacity on FRR and was not returned to 15% of the reserve capacity on FRR within the time to restore frequency, distinguishing between positive and negative FRCE. The calculation procedures of these target parameters are set in both the Nordic and the Continental Europe Synchronous Area Operational Agreements. The objective behind the Level 1 and Level 2 parameters is to provide quality targets for the individual FRCE quality of each LFC block. Since it is the responsibility of each TSO in its LFC block to keep FRCE as low as possible, the Level 1 and Level 2 parameters must not be exploited to reduce reserves or reserves activation. These parameters should rather be interpreted as an absolute warning limit that shows that the ACE quality is below the required standard and that the respective countermeasures have been reported and will be implemented urgently.

For the LFC blocks of the GB and IE/Nl synchronous area, during operation in a normal state or alert state and in accordance with Article 18(1) and (2), the following data are presented on a monthly basis and for a data-set containing the average values of the FRCE of the LFC block over time intervals with a length of one minute: the number of events for which the absolute value of the FRCE exceeded the maximum steady-state frequency deviation and the FRCE was not returned to 10% of the maximum steady-state frequency deviation within the time to restore frequency, distinguishing between positive and negative FRCE.

## Continental Europe

### Frequency Performance

In the following figures, data from 2022 and 2023 for the Continental Europe synchronous area are presented. Input values for frequency are based on instantaneous frequency values. Based on the input values, the mean value, standard deviation and percentiles were calculated. Moreover, any time periods and events where the system frequency was outside of predefined ranges were also indicated. For data points where the frequency was outside the 50 and 800 mHz range, time is measured in minutes.

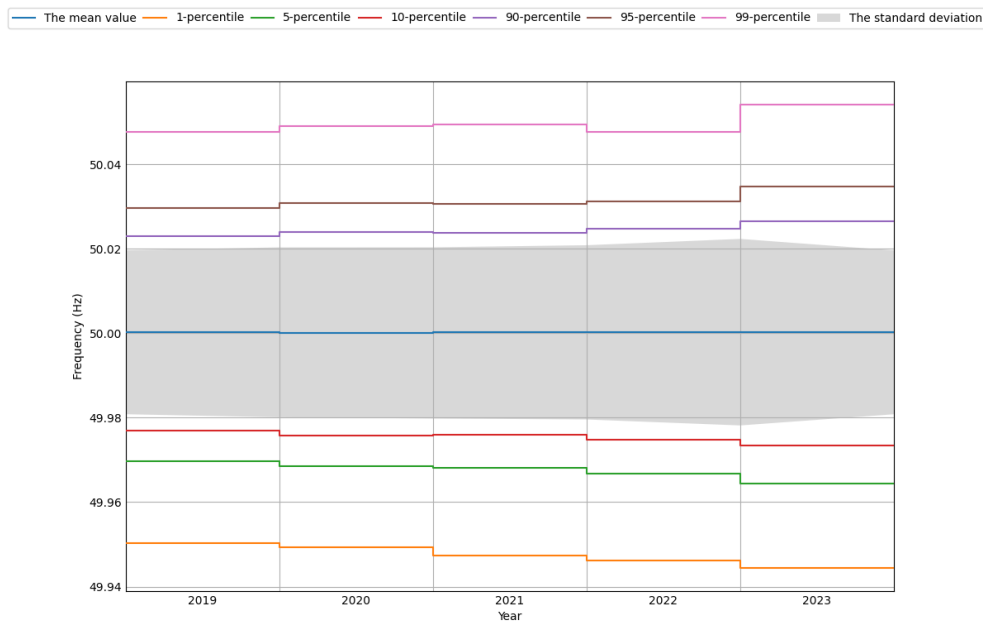


Figure 2 Annual frequency percentiles and standard deviation in Continental Europe for 2019–2023

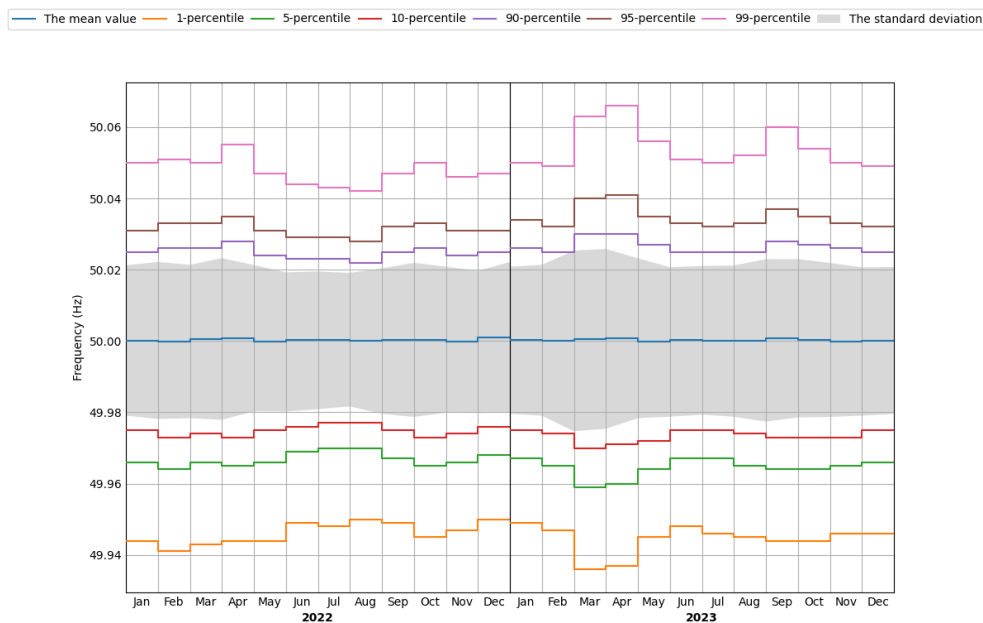


Figure 3 Monthly frequency percentiles and standard deviation in Continental Europe for 2023 and 2022

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In Figures 4 and 5, the accumulated minutes outside standard ranges are presented for the years 2022 and 2023, respectively. The frequency quality target parameter, as defined in the SOGL, is 15000 minutes per year for each synchronous area. The monthly target parameter can be considered as 1/12 of this value, that is, 1250 minutes.

Figure 22 shows that the frequency for the first half of 2022 was close to the limit, but improved in the second half of the year so that summarized for 2022 the frequency quality criteria was inside the limits of SOGL.

Figure 23 shows that the frequency quality target for 2023 was not fulfilled in Continental Europe. The reason behind exceeding the target were frequent situations of long-lasting frequency deviations (LLFD) in the first half of 2023, mostly in direction of over-frequency, and especially in the months of March, April and May. The control blocks of Bulgaria and France were the most significant contributors of the increase, but other control blocks contributed as well. Mitigation measures to reach quality target parameters are provided in the respective chapter.

The annual trend shows that between 2020 and 2022 the frequency was between 9 000 and 11 000 minutes outside the standard frequency range of +/- 50mHz in Continental Europe (CE). The measured values are much higher compared to the other synchronous areas; however, the other synchronous areas have much higher standard frequency ranges (+/- 100 or +/-200 mHz).

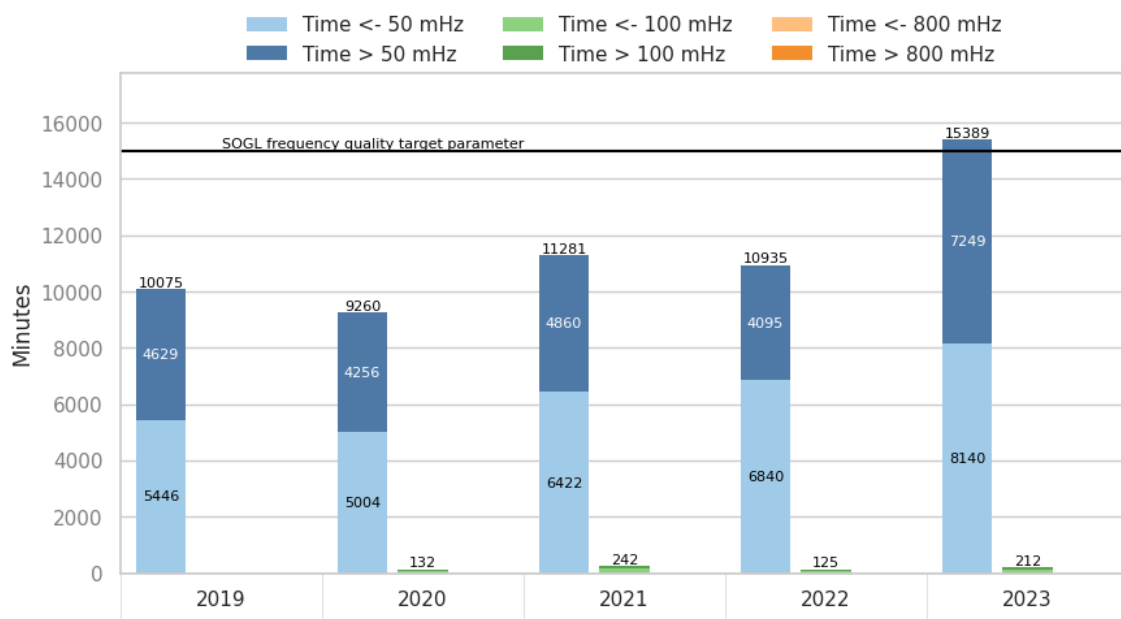


Figure 4 Annual number of minutes outside the standard ranges in Continental Europe for 2019–2023

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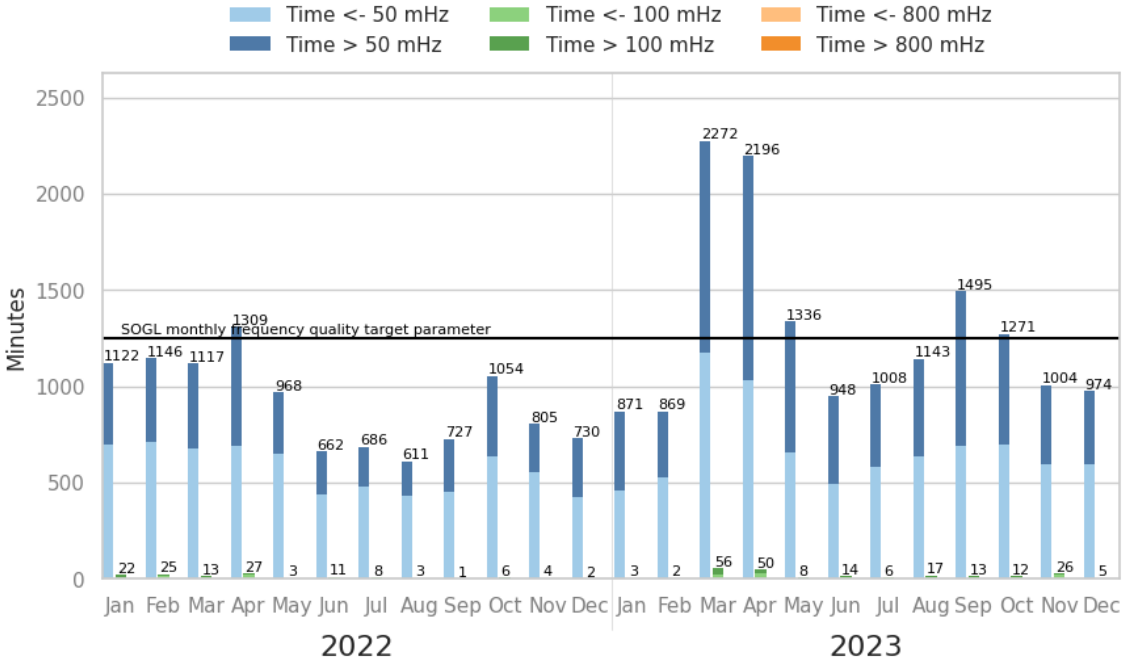


Figure 5 Monthly number of minutes outside the standard ranges in Continental Europe for 2023 and 2022

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## LFC Block Performance

In this chapter Continental Europe Frequency Quality Evaluation Criteria for LFC blocks is presented. Limits for Level 1 and Level 2 are calculated retroactively in line with Synchronous Area Framework Agreement for Continental Europe, whose entry into force was 14th of April 2019. FRCE values are calculated on a basis of 15 min Area Control Error (ACE) data. Additionally, events which indicate where FRCE exceeds 60 % of FRR used and not returned to 15 % of FRR during 15 minutes time period are reported. Complete list of data provided by LFC blocks is shown in the Appendix II.

### Level 1 and Level 2 statistics

In the following graphs, the monthly distribution of FRCE time intervals outside Level 1 and Level 2 ranges is presented separately for positive and negative time intervals, for every month for 2022 and 2023, for each LFC block in the Continental Europe Synchronous Area. Level 1 and level 2 FRCE ranges are the first and second range used for system frequency quality evaluation purposes on LFC block level, within which the FRCE should be kept for a specified percentage of the time, as defined in SOGL Article 3(134) and 3(135).

The number of time intervals in which average FRCE was higher than Level 1 is shown with dots, while for the opposite direction it is denoted by the symbol x. The level 1 and level 2 Frequency Restoration Control Error Target Parameters for the Continental Europe LFC blocks are presented in Table 8 for the respective years and measured in MW.

LFC Block	2022		01.01.–30.04.2023		01.05.–31.12.2023	
	Level 1	Level 2	Level 1	Level 2	Level 1	Level 2
AK	32	60	32	60	31	58
APG	89	169	89	169	76	145
CEPS	89	169	89	169	79	149
ELIA	96	182	96	182	85	160
ESO	63	118	63	118	56	106
Germany	250	474	250	474	220	416
IPTO	72	136	72	136	66	124
MAVIR	64	122	64	122	57	107
PSE	132	249	132	249	119	225
REE	206	389	206	389	156	295
REN	75	141	75	141	64	121
RTE	231	436	231	436	205	387
SEPS	55	104	55	104	49	93
SG	83	158	83	158	71	134
SHB	69	130	69	130	61	115
SMM	70	133	70	133	61	116
TEIAS	187	353	187	353	165	312
TEL	79	149	79	149	70	132
TERNA	178	337	178	337	157	297
TTB	112	213	112	213	95	179
UAMD	123	233	123	233	82	156

Table 8 Level 1 FRCE range and the level 2 FRCE range (in MW) for the Continental Europe Synchronous Area for 2022 and 2023.

Limit for the maximum number of 15 minutes time intervals per year outside the Level 1 and Level 2 FRCE range for each LFC Block	2022	2023	2022	2023	2022	2023
	10512	1752	10512	1752	10512	1752

Table 9 Limits for the number of 15 minutes time intervals per year outside the level 1 and level 2 FRCE range for 2022 and 2023, as defined in SOGL Article 3(134) and 3(135).

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Figure 6 CE LFCs 2022 FRCE Time Intervals outside Level 1 Range

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Figure 7 CE LFCs 2022 FRCE Time Intervals outside Level 2 Range



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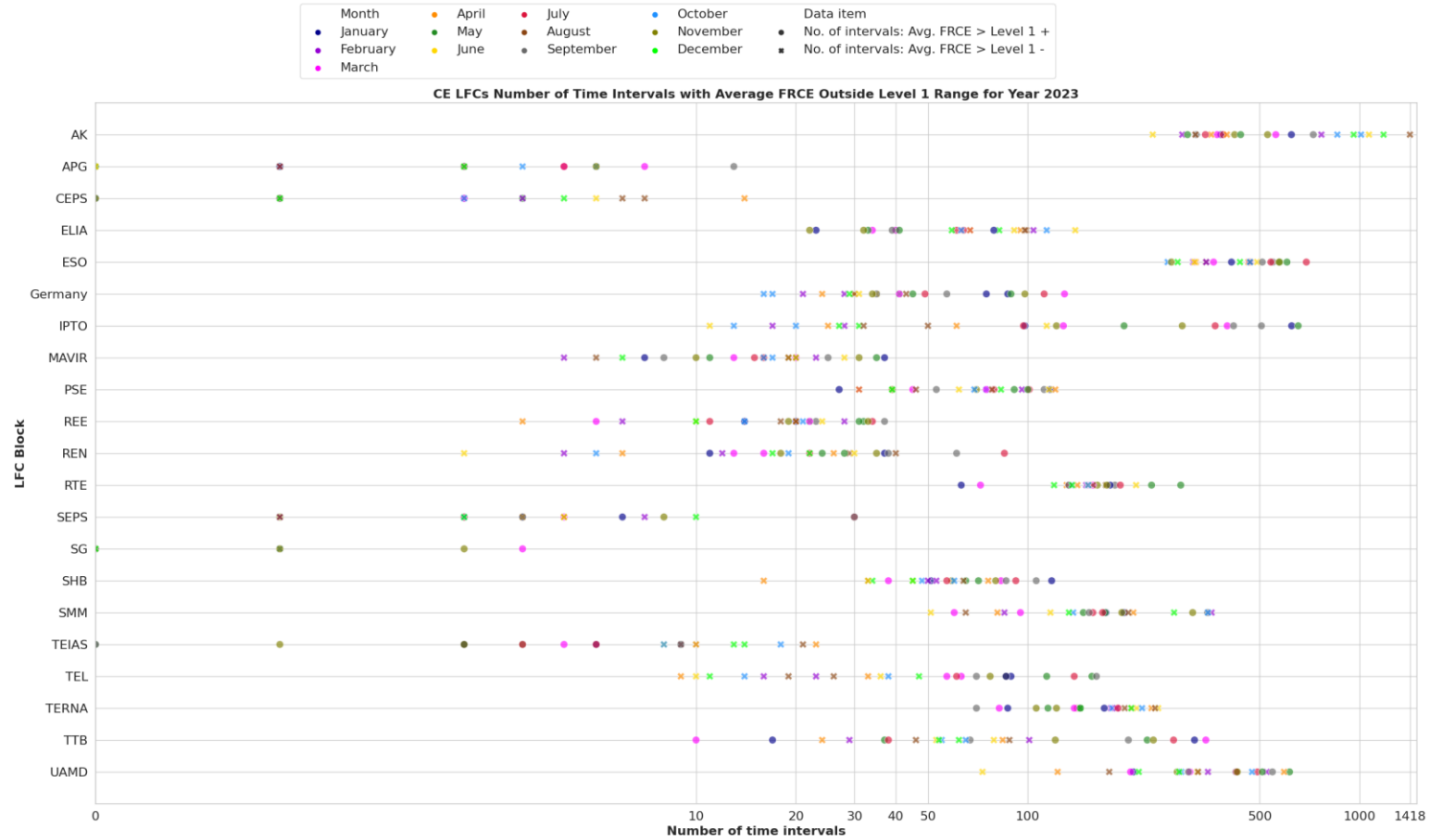


Figure 8 CE LFCs 2023 FRCE Time Intervals outside Level 1 Range

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Figure 9 CE LFCs 2023 FRCE Time Intervals outside Level 2 Range

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## FRCE vs. FRR

The ability of LFC blocks to regulate their own FRCE can be assessed by comparing the FRCE to the reserve capacity from the dimensioning process, as described in Article 157 of the SOGL. Both automatic (aFRR) and manual (mFRR) FRR are included. Free energy bids can optionally be included.

Positive and negative FRR is considered individually, that is, positive FRR (FRR+) is compared to the negative FRCE, and negative FRR (FRR-) is compared to the positive FRCE. FRCE values include all correction signals (e.g., for TSOs part of an Imbalance Netting Process) and is the value after the adjustment process for TSOs part of an FRR activation process. The values used are the 1-minute average values. The granularity of the FRCE values (used to calculate the 1-minute average) is 10 seconds or lower.

