

National Grid Electricity System
Operator, Electricity Transmission
Licensees and other interested
parties

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Dear Colleague,

Frequency Risk and Control Report – 29 March 2023: the Authority's decision

This letter comprises the Authority's¹ decision to approve² the Frequency Risk and Control Report 2023³ (FRCR 2023) and its recommendations. The FRCR 2023 was submitted to us by the Electricity System Operator (ESO) on 29 March 2023.

Background

On 9 August 2019, there was a near-simultaneous loss of two large generators and consequential losses of Distributed Energy Resources (DER). These combined power losses went beyond the back-up power generation arrangements that the ESO had in place to keep the system stable, resulting in a significant frequency event. This triggered the disconnection, loss of power and disruption to more than one million customers.

Both our⁴ and the government's Energy Emergencies Executive Committee⁵ investigations into the incident required the ESO, in consultation with industry, to undertake a review of the Security and Quality of Supply Standard (SQSS) requirements for holding reserve, response and system inertia. On 10 December 2020, we approved SQSS modification GSR027⁶. GSR027

¹ References to the "Authority", "Ofgem", "we" and "our" are used interchangeably in this document. The Authority refers to GEMA, the Gas and Electricity Markets Authority. The Office of Gas and Electricity Markets (Ofgem) supports GEMA in its day to day work. This decision is made by or on behalf of GEMA.

² This document is notice of the reasons for this decision as required by section 49A of the Electricity Act 1989.

³ The FRCR is available on the ESO's website: <https://www.nationalgrideso.com/industry-information/codes/security-and-quality-supply-standards/frequency-risk-control-report>

⁴ Our report of the 9 August 2019 power outage can be viewed here: <https://www.ofgem.gov.uk/publications-and-updates/investigation-9-august-2019-power-outage>

⁵ The government's Energy Emergencies Executive Committee report on the 9 August 2019 power outage can be viewed here: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/855767/e3c-gb-power-disruption-9-august-2019-final-report.pdf

⁶ Our decision to approve SQSS modification GSR027 can be found on our website: <https://www.ofgem.gov.uk/publications-and-updates/gsr027-review-nets-sqss-criteria-frequency-control-drive-reserve-response-and-inertia-holding-gb-electricity-system>

made changes to sections of the SQSS governing how the ESO secures against frequency deviations, introducing the requirement for an annual FRCR governing the ESO policies on securing against frequency deviations. The initial FRCR was submitted to us by the ESO on 1 April 2021, and we issued our decision to approve this on 12 May 2021⁷. The second FRCR (2022) was submitted to us by the ESO on 1 April 2022, and we issued our decision to approve this on 23 June 2022⁸.

The FRCR 2023

This third edition of the FRCR assesses the impact and benefit of reducing the minimum system inertia requirement, currently 140GVAs, and reassesses the approved recommendations of the FRCR 2022.⁹ The methodology for FRCR 2023 remains largely unchanged from that set out in FRCR 2022. Changes primarily relate to the use of up to date data (both risk and cost), including expected connections, within the assessment.

In assessing the reduction of the minimum system inertia requirements, five scenarios were considered; 140GVAs, 130GVAs, 120GVAs, 110GVAs and 100GVAs. The controls as per existing FRCR recommendations¹⁰ were costed and applied to each scenario, which were compared with regards to the residual likelihood of the frequency deviations listed in table 1, below. This found the residual likelihood of frequency deviations to be identical for each of the five scenarios, with £65m savings in reducing minimum system inertia to 120GVA.s, and a further £5m savings in reducing minimum inertia further to 100GVAs.

The ESO notes their ambition to operate the system at reduced minimum inertia in order to decarbonise the operation of the system, however also note the system value of inertia. They therefore consider 120GVA.s to be the optimal level of inertia to apply, allowing for a cautious approach to further reductions. They note that assessments carried out as part of the Operability Strategy Report¹¹ found no system operability impacts for 2023 and 2024 when considering reduced inertia levels to 120GVA.s.