The reported number of events indicates the occurrence of large imbalances in LFC blocks (equal or higher than 60 % of dimensioned FRR) and an insufficient capability of LFC blocks to solve them during the time to restore frequency.<sup>1</sup>

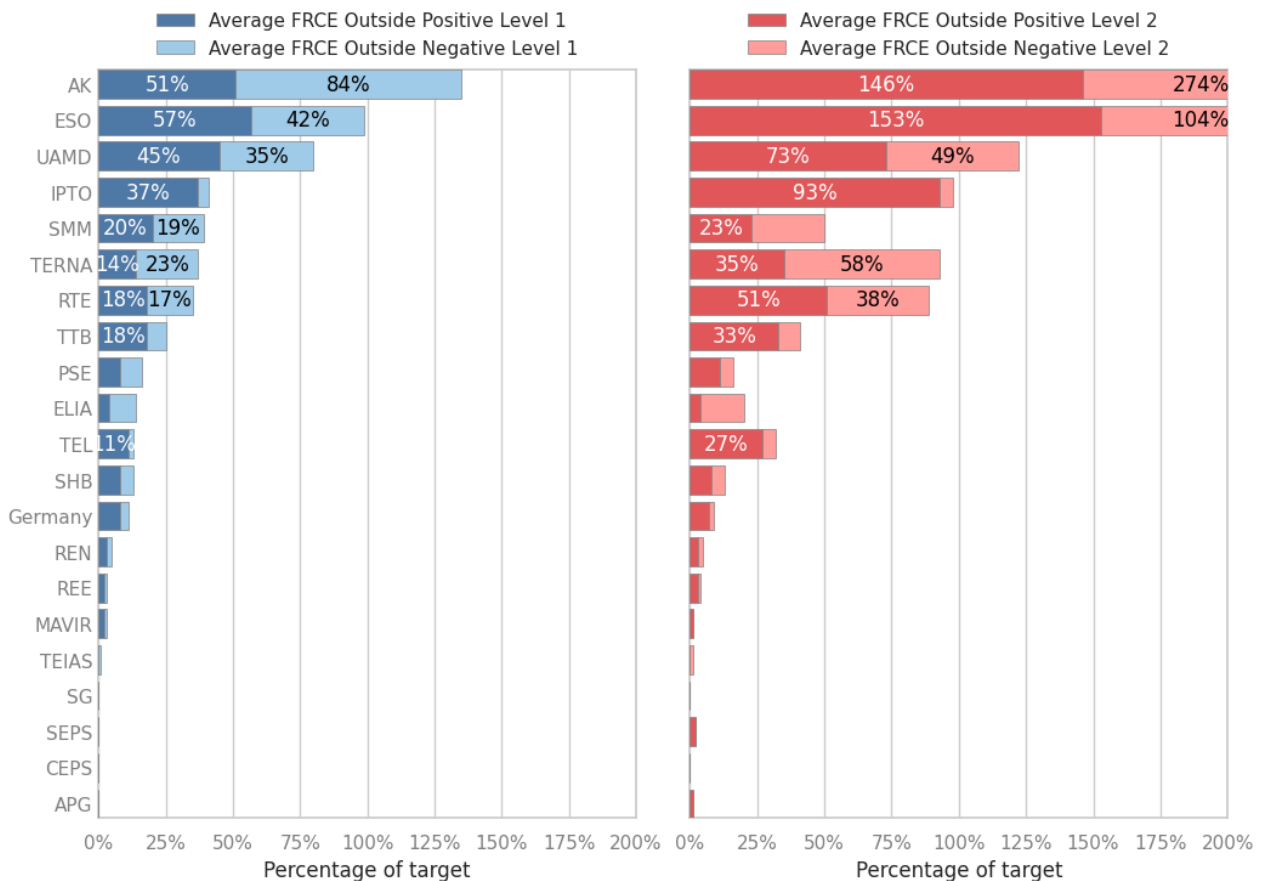


Figure 10 FRCE percentages by LFC Block in Continental Europe, ranked by average FRCE outside level 1, in 2023

<sup>1</sup> SOGL Annex III, Table 1 - Frequency quality defining parameters of the synchronous areas

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Figure 11 CE LFC Blocks 2022 FRCE Outside FRR Capacity within 15 minutes

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Figure 12 CE LFC Blocks 2023 FRCE Outside FRR Capacity within 15 minutes

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## Frequency quality evaluation

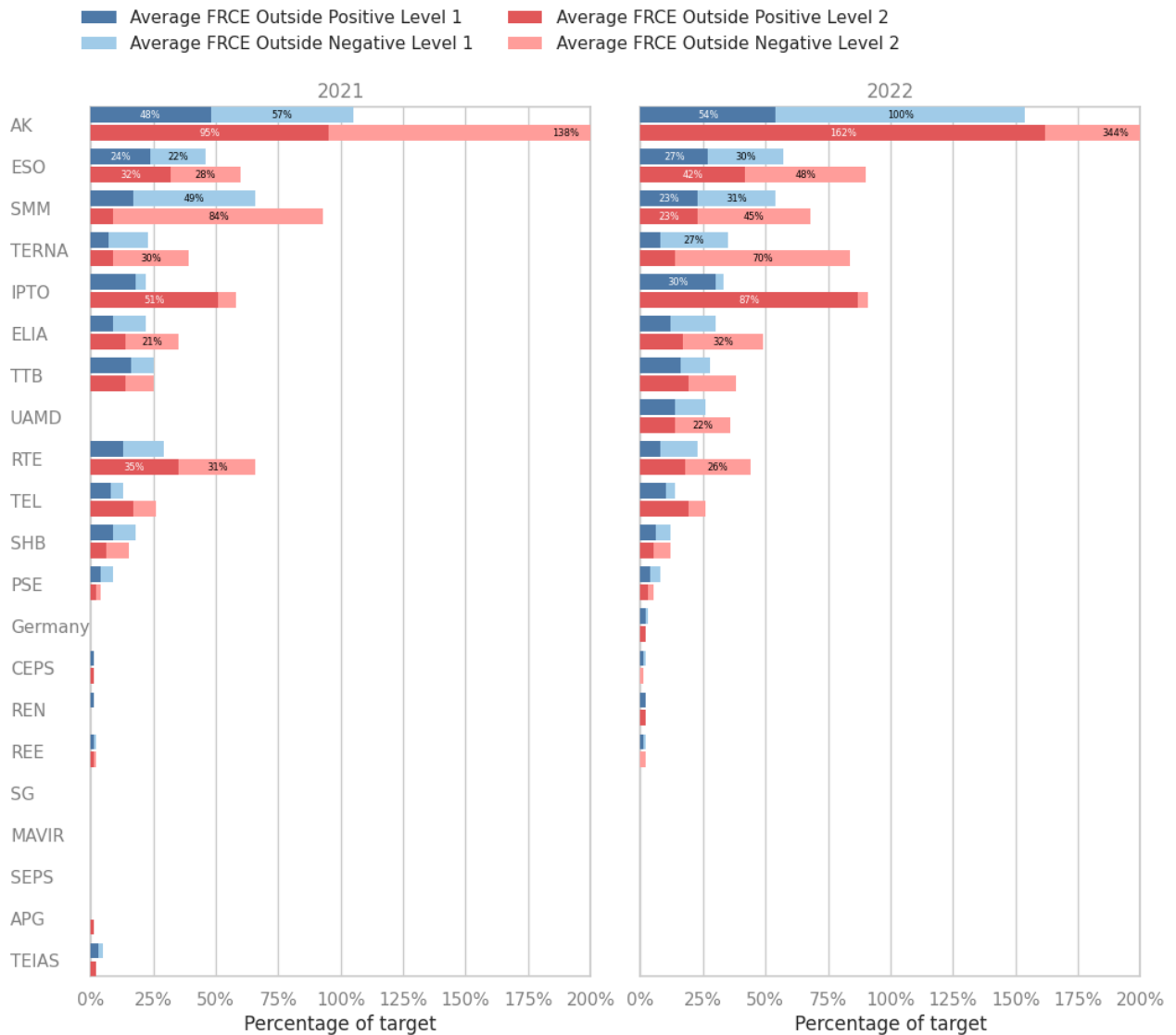


Figure 13 Number of time intervals with average FRCE outside Level 1 and 2 target by LFC Block in Continental Europe in 2022 and 2023

## I. Mitigation Measures Analysis

The annual report on load-frequency control provides a description and date of implementation of any mitigation measures and ramping requirements in which TSOs were involved taken in the previous calendar year to alleviate deterministic frequency deviations in accordance with SOGL Articles 137 and 138

In accordance with Article 138 of the SOGL, when the values calculated for the period of one calendar year with respect to the frequency quality target parameters are outside the targets set for the synchronous area, all TSOs of the relevant synchronous area should provide analysis and mitigation measures. Furthermore, when the calculated for one calendar year with respect to the FRCE target parameters are outside the targets set for the LFC block, all TSOs of the relevant LFC block should provide analysis and mitigation measures.

According to Article 138 of the SOGL, this information should contain:

- a) analysis of whether the frequency quality target parameters or the FRCE target parameters will remain outside the targets set for the synchronous area or for the LFC block and, in case of a justified risk that this may happen, analysis of the causes and a set of recommendations; and
- b) description of any mitigation measures developed to ensure that the targets for the synchronous area or for the LFC block can be met in the future.

For the reporting period, encompassing the years 2022 and 2023, in line with Figure 13, the following analysis and mitigation measures were reported from LFC blocks in Continental Europe:

### Mitigation measures for year 2022:

AK

**Analysis** "The main cause was the combination of several events uncontrollable by KOSTT (outage of the largest unit, need for additional import), which led to high ACE in KOSTT Control Area and in respective CB AK. For consequences the CB AK ACE exceeded the limits of Level 1 and Level 2. Within the CB AK, mFRR reserves were activated in the OST Control Area, but the amount of mFRR was not sufficient to cover the entire imbalance".

**Mitigation measures** As the root cause was a combination of several uncontrollable events by TSOs (low hydro levels, outage of the largest unit, disruptions in the energy market), OST will take measures to prevent this from happening again.

### Mitigation measures for year 2023:

RTE

**Analysis** Although the strike in 2023 can be considered an exceptional event, RTE will be implementing measures over the coming months and years that could have helped during the period.

**Mitigation measures** The daily tender for aFRR, launched in 2021 and abandoned after few weeks, will be relaunched mid-2024. Change in the remuneration scheme of the reserve should avoid the arbitration that occurred during the strike.

RTE will extend its mFRR/RR contracting process, today only performed for upward reserves, to downward reserves.

RTE is going to connect to PICASSO in 2024, which could help to cope with problems of lack of aFRR in some cases.

RTE intensifies its action towards Public Authorities to ensure that renewables will actively participate in the balancing mechanism and in the reserve procurement. Furthermore, work has been undertaken to make them subject to the same scheduling requirements as other production sectors. As well as improving our daily basis vision of the renewables production, this will improve the management of negative spot price episode.

## ESO

### Analysis

Since the beginning of 2023, ESO faces significant issue to follow interchange schedules, as a result of limited possibility to balancing own control area. In most of the cases when the control area ACE exceeded the required limits for Level1, Level 2, DFD limit, as well as the 375MW limit, ESO had no downward regulation capability.

There are two main reasons for this – one market and one technical.

For the first mentioned reason, market measures in balancing market mechanism were not sufficient to prevent these imbalances in ESO control area, due to the delayed market changes.

For the second mentioned reason, technical, there was two unpredictable coincidences:

1. The accident in PSHPP Chaira, in the first trimester of 2022. This PSHHP was with capability of 880MW generation and 760MW consumption (pumps). The complete loss of this power plant, reduce dramatically capability for regulation.
2. The rehabilitation of the other HPPs, which reduce possibility for downward regulation, using pumps.

### Mitigation measures

Mitigation measures that was taken by ESO:

1. ESO as a responsible for control of own CA, informed ministry and NRA for the situation. As a result of the formal correspondence, when we have a prediction for excess of generation, orders to all producers, connected to the transmission and distribution grid are issued to strictly follow its market schedules announced in advance to the system operator, between 10.00 to 17.00 p.m. For imbalances, restrictive measures towards the producers are taken from the ministry of energy according to the Bulgarian energy act.

2. Reducing the interchange transmission capacity in direction BG in compliance with HAR for the days with expected excess of RES generation.

Expected additional actions:

1. Market changes, including negative prices introduction for balancing energy and removing cap for balancing energy prices was expected till middle of 2024.
2. Two units in PSHPP Chaira (210MW generation/180MW pump per unit) are expected to be in operation in late 2024 or early 2025.

## UAMD

### Analysis

- 1) significant loss of generation certified for ancillary services, caused by russia's military aggression
- 2) 1-hour settlement period, which makes it impossible to adjust the schedule closer to the moment of real time

### Mitigation measures

- 1) the need to develop new generation and ESS to ensure adequacy of reserves
- 2) transition in the next 1-2 years to 15-minute settlement period on the electricity market

## AK

### Analysis

"The main cause was the combination of several events uncontrollable by KOSTT (outage of the largest unit, need for additional import), which led to high ACE in KOSTT Control Area and in respective CB AK. For consequences the CB AK ACE exceeded the limits of Level 1 and Level 2.



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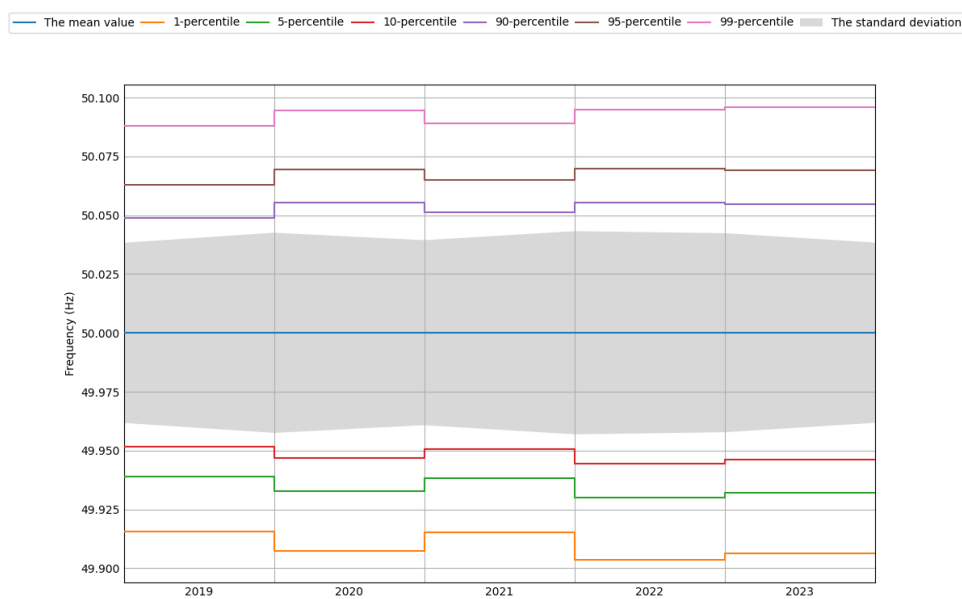
Within the CB AK, mFRR reserves were activated in the OST Control Area, but the amount of mFRR was not sufficient to cover the entire imbalance".

Mitigation measures TBD

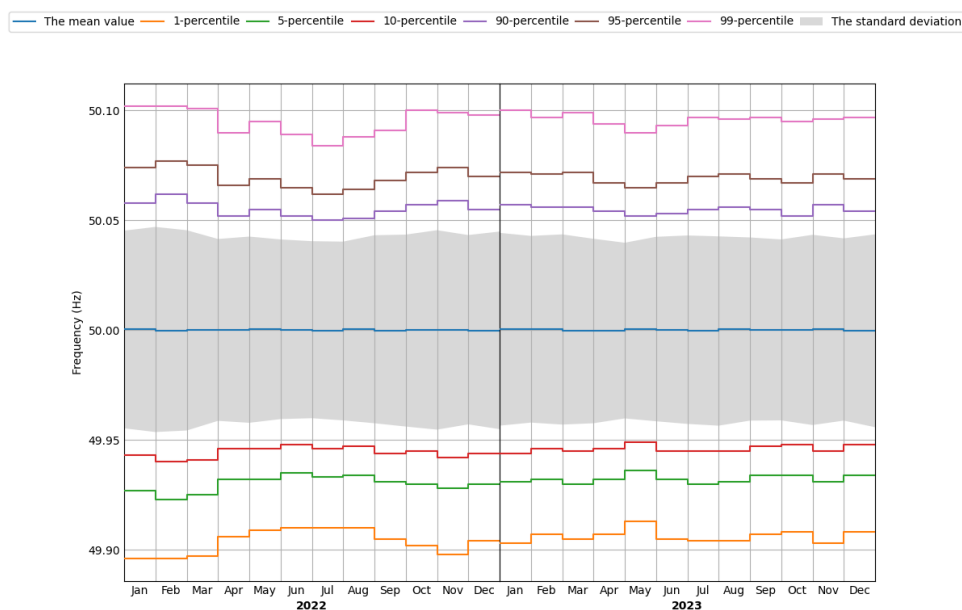
## Ireland/Northern Ireland

### Frequency Performance

The tables and figures in the Section present frequency performance for the synchronous area of Ireland/Northern Ireland for the years 2022 and 2023, along with five year annual values for 2019–2023. The input values for frequency are based on instantaneous frequency values. Based on the input values, the mean value, standard deviation and percentiles were calculated. Moreover, any time periods and events when the system frequency was outside of predefined ranges were also indicated. For data points when the frequency was outside the 200–1000 mHz range, time is measured in minutes.



**Figure 14 Annual frequency percentiles and standard deviation in Ireland/Northern Ireland for 2019–2023**



**Figure 15 Monthly frequency percentiles and standard deviation in Ireland/Northern Ireland 2023 and 2022**

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In Figures 16 and 17, the accumulated minutes outside standard ranges are presented for the years 2022 and 2023 respectively. The frequency quality target parameter, as defined in the SOGL, is 15000 minutes per year for each synchronous area. The monthly target parameter can be considered as 1/12 of this value, that is, 1250 minutes.

The graphs in Figures 4, 5 and 5a below show that the frequency quality was exceptionally good and that all frequency quality target parameters from SOGL were fulfilled in the Ireland/Northern Ireland Synchronous Area for the respective years.

The yearly trend shows that only very few minutes were observed where the frequency was outside the standard frequency range of +/- 200mHz for IE/NI.

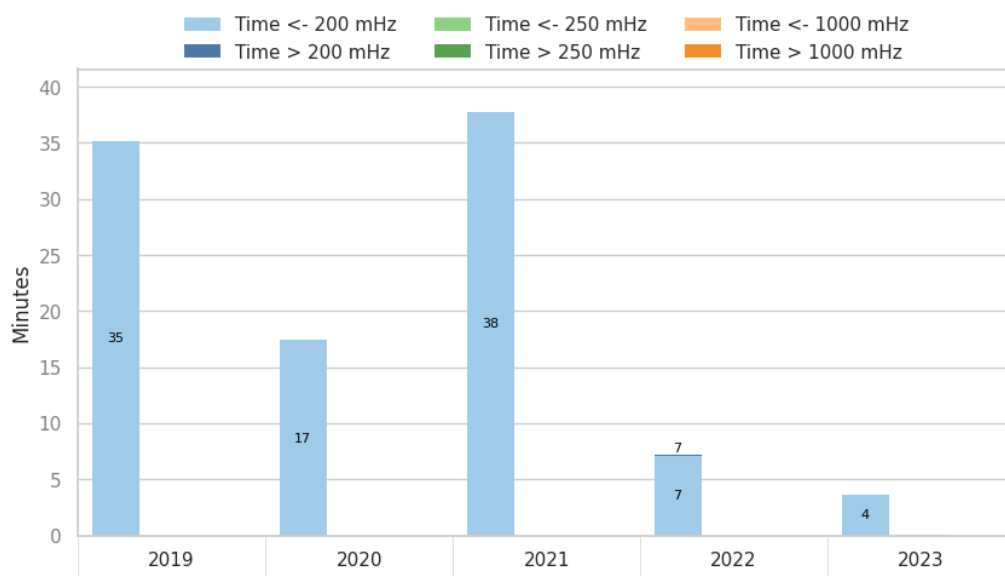


Figure 16 Annual number of minutes outside the standard ranges in Ireland/Northern Ireland for 2019–2023

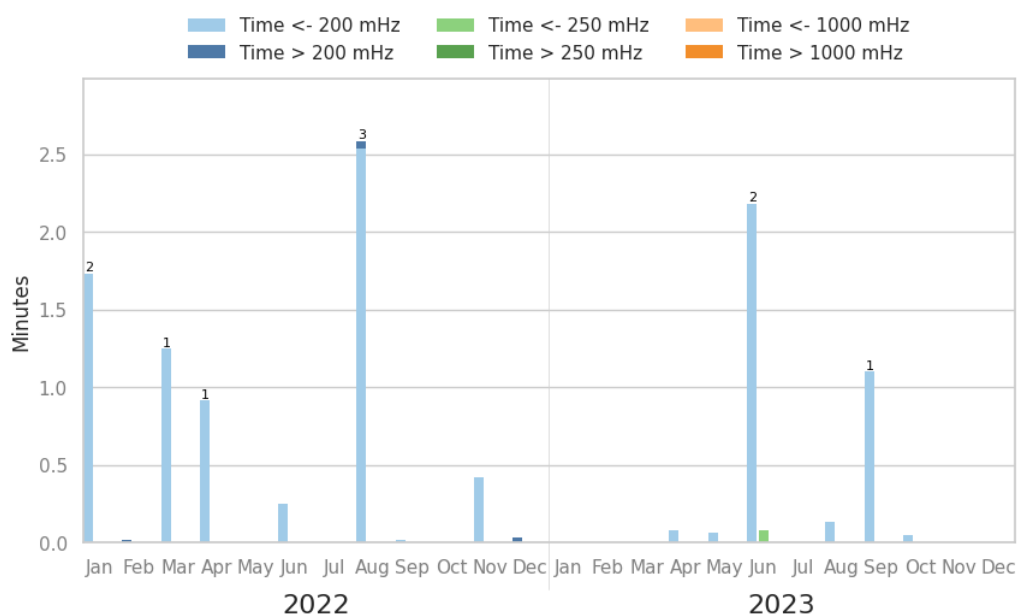
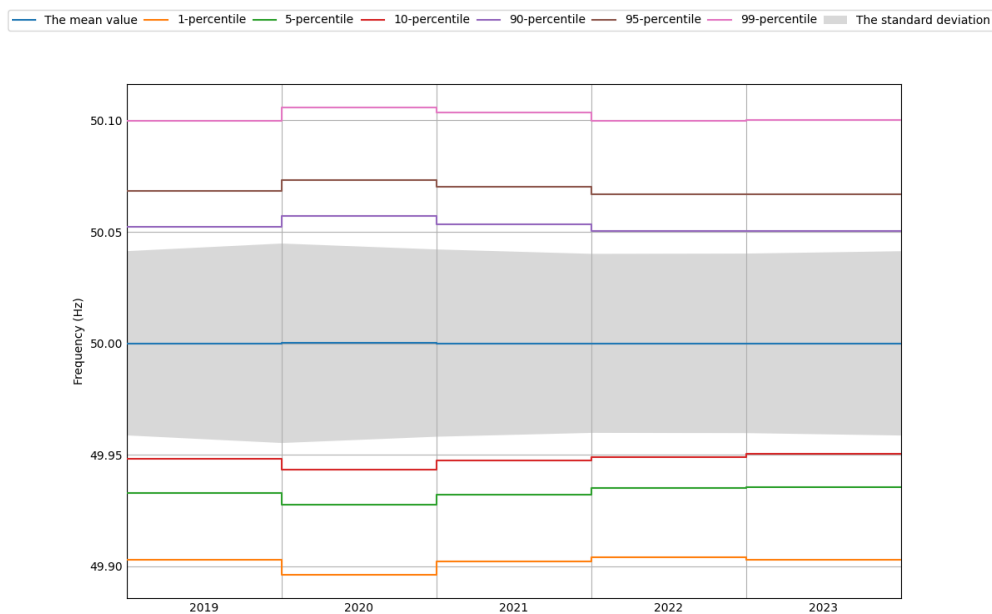


Figure 17 Monthly number of minutes outside the standard ranges in Ireland/Northern Ireland for 2023 and 2022 by month

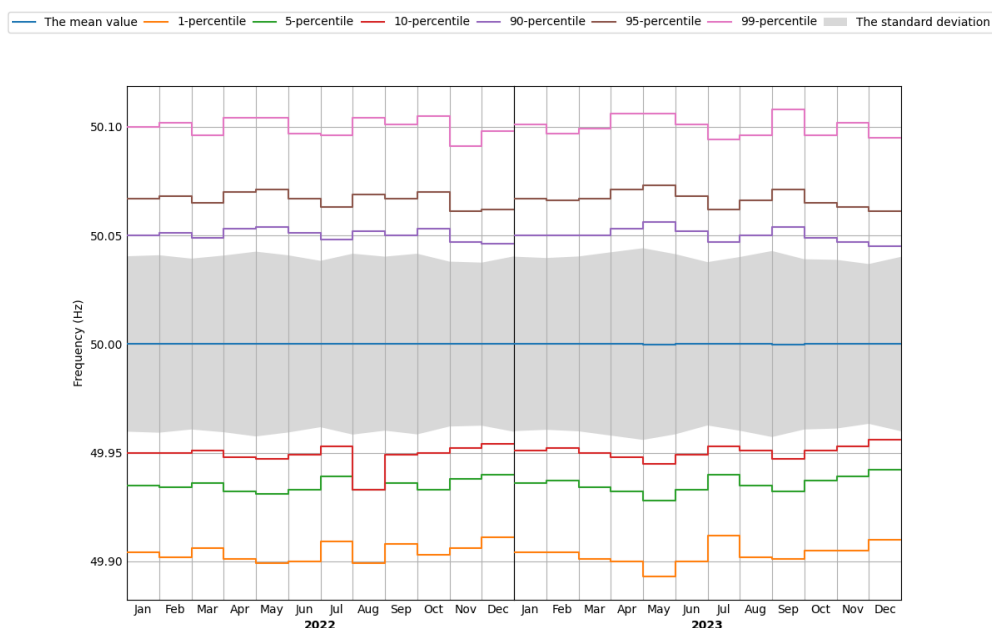
## Nordic

### Frequency Performance

The following figures present frequency performance of the Nordic synchronous area for 2022 and 2023. Input values for frequency are based on instantaneous frequency values. Based on the input values, the mean value, standard deviation and percentiles were calculated. Moreover, any time periods and events where the system frequency was outside of predefined ranges were also indicated. For data points where the frequency was outside the 100–1000 mHz range, time is measured in minutes.



**Figure 18 Annual frequency percentiles and standard deviation in the Nordic synchronous area for 2019–2023**



**Figure 19 Monthly frequency percentiles and standard deviation in the Nordic synchronous area for 2023 and 2022**

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In Figures 20 and 21, the accumulated minutes outside standard ranges are presented for the years 2022 and 2023. The frequency quality target parameter, as defined in the SOGL, is 15000 minutes per year for each synchronous area. The monthly target parameter can be considered as 1/12 of this value, that is, 1250 minutes.

The graphs in Figures 12, 13 and 13a below show that the frequency quality target parameters from SOGL were fulfilled for the respective years in the Nordic Synchronous Area. Nevertheless, over-frequency problems seem to be increasing even though the frequency quality is stable. The reason behind increasing over-frequencies is most probably the increased penetration of renewable energy sources (RES). TSOs are actively reviewing their mFRR capacity for downward activation to combat these, and the Nordics are establishing a common (daily) capacity market as an additional mitigation measure.

The annual trend for 2020–2023 shows a stable trend, where the frequency was outside the standard frequency range (of +/- 100mHz) for around 10,000 minutes per year in the Nordics.

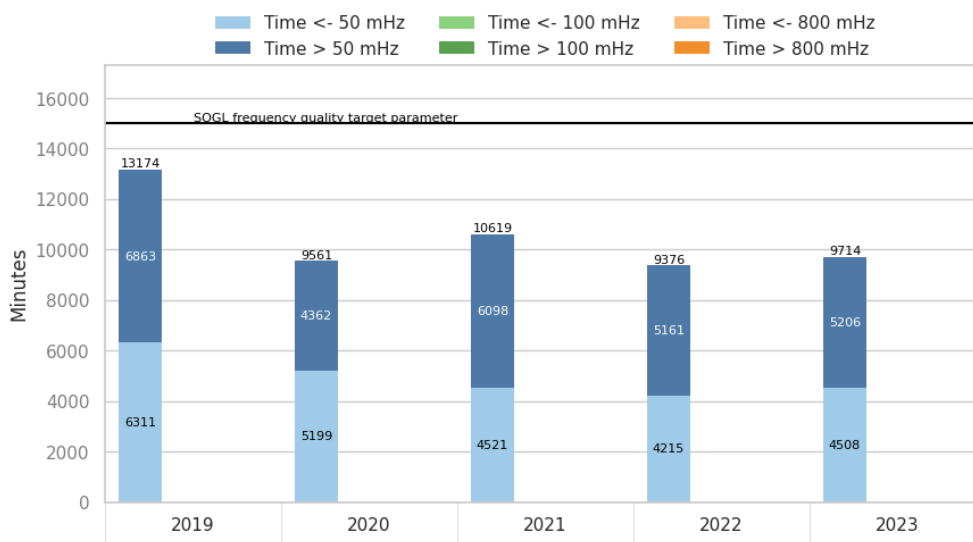


Figure 20 Annual number of minutes outside the standard ranges in the Nordic 2019–2023

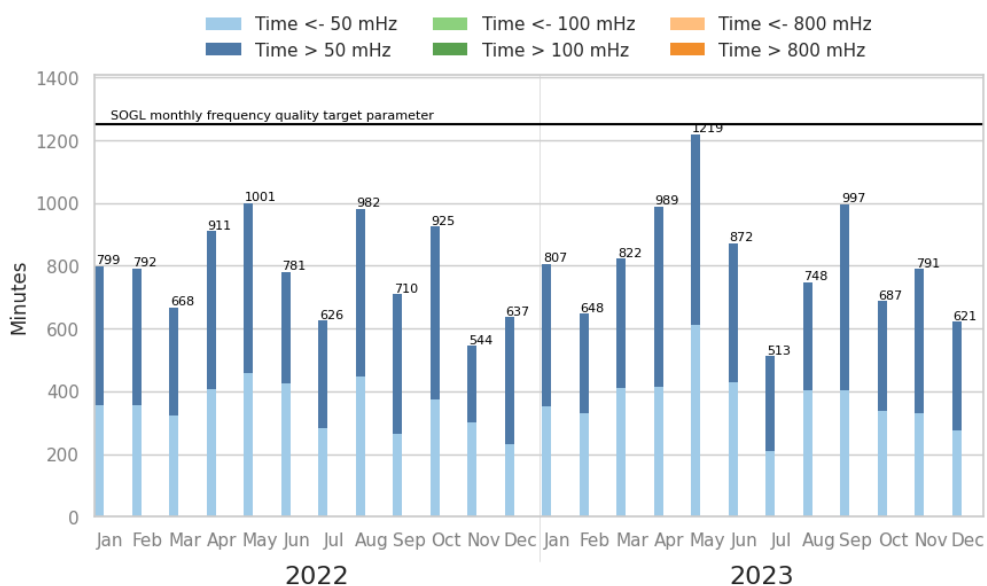


Figure 21 Monthly number of minutes outside the standard ranges in the Nordic synchronous area for 2023 and 2022

## Level 1 and Level 2 statistics

Figures 22 to 25 present the monthly distribution of FRCE time intervals outside the Level 1 range and Level 2 range for positive and negative time intervals is presented by month and year. If the maximum number of intervals exceeds 10512 for Level 1 or 1752 for Level 2, then mitigation measures must be proposed and taken.

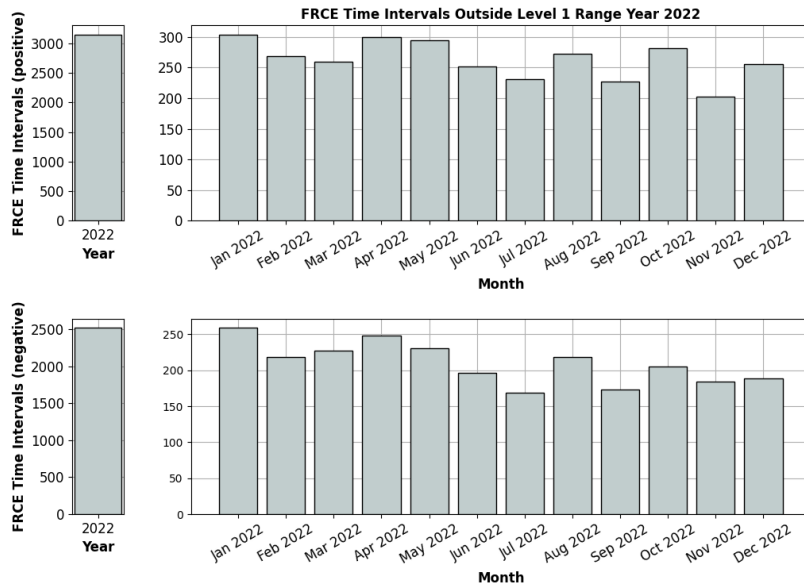


Figure 22 Nordic LFC 2022 FRCE Time Intervals Outside Level 1 Range

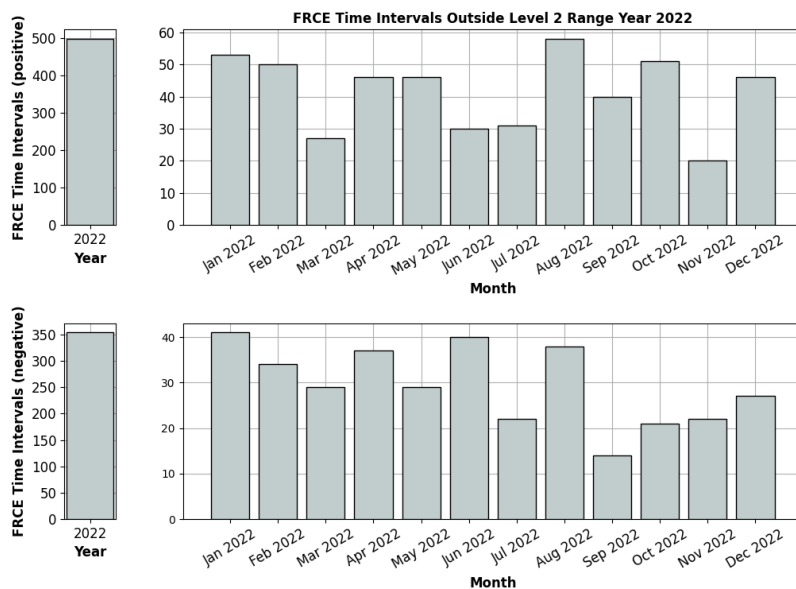


Figure 23 Nordic LFC 2022 FRCE Time Intervals Outside Level 2 Range

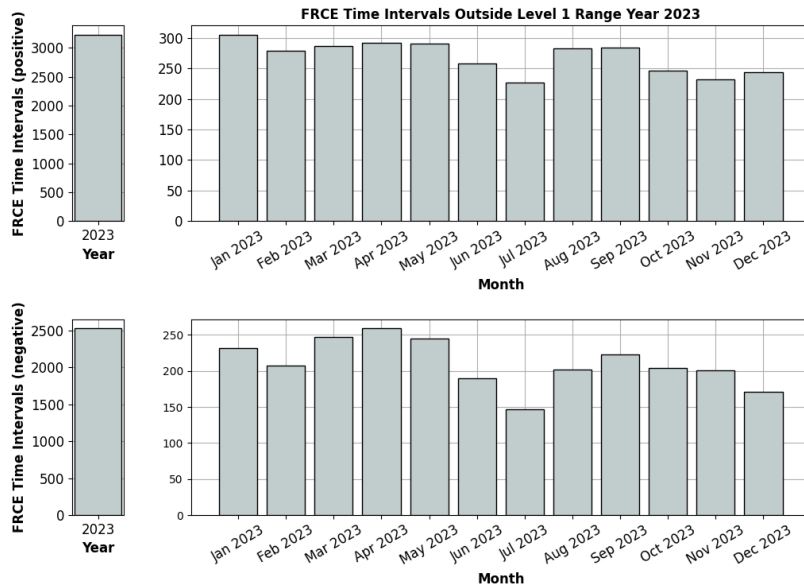


Figure 24 Nordic LFC 2023 FRCE Time Intervals Outside Level 1 Range

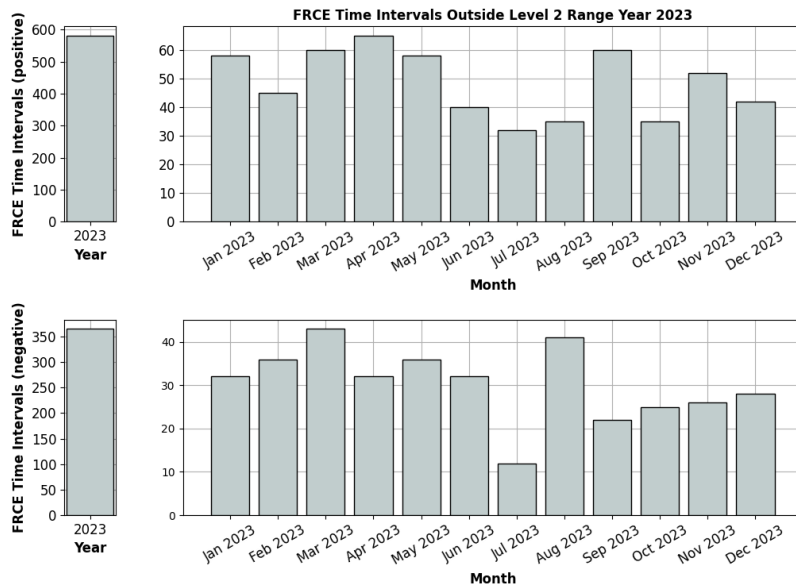


Figure 25 Nordic LFC 2023 FRCE Time Intervals Outside Level 2 Range

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## FRCE vs. FRR

The ability of LFC blocks to regulate their own FRCE can be assessed by comparing the FRCE to the reserve capacity from the dimensioning process, as described in Article 157 of the SOGL. Both automatic (aFRR) and manual (mFRR) FRR are included. Free energy bids can optionally be included. Positive and negative FRR is considered individually, that is, positive FRR (FRR+) is compared to the negative FRCE, and a negative FRR (FRR-) is compared to the positive FRCE. FRCE values include all correction signals (e.g., for TSOs part of an Imbalance Netting Process) and is the value after the adjustment process for TSOs part of an FRR activation process. The values used are the 1-minute average values. The granularity of the FRCE values (used to calculate the 1-minute average) is 10 seconds or lower.

The reported number of events indicates the occurrence of large imbalances in LFC blocks (equal or higher than 60 % of dimensioned FRR) and an insufficient capability of LFC blocks to solve them during the time to restore frequency.

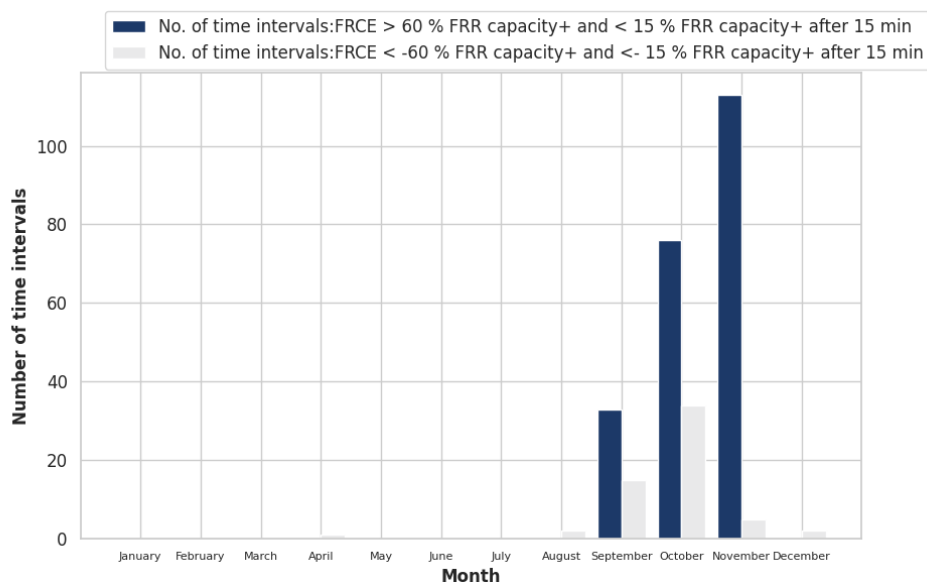


Figure 26 Nordic LFC 2022 FRCE Outside FRR Capacity within 15 minutes

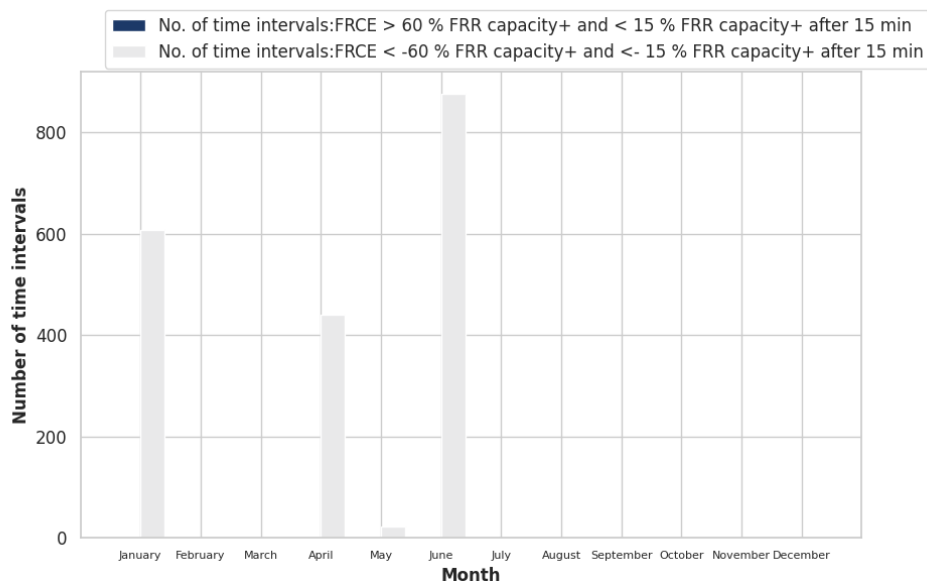


Figure 27 Nordic LFC 2023 FRCE Outside FRR Capacity within 15 minutes



## Frequency quality evaluation

### I. Mitigation Measures Analysis

The annual report on load-frequency control provides a description and date of implementation of any mitigation measures and ramping requirements to alleviate deterministic frequency deviations taken in the previous calendar year in accordance with SOGL Articles 137 and 138, in which TSOs were involved.

In accordance with Article 138 of the SOGL, when the values of the frequency quality target parameters calculated for the period of one calendar year are outside the targets set for the synchronous area, all TSOs of the relevant synchronous area should provide analysis and mitigation measures. Furthermore, when the FRCE target parameter values are outside the targets set for the LFC block, all TSOs of the relevant LFC block should provide analysis and mitigation measures.

According to Article 138 of the SOGL, the information contains:

(a) analysis of whether the frequency quality target parameters or the FRCE target parameters will remain outside the targets set for the synchronous area or for the LFC block and, in case of a justified risk that this may happen, an analysis of the causes and a set of recommendations; and

(b) description of any mitigation measures developed to ensure that the targets for the synchronous area or for the LFC block can be met in the future.

For the reporting period, which included the years 2022 and 2023, in line with Figures 27–30, the following analysis and mitigation measures were reported from the Nordic LFC Block:

#### **Mitigation measures for year 2022:**

There were no mitigation measures applied as FRCE performance was in the required range.

#### **Mitigation measures for year 2023:**

There were no mitigation measures applied as FRCE performance was in the required range.

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## Great Britain

### Frequency Performance

The figures in this Section present the frequency performance for Great Britain for the years 2022 and 2023. Input values for frequency are based on instantaneous frequency values. Based on the input values, mean value, standard deviation and percentiles were calculated. Moreover, any time periods and events where the system frequency was outside of predefined ranges were also indicated. For data points where the frequency was outside of the 200 mHz–800 mHz range, time is measured in minutes.