⁷ Our decision to approve the initial FRCR 2021 can be found on our website;

<https://www.ofgem.gov.uk/publications/authority-decision-approve-frequency-risk-and-control-report-april-2021>

⁸ Our decision to approve FRCR 2022 can be found on our website; <https://www.ofgem.gov.uk/publications/authority-decision-approve-frequency-risk-and-control-report-april-2022>

⁹ We note that reducing the level of minimum inertia below 140GVAs was listed as an item for future consideration in FRCR 2022, which can be viewed here; <https://www.nationalgrideso.com/industry-information/codes/security-and-quality-supply-standard-sqss/frequency-risk-and-control>

¹⁰ We note that existing FRCR recommendation is to apply individual loss risk controls to prevent BMU+RoCoF losses resulting in a frequency deviation below 49.2Hz. Primarily due to the reduction of the RoCoF risk via the ALoMCP, and the increase in Dynamic Containment availability, this is now achievable through system wide controls only, though the ESO will apply individual loss risk controls in real time if needed.

¹¹ The Operability Strategy Report 2023 can be found on the ESO's website here:

<https://www.nationalgrideso.com/document/273801/download>

The FRCR also reassessed the existing recommendation to not apply individual loss risk controls to mitigate BMU+VS events, and simultaneous events¹². It did so by re-running the FRCR assessment using the FRCR 2023 methodology and updated data sets. It found that:

- an additional spend of £13m is required to mitigate BMU+VS (outage) events reduced the residual likelihood of frequency deviations beyond 49.2Hz from 1-in-17 years, to 1-in-18 years
- a further spend of £306m is required to mitigate BMU+VS (intact) events reducing the residual likelihood of frequency deviations beyond 49.2Hz further to 1-in-20 years, and
- that securing for all simultaneous events would cost circa. £321m per year and would require circa. 3.5 times the current volume of Dynamic Containment capacity.

The ESO does not consider that mitigating BMU+VS (outage or intact) nor simultaneous events represents good value for consumers. Consequently, the ESO does not recommend any changes to the current policy. Furthermore, the ESO notes that a large portion of simultaneous events are already covered by existing FRCR policy.

The FRCR 2023 recommendation is to:

1. Reduce the minimum system inertia policy from 140GVA.s to 120GVA.s. The ESO proposes a two stage approach, firstly reducing from 140GVA.s. to 130GVA.s followed by a monitoring period before reducing system inertia further to 120GVA.s. Industry will be informed of the timings and details of changes via the Operational Transparency Forum or similar industry fora.
2. Apply individual loss risk controls to BMU-only (and consequential RoCoF losses) to prevent frequency decreasing below 49.2Hz or above 50.5Hz.¹³
3. Do not apply individual loss risk controls to BMU+VS events (intact or outage).
4. Do not apply additional system-wide controls to secure simultaneous events.

Applying the FRCR recommended policies results in indicative costs for 2023/24 of £264m, and residual likelihood of frequency deviations as listed in Table 1, below. These costs represent system wide controls only, the ESO does not anticipate taking any targeted individual loss risk controls in 2023/24, though will do so in real time if required.

¹² 'BMU+VS' and 'simultaneous events' refer to losses as per the events and loss risks defined in paragraph 9.3 of the FRCR 2023.

¹³ We note the FRCR 2023 considers BMU-only & consequential RoCoF risks can be fully mitigated by system wide controls only. However, as Frequency Response, a system wide control, is procured at the day-ahead planning stage, availability may vary. The ESO do not plan on using individual loss risk controls against BMU-only & consequential RoCoF risks, though will do so in real time if needed.