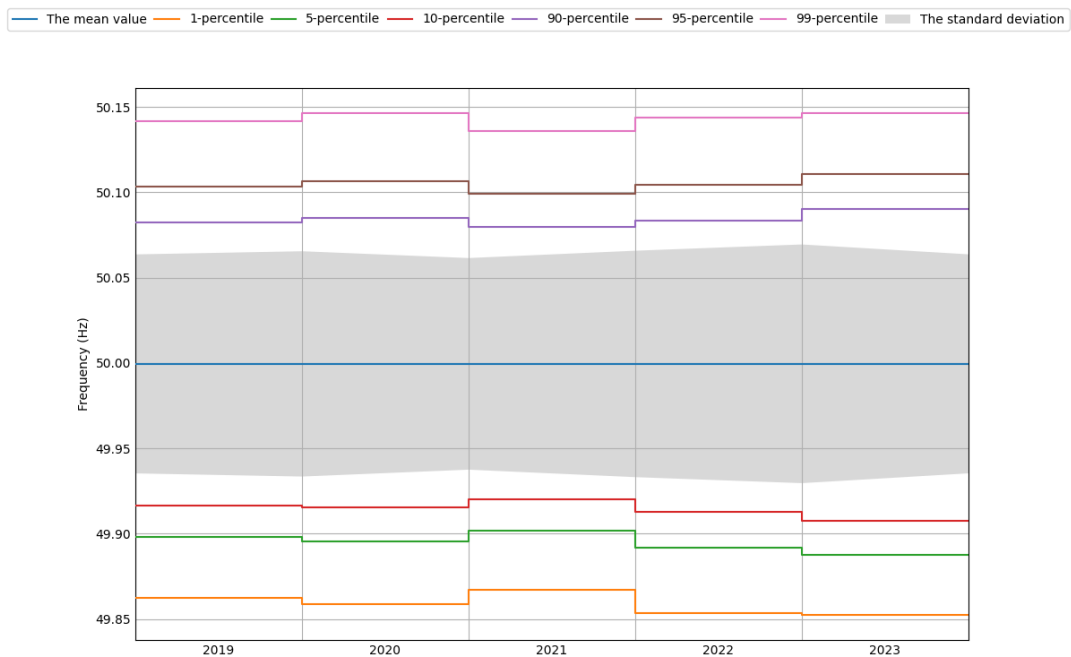


Figure 28 Annual frequency percentiles and standard deviation in Great Britain 2019–2023

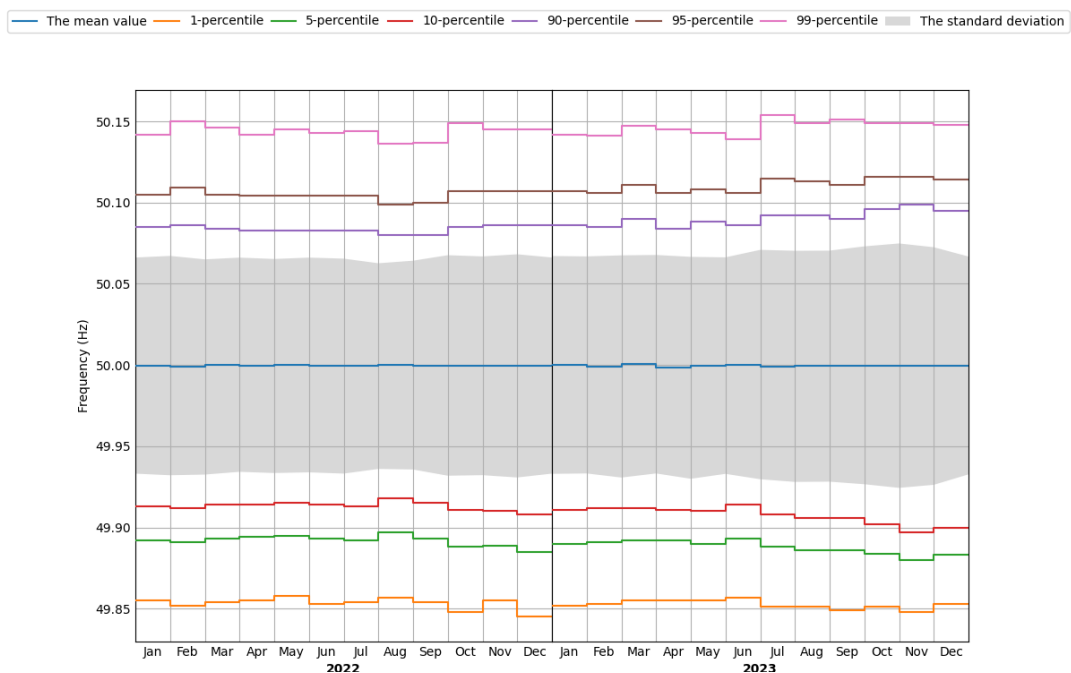


Figure 29 Monthly frequency percentiles and standard deviation in Great Britain for 2023 and 2022

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In Figures 30 and 31, the accumulated minutes outside standard ranges are presented for the years 2022 and 2023, respectively. The frequency quality target parameter, as defined in the SOGL, is 15000 minutes per year for each synchronous area. The monthly target parameter can be considered as 1/12 of this value, that is, 1250 minutes.

The graphs in Figures 8, 9 and 9a below show that the frequency quality was exceptionally good and that all target parameters from SOGL were fulfilled in the Great Britain Synchronous Area during the respective years.

The yearly trend shows that only a few minutes were observed where the frequency was outside the standard frequency range of +/- 200mHz for GB.

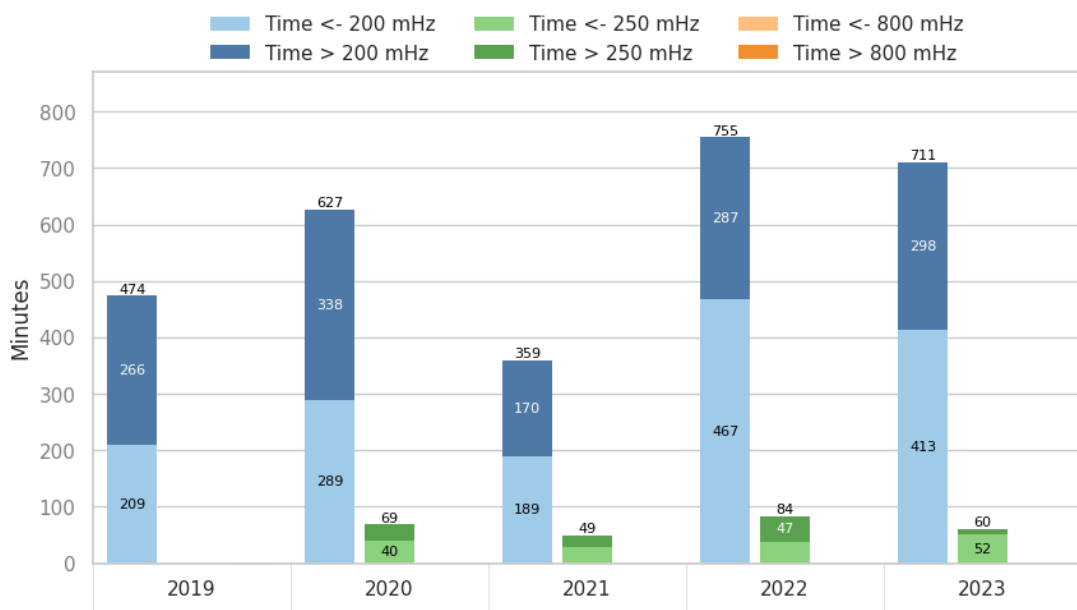


Figure 30 Annual number of minutes outside the standard ranges in Great Britain for 2019–2023

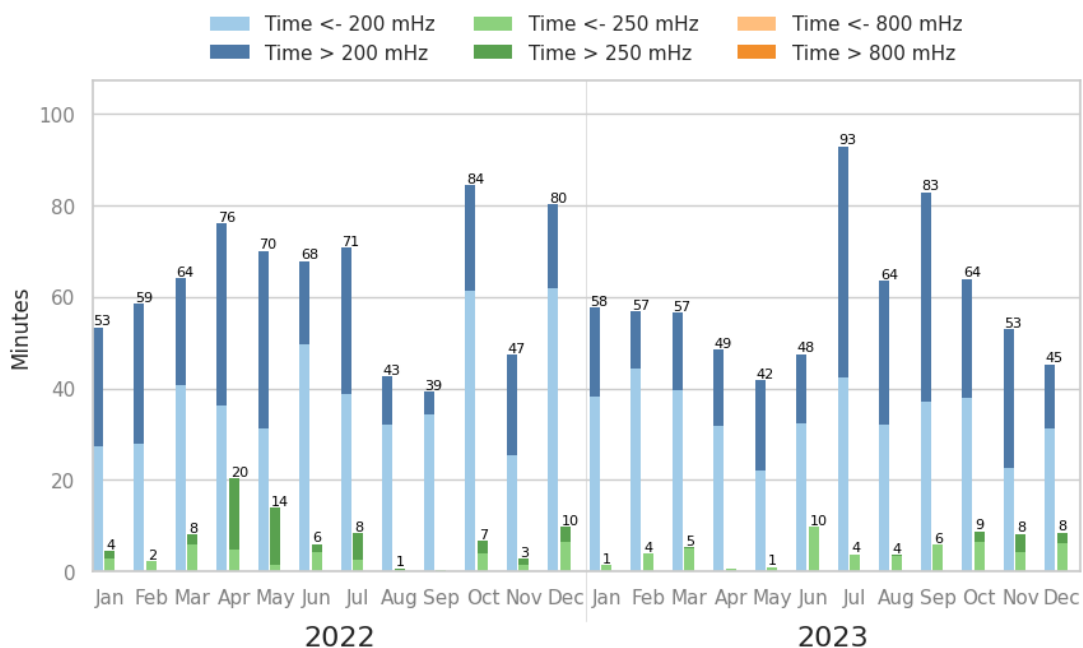


Figure 31 Monthly number of minutes outside the standard ranges in Great Britain for 2023 and 2022

## FCR data

### Introduction

The annual report on load-frequency control provides information on the FCR obligations and the initial FCR obligations of each TSO, covering each month of at least two previous calendar years. Furthermore, the SOGL requests that companies report two separate values regarding FCR with the following definitions:

- a) FCR obligation refers to the portion of all the FCR that falls under the responsibility of a TSO; and
- b) Initial FCR obligation refers to the amount of FCR allocated to a TSO on the basis of a sharing key.

Initial FCR obligation is reported on a monthly basis as an average value of FCR in MWs for the reported month. For TSOs that have the same value of initial FCR obligation for the whole year, TSO reports the same value for all months for the reported year. Otherwise, if the initial FCR obligation is not constant during a period, the TSO reports an average value of the FCR on a monthly level for the reported year.

#### Continental Europe TSOs

Tables 10 and 11, the FCR is given for every Continental Europe TSO from January (I) to December (XII) for 2022 and 2023, respectively. If more than one TSO is operating inside the Member State (e.g., Germany) the provided value per TSO is summarised for the Member State to enable comparability. The determined value describes the amount of initial FCR obligation inside the respective TSO, divided by the amount of procured FCR inside the TSO. This value is calculated as a percentage. Values higher than 100% indicate that respective TSO exported a percentage amount of FCR to other TSOs, while if the reported value is lower than 100 %, this means that the TSO imported part of its FCR from other TSOs (Part of its initial FCR obligation is contracted outside its responsibility area). If the value is equal to 100%, this mean that all FCR is ensured inside the TSO's area of responsibility. For the case of missing data or data that was not provided in a timely manner, the entry shows N/A.

#### Nordic TSOs

Tables 12 and 13, the FCR is pictured for every Nordic TSO from January (I) to December (XII) for 2022 and 2023, respectively. The initial FCR obligation for each TSO is the FCR-D capacity, that is, the frequency containment reserve (FCR) used to stabilise the frequency deviations between 49.5 and 50.5 Hz during disturbances. Each TSO ensures these capacities with a combination of mandatory requirements, internal markets, and a common market.

#### IE/NI and GB TSOs

In Tables 14 to 17 below, the FCR is presented from January (I) to December (XII) for 2022 and 2023. The FCR requirement for the Synchronous Area of IE/NI and GB is dynamic and it varies over a day; therefore, it is represented as a historical monthly MW average. In calculating the 'Average monthly FCR', the record spot FCR values are averaged over the monthly period. The amount of FCR obtained inside the area of TSO is also given as a percentage.

The following tables show FCR per TSO separately for each Synchronous Area presented in this report.

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## TSO data

### Continental Europe

It should be noted that eleven TSOs participated in the **FCR Cooperation** to procure their FCR in 2023 and 2022. Therefore, the value of procured FCR can be different from the initial FCR obligation due to export and import. These countries (TSOs) are Austria (APG), Czech Republic (CEPS), Belgium (Elia), Switzerland (Swissgrid), Germany (50Hertz, Amprion, TenneT DE, TransnetBW), Slovenia (ELES), Western Denmark (Energinet), France (RTE) and the Netherlands (TenneT NL). More information about the FCR Cooperation can be found at [https://www.entsoe.eu/network\\_codes/eb/fcr/](https://www.entsoe.eu/network_codes/eb/fcr/). Furthermore, bilateral cooperation between TSOs might impact the procured FCR. For example, SEPS imported FCR from CEPS in 2022 and 2023. Additionally, PSE procures slightly more FCR than necessary because they do not yet have divisible offers.

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2022

Name	Initial obligation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>50Hertz</b>	112 MW	236 %	230 %	261 %	236 %	234 %	247 %	242 %	259 %	261 %	244 %	228 %	213 %
<b>Amprion</b>	204 MW	79 %	79 %	79 %	76 %	68 %	77 %	78 %	75 %	79 %	83 %	81 %	79 %
<b>APG</b>	73 MW	105 %	113 %	115 %	130 %	134 %	123 %	136 %	127 %	123 %	125 %	130 %	121 %
<b>CEPS</b>	73 MW	110 %	110 %	111 %	107 %	108 %	108 %	104 %	105 %	107 %	111 %	108 %	110 %
CGES	3 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
<b>ELES</b>	15 MW	25 %	20 %	20 %	17 %	15 %	13 %	14 %	9 %	12 %	24 %	10 %	12 %
<b>Elia</b>	86 MW	32 %	32 %	33 %	32 %	33 %	32 %	31 %	32 %	35 %	35 %	33 %	37 %
EMS	45 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
<b>Energinet (CE)</b>	22 MW	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	8 %	11 %	4 %	6 %
ESO	36 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
HOPS	15 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
IPTO	48 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
KOSTT	3 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
MAVIR	38 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	102 %	101 %	100 %	100 %
MEPSO	6 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
NOS BiH	13 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
OST	6 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
PSE	159 MW	107 %	107 %	109 %	107 %	108 %	105 %	107 %	107 %	108 %	109 %	108 %	107 %
Red Eléctrica	388 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
REN	51 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
RTE	489 MW	111 %	110 %	104 %	110 %	112 %	112 %	104 %	99 %	102 %	111 %	122 %	125 %
SEPS	28 MW	75 %	79 %	75 %	81 %	76 %	65 %	59 %	58 %	56 %	65 %	74 %	78 %
<b>Swissgrid</b>	62 MW	86 %	88 %	73 %	89 %	144 %	143 %	149 %	128 %	100 %	82 %	53 %	61 %
TEIAS	320 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
<b>TenneT DE</b>	167 MW	105 %	106 %	101 %	104 %	95 %	84 %	87 %	91 %	92 %	87 %	89 %	97 %
<b>TenneT NL</b>	116 MW	62 %	70 %	58 %	60 %	59 %	56 %	56 %	62 %	58 %	66 %	63 %	53 %
Terna	293 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Transelectrica	57 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
<b>TransnetBW</b>	72 MW	49 %	40 %	73 %	43 %	26 %	28 %	67 %	83 %	81 %	46 %	30 %	33 %
Ukrenergo	0 MW	0 %	0 %	105 %	105 %	86 %	79 %	66 %	74 %	66 %	82 %	79 %	48 %

Table 10 FCR statistics for each TSO in Continental Europe for 2022. TSOs that participated in the FCR Cooperation are bolded.

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2023

Name	Initial obligation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>50Hertz</b>	115 MW	206 %	231 %	220 %	211 %	221 %	199 %	204 %	225 %	222 %	234 %	248 %	225 %
<b>Amprion</b>	210 MW	76 %	82 %	90 %	113 %	96 %	104 %	103 %	101 %	94 %	82 %	82 %	96 %
<b>APG</b>	72 MW	122 %	128 %	128 %	99 %	70 %	124 %	115 %	93 %	107 %	118 %	101 %	86 %
<b>CEPS</b>	76 MW	109 %	109 %	72 %	59 %	51 %	39 %	46 %	47 %	51 %	50 %	64 %	68 %
CGES	4 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
<b>ELES</b>	15 MW	11 %	7 %	11 %	3 %	5 %	5 %	5 %	2 %	3 %	6 %	2 %	5 %
<b>Elia</b>	88 MW	36 %	34 %	37 %	34 %	32 %	34 %	32 %	32 %	33 %	32 %	32 %	32 %
EMS	36 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
<b>Energinet (CE)</b>	23 MW	5 %	3 %	7 %	1 %	6 %	4 %	8 %	7 %	8 %	16 %	15 %	18 %
ESO	39 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
HOPS	17 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
IPTO	53 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
KOSTT	3 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
MAVIR	39 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
MEPSO	6 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
NOS BiH	14 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
OST	9 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
PSE	174 MW	102 %	104 %	102 %	101 %	100 %	100 %	100 %	100 %	100 %	100 %	101 %	101 %
Red Eléctrica	299 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
REN	50 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
RTE	514 MW	128 %	120 %	121 %	124 %	124 %	128 %	125 %	125 %	124 %	125 %	129 %	130 %
SEPS	30 MW	70 %	73 %	57 %	60 %	57 %	62 %	52 %	56 %	48 %	56 %	58 %	63 %
<b>Swissgrid</b>	62 MW	94 %	90 %	118 %	140 %	129 %	135 %	116 %	110 %	68 %	85 %	81 %	77 %
TEIAS	334 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
<b>TenneT DE</b>	171 MW	90 %	87 %	86 %	91 %	91 %	83 %	82 %	90 %	87 %	91 %	88 %	86 %
<b>TenneT NL</b>	111 MW	52 %	63 %	65 %	62 %	62 %	55 %	48 %	49 %	45 %	45 %	45 %	52 %
Terna	310 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Transelectrica	60 MW	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
<b>TransnetBW</b>	74 MW	25 %	9 %	20 %	9 %	12 %	7 %	8 %	12 %	9 %	9 %	10 %	10 %
Ukrenergo	129 MW	22 %	19 %	36 %	41 %	58 %	58 %	37 %	32 %	48 %	54 %	59 %	42 %

Table 11 FCR statistics for each TSO in Continental Europe for 2023. TSOs that participated in the FCR Cooperation are bolded.

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## Nordic

### 2022

Name	Initial obligation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Energinet (Nordic)</b>	39 MW	103%	103%	102%	103%	103%	95%	100%	100%	103%	102%	97%	100%
<b>Fingrid</b>	282 MW	103%	101%	100%	100%	84%	96%	100%	100%	101%	100%	100%	100%
<b>Statnett</b>	555 MW	165%	169%	169%	155%	142%	125%	135%	143%	133%	146%	145%	152%
<b>Svenska kraftnät</b>	545 MW	91%	85%	85%	94%	108%	107%	105%	106%	104%	108%	99%	93%

Table 12 FCR statistics for each TSO in the Nordics for 2022. Note that the Nordic FCR values were incorrectly reported in the 2022 annual report and have been corrected above.

### 2023

Name	Initial obligation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Energinet (Nordic)</b>	44 MW	97%	100%	99%	99%	98%	98%	98%	98%	99%	97%	100%	100%
<b>Fingrid</b>	290 MW	99%	99%	98%	98%	81%	98%	97%	97%	97%	100%	99%	99%
<b>Statnett</b>	553 MW	157%	161%	154%	151%	140%	146%	149%	136%	142%	134%	147%	153%
<b>Svenska kraftnät</b>	554 MW	99%	98%	97%	104%	108%	100%	53%	63%	107%	114%	97%	99%

Table 13 FCR statistics for each TSO in the Nordics for 2023



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## Ireland/Northern Ireland

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly FCR [MW]	282	237	277	288	291	294	301	303	303	266	271	291
FCR obtained inside the area of TSO [%]	77%	77%	82%	86%	79%	77%	85%	80%	83%	79%	80%	78%

Table 14 FCR statistics for each TSO in Ireland/Northern Ireland for year 2022

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly FCR [MW]	282	302	311	300	326	323	312	296	307	327	304	262
FCR obtained inside the area of TSO [%]	93%	95%	93%	93%	91%	91%	93%	93%	92%	93%	94%	94%

Table 15 FCR statistics for each TSO in Ireland/Northern Ireland for 2023

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## Great Britain

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly FCR [MW]	1204	1252	1221	1415	1666	1791	1856	1719	1807	1772	1629	1305
FCR obtained inside the area of TSO [%]	96%	96%	96%	96%	98%	100%	100%	100%	100%	100%	100%	100%

Table 16 FCR statistics for Great Britain for 2022. Note that the FCR obtained inside GB in June and October for 2022 were incorrectly reported as 1% in the annual report of 2022.