Frequency Deviation	Duration	Likelihood
Greater than 50.5Hz	Any	1-in-600 years
Between 49.2Hz and 49.5Hz	Up to 60s	2 times per year
Between 48.8Hz and 49.2Hz	Any	1-in-17 years
Less than 48.8Hz	Any	1-in-30 years

Table 1 – frequency risk after applying FRCR recommendations¹⁴

Industry Consultation

The ESO consulted on the FRCR 2023 from 13 February 2023 to 24 February 2023, receiving six responses, five of which were supportive of the recommendations with respect to infeed losses. One respondent considered the assessment of probability of events and cost assumptions to be unclear, and suggested a number of areas of further work, and was therefore unable to support the FRCR 2023 recommendations.

All respondents expressed concern regarding the grid stability and operational impacts of reducing system inertia. In particular, respondents noted that there was insufficient information on the ESOs assessment of the operation of a low inertia system in support of the ESOs view that there will be no system operability impacts for 2023 and 2024 when considering reduced inertia levels to 120GVA.s. Through discussion with the ESO we understand and agree that a detailed view of their FRCR assessment cannot be shared as it relies on commercially sensitive data which has the potential to distort or adversely influence markets or tenders. We note that on 28th March 2023, the ESO held a stability ‘deepdive’ webinar following the Operability Strategy Report 2023 webinar held on 24th January 2023¹⁵. This webinar focused on system inertia and short circuit level, inviting industry views on further technical publications on the subjects. We consider the issues relating to low system inertia and grid stability identified by consultation respondents are adequately discussed within the webinars, noting that detail of system studies cannot be shared due to confidentiality.

We note that a respondent noted concern over the influence of high gas prices on FRCR 2023 recommendations. Through discussion with the ESO, they acknowledge that decreasing gas prices may reduce the cost-saving figures within the FRCR 2023, but note that the cost-savings would not be eroded completely, consequently the recommendations will remain unchanged.

¹⁴ We note that this table was not included in the FRCR 2023, however its content aligns with the FRCR 2023 findings and has been verified by the ESO.

¹⁵ Both webinars can be found on the ESO’s website here; <https://www.nationalgrideso.com/research-and-publications/system-operability-framework-sof>

We note that a respondent noted concern over the lack of clarity of the Grid Code Fault Ride Through definition, and its impact on likelihood of loss of infeed. We note that Fault Ride Through issues are resolved in real time via the measures put in place under GC0151¹⁶, and the lack of clarity in the Grid Code Fault Ride Through definition is being addressed via the ongoing GC0155¹⁷. Through discussion with the ESO, we understand that Fault Ride Through compliance is assumed within the FRCR assessments.

SQSS Panel recommendation

The SQSS Panel voted by majority to recommend the FRCR 2023 and methodology be submitted to the Authority for approval on 16 March 2023.

Decision notice

This letter sets out the Authority's decision on the implementation of the FRCR 2023 (referenced in the SQSS) and its proposals, and the reasons for that decision. We have considered the issues raised by the FRCR 2023 and its proposals dated 29 March 2023, including taking into account the responses to industry consultation, the SQSS Panel vote and the SQSS Panel recommendation, and conclude that:

- implementation of the FRCR 2023 and its proposals will better facilitate the achievement of objective (i) and (ii) of the NETS SQSS;¹⁸ and
- approving the FRCR 2023 and its proposals is consistent with our principal objective and statutory duties.¹⁹

Reasons for our decision

We note industry concern with regards to the stability and operational impacts of reducing system inertia. We note and stress that the recommendations of the FRCR 2023 are **strictly with respect to frequency risks**. Other operational risks, including short circuit level which can be influenced by inertia²⁰, are assessed, considered and resolved separately, including where this may increase system inertia above the FRCR 2023 recommended **minimum** level.