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly FCR [MW]	1256	1235	1051	1105	1187	1289	1666	1469	1498	1542	1301	1530
FCR obtained inside the area of TSO [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 17 FCR statistics for Great Britain for 2023

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## Glossary

Abbreviation	Meaning
AGC	Automatic Generation Control
CE	Continental Europe
EMS	Energy Management System
FCP	Frequency Containment Process
FRCE	Frequency Restoration Control Error
FRP	Frequency Restoration Process
FRR	Frequency Restoration Reserves
GB	Great Britain
IE/Nl	Ireland and Northern Ireland
LF-Controller	Load-Frequency Controller
LFC	Load-Frequency Control
PGM	Power-Generating Module
SCADA	Supervisory Control And Data Acquisition
SOC	System Operations Committee
TO	Transmission owner
TSO	Transmission System Operator
aFRR	Automatic Frequency Restoration Reserves
mFRR	Manual Frequency Restoration Reserves

Table 18 Abbreviations

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## Appendix I – Synchronous Area Data

### Continental Europe

2022

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
<b>The mean value</b>	50.00015	49.99986	50.00057	50.00079	49.99974	50.00020	50.00037	49.99997	50.00031	50.00038	49.99974	50.00108	50.00026
<b>The standard deviation</b>	0.0211	0.0220	0.0215	0.0227	0.0205	0.0195	0.0193	0.0187	0.0204	0.0216	0.0205	0.0199	0.0206
<b>1-percentile</b>	49.944	49.941	49.943	49.944	49.944	49.949	49.948	49.950	49.949	49.945	49.947	49.950	49.946
<b>5-percentile</b>	49.966	49.964	49.966	49.965	49.966	49.969	49.970	49.970	49.967	49.965	49.966	49.968	49.967
<b>10-percentile</b>	49.975	49.973	49.974	49.973	49.975	49.976	49.977	49.977	49.975	49.973	49.974	49.976	49.975
<b>90-percentile</b>	50.025	50.026	50.026	50.028	50.024	50.023	50.023	50.022	50.025	50.026	50.024	50.025	50.025
<b>95-percentile</b>	50.031	50.033	50.033	50.035	50.031	50.029	50.029	50.028	50.032	50.033	50.031	50.031	50.031
<b>99-percentile</b>	50.050	50.051	50.050	50.055	50.047	50.044	50.043	50.042	50.047	50.050	50.046	50.047	50.048
<b>Time(min) &gt; 50 mHz</b>	425	433	441	620	321	222	204	177	277	417	252	306	4095
<b>Time(min) &lt; -50 mHz</b>	698	712	676	689	646	439	482	434	450	637	552	424	6840
<b>Time(min) &gt; 800 mHz</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Time(min) &lt; -800 mHz</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of events freq. deviation &gt; 100 mHz and not &lt; 25 mHz</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of events freq. deviation &lt; -100 mHz and not &lt; -25 mHz</b>	0	0	1	1	0	1	1	0	0	0	0	0	4

Table 19 CE SA Performance for year 2022

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2023

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
<b>The mean value</b>	50.00022	50.00002	50.00061	50.00079	49.99974	50.00020	49.99997	50.00016	50.00079	50.00030	49.99986	50.00013	50.00023
<b>The standard deviation</b>	0.0206	0.0212	0.0253	0.0252	0.0224	0.0210	0.0208	0.0212	0.0228	0.0222	0.0216	0.0208	0.0221
<b>1-percentile</b>	49.949	49.947	49.936	49.937	49.945	49.948	49.946	49.945	49.944	49.944	49.946	49.946	49.944
<b>5-percentile</b>	49.967	49.965	49.959	49.960	49.964	49.967	49.967	49.965	49.964	49.964	49.965	49.966	49.964
<b>10-percentile</b>	49.975	49.974	49.970	49.971	49.972	49.975	49.975	49.974	49.973	49.973	49.973	49.975	49.973
<b>90-percentile</b>	50.026	50.025	50.030	50.030	50.027	50.025	50.025	50.025	50.028	50.027	50.026	50.025	50.027
<b>95-percentile</b>	50.034	50.032	50.040	50.041	50.035	50.033	50.032	50.033	50.037	50.035	50.033	50.032	50.035
<b>99-percentile</b>	50.050	50.049	50.063	50.066	50.056	50.051	50.050	50.052	50.060	50.054	50.050	50.049	50.054
<b>Time(min) &gt; 50 mHz</b>	414	340	1099	1164	678	455	429	505	803	574	412	377	7249
<b>Time(min) &lt; -50 mHz</b>	456	530	1173	1032	658	493	579	639	692	698	592	598	8140
<b>Time(min) &gt; 800 mHz</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Time(min) &lt; -800 mHz</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of events freq. deviation &gt; 100 mHz and not &lt; 25 mHz</b>	0	0	3	5	1	1	0	2	1	1	0	0	14
<b>No. of events freq. deviation &lt; -100 mHz and not &lt; -25 mHz</b>	0	0	4	1	0	1	0	0	2	1	2	0	11

Table 20 CE SA Performance for year 2023

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## Ireland/Northern Ireland

2022

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
The mean value	50.00030	49.99990	50.00010	50.00020	50.00040	50.00020	49.99960	50.00040	49.99980	50.00010	50.00020	49.99990	50.00009
The standard deviation	0.0450	0.0467	0.0456	0.0414	0.0424	0.0409	0.0403	0.0407	0.0428	0.0437	0.0454	0.0431	0.0432
1-percentile	49.896	49.896	49.897	49.906	49.909	49.910	49.910	49.910	49.905	49.902	49.898	49.904	49.904
5-percentile	49.927	49.923	49.925	49.932	49.932	49.935	49.933	49.934	49.931	49.930	49.928	49.930	49.930
10-percentile	49.943	49.940	49.941	49.946	49.946	49.948	49.946	49.947	49.944	49.945	49.942	49.944	49.944
90-percentile	50.058	50.062	50.058	50.052	50.055	50.052	50.050	50.051	50.054	50.057	50.059	50.055	50.055
95-percentile	50.074	50.077	50.075	50.066	50.069	50.065	50.062	50.064	50.068	50.072	50.074	50.070	50.070
99-percentile	50.102	50.102	50.101	50.090	50.095	50.089	50.084	50.088	50.091	50.100	50.099	50.098	50.095
Time(min) > 200 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
Time(min) < -200 mHz	2	0	1	1	0	0	0	3	0	0	0	0	7
Time(min) > 1000 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
Time(min) < -1000 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
No.of events freq.dev > 400 and > 200 mHz within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev < -400 and < -200 mHz within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev > 500 mHz and > 1 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev < -500 mHz and > 1 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 21 IE/NI SA Performance for year 2022

# 2023 ALFC REPORT

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2023

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
<b>The mean value</b>	50.00040	50.00030	49.99960	49.99980	50.00050	50.00020	49.99960	50.00050	50.00010	50.00010	50.00030	49.99970	50.00009
<b>The standard deviation</b>	0.0439	0.0425	0.0433	0.0420	0.0400	0.0420	0.0429	0.0431	0.0417	0.0412	0.0433	0.0415	0.0423
<b>1-percentile</b>	49.903	49.907	49.905	49.907	49.913	49.905	49.904	49.904	49.907	49.908	49.903	49.908	49.906
<b>5-percentile</b>	49.931	49.932	49.930	49.932	49.936	49.932	49.930	49.931	49.934	49.934	49.931	49.934	49.932
<b>10-percentile</b>	49.944	49.946	49.945	49.946	49.949	49.945	49.945	49.945	49.947	49.948	49.945	49.948	49.946
<b>90-percentile</b>	50.057	50.056	50.056	50.054	50.052	50.053	50.055	50.056	50.055	50.052	50.057	50.054	50.055
<b>95-percentile</b>	50.072	50.071	50.072	50.067	50.065	50.067	50.070	50.071	50.069	50.067	50.071	50.069	50.069
<b>99-percentile</b>	50.100	50.097	50.099	50.094	50.090	50.093	50.097	50.096	50.097	50.095	50.096	50.097	50.096
<b>Time(min) &gt; 200 mHz</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Time(min) &lt; -200 mHz</b>	0	0	0	0	0	2	0	0	1	0	0	0	4
<b>Time(min) &gt; 1000 mHz</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Time(min) &lt; -1000 mHz</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>No.of events freq.dev &gt; 400 and &gt; 200 mHz within 15 min</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of events freq.dev &lt; -400 and &lt; -200 mHz within 15 min</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of events freq.dev &gt; 500 mHz and &gt; 1 min</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of events freq.dev &lt; -500 mHz and &gt; 1 min</b>	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 22 IE/NI SA Performance for year 2023

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## Nordic

2022

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
The mean value	50.00003	49.99999	50.00006	50.00000	50.00006	50.00000	49.99994	50.00018	49.99998	49.99998	49.99995	49.99998	50.00001
The standard deviation	0.0404	0.0408	0.0393	0.0407	0.0425	0.0408	0.0383	0.0416	0.0401	0.0416	0.0380	0.0375	0.0401
1-percentile	49.904	49.902	49.906	49.901	49.899	49.900	49.909	49.899	49.908	49.903	49.906	49.911	49.904
5-percentile	49.935	49.934	49.936	49.932	49.931	49.933	49.939	49.933	49.936	49.933	49.938	49.940	49.935
10-percentile	49.950	49.950	49.951	49.948	49.947	49.949	49.953	49.933	49.949	49.950	49.952	49.954	49.949
90-percentile	50.050	50.051	50.049	50.053	50.054	50.051	50.048	50.052	50.050	50.053	50.047	50.046	50.050
95-percentile	50.067	50.068	50.065	50.070	50.071	50.067	50.063	50.069	50.067	50.070	50.061	50.062	50.067
99-percentile	50.100	50.102	50.096	50.104	50.104	50.097	50.096	50.104	50.101	50.105	50.091	50.098	50.100
Time(min) > 100 mHz	445	438	347	503	544	356	344	534	447	552	244	407	5161
Time(min) < -100 mHz	354	354	321	408	457	425	282	448	263	373	300	230	4215
Time(min) > 1000 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
Time(min) < -1000 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
No.of events freq.deviation > 200 mHz and > 100 mHz within 15 minutes	0	0	0	0	0	0	0	0	0	0	0	16	16
No.of events freq.deviation < -200 mHz and < -100 mHz within 15 minutes	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 23 Nordic SA Performance for year 2022



# 2023 ALFC REPORT

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2023

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
The mean value	50.00006	50.00006	50.00004	49.99998	49.99991	50.00011	50.00007	50.00001	49.99985	49.99993	50.00004	49.99998	50.00000
The standard deviation	0.0401	0.0395	0.0402	0.0422	0.0441	0.0415	0.0376	0.0400	0.0428	0.0392	0.0388	0.0368	0.0402
1-percentile	49.904	49.904	49.901	49.900	49.893	49.900	49.912	49.902	49.901	49.905	49.905	49.910	49.903
5-percentile	49.936	49.937	49.934	49.932	49.928	49.933	49.940	49.935	49.932	49.937	49.939	49.942	49.935
10-percentile	49.951	49.952	49.950	49.948	49.945	49.949	49.953	49.951	49.947	49.951	49.953	49.956	49.951
90-percentile	50.050	50.050	50.050	50.053	50.056	50.052	50.047	50.050	50.054	50.049	50.047	50.045	50.050
95-percentile	50.067	50.066	50.067	50.071	50.073	50.068	50.062	50.066	50.071	50.065	50.063	50.061	50.067
99-percentile	50.101	50.097	50.099	50.106	50.106	50.101	50.094	50.096	50.108	50.096	50.102	50.095	50.100
Time(min) > 100 mHz	455	318	410	576	606	443	302	344	595	349	462	346	5206
Time(min) < -100 mHz	352	330	412	413	613	429	211	404	402	338	329	275	4508
Time(min) > 1000 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
Time(min) < -1000 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
No.of events freq.deviation > 200 mHz and > 100 mHz within 15 minutes	0	0	0	16	0	0	16	0	43	0	44	0	119
No.of events freq.deviation < -200 mHz and < -100 mHz within 15 minutes	0	0	0	0	0	0	0	25	0	0	0	0	25

Table 24 Nordic SA Performance for year 2023

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## Great Britain

2022

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
The mean value	49.99963	49.99879	50.00017	49.99938	50.00001	49.99931	49.99932	49.99993	49.99971	49.99950	49.99945	49.99965	49.99957
The standard deviation	0.0665	0.0675	0.0662	0.0659	0.0659	0.0661	0.0662	0.0633	0.0643	0.0679	0.0673	0.0687	0.0663
1-percentile	49.855	49.852	49.854	49.855	49.858	49.853	49.854	49.857	49.854	49.848	49.855	49.845	49.853
5-percentile	49.892	49.891	49.893	49.894	49.895	49.893	49.892	49.897	49.893	49.888	49.889	49.885	49.892
10-percentile	49.913	49.912	49.914	49.914	49.915	49.914	49.913	49.918	49.915	49.911	49.910	49.908	49.913
90-percentile	50.085	50.086	50.084	50.083	50.083	50.083	50.083	50.080	50.080	50.085	50.086	50.086	50.084
95-percentile	50.105	50.109	50.105	50.104	50.104	50.104	50.104	50.099	50.100	50.107	50.107	50.107	50.105
99-percentile	50.142	50.150	50.146	50.142	50.145	50.143	50.144	50.136	50.137	50.149	50.145	50.145	50.144
Time(min) > 200 mHz	26	31	23	40	39	18	32	10	5	23	22	18	287
Time(min) < -200 mHz	27	28	41	36	31	50	39	32	34	61	25	62	467
Time(min) > 800 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
Time(min) < -800 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
No.of events freq.dev > 400 and > 200 mHz within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev < -400 and < -200 mHz within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev > 500 mHz and > 1 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev < -500 mHz and > 1 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 25 GB SA Performance for year 2022

# 2023 ALFC REPORT

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2023

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
The mean value	50.00003	49.99910	50.00048	49.99826	49.99962	50.00027	49.99917	49.99929	49.99980	49.99959	49.99936	49.99971	49.99956
The standard deviation	0.0670	0.0668	0.0684	0.0672	0.0683	0.0666	0.0706	0.0711	0.0711	0.0732	0.0752	0.0731	0.0699
1-percentile	49.852	49.853	49.855	49.855	49.855	49.857	49.851	49.851	49.849	49.851	49.848	49.853	49.853
5-percentile	49.890	49.891	49.892	49.892	49.890	49.893	49.888	49.886	49.886	49.884	49.880	49.883	49.888
10-percentile	49.911	49.912	49.912	49.911	49.910	49.914	49.908	49.906	49.906	49.902	49.897	49.900	49.907
90-percentile	50.086	50.085	50.090	50.084	50.088	50.086	50.092	50.092	50.090	50.096	50.099	50.095	50.090
95-percentile	50.107	50.106	50.111	50.106	50.108	50.106	50.115	50.113	50.111	50.116	50.116	50.114	50.111
99-percentile	50.142	50.141	50.147	50.145	50.143	50.139	50.154	50.149	50.151	50.149	50.149	50.148	50.146
Time(min) > 200 mHz	19	13	17	17	20	15	50	32	46	26	30	14	298
Time(min) < -200 mHz	38	44	40	32	22	33	43	32	37	38	23	31	413
Time(min) > 800 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
Time(min) < -800 mHz	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev > 400 and > 200 mHz within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev < -400 and < -200 mHz within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev > 500 mHz and > 1 min	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of events freq.dev < -500 mHz and > 1 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 26 GB SA Performance for year 2023

## Appendix II – LFC Block data

### Continental Europe

AK

2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-35.8	-11.4	-40.7	-13.3	10.1	15.8	-11.6	0.0	-4.7	-25.8	-18.1	-21.8	-13.1
The standard deviation	77	69	67	76	49	41	51	49	44	44	70	66	59
1-percentile	-214	-193	-217	-253	-123	-73	-155	-149	-125	-210	-151	-212	-173
5-percentile	-157	-131	-154	-155	-60	-37	-114	-85	-78	-95	-94	-144	-109
10-percentile	-131	-93	-126	-110	-37	-21	-80	-55	-59	-70	-74	-101	-80
90-percentile	46	71	40	70	70	59	47	56	40	8	42	46	50
95-percentile	85	98	65	103	94	86	70	73	61	26	78	83	77
99-percentile	182	171	115	159	162	165	113	113	131	65	143	151	139
Number of time intervals: average FRCE > Level 1 positive	418	637	331	595	728	702	422	648	367	109	363	397	5717
Number of time intervals: average FRCE < Level 1 negative	1494	975	1521	967	341	174	822	491	631	1033	990	1113	10552
Number of time intervals: average FRCE > Level 2 positive	233	370	143	345	384	290	196	265	144	35	201	237	2843
Number of time intervals: average FRCE < Level 2 negative	1058	632	1046	638	150	55	433	239	309	400	454	625	6039
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 27 LFC Block Performance for Block AK for year 2022

2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-25.4	-23.6	-19.4	-4.5	5.5	4.7	-3.9	3.3	1.2	-21.3	-0.9	-27.3	-9.3
The standard deviation	69	57	59	43	37	41	36	39	31	45	66	75	50
1-percentile	-181	-212	-185	-112	-95	-175	-90	-96	-118	-132	-161	-291	-154
5-percentile	-130	-117	-144	-70	-61	-53	-54	-52	-45	-97	-104	-154	-90
10-percentile	-102	-95	-102	-57	-42	-23	-34	-31	-29	-79	-78	-109	-65
90-percentile	48	39	45	46	51	41	38	40	37	29	84	55	46
95-percentile	95	59	66	71	69	61	62	81	53	51	120	87	73
99-percentile	216	105	100	121	114	117	111	158	97	104	175	144	130
Number of time intervals: average FRCE > Level 1 positive	388	322	420	623	559	438	343	382	372	303	725	528	5403
Number of time intervals: average FRCE < Level 1 negative	1418	1010	960	767	398	238	320	292	357	1067	857	1181	8865
Number of time intervals: average FRCE > Level 2 positive	254	133	193	293	204	150	162	207	122	115	466	264	2563
Number of time intervals: average FRCE < Level 2 negative	820	581	593	383	154	137	113	109	123	567	484	747	4811
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 28 LFC Block Performance for Block AK for year 2023

# 2023 ALFC REPORT



25 September 2024

## APG

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-0.3	-0.9	0.2	0.2	0.4	0.0	0.1	-0.2	0.0	0.3	0.1	0.4	0.0
The standard deviation	28	32	29	31	29	24	22	22	23	22	22	21	25
1-percentile	-86	-100	-85	-93	-87	-71	-67	-70	-73	-67	-66	-62	-77
5-percentile	-41	-50	-45	-49	-47	-37	-34	-35	-37	-34	-34	-32	-40
10-percentile	-25	-32	-29	-31	-30	-24	-22	-22	-23	-21	-21	-20	-25
90-percentile	24	30	28	31	31	23	22	21	23	22	20	20	25
95-percentile	38	45	43	48	47	35	33	33	36	33	31	31	38
99-percentile	73	79	79	87	87	63	62	59	68	63	60	58	70
Number of time intervals: average FRCE > Level 1 positive	1	0	1	5	2	3	0	0	1	0	0	3	16
Number of time intervals: average FRCE < Level 1 negative	6	12	1	3	1	4	0	4	2	0	1	2	36
Number of time intervals: average FRCE > Level 2 positive	0	0	0	2	0	2	0	0	0	0	0	0	4
Number of time intervals: average FRCE < Level 2 negative	3	7	0	1	0	2	0	0	0	0	0	2	15
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	1	0	0	2	0	1	0	0	0	0	0	0	4
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	3	0	0	0	1	0	0	0	0	0	1	5

Table 29 LFC Block Performance for Block APG for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	0.2	0.4	0.3	0.6	0.9	0.2	0.2	0.6	0.3	0.4	0.3	0.4	0.4
The standard deviation	21	24	26	30	31	22	25	27	21	25	27	21	25
1-percentile	-67	-74	-78	-84	-87	-72	-78	-81	-68	-81	-83	-62	-76
5-percentile	-33	-36	-39	-41	-41	-35	-38	-40	-33	-37	-37	-32	-37
10-percentile	-20	-22	-23	-25	-24	-22	-23	-24	-19	-21	-21	-20	-22
90-percentile	20	23	24	25	26	22	23	24	19	22	21	20	22
95-percentile	32	36	39	42	43	35	39	40	33	37	36	31	37
99-percentile	60	73	74	85	101	68	78	85	69	78	79	58	76
Number of time intervals: average FRCE > Level 1 positive	0	4	1	4	13	0	1	7	0	2	2	5	39
Number of time intervals: average FRCE < Level 1 negative	1	0	2	1	3	0	1	0	0	1	5	2	16
Number of time intervals: average FRCE > Level 2 positive	0	0	1	3	11	0	1	2	0	0	2	0	20
Number of time intervals: average FRCE < Level 2 negative	0	0	0	0	3	0	1	0	0	0	0	2	6
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	1	0	0	0	0	0	0	0	1
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	1	1	2	0	0	1	1	0	1	0	7

Table 30 LFC Block Performance for Block APG for year 2023

# 2023 ALFC REPORT



25 September 2024

## CEPS

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	2.3	0.6	2.2	-0.8	-1.2	0.2	-1.2	0.0	-0.3	-0.1	-0.5	-0.5	0.1
The standard deviation	45	40	46	48	41	40	41	41	38	36	36	45	41
1-percentile	-118	-114	-124	-141	-124	-111	-125	-110	-103	-102	-103	-132	-117
5-percentile	-56	-55	-58	-75	-62	-58	-61	-63	-57	-53	-52	-69	-60
10-percentile	-39	-38	-39	-50	-42	-41	-43	-44	-40	-38	-36	-47	-41
90-percentile	45	40	46	47	40	41	42	45	40	38	36	47	42
95-percentile	73	59	72	74	60	59	59	65	58	54	52	70	63
99-percentile	154	130	156	145	114	114	110	114	107	97	96	135	123
Number of time intervals: average FRCE > Level 1 positive	27	11	29	13	2	11	6	7	5	1	0	1	113
Number of time intervals: average FRCE < Level 1 negative	5	4	11	16	15	9	17	5	6	6	8	7	109
Number of time intervals: average FRCE > Level 2 positive	3	0	3	1	0	3	1	2	1	0	0	1	15
Number of time intervals: average FRCE < Level 2 negative	1	2	2	3	2	0	4	0	1	0	2	2	19
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	1	0	0	0	1	0	0	0	1	0	3
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 31 LFC Block Performance for Block CEPS for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	0.0	0.0	0.0	-0.5	0.1	0.0	-0.3	-0.8	-0.2	0.2	0.1	0.1	-0.1
The standard deviation	38	39	38	37	32	32	36	35	35	36	32	33	35
1-percentile	-109	-121	-107	-108	-90	-87	-91	-97	-91	-98	-86	-87	-98
5-percentile	-56	-58	-57	-54	-49	-47	-49	-48	-49	-52	-48	-49	-51
10-percentile	-39	-39	-40	-37	-35	-34	-35	-34	-36	-38	-35	-36	-37
90-percentile	39	39	40	37	35	35	35	34	36	38	35	36	37
95-percentile	56	57	57	53	49	48	49	47	49	54	48	49	51
99-percentile	109	116	111	105	89	84	91	88	88	101	88	88	97
Number of time intervals: average FRCE > Level 1 positive	2	1	3	0	0	1	1	2	1	1	1	0	13
Number of time intervals: average FRCE < Level 1 negative	1	1	2	7	0	4	3	14	5	6	2	1	46
Number of time intervals: average FRCE > Level 2 positive	0	0	1	0	0	0	1	0	1	0	0	0	3
Number of time intervals: average FRCE < Level 2 negative	1	0	0	3	0	1	2	5	2	2	1	0	17
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 32 LFC Block Performance for Block CEPS for year 2023

# 2023 ALFC REPORT



25 September 2024

## ELIA

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-9.1	-2.1	-8.6	0.7	1.2	-7.2	-4.2	-13.7	-1.1	5.5	-0.8	-5.1	-3.7
The standard deviation	61	79	77	70	68	59	59	57	55	57	50	45	62
1-percentile	-226	-249	-247	-217	-203	-213	-206	-225	-199	-176	-172	-177	-209
5-percentile	-116	-139	-141	-102	-94	-102	-94	-113	-88	-80	-77	-75	-102
10-percentile	-74	-84	-89	-61	-57	-62	-54	-66	-51	-44	-45	-44	-61
90-percentile	47	75	62	63	57	41	44	29	51	62	46	32	51
95-percentile	73	112	107	101	100	74	75	48	84	93	69	51	82
99-percentile	144	222	216	228	215	166	165	124	159	173	152	99	172
Number of time intervals: average FRCE > Level 1 positive	93	180	172	159	156	85	94	46	106	137	75	34	1337
Number of time intervals: average FRCE < Level 1 negative	198	230	268	155	145	160	145	192	130	108	95	97	1923
Number of time intervals: average FRCE > Level 2 positive	15	43	40	54	44	23	23	9	14	27	15	6	313
Number of time intervals: average FRCE < Level 2 negative	56	75	83	48	37	48	44	61	35	24	24	27	562
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	3	1	4	16	9	3	5	2	5	2	0	1	51

Table 33 LFC Block Performance for Block ELIA for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-6.1	-5.2	-7.5	-2.6	-3.2	-3.4	5.8	0.0	0.5	0.9	1.0	2.6	-1.4
The standard deviation	44	44	52	49	41	38	41	35	39	42	35	34	41
1-percentile	-180	-158	-218	-176	-158	-143	-128	-125	-145	-167	-113	-119	-153
5-percentile	-78	-80	-93	-79	-72	-57	-48	-52	-61	-63	-52	-45	-65
10-percentile	-44	-49	-55	-48	-42	-38	-27	-30	-34	-37	-30	-24	-38
90-percentile	29	35	37	39	32	29	44	33	37	42	37	35	36
95-percentile	46	53	53	59	53	45	65	49	55	62	51	48	53
99-percentile	91	100	101	136	93	90	114	92	96	108	95	81	100
Number of time intervals: average FRCE > Level 1 positive	23	34	33	61	40	32	79	40	41	64	39	22	508
Number of time intervals: average FRCE < Level 1 negative	104	95	139	99	114	82	67	67	91	98	63	59	1078
Number of time intervals: average FRCE > Level 2 positive	5	2	3	18	3	7	18	6	6	5	1	2	76
Number of time intervals: average FRCE < Level 2 negative	28	19	45	26	29	23	19	16	22	30	13	16	286
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	3	0	1	4	2	3	2	1	1	0	0	0	17

Table 34 LFC Block Performance for Block ELIA for year 2023

# 2023 ALFC REPORT



25 September 2024

## ESO

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	0.8	4.1	0.0	1.0	-2.4	-5.0	-3.5	-5.3	-4.2	-2.0	-0.2	6.8	-0.8
The standard deviation	49	53	47	54	47	55	49	40	62	65	70	80	56
1-percentile	-143	-149	-140	-139	-141	-158	-148	-126	-170	-194	-185	-173	-155
5-percentile	-75	-77	-79	-83	-75	-92	-83	-75	-90	-103	-108	-95	-86
10-percentile	-50	-50	-55	-60	-54	-65	-57	-50	-60	-72	-69	-63	-59
90-percentile	54	62	52	60	48	55	49	38	57	68	63	71	56
95-percentile	79	91	76	89	68	78	69	55	83	100	97	116	83
99-percentile	135	165	124	161	127	128	123	89	136	176	230	362	163
Number of time intervals: average FRCE > Level 1 positive	240	262	229	270	180	232	187	113	238	324	288	351	2914
Number of time intervals: average FRCE < Level 1 negative	215	192	241	274	224	300	248	210	269	361	323	299	3156
Number of time intervals: average FRCE > Level 2 positive	52	66	38	80	40	39	36	11	46	100	101	140	749
Number of time intervals: average FRCE < Level 2 negative	54	57	48	62	49	85	59	40	78	109	115	88	844
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	19	24	19	28	15	21	9	2	23	5	33	35	233
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	6	4	3	5	8	5	8	3	7	1	10	10	70

Table 35 LFC Block Performance for Block ESO for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	17.8	2.5	12.3	37.8	20.7	-0.4	3.6	-2.1	12.8	1.6	1.1	5.3	9.4
The standard deviation	106	72	107	144	85	51	64	80	72	81	85	78	85
1-percentile	-193	-207	-222	-181	-151	-154	-204	-264	-199	-249	-271	-232	-211
5-percentile	-105	-110	-130	-112	-80	-84	-97	-151	-94	-136	-137	-118	-113
10-percentile	-66	-74	-90	-75	-51	-55	-63	-87	-61	-86	-90	-78	-73
90-percentile	105	82	117	143	93	54	70	83	98	89	91	94	93
95-percentile	184	116	171	291	148	78	109	120	141	131	145	136	147
99-percentile	473	230	380	754	386	149	190	205	223	213	233	221	305
Number of time intervals: average FRCE > Level 1 positive	466	363	604	691	548	271	411	466	575	540	509	572	6016
Number of time intervals: average FRCE < Level 1 negative	315	321	491	344	264	283	345	462	318	469	467	436	4515
Number of time intervals: average FRCE > Level 2 positive	255	129	294	369	246	80	163	193	251	223	237	246	2686
Number of time intervals: average FRCE < Level 2 negative	115	116	191	124	82	92	126	228	116	232	227	183	1832
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	56	58	104	79	55	23	52	70	87	82	93	88	847
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	16	15	26	16	11	4	20	33	13	30	36	26	246

Table 36 LFC Block Performance for Block ESO for year 2023



# 2023 ALFC REPORT



25 September 2024

## Germany

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-6.0	9.0	-5.0	3.0	-6.0	4.0	-16.0	5.0	-6.0	16.0	32.0	22.0	4.3
The standard deviation	45	64	61	44	41	54	74	82	79	73	98	82	66
1-percentile	-104	-96	-210	-94	-101	-88	-221	-207	-217	-181	-229	-211	-163
5-percentile	-69	-55	-105	-57	-66	-54	-132	-110	-124	-92	-105	-104	-89
10-percentile	-52	-39	-65	-42	-51	-41	-94	-77	-85	-58	-59	-62	-60
90-percentile	40	57	59	54	41	49	60	96	68	98	135	111	72
95-percentile	60	78	80	70	59	66	94	131	108	138	198	160	104
99-percentile	128	124	150	134	119	121	185	240	244	229	336	251	188
Number of time intervals: average FRCE > Level 1 positive	7	7	3	7	4	14	14	24	30	19	80	33	242
Number of time intervals: average FRCE < Level 1 negative	2	1	17	1	0	0	17	10	15	8	21	15	107
Number of time intervals: average FRCE > Level 2 positive	1	4	0	1	0	11	1	5	3	1	8	1	36
Number of time intervals: average FRCE < Level 2 negative	0	1	0	0	0	0	1	0	1	0	6	1	10
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	1	0	0	0	0	1	2	2	1	1	4	12
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	1	1	0	0	1	1	2	2	2	3	13

Table 37 LFC Block Performance for Block Germany for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	37.0	39.0	18.0	21.0	17.0	15.0	10.0	-2.0	2.0	9.0	9.0	1.0	14.7
The standard deviation	88	122	98	98	81	119	85	78	83	84	79	83	92
1-percentile	-215	-255	-237	-226	-187	-246	-196	-215	-230	-250	-188	-227	-223
5-percentile	-83	-99	-121	-111	-90	-127	-105	-107	-124	-107	-90	-112	-106
10-percentile	-48	-57	-81	-76	-59	-81	-72	-74	-84	-71	-63	-77	-70
90-percentile	130	150	127	138	104	104	102	74	91	96	84	80	107
95-percentile	179	214	185	194	157	164	162	118	139	142	129	120	159
99-percentile	298	488	329	320	281	551	287	259	259	274	231	234	318
Number of time intervals: average FRCE > Level 1 positive	87	129	89	112	57	98	75	41	45	49	35	34	851
Number of time intervals: average FRCE < Level 1 negative	28	30	35	30	17	41	21	24	31	43	16	29	345
Number of time intervals: average FRCE > Level 2 positive	2	35	8	15	6	46	5	5	2	3	4	3	134
Number of time intervals: average FRCE < Level 2 negative	7	7	5	1	2	1	1	4	3	2	1	7	41
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	3	2	1	1	2	1	6	1	0	2	1	0	20
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	3	2	1	2	1	0	2	0	0	2	2	2	17

Table 38 LFC Block Performance for Block Germany for year 2023

# 2023 ALFC REPORT



25 September 2024

## IPTO

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	10.3	23.1	11.3	39.5	21.3	13.3	2.8	-1.8	9.1	33.6	16.3	19.1	16.5
The standard deviation	36	56	40	91	51	44	39	27	56	80	56	75	54
1-percentile	-51	-31	-46	-92	-52	-61	-83	-74	-92	-86	-71	-125	-72
5-percentile	-19	-13	-17	-23	-16	-23	-44	-46	-47	-40	-42	-61	-33
10-percentile	-12	-9	-10	-12	-10	-14	-32	-32	-34	-26	-30	-39	-22
90-percentile	38	89	40	156	82	48	35	26	47	136	71	92	72
95-percentile	80	146	85	241	125	98	54	37	93	209	124	150	120
99-percentile	179	255	192	400	220	198	160	70	263	336	259	334	239
Number of time intervals: average FRCE > Level 1 positive	161	301	174	546	328	188	104	28	178	518	276	355	3157
Number of time intervals: average FRCE < Level 1 negative	14	4	16	36	21	15	36	35	48	41	26	105	397
Number of time intervals: average FRCE > Level 2 positive	54	152	69	327	125	88	46	5	86	286	118	181	1537
Number of time intervals: average FRCE < Level 2 negative	3	0	4	11	6	0	9	1	8	11	2	25	80
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	69	129	70	140	150	94	49	33	77	170	118	127	1226
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	2	1	4	6	2	2	7	3	0	3	2	6	38

Table 39 LFC Block Performance for Block IPTO for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	38.7	24.9	37.3	20.9	26.2	6.0	6.4	6.1	13.4	5.8	27.4	17.9	19.3
The standard deviation	80	68	92	61	58	36	28	36	37	30	56	52	53
1-percentile	-71	-109	-135	-99	-50	-67	-51	-57	-46	-69	-49	-62	-72
5-percentile	-38	-45	-57	-42	-25	-34	-27	-28	-21	-27	-22	-27	-33
10-percentile	-24	-27	-32	-27	-14	-21	-18	-18	-13	-18	-12	-16	-20
90-percentile	140	105	151	92	87	32	31	31	46	30	122	65	78
95-percentile	201	164	218	141	136	56	52	58	86	47	122	113	116
99-percentile	331	287	378	268	257	177	123	163	169	128	232	247	230
Number of time intervals: average FRCE > Level 1 positive	624	399	653	367	417	122	98	128	195	97	506	292	3898
Number of time intervals: average FRCE < Level 1 negative	28	61	114	50	20	31	17	25	11	32	13	27	429
Number of time intervals: average FRCE > Level 2 positive	307	179	351	154	169	54	28	47	74	32	116	123	1634
Number of time intervals: average FRCE < Level 2 negative	2	14	29	14	0	7	2	9	4	4	3	7	95
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	87	77	134	70	69	20	11	15	23	18	42	37	603
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	1	0	0	1

Table 40 LFC Block Performance for Block IPTO for year 2023

# 2023 ALFC REPORT



25 September 2024

## MAVIR

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	0.8	1.2	0.7	1.3	1.0	0.4	0.4	0.4	0.4	0.0	-0.1	0.0	0.5
The standard deviation	15	17	19	17	14	16	17	14	17	20	25	16	17
1-percentile	-45	-49	-56	-49	-41	-43	-44	-41	-48	-59	-39	-45	-47
5-percentile	-24	-27	-31	-27	-21	-25	-27	-24	-26	-32	-24	-27	-26
10-percentile	-15	-18	-21	-19	-14	-18	-19	-17	-18	-22	-15	-18	-18
90-percentile	16	19	21	20	16	17	18	17	19	21	15	16	18
95-percentile	23	27	30	28	23	24	24	23	27	30	21	24	25
99-percentile	42	49	52	52	40	42	45	38	49	52	36	42	45
Number of time intervals: average FRCE > Level 1 positive	6	8	9	16	4	1	4	1	3	15	3	7	77
Number of time intervals: average FRCE < Level 1 negative	5	12	20	5	4	4	10	2	8	20	4	6	100
Number of time intervals: average FRCE > Level 2 positive	0	0	1	1	1	0	0	0	0	0	0	1	4
Number of time intervals: average FRCE < Level 2 negative	0	0	2	0	0	2	2	0	0	4	1	1	12
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 41 LFC Block Performance for Block MAVIR for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	1.0	1.8	1.3	1.3	1.0	0.8	0.9	0.4	0.9	0.7	0.3	0.2	0.9
The standard deviation	15	21	24	17	17	20	21	17	16	16	15	15	18
1-percentile	-44	-55	-63	-48	-49	-54	-53	-52	-49	-53	-42	-43	-50
5-percentile	-25	-27	-33	-27	-25	-30	-29	-28	-24	-25	-26	-26	-27
10-percentile	-17	-17	-22	-16	-17	-20	-19	-18	-15	-16	-16	-16	-18
90-percentile	17	19	22	19	17	19	19	17	16	17	16	16	18
95-percentile	26	28	36	27	26	30	27	25	24	25	23	23	27
99-percentile	44	60	68	52	54	59	61	48	47	49	43	40	52
Number of time intervals: average FRCE > Level 1 positive	7	20	35	15	25	31	37	13	11	16	8	10	228
Number of time intervals: average FRCE < Level 1 negative	4	16	28	5	17	20	23	20	19	19	16	6	193
Number of time intervals: average FRCE > Level 2 positive	0	5	7	3	1	4	2	1	0	0	1	0	24
Number of time intervals: average FRCE < Level 2 negative	0	0	1	0	1	4	1	2	2	0	1	0	12
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	2	1	0	0	1	0	0	0	0	0	0	4
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 42 LFC Block Performance for Block MAVIR for year 2023

# 2023 ALFC REPORT



25 September 2024

## PSE

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	0.1	2.5	1.2	3.3	1.4	-1.9	1.6	-1.1	0.7	3.3	-0.2	-0.4	0.9
The standard deviation	53	57	56	57	61	59	58	54	54	53	46	49	55
1-percentile	-136	-148	-152	-133	-154	-163	-142	-154	-142	-145	-136	-144	-146
5-percentile	-89	-87	-89	-86	-87	-94	-89	-90	-86	-81	-78	-82	-87
10-percentile	-61	-61	-65	-60	-59	-64	-65	-62	-59	-56	-55	-57	-60
90-percentile	60	64	63	65	63	60	65	60	60	61	53	54	61
95-percentile	83	94	90	96	84	86	94	85	84	86	70	76	86
99-percentile	134	174	149	174	145	137	166	134	146	152	113	119	145
Number of time intervals: average FRCE > Level 1 positive	29	52	45	64	39	32	63	31	45	54	17	20	491
Number of time intervals: average FRCE < Level 1 negative	32	34	45	28	50	51	45	52	39	40	33	42	491
Number of time intervals: average FRCE > Level 2 positive	5	10	7	6	8	0	12	1	3	5	2	2	61
Number of time intervals: average FRCE < Level 2 negative	3	2	2	3	8	10	1	5	6	5	0	3	48
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	2	5	1	7	2	0	6	1	2	4	2	2	34
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	2	2	1	1	3	6	2	3	3	3	0	1	27

Table 43 LFC Block Performance for Block PSE for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	0.4	1.6	4.4	6.5	4.1	-1.1	4.6	-2.0	0.9	1.0	0.0	1.3	1.8
The standard deviation	46	54	67	71	70	59	70	62	66	61	50	47	60
1-percentile	-132	-137	-158	-154	-174	-182	-162	-195	-173	-181	-156	-133	-161
5-percentile	-74	-82	-92	-85	-91	-93	-96	-105	-104	-95	-86	-69	-89
10-percentile	-51	-56	-61	-58	-62	-65	-64	-74	-69	-62	-57	-47	-61
90-percentile	49	57	66	71	69	59	73	65	70	60	56	50	62
95-percentile	74	84	100	110	105	89	108	94	101	91	81	74	93
99-percentile	127	151	223	267	239	148	262	146	188	176	137	129	183
Number of time intervals: average FRCE > Level 1 positive	27	45	91	101	112	70	117	75	100	79	53	39	909
Number of time intervals: average FRCE < Level 1 negative	31	31	62	46	75	83	96	121	116	78	69	39	847
Number of time intervals: average FRCE > Level 2 positive	1	12	25	32	33	9	37	4	20	20	2	8	203
Number of time intervals: average FRCE < Level 2 negative	1	3	6	5	10	12	5	15	16	17	2	5	97
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	4	6	12	13	14	6	13	1	7	6	0	4	86
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	1	1	2	1	3	6	2	8	4	7	0	2	37

Table 44 LFC Block Performance for Block PSE for year 2023

# 2023 ALFC REPORT



25 September 2024

## REE

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	2.7	-0.6	5.4	3.9	-2.0	-3.2	4.3	5.4	8.2	6.3	5.6	9.1	3.8
The standard deviation	56	55	51	69	60	49	42	43	52	48	54	49	52
1-percentile	-154	-151	-149	-212	-189	-173	-118	-122	-127	-132	-141	-115	-148
5-percentile	-77	-72	-63	-86	-84	-73	-56	-56	-62	-61	-69	-56	-68
10-percentile	-48	-50	-42	-51	-54	-48	-36	-37	-40	-37	-41	-34	-43
90-percentile	54	50	57	63	50	41	47	51	60	54	55	57	53
95-percentile	82	77	81	87	74	58	61	67	79	72	76	77	74
99-percentile	179	155	155	197	142	101	96	110	135	124	148	133	140
Number of time intervals: average FRCE > Level 1 positive	21	11	13	28	11	3	0	1	8	8	11	14	129
Number of time intervals: average FRCE < Level 1 negative	12	14	11	31	24	17	7	10	13	10	11	8	168
Number of time intervals: average FRCE > Level 2 positive	0	1	3	4	1	1	0	0	2	1	3	1	17
Number of time intervals: average FRCE < Level 2 negative	5	4	0	9	10	7	4	1	2	2	3	2	49
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	5	2	4	5	2	1	0	0	2	0	2	2	25
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	4	3	1	8	6	1	3	0	0	1	2	2	31