¹⁶ Our decision to approve Grid Code modification GC0151 can be viewed here;

<https://www.ofgem.gov.uk/publications/gc0151-grid-code-compliance-fault-ride-through-requirements>

¹⁷ GC0155: 'Clarification of Fault Ride Through Technical Requirements' is a Grid Code modification proposal currently in workgroup phase. Information on GC0155 can be found here; <https://www.nationalgrideso.com/industry-information/codes/gc/modifications/gc0155-clarification-fault-ride-through-technical>

¹⁸ The NETS SQSS objectives are set out in chapter 3 of the NETS SQSS Industry Governance Framework, available here: <https://www.nationalgrideso.com/industry-information/codes/security-and-quality-supply-standard-sqss/sqss-code-documents>

¹⁹ In making its decision, the Authority must act in accordance with its principal objective to protect the interests of existing and future consumers, and its statutory duties. The Authority's statutory duties are detailed mainly in the Electricity Act 1989 (in particular, but not limited to section 3A) as amended.

²⁰ For example due to the inherent inertia provided by synchronous machines providing short circuit level.

Noting that operating a low inertia system is necessary in order to meet net-zero targets, we consider the ESOs proposed approach of a gradual reduction in minimum system inertia followed by a period of monitoring and assessment seeks to ensure there are no undue impacts to the system or its users. We consider this to be a sensible, cautious approach. We encourage the ESO to set out how it will coordinate with and involve industry in its monitoring and assessment of operating a lower inertia system, through the Operational Transparency Forum or similar industry fora.

Overall, we consider the FRCR has made the criteria by which the ESO balances cost and risk of frequency deviations (above 50.5Hz, or below 49.5Hz, 49.2Hz and 48.8Hz) more transparent. It assesses the risk of a discrete list of single events, and a statistical summary of simultaneous events, leading to frequency deviations, and the cost of a mix of options available to the ESO to prevent, or reduce the likelihood of, such frequency deviations from occurring. The analysis therefore quantitatively demonstrates why the FRCR 2023 proposals represent an appropriate balance between the cost and residual likelihood of frequency deviations. We therefore consider that the implementation of FRCR 2023 and its proposals is in the interest of consumers.

We further note that the FRCR 2023 gives the ESO latitude in managing system risk when events occur that are outwith the scenarios considered in the FRCR 2023, such as severe weather etc.

We consider the FRCR 2023 to better facilitate NETS SQSS objective (i) and (ii), and have a neutral impact on the other objectives.

(i) facilitate the planning, development and maintenance of an efficient, coordinated and economical system of electricity transmission, and the operation of that system in an efficient, economic and coordinated manner;

The FRCR 2023 increases transparency in the criteria by which the ESO balances cost and risk to control system frequency by making explicit the events that will and will not be secured for.

We note that the FRCR 2023 recommends to continue with existing policies, other than reducing minimum system inertia to 120GVA.s. We appreciate that this represents total system inertia, including contribution from machines providing other stability services, but note that this is a **minimum** inertia policy **with respect to frequency risks only**. There are no conflicts in managing system stability whilst implementing the FRCR 2023 recommendations. We therefore consider the recommendations of the FRCR 2023 better facilitates this SQSS

objective, in particular better facilitating efficient, economic and coordinated operation of the system.

(ii) ensure an appropriate level of security and quality of supply and safe operation of the National Electricity Transmission System;

The FRCR 2023 assessed variations in ESO policy in securing against frequency diversions with respect to the cost and residual likelihood of frequency diversions. In doing so it demonstrates that the appropriate balance between cost and risk is achieved. We therefore consider it better facilitates this SQSS objective.

Implementation

In this letter we have set out our decision to approve the FRCR 2023. This decision takes effect immediately. The ESO proposes a two stage approach, firstly reducing from 140GVA.s. to 130GVA.s followed by a monitoring period before reducing system inertia further to 120GVA.s. Industry will be informed of the timings and details of changes via the Operational Transparency Forum or similar industry fora. We encourage the ESO to also set out how it will coordinate with and involve industry in its monitoring and assessment of operating a lower inertia system.

Martin Queen

Head of Engineering Systems and Policy – Analysis & Assurance

Signed for and on behalf of the Authority