Table 45 LFC Block Performance for Block REE for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	9.8	6.2	11.6	3.1	4.4	4.5	3.0	2.4	8.2	12.2	16.6	12.0	7.8
The standard deviation	50	44	61	56	51	50	56	51	59	60	51	50	53
1-percentile	-115	-115	-130	-148	-141	-142	-150	-138	-144	-131	-112	-123	-132
5-percentile	-62	-62	-60	-73	-67	-60	-58	-63	-68	-62	-48	-54	-62
10-percentile	-38	-40	-36	-46	-42	-38	-38	-40	-40	-36	-28	-31	-38
90-percentile	63	57	61	49	51	51	47	46	59	66	69	64	57
95-percentile	87	78	87	70	72	75	67	66	84	92	90	90	80
99-percentile	160	115	213	124	144	135	130	122	159	164	172	160	150
Number of time intervals: average FRCE > Level 1 positive	14	5	32	11	23	19	20	22	31	34	37	33	281
Number of time intervals: average FRCE < Level 1 negative	6	3	10	18	21	22	28	20	24	20	14	10	196
Number of time intervals: average FRCE > Level 2 positive	1	0	8	3	7	3	5	10	9	7	6	6	65
Number of time intervals: average FRCE < Level 2 negative	0	0	1	4	2	5	6	2	3	2	3	2	30
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	1	1	3	2	1	1	1	3	2	3	0	0	18
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	1	0	1	2	0	0	1	0	1	6

Table 46 LFC Block Performance for Block REE for year 2023

# 2023 ALFC REPORT



25 September 2024

## REN

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	1.4	0.1	1.9	1.5	0.2	1.2	0.9	1.7	2.5	2.0	4.0	5.0	1.9
The standard deviation	15	15	15	15	14	17	16	15	21	21	21	21	17
1-percentile	-32	-45	-42	-38	-39	-49	-62	-38	-46	-52	-39	-35	-43
5-percentile	-12	-18	-14	-13	-15	-17	-18	-14	-17	-14	-16	-12	-15
10-percentile	-8	-10	-8	-8	-9	-10	-9	-8	-9	-8	-10	-8	-9
90-percentile	11	10	13	11	10	12	13	13	16	13	19	22	14
95-percentile	19	16	22	18	16	22	23	22	29	22	36	38	23
99-percentile	50	53	55	53	34	56	52	55	70	70	83	90	60
Number of time intervals: average FRCE > Level 1 positive	13	9	17	10	6	18	14	13	28	26	38	52	244
Number of time intervals: average FRCE < Level 1 negative	7	12	6	8	6	9	17	5	11	15	4	4	104
Number of time intervals: average FRCE > Level 2 positive	3	1	1	3	0	1	0	1	6	8	7	12	43
Number of time intervals: average FRCE < Level 2 negative	3	2	0	0	1	0	0	1	1	4	2	1	15
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	15	14	15	8	5	6	11	12	11	11	17	20	145
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	1	2	1	5	4	5	13	4	5	6	10	4	60

Table 47 LFC Block Performance for Block REN for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	4.2	1.7	3.0	-1.1	1.2	0.3	0.3	-0.5	0.7	2.2	4.8	1.9	1.6
The standard deviation	18	16	18	31	19	17	14	18	20	24	19	18	19
1-percentile	-24	-38	-34	-75	-48	-52	-48	-61	-65	-69	-23	-51	-49
5-percentile	-12	-14	-13	-22	-17	-18	-17	-21	-23	-26	-11	-16	-17
10-percentile	-8	-9	-9	-11	-10	-10	-9	-11	-12	-12	-7	-9	-10
90-percentile	18	14	15	11	12	11	9	10	15	17	18	15	14
95-percentile	33	24	27	21	22	19	17	17	26	37	34	26	25
99-percentile	80	61	71	60	74	56	44	47	63	93	87	66	67
Number of time intervals: average FRCE > Level 1 positive	37	16	24	22	38	18	11	13	28	85	61	35	388
Number of time intervals: average FRCE < Level 1 negative	4	6	2	29	19	22	12	26	30	40	5	17	212
Number of time intervals: average FRCE > Level 2 positive	5	0	4	3	8	6	2	2	4	10	9	6	59
Number of time intervals: average FRCE < Level 2 negative	0	2	0	8	4	3	2	4	6	5	2	4	40
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	25	3	12	8	7	8	8	13	17	18	19	15	153
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	2	4	2	9	18	2	3	3	5	9	0	6	63

Table 48 LFC Block Performance for Block REN for year 2023

# 2023 ALFC REPORT



25 September 2024

## RTE

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-2.8	0.7	-1.0	-2.2	-6.0	-10.8	-14.3	-7.8	-9.4	1.6	-12.4	-4.8	-5.8
The standard deviation	136	129	140	158	140	136	158	141	150	147	133	136	142
1-percentile	-451	-445	-406	-596	-477	-505	-578	-466	-506	-482	-530	-486	-494
5-percentile	-204	-198	-202	-227	-212	-228	-270	-215	-248	-214	-230	-201	-221
10-percentile	-130	-130	-133	-144	-130	-133	-156	-136	-152	-136	-137	-122	-137
90-percentile	107	114	112	122	106	105	112	108	117	127	99	100	111
95-percentile	158	163	160	175	151	148	162	155	167	196	138	145	160
99-percentile	404	403	446	523	408	310	446	447	427	489	344	422	422
Number of time intervals: average FRCE > Level 1 positive	82	75	87	100	67	50	79	79	81	119	49	67	935
Number of time intervals: average FRCE < Level 1 negative	120	94	121	135	133	141	184	136	162	128	143	122	1619
Number of time intervals: average FRCE > Level 2 positive	22	19	32	39	28	12	31	31	27	41	19	26	327
Number of time intervals: average FRCE < Level 2 negative	30	28	27	50	38	42	54	36	43	39	46	36	469
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	23	21	33	39	26	18	28	23	24	33	25	24	317
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	1	0	4	6	3	6	12	3	4	1	5	4	49

Table 49 LFC Block Performance for Block RTE for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-10.4	-7.5	23.7	1.4	18.2	55.9	10.2	7.8	20.4	10.2	0.7	9.3	11.7
The standard deviation	141	142	259	192	175	559	174	171	227	175	160	160	211
1-percentile	-545	-528	-734	-569	-428	-477	-473	-493	-665	-478	-553	-497	-536
5-percentile	-236	-228	-337	-262	-198	-185	-209	-198	-212	-213	-212	-196	-224
10-percentile	-136	-142	-185	-154	-120	-113	-128	-136	-150	-145	-134	-128	-139
90-percentile	104	115	218	130	144	122	133	134	172	154	130	144	142
95-percentile	149	156	433	216	259	236	233	217	338	244	192	227	242
99-percentile	347	380	973	705	725	1521	650	593	866	615	546	533	705
Number of time intervals: average FRCE > Level 1 positive	63	72	289	133	183	162	177	157	236	190	133	173	1968
Number of time intervals: average FRCE < Level 1 negative	152	131	212	172	135	120	150	141	152	157	152	136	1810
Number of time intervals: average FRCE > Level 2 positive	14	17	147	60	94	93	86	69	122	84	50	60	896
Number of time intervals: average FRCE < Level 2 negative	49	40	93	60	37	41	51	56	78	50	63	50	668
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	23	24	101	44	67	42	53	48	77	63	45	62	649
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	7	4	17	10	4	2	8	4	15	3	6	6	86

Table 50 LFC Block Performance for Block RTE for year 2023

# 2023 ALFC REPORT



25 September 2024

## SEPS

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-0.1	-0.3	-0.3	0.1	-0.2	-0.1	-0.2	-0.2	-0.8	-0.6	-0.8	-0.3	-0.3
The standard deviation	7	7	7	5	6	7	7	7	9	8	9	8	7
1-percentile	-25	-25	-25	-17	-15	-21	-27	-26	-31	-30	-34	-28	-25
5-percentile	-9	-10	-11	-6	-7	-9	-9	-11	-14	-12	-13	-10	-10
10-percentile	-6	-6	-6	-4	-4	-6	-6	-7	-8	-7	-8	-7	-6
90-percentile	6	6	6	4	4	6	6	7	7	6	7	6	6
95-percentile	9	8	8	7	6	8	9	10	10	9	9	8	8
99-percentile	16	18	18	15	12	15	15	16	18	16	16	16	16
Number of time intervals: average FRCE > Level 1 positive	0	0	2	1	1	0	0	0	1	3	0	2	10
Number of time intervals: average FRCE < Level 1 negative	7	1	1	1	3	2	5	7	10	7	8	5	57
Number of time intervals: average FRCE > Level 2 positive	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of time intervals: average FRCE < Level 2 negative	0	0	0	0	0	0	0	0	2	1	2	0	5
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 51 LFC Block Performance for Block SEPS for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-0.3	0.1	-0.1	1.4	1.7	-0.3	0.2	0.3	0.4	0.2	0.0	0.4	0.3
The standard deviation	12	8	8	22	17	8	7	6	8	8	7	8	10
1-percentile	-31	-23	-22	-25	-16	-21	-18	-17	-20	-20	-22	-21	-21
5-percentile	-13	-10	-10	-12	-7	-9	-9	-8	-11	-11	-11	-10	-10
10-percentile	-8	-6	-7	-8	-5	-5	-6	-5	-8	-7	-7	-7	-7
90-percentile	7	7	6	7	6	5	6	6	8	7	7	8	7
95-percentile	11	10	10	12	9	8	9	8	11	11	10	11	10
99-percentile	23	20	20	51	48	17	18	16	21	20	19	27	25
Number of time intervals: average FRCE > Level 1 positive	3	4	2	30	30	1	6	2	2	2	3	8	93
Number of time intervals: average FRCE < Level 1 negative	7	2	3	4	1	10	1	3	4	1	2	2	40
Number of time intervals: average FRCE > Level 2 positive	1	1	1	15	21	0	0	0	0	1	0	0	40
Number of time intervals: average FRCE < Level 2 negative	3	0	0	0	0	1	0	0	0	0	0	0	4
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	9	5	0	0	0	0	0	0	0	14
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 52 LFC Block Performance for Block SEPS for year 2023



# 2023 ALFC REPORT



25 September 2024

SG

## 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	0.0	0.0	0.0	-0.1	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1
The standard deviation	6	6	6	6	6	6	6	6	6	6	6	6	6
1-percentile	-19	-23	-21	-20	-17	-18	-16	-18	-23	-20	-20	-18	-19
5-percentile	-12	-12	-12	-11	-9	-10	-10	-10	-12	-12	-11	-10	-11
10-percentile	-8	-8	-7	-7	-6	-7	-7	-6	-7	-7	-7	-6	-7
90-percentile	7	7	7	6	6	6	6	6	7	7	7	6	7
95-percentile	10	10	9	9	8	9	8	8	10	10	9	8	9
99-percentile	16	16	15	16	14	15	13	14	15	16	15	14	15
Number of time intervals: average FRCE > Level 1 positive	0	0	0	0	1	0	0	0	0	0	0	1	2
Number of time intervals: average FRCE < Level 1 negative	0	0	0	2	0	0	0	0	0	0	0	0	2
Number of time intervals: average FRCE > Level 2 positive	0	0	0	0	0	0	0	0	0	0	0	1	1
Number of time intervals: average FRCE < Level 2 negative	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 53 LFC Block Performance for Block SG for year 2022

## 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-0.1	0.7	0.0	0.0	-0.1	0.0	-0.2	-0.3	-0.2	0.0	0.0	0.1	0.0
The standard deviation	6	23	7	6	5	10	6	6	6	6	6	6	8
1-percentile	-20	-18	-20	-20	-17	-17	-17	-19	-20	-19	-17	-17	-18
5-percentile	-11	-11	-12	-11	-10	-9	-10	-11	-11	-10	-10	-10	-11
10-percentile	-7	-7	-8	-8	-6	-6	-6	-7	-8	-7	-6	-6	-7
90-percentile	7	7	7	7	6	5	6	6	7	6	6	6	6
95-percentile	9	9	10	10	8	7	8	9	10	9	8	8	9
99-percentile	16	15	17	16	13	13	13	15	15	14	13	14	14
Number of time intervals: average FRCE > Level 1 positive	0	3	0	0	0	2	0	0	0	0	0	1	6
Number of time intervals: average FRCE < Level 1 negative	0	0	0	0	0	1	0	1	0	0	1	0	3
Number of time intervals: average FRCE > Level 2 positive	0	3	0	0	0	2	0	0	0	0	0	1	6
Number of time intervals: average FRCE < Level 2 negative	0	0	0	0	0	1	0	0	0	0	0	0	1
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	1	0	0	0	1	0	0	0	0	0	0	2
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 54 LFC Block Performance for Block SG for year 2023

# 2023 ALFC REPORT



25 September 2024

## SHB

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	9.7	13.3	9.3	12.7	10.4	9.5	6.1	1.9	-8.6	-5.2	1.3	-3.3	4.8
The standard deviation	25	26	31	27	23	34	31	32	40	30	31	37	31
1-percentile	-71	-65	-79	-72	-62	-93	-85	-87	-148	-101	-86	-129	-90
5-percentile	-30	-25	-34	-25	-21	-47	-42	-47	-69	-55	-47	-62	-42
10-percentile	-14	-15	-19	-13	-11	-27	-26	-33	-49	-39	-32	-43	-27
90-percentile	30	40	37	41	32	42	35	31	30	24	37	30	34
95-percentile	41	55	50	55	43	54	52	46	48	39	50	44	48
99-percentile	83	95	89	93	82	87	97	95	96	72	82	79	88
Number of time intervals: average FRCE > Level 1 positive	55	67	60	83	51	69	77	68	65	33	59	47	734
Number of time intervals: average FRCE < Level 1 negative	36	26	37	30	21	64	51	64	143	80	55	119	726
Number of time intervals: average FRCE > Level 2 positive	7	8	6	9	8	6	11	8	13	3	7	7	93
Number of time intervals: average FRCE < Level 2 negative	4	2	10	3	2	9	3	12	43	11	8	30	137
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	3	0	3	2	3	1	4	2	7	3	2	1	31
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	1	0	0	0	0	2	0	0	2	0	0	0	5

Table 55 LFC Block Performance for Block SHB for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	3.6	6.6	9.2	9.1	7.4	7.3	10.3	0.2	4.9	2.0	9.0	10.9	6.7
The standard deviation	30	26	28	32	29	29	32	29	25	27	29	26	28
1-percentile	-98	-58	-80	-78	-80	-73	-87	-92	-64	-80	-93	-68	-79
5-percentile	-43	-30	-30	-32	-30	-26	-26	-43	-31	-41	-36	-27	-33
10-percentile	-27	-17	-16	-18	-16	-13	-13	-26	-19	-28	-20	-13	-19
90-percentile	35	29	37	38	36	30	38	24	28	28	38	39	33
95-percentile	50	43	52	57	52	42	54	42	44	42	50	50	48
99-percentile	86	84	88	107	94	94	113	94	87	75	79	83	90
Number of time intervals: average FRCE > Level 1 positive	51	38	65	92	106	59	118	83	71	57	86	80	906
Number of time intervals: average FRCE < Level 1 negative	53	16	45	33	48	34	50	76	33	64	60	45	557
Number of time intervals: average FRCE > Level 2 positive	7	8	3	18	15	21	29	20	8	6	11	9	155
Number of time intervals: average FRCE < Level 2 negative	4	3	6	8	10	10	12	10	5	9	9	7	93
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	3	1	0	5	5	2	2	0	0	0	0	0	18
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	1	0	0	0	0	0	0	0	0	1

Table 56 LFC Block Performance for Block SHB for year 2023

# 2023 ALFC REPORT



25 September 2024

## SMM

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-25.4	-2.9	-13.9	-21.5	0.3	8.5	10.3	4.3	-8.7	-12.0	-9.3	-6.8	-6.4
The standard deviation	57	62	60	53	41	44	50	70	46	81	59	55	57
1-percentile	-198	-163	-164	-183	-111	-91	-97	-229	-144	-286	-169	-155	-166
5-percentile	-118	-107	-110	-119	-50	-52	-61	-81	-72	-204	-102	-93	-97
10-percentile	-95	-79	-84	-87	-36	-37	-43	-52	-50	-80	-73	-71	-66
90-percentile	40	74	61	35	46	69	76	68	33	57	50	56	56
95-percentile	63	99	83	62	66	86	101	111	54	83	75	85	81
99-percentile	108	135	134	104	115	131	155	212	104	145	137	139	135
Number of time intervals: average FRCE > Level 1 positive	122	288	228	106	122	278	357	285	82	215	160	204	2447
Number of time intervals: average FRCE < Level 1 negative	562	331	435	433	77	73	93	192	159	326	315	304	3300
Number of time intervals: average FRCE > Level 2 positive	15	7	31	7	19	28	67	107	12	44	31	36	404
Number of time intervals: average FRCE < Level 2 negative	99	33	72	104	20	6	8	66	31	235	67	48	789
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	2	4	2	0	4	3	11	9	1	6	4	8	54
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	3	0	3	1	1	0	0	2	1	13	2	2	28

Table 57 LFC Block Performance for Block SMM for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-11.2	-15.1	-0.6	-9.0	3.6	0.9	2.3	0.9	7.8	3.2	-15.6	2.4	-2.5
The standard deviation	59	48	42	56	61	52	44	31	34	34	66	68	50
1-percentile	-162	-167	-117	-148	-97	-218	-91	-83	-72	-76	-301	-148	-140
5-percentile	-105	-90	-62	-79	-59	-64	-49	-47	-45	-45	-110	-81	-70
10-percentile	-80	-59	-43	-61	-45	-39	-35	-33	-31	-32	-70	-58	-49
90-percentile	53	29	45	36	68	50	45	36	51	43	40	63	47
95-percentile	83	46	69	55	93	74	65	51	64	64	62	87	68
99-percentile	154	91	131	80	140	126	113	90	101	105	105	176	118
Number of time intervals: average FRCE > Level 1 positive	195	60	147	157	348	192	172	95	171	168	153	314	2172
Number of time intervals: average FRCE < Level 1 negative	358	208	117	201	137	133	85	81	51	65	349	276	2061
Number of time intervals: average FRCE > Level 2 positive	50	3	29	33	72	39	26	11	18	18	24	82	405
Number of time intervals: average FRCE < Level 2 negative	62	56	18	39	13	54	26	6	7	6	133	63	483
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	4	1	5	5	4	9	4	2	0	6	7	8	55
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	2	7	2	2	1	3	4	0	0	0	3	1	25

Table 58 LFC Block Performance for Block SMM for year 2023

# 2023 ALFC REPORT



25 September 2024

## TEIAS

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-2.9	-2.6	-4.0	-5.7	-5.0	-5.0	-3.7	-2.7	-3.0	0.3	-1.2	-1.4	-3.1
The standard deviation	27	26	28	32	25	25	21	20	19	27	22	21	25
1-percentile	-90	-87	-96	-128	-109	-105	-72	-72	-73	-126	-90	-78	-94
5-percentile	-52	-56	-61	-69	-58	-57	-50	-46	-47	-53	-45	-44	-53
10-percentile	-41	-45	-49	-54	-46	-44	-40	-37	-37	-38	-35	-34	-42
90-percentile	36	36	34	35	29	26	26	25	25	39	31	30	31
95-percentile	50	48	48	50	41	37	37	35	35	50	41	39	43
99-percentile	101	108	110	99	83	74	66	75	63	85	65	63	83
Number of time intervals: average FRCE > Level 1 positive	4	8	13	6	5	5	6	3	0	8	3	3	64
Number of time intervals: average FRCE < Level 1 negative	4	0	3	11	7	4	3	3	0	15	4	2	56
Number of time intervals: average FRCE > Level 2 positive	1	0	1	0	1	2	0	0	0	0	0	0	5
Number of time intervals: average FRCE < Level 2 negative	1	0	0	4	0	0	0	0	0	0	1	2	8
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	1	0	0	1
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	1	0	0	0	0	0	0	0	0	1

Table 59 LFC Block Performance for Block TEIAS for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	2.0	-9.4	-9.4	-10.1	-7.6	-9.7	-13.9	-11.2	-13.6	-11.2	-11.2	-9.7	-9.6
The standard deviation	37	37	36	46	36	37	39	38	31	35	41	36	37
1-percentile	-110	-130	-120	-164	-109	-116	-123	-144	-106	-104	-138	-108	-123
5-percentile	-47	-59	-61	-67	-59	-62	-64	-64	-58	-60	-65	-61	-61
10-percentile	-33	-44	-46	-49	-45	-48	-52	-49	-45	-47	-49	-48	-46
90-percentile	37	27	29	34	32	32	27	29	21	27	31	31	30
95-percentile	47	38	41	48	44	42	38	40	32	41	44	44	42
99-percentile	75	82	70	88	66	67	60	70	59	78	85	69	72
Number of time intervals: average FRCE > Level 1 positive	5	4	3	3	2	1	2	0	0	5	9	2	36
Number of time intervals: average FRCE < Level 1 negative	9	10	8	21	8	14	10	23	10	9	18	13	153
Number of time intervals: average FRCE > Level 2 positive	0	0	0	2	0	1	1	0	0	0	0	0	4
Number of time intervals: average FRCE < Level 2 negative	1	2	1	4	2	3	1	1	0	0	4	0	19
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	1	0	0	0	0	1	2	0	0	0	0	4
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	1	0	0	0	1	0	1	0	3

Table 60 LFC Block Performance for Block TEIAS for year 2023

# 2023 ALFC REPORT



25 September 2024

TEL

2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	4.9	6.0	5.0	6.6	3.6	5.8	3.7	1.5	4.9	4.6	3.2	2.9	4.4
The standard deviation	42	44	40	39	27	38	35	30	33	37	30	41	36
1-percentile	-123	-114	-100	-90	-48	-74	-101	-100	-91	-88	-75	-107	-92
5-percentile	-37	-27	-25	-21	-18	-22	-23	-24	-22	-23	-22	-20	-24
10-percentile	-20	-17	-16	-13	-11	-15	-14	-15	-13	-14	-14	-12	-15
90-percentile	34	32	26	27	17	23	19	16	24	22	18	19	23
95-percentile	73	69	63	69	34	62	44	31	56	48	37	44	52
99-percentile	158	157	155	177	109	167	134	114	141	136	125	145	143
Number of time intervals: average FRCE > Level 1 positive	140	112	125	124	54	107	85	51	94	85	61	82	1120
Number of time intervals: average FRCE < Level 1 negative	64	41	45	34	17	24	40	41	30	35	24	43	438
Number of time intervals: average FRCE > Level 2 positive	32	29	39	47	17	40	26	20	23	26	21	29	349
Number of time intervals: average FRCE < Level 2 negative	21	18	13	12	4	9	8	9	8	10	6	20	138
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 61 LFC Block Performance for Block TEL for year 2022

2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	5.8	3.7	9.0	8.6	10.0	5.2	6.4	2.3	6.3	2.6	2.0	2.6	5.4
The standard deviation	34	26	48	42	47	29	48	32	33	29	30	37	36
1-percentile	-68	-44	-97	-71	-41	-42	-40	-74	-35	-55	-80	-110	-63
5-percentile	-21	-21	-21	-18	-17	-17	-20	-23	-20	-20	-24	-22	-20
10-percentile	-13	-14	-13	-12	-12	-11	-13	-14	-13	-13	-14	-13	-13
90-percentile	26	19	36	29	28	20	18	16	20	15	16	15	21
95-percentile	54	32	82	74	77	45	37	30	48	24	30	32	47
99-percentile	144	126	191	196	207	135	200	125	160	124	138	144	157
Number of time intervals: average FRCE > Level 1 positive	89	57	156	138	161	86	86	63	114	61	70	77	1158
Number of time intervals: average FRCE < Level 1 negative	23	9	36	26	14	11	16	33	10	19	38	47	282
Number of time intervals: average FRCE > Level 2 positive	30	15	60	57	75	30	51	29	46	23	33	33	482
Number of time intervals: average FRCE < Level 2 negative	9	2	15	6	7	5	5	12	0	8	11	20	100
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 62 LFC Block Performance for Block TEL for year 2023

# 2023 ALFC REPORT



25 September 2024

## TERNA

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-19.1	-17.7	-21.9	-21.4	-20.6	-31.4	-35.0	-26.5	-25.8	-6.6	-26.7	-17.8	-22.5
The standard deviation	121	150	138	157	130	136	144	124	147	135	139	130	138
1-percentile	-491	-579	-510	-589	-531	-597	-597	-532	-603	-494	-585	-557	-555
5-percentile	-228	-286	-279	-307	-245	-284	-310	-274	-287	-203	-295	-233	-269
10-percentile	-133	-149	-157	-169	-144	-165	-187	-136	-170	-126	-156	-130	-152
90-percentile	82	103	84	93	84	69	80	70	94	105	79	84	86
95-percentile	116	158	126	148	123	103	120	106	133	169	113	118	128
99-percentile	208	398	302	411	270	196	234	198	304	377	240	296	286
Number of time intervals: average FRCE > Level 1 positive	51	112	75	106	60	40	62	38	86	127	55	72	884
Number of time intervals: average FRCE < Level 1 negative	207	221	257	274	232	265	311	234	275	180	257	197	2910
Number of time intervals: average FRCE > Level 2 positive	10	31	21	43	20	9	14	12	27	43	13	19	262
Number of time intervals: average FRCE < Level 2 negative	83	99	104	116	88	115	138	106	113	74	112	88	1236
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	38	163	105	453	129	59	92	63	196	308	90	132	1828
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	516	769	759	1139	685	921	995	1042	866	456	948	821	9917

Table 63 LFC Block Performance for Block TERNA for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-8.6	-16.6	-15.6	-5.0	-1.1	-2.2	0.7	-9.6	-2.9	-4.3	-15.7	-8.3	-7.4
The standard deviation	127	136	150	143	123	123	135	145	127	147	126	141	135
1-percentile	-489	-515	-561	-496	-424	-440	-455	-531	-422	-520	-509	-540	-492
5-percentile	-208	-241	-271	-235	-177	-158	-187	-241	-204	-233	-232	-203	-216
10-percentile	-115	-142	-149	-125	-103	-96	-106	-120	-121	-129	-123	-101	-119
90-percentile	87	94	100	111	92	86	109	86	104	104	79	77	94
95-percentile	131	139	149	176	151	141	178	146	157	185	109	120	149
99-percentile	393	339	412	431	397	409	490	440	420	493	300	417	412
Number of time intervals: average FRCE > Level 1 positive	87	82	115	141	143	122	170	138	144	187	70	106	1505
Number of time intervals: average FRCE < Level 1 negative	178	206	247	196	180	144	185	236	213	242	221	205	2453
Number of time intervals: average FRCE > Level 2 positive	36	27	42	49	59	59	64	62	60	77	29	56	620
Number of time intervals: average FRCE < Level 2 negative	64	81	105	75	65	65	76	111	77	106	100	94	1019
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	231	106	260	286	347	256	410	394	466	550	169	317	3792
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	514	517	982	669	506	506	615	1030	648	1054	744	764	8549

Table 64 LFC Block Performance for Block TERNA for year 2023

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TTB

2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-1.6	3.5	-3.6	-2.2	-5.9	1.1	13.7	3.8	14.6	14.9	9.3	6.2	4.5
The standard deviation	75	83	81	94	110	76	70	59	63	65	52	52	73
1-percentile	-233	-246	-267	-305	-286	-219	-139	-153	-124	-146	-131	-145	-199
5-percentile	-111	-134	-136	-151	-119	-105	-78	-84	-68	-70	-65	-74	-100
10-percentile	-77	-83	-88	-91	-83	-71	-55	-56	-47	-48	-40	-48	-66
90-percentile	73	94	83	85	72	72	93	68	86	91	63	62	79
95-percentile	99	128	114	121	103	105	142	97	122	137	94	87	112
99-percentile	178	219	199	219	214	235	255	204	229	231	186	155	210
Number of time intervals: average FRCE > Level 1 positive	107	188	159	166	129	133	225	98	170	196	102	86	1759
Number of time intervals: average FRCE < Level 1 negative	145	163	213	216	178	130	56	74	42	45	44	59	1365
Number of time intervals: average FRCE > Level 2 positive	19	32	24	33	30	34	52	25	36	37	13	11	346
Number of time intervals: average FRCE < Level 2 negative	36	43	52	82	51	30	11	12	9	10	6	5	347
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	1	2	3	13	10	8	10	4	4	1	0	1	57
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	9	10	31	39	24	20	11	23	13	7	8	10	205

Table 65 LFC Block Performance for Block TTB for year 2022

2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	1.0	0.5	1.1	4.5	3.4	3.9	18.2	19.2	12.6	17.9	12.7	13.5	9.0
The standard deviation	38	35	54	65	53	54	75	76	67	77	57	56	59
1-percentile	-111	-107	-154	-132	-150	-123	-150	-135	-132	-149	-117	-121	-132
5-percentile	-50	-55	-67	-66	-58	-69	-76	-70	-71	-72	-61	-64	-65
10-percentile	-35	-36	-44	-43	-38	-46	-47	-49	-47	-43	-38	-40	-42
90-percentile	37	39	47	50	51	54	98	106	79	90	71	81	67
95-percentile	53	52	71	71	70	86	156	161	131	145	114	119	102
99-percentile	95	84	123	123	118	207	282	302	256	317	217	201	194
Number of time intervals: average FRCE > Level 1 positive	17	10	37	38	67	121	318	344	229	275	201	239	1896
Number of time intervals: average FRCE < Level 1 negative	29	24	53	46	65	62	101	84	79	88	55	54	740
Number of time intervals: average FRCE > Level 2 positive	4	2	5	17	6	41	128	119	70	97	62	41	592
Number of time intervals: average FRCE < Level 2 negative	8	1	16	13	23	11	16	12	14	23	2	5	144
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	1	0	2	5	1	0	0	1	0	1	0	0	11
Number of events: FRCE < -60 % FRR capacity + and not > - 15 % FRR capacity + within 15 min	7	1	20	10	15	5	9	7	8	10	1	0	93

Table 66 LFC Block Performance for Block TTB for year 2023

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## UAMD

### 2022

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	0.0	0.0	0.0	2.0	9.2	10.9	9.1	18.8	16.6	-0.8	-29.0	-21.8	1.3
The standard deviation	0	0	0	31	41	41	55	71	70	648	164	121	103
1-percentile	0	0	0	-66	-78	-59	-158	-169	-165	-257	-751	-357	-172
5-percentile	0	0	0	-35	-33	-27	-68	-87	-93	-134	-316	-220	-84
10-percentile	0	0	0	-26	-23	-21	-38	-46	-54	-90	-187	-159	-54
90-percentile	0	0	0	32	55	58	75	104	103	138	112	102	65
95-percentile	0	0	0	50	89	101	109	148	146	184	169	160	96
99-percentile	0	0	0	113	166	156	173	238	219	283	295	281	161
Number of time intervals: average FRCE > Level 1 positive	0	0	0	22	66	113	115	218	203	336	250	235	1558
Number of time intervals: average FRCE < Level 1 negative	0	0	0	1	8	5	60	78	82	177	433	455	1299
Number of time intervals: average FRCE > Level 2 positive	0	0	0	2	5	4	6	32	20	67	67	57	260
Number of time intervals: average FRCE < Level 2 negative	0	0	0	0	1	0	3	4	6	35	214	125	388
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	0	0	0	6	19	10	36	236	78	512	882	595	2374
Number of events: FRCE < -60 % FRR capacity + and not > -15 % FRR capacity + within 15 min	0	0	0	0	0	0	0	0	1	7	610	91	709

Table 67 LFC Block Performance for Block UAMD for year 2022

### 2023

Data item	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yr.
The mean value	-27.7	21.1	50.1	27.4	5.1	2.3	2.7	-25.7	8.8	7.8	-0.1	10.3	6.8
The standard deviation	111	88	94	104	115	66	80	76	89	83	72	78	88
1-percentile	-306	-233	-171	-233	-243	-173	-189	-232	-213	-199	-169	-180	-212
5-percentile	-209	-112	-83	-132	-157	-98	-128	-158	-132	-124	-112	-118	-130
10-percentile	-165	-64	-40	-85	-118	-67	-91	-121	-92	-88	-82	-78	-91
90-percentile	98	130	183	162	122	79	104	64	124	107	87	108	114
95-percentile	145	175	224	210	157	117	150	97	170	150	133	155	157
99-percentile	301	275	305	307	244	211	219	171	244	253	220	248	250
Number of time intervals: average FRCE > Level 1 positive	208	308	615	492	546	282	424	204	509	425	305	428	4746
Number of time intervals: average FRCE < Level 1 negative	525	123	73	176	474	216	349	592	324	326	290	286	3754
Number of time intervals: average FRCE > Level 2 positive	54	47	132	99	154	73	134	43	174	136	103	147	1296
Number of time intervals: average FRCE < Level 2 negative	111	27	13	32	153	46	66	155	93	70	42	60	868
Number of events: FRCE > 60 % FRR capacity - and not < 15 % FRR capacity - within 15 min	612	305	1051	742	244	91	163	16	286	362	199	259	4330
Number of events: FRCE < -60 % FRR capacity + and not > -15 % FRR capacity + within 15 min	0	9	0	0	0	0	0	0	0	0	0	0	9

Table 68 LFC Block Performance for Block UAMD for year 2023



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## Ireland/Northern Ireland

2022

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No.of events: FRCE > 500 mHz and > 50 mHz after 15 min	0	0	0	0	0	0	0	0	0	0	0	0
No.of events: FRCE < -500 mHz and< -50 mHz after 15 min	0	0	0	0	0	0	0	0	0	0	0	0

Table 69 IE/NI LFC FRCE Statistic for year 2022

2023

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No.of events: FRCE > 500 mHz and > 50 mHz after 15 min	0	0	0	0	0	0	0	0	0	0	0	0
No.of events: FRCE < -500 mHz and< -50 mHz after 15 min	0	0	0	0	0	0	0	0	0	0	0	0

Table 70 IE/NI LFC FRCE Statistic for year 2023

Additionally, the synchronous areas of GB and IE/NI are each required to report the number of time intervals outside Level 1 and Level 2 FRCE ranges over the course of one year, which is presented in Table 71. The time intervals are aligned with Annex III, Table 1 of the SOGL. The number of time intervals is calculated using the following procedure:

1. If the frequency deviation is  $\geq 200$  mHz over a 15 -minute period or  $\leq -200$  mHz over a 15-minutes period, this qualifies as a Level 1 event.
2. If the frequency deviation is  $\geq 500$  mHz over a 1-minute period or  $\leq -500$  mHz over a 1-minute period, this qualifies as a Level 2 event.
3. The Level 1 FRCE target parameter = 3%, which is  $35\,040$  (periods)  $\times 0.03 = 1\,051$  periods.
4. The Level 2 FRCE target parameter = 1%, which is  $525\,600$  (periods)  $\times 0.01 = 5\,256$  periods.
5. The number of Level 1 periods calculated in step 1 must be less than or equal to 1 051.
6. The number of Level 2 periods calculated in step 3 must be less than or equal to 5 256.

Data item	2022	2023
Number of time intervals frequency deviates outside +/- 200 mHz	0	0
Number of time intervals frequency deviates outside +/- 500 mHz	0	0

Table 71 IE/NI LFC Number of Time Intervals Outside Range for years 2022 and 2023

## Nordic

The Nordic LFC block performance is presented in the following tables. The Level 1 and Level 2 limits are calculated according to the methodology defined in the Synchronous Area Framework Agreement. The Level 1 and Level 2 Frequency Restoration Control Error Target Parameters for the Nordic LFC block are presented in Table 72.

FRCE target parameters	Level 1	Level 2
FRCE range	40 mHz	76 mHz
Target for the maximum number of 15 minutes time intervals per year outside the level 1 and level 2 FRCE range	30 %	5%

**Table 72 Level 1 FRCE range and the level 2 FRCE range for the Nordic Area and targets for the number of 15 minutes time intervals per year outside the level 1 and level 2 FRCE range**

The methodology for the calculation of these target parameters is as defined in the Nordic Synchronous Area Operational Agreement. FRCE values are calculated on a basis of 15-minute frequency data. The percentages in Table 74 refer to 30% or 5% of the time intervals of the year. Additionally, events which indicate where FRCE exceeds 60% of FRR used and is not returned to 15% of FRR during a 15-minute time period are reported.

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## Nordic LFC Block Performance

2022

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
The mean value	50.00003	49.99999	50.00006	50.00000	50.00006	50.00000	49.99994	50.00018	49.99998	49.99998	49.99995	49.99998	50.00001
The standard deviation	0.0404	0.0408	0.0393	0.0407	0.0425	0.0408	0.0383	0.0416	0.0401	0.0416	0.0380	0.0375	0.0401
1-percentile	49.904	49.902	49.906	49.901	49.899	49.900	49.909	49.899	49.908	49.903	49.906	49.911	49.904
5-percentile	49.935	49.934	49.936	49.932	49.931	49.933	49.939	49.933	49.936	49.933	49.938	49.940	49.935
10-percentile	49.950	49.950	49.951	49.948	49.947	49.949	49.953	49.933	49.949	49.950	49.952	49.954	49.949
90-percentile	50.050	50.051	50.049	50.053	50.054	50.051	50.048	50.052	50.050	50.053	50.047	50.046	50.050
95-percentile	50.067	50.068	50.065	50.070	50.071	50.067	50.063	50.069	50.067	50.070	50.061	50.062	50.067
99-percentile	50.100	50.102	50.096	50.104	50.104	50.097	50.096	50.104	50.101	50.105	50.091	50.098	50.100
Number of time intervals: average FRCE > Level 1 positive	304	269	260	300	294	252	231	273	227	281	203	256	3150
Number of time intervals: average FRCE < Level 1 negative	259	219	227	248	231	197	169	219	173	205	184	189	2520
Number of time intervals: average FRCE > Level 2 positive	53	50	27	46	46	30	31	58	40	51	20	46	498
Number of time intervals: average FRCE < Level 2 negative	41	34	29	37	29	40	22	38	14	21	22	27	354
No.of time intervals: FRCE > 60 % FRR capacity + and < 15 % FRR capacity + after 15 min	0	0	0	0	0	0	0	0	33	76	113	0	222
No. of time intervals: FRCE < - 60 % FRR capacity + and < -15 % FRR capacity + after 15 min	0	0	0	1	0	0	0	2	15	34	5	2	59

Table 73 Nordic LFC Block Performance for year 2022

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2023

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
<b>The mean value</b>	50.00006	50.00006	50.00004	49.99998	49.99991	50.00011	50.00007	50.00001	49.99985	49.99993	50.00004	49.99998	50.00000
<b>The standard deviation</b>	0.0401	0.0395	0.0402	0.0422	0.0441	0.0415	0.0376	0.0400	0.0428	0.0392	0.0388	0.0368	0.0402
<b>1-percentile</b>	49.904	49.904	49.901	49.900	49.893	49.900	49.912	49.902	49.901	49.905	49.905	49.910	49.903
<b>5-percentile</b>	49.936	49.937	49.934	49.932	49.928	49.933	49.940	49.935	49.932	49.937	49.939	49.942	49.935
<b>10-percentile</b>	49.951	49.952	49.950	49.948	49.945	49.949	49.953	49.951	49.947	49.951	49.953	49.956	49.951
<b>90-percentile</b>	50.050	50.050	50.050	50.053	50.056	50.052	50.047	50.050	50.054	50.049	50.047	50.045	50.050
<b>95-percentile</b>	50.067	50.066	50.067	50.071	50.073	50.068	50.062	50.066	50.071	50.065	50.063	50.061	50.067
<b>99-percentile</b>	50.101	50.097	50.099	50.106	50.106	50.101	50.094	50.096	50.108	50.096	50.102	50.095	50.100
<b>Number of time intervals: average FRCE &gt; Level 1 positive</b>	305	279	287	292	291	258	227	283	284	246	232	243	3227
<b>Number of time intervals: average FRCE &lt; Level 1 negative</b>	232	208	247	259	245	190	147	202	223	204	201	171	2529
<b>Number of time intervals: average FRCE &gt; Level 2 positive</b>	58	45	60	65	58	40	32	35	60	35	52	42	582
<b>Number of time intervals: average FRCE &lt; Level 2 negative</b>	32	36	43	32	36	32	12	41	22	25	26	28	365
<b>No. of time intervals: FRCE &gt; 60 % FRR capacity + and &lt; 15 % FRR capacity + after 15 min</b>	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of time intervals: FRCE &lt; - 60 % FRR capacity + and &lt; -15 % FRR capacity + after 15 min</b>	608	0	0	439	22	876	0	0	0	0	0	0	1945

Table 74 Nordic LFC Block Performance for year 2023

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## Great Britain

2022

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No. of events: FRCE > 500 mHz and > 50 mHz after 15 min	0	0	0	0	0	0	0	0	0	0	0	0
No. of events: FRCE < -500 mHz and < -50 mHz after 15 min	0	0	0	0	0	0	0	0	0	0	0	0

Table 75 GB LFC FRCE Statistic for year 2022

2023

Data item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No. of events: FRCE > 500 mHz and > 50 mHz after 15 min	0	0	0	0	0	0	0	0	0	0	0	0
No. of events: FRCE < -500 mHz and < -50 mHz after 15 min	0	0	0	0	0	0	0	0	0	0	0	0

Table 76 GB LFC FRCE Statistic for year 2023

Additionally, the synchronous areas of GB and IE/NI are required to report the number of time intervals outside Level 1 and Level 2 FRCE ranges over the course of one year. The GB values are presented in Table 77. The time intervals are aligned with Annex III, Table 1, of the SOGL and the number of time intervals is calculated using the following procedure:

1. If the frequency deviation is  $\geq 200$  mHz over a 15-minutes period or  $\leq -200$  mHz over a 15-minute period, this qualifies as a Level 1 event.
2. If the frequency deviation is  $\geq 500$  mHz over a 1-minute period or  $\leq -500$  mHz over a 1-minute period, this qualifies as a Level 2 event.
3. The Level 1 FRCE target parameter = 3%, which is  $35\,040$  (periods)  $\times 0.03 = 1\,051$  periods.
4. The Level 2 FRCE target parameter = 1%, which is  $525\,600$  (periods)  $\times 0.01 = 5\,256$  periods.

Data item	2022	2023
Number of time intervals frequency deviates outside +/- 200 mHz	0	0
Number of time intervals frequency deviates outside +/- 500 mHz	0	0

Table 77 GB LFC Number of Time Intervals Outside Range for years 2022 and 2023