

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

Email: peter.bingham@ofgem.gov.uk

Date: 12 May 2021

Dear Colleague,

Frequency Risk and Control Report – April 2021: the Authority’s decision

This letter comprises the Authority’s¹ decision to approve² the Frequency Risk and Control Report³ (FRCR) and its recommendations. The FRCR was submitted by the Electricity System Operator (ESO) on 1 April 2021.

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 SQSS requirements for holding reserve, response and system inertia. On 10 December 2020, we approved Security and Quality of Supply Standard (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-old/modifications/gsr027-review>

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. It introduced the requirement for:

- the ESO to produce, and consult with industry on, an FRCR Methodology designed to facilitate the economic assessment of the risk of unacceptable frequency conditions occurring on the National Electricity Transmission System and which of these risks will be secured;
- the SQSS Panel to approve the FRCR Methodology;
- the ESO to produce, and consult with industry on, an FRCR in line with the approved FRCR Methodology; and,
- the SQSS Panel to recommend the FRCR be submitted to the Authority for approval.

The FRCR was submitted to us by the ESO on 1 April 2021.⁷

The FRCR

This first edition of the FRCR aims to make the criteria by which the ESO balances the cost and risk of frequency deviations more transparent to industry and stakeholders. It's analysis assesses the cost of controlling, and residual likelihood of frequency deviations⁸ of all single events⁹. The events considered are categorised as Balancing Mechanism Units (BMU) only losses, Vector Shift only losses¹⁰, and BMU+Vector Shift losses, each along with any consequential Rate of Change of Frequency (RoCoF) losses¹¹. The explicit consideration of consequential DER losses was a key driver for GSR027.

The FRCR contains two main proposals:

1. Continue with the ESO's current internal operational policy of maintaining minimum system inertia (encompassing all system-wide frequency response and inertia controls) at 140GVA.s. Analysis demonstrated that increasing minimum system inertia to 160GVA.s would cost an additional circa. £100m but would offer no benefit to the remaining risk of system frequency deviations.

⁷ The FRCR Methodology, the FRCR and their respective consultations can be found on the ESO's website: <https://www.nationalgrideso.com/industry-information/codes/security-and-quality-supply-standards-old/modifications/gsr027-review>

⁸ Frequency deviations are categorised as above 50.5Hz or below, 49.5Hz, 49.2Hz, or 48.8Hz. We note that 50.5Hz and 49.5Hz are the steady state frequency limits as per the SQSS. 49.2Hz was the transient frequency limit as per the SQSS prior to the introduction of GSR027. 48.8Hz is the trigger for Low Frequency Demand Disconnection leading to the disconnection of customers.

⁹ Single events comprise of the single Loss of Power Infeed or Outfeed, or single faults of primary transmission equipment (i.e. a single transmission circuit, a busbar or mesh corner or a double circuit overhead line)

¹⁰ Vector Shift losses are DER losses due to Vector Shift Loss of Mains protection tripping.

¹¹ RoCoF losses are DER losses due to RoCoF Loss of Mains protection tripping.

2. To apply individual loss risk controls to BMU infeed losses (and consequential RoCoF losses) to prevent frequency decreasing below 49.2Hz (returning to 49.5Hz or above within 60s).

This is a relaxation of current ESO policy, which is:

- to apply individual loss risk controls to BMU infeed losses less than 1GW to prevent frequency decreasing below 49.5Hz. Analysis demonstrated that retaining this existing policy would be expected to incur £23m in additional costs relative to the proposed policy change and offer little benefit to the remaining risk of system frequency deviations; and,
- to apply individual loss risk controls to BMU infeed losses greater than 1GW to prevent frequency decreasing below 49.2Hz (returning to 49.5Hz within 60s). The FRCR proposes to extend this policy to cover all BMU infeed losses. In general, securing the largest BMU infeed loss to 49.2Hz would ensure smaller losses are maintained well within the 49.2Hz limit.

The FRCR also contains two other recommendations:

1. To continue to grow the capacity of Dynamic Containment Low in line with the projected pipeline (anticipated to be 900MW in July 2021 from 500MW in April 2021). Analysis demonstrated this to increase the cost of system-wide frequency response and inertia controls by circa. £20m, but decreased the cost of individual loss risk controls by circa. £4m. It notes that this reduces the ESO's use of individual loss risk controls, moving them to system-wide frequency response and inertia controls and competitive markets. We note that Dynamic Containment Low is the only frequency response service able to act fast enough to arrest risks posed by RoCoF Loss of Mains protection losses, thus reducing overall actions to curtail RoCoF Loss of Mains protection losses and reducing the residual risk profile to that set out below.
2. To continue with the Accelerated Loss of Mains Change Programme (ALoMCP) for both Vector Shift and RoCoF Loss of Mains protection on distributed generation as this reduces the risk of Vector Shift or consequential RoCoF losses.

Applying the FRCR recommended policies¹², results in indicative costs for 2021/22 of £244m (£240m for system-wide frequency response and inertia controls, and £4m for individual loss risk controls) and residual likelihood of frequency deviations as listed in Table 1, below. This represents a saving of £23m when compared to the indicative costs for 2021/22 of the ESO's current policies.

¹² The ESO policy resulting from the inclusion of the FRCR recommendations can be seen in chapter 14.2 of the FRCR.

Frequency Deviation	Duration	Likelihood
Greater than 50.5Hz	Any	1-in-1100 years
Between 49.2Hz and 49.5Hz	Up to 60s	2 times per year
Between 48.4Hz and 49.2Hz	Any	1-in-22 years
Less than 48.8Hz	Any	1-in-270 years

Table 1 – frequency risk after applying FRCR recommendations

Industry Consultation

The ESO consulted on the FRCR Methodology from 21 December 2020 to 13 January 2021, receiving seven responses generally supportive of the proposed FRCR Methodology. The ESO made a number of changes to further clarify the FRCR Methodology in response.

The ESO consulted on the FRCR between 1 March 2021 and 12 March 2021, receiving six responses broadly supporting all four recommendations of the FRCR. The ESO made a number of changes to further clarify the FRCR in response.

We consider the changes made by the ESO to both the FRCR Methodology and the FRCR have addressed concerns raised in the consultations. We note in particular that the responses regarding enhancing the considerations of the FRCR have been included in the list of items to be prioritised for future inclusion in chapter 13 of the FRCR. We further note that this is the first iteration of the FRCR, and that the SQSS requires the ESO to review and consider improvements to the FRCR at least annually.

NETS SQSS Panel recommendation

The SQSS Panel unanimously recommended the FRCR Methodology be used to produce an FRCR on 29 January 2021. The SQSS Panel unanimously recommended the FRCR be submitted to the Authority for approval on 30 March 2021.

Decision notice

This letter sets out the Authority’s decision on the implementation of the FRCR (referenced in the SQSS) and its proposals, and the reasons for that decision. We have considered the issues raised by the FRCR and its proposals dated 1 April 2021, including taking into account the responses to industry consultations, the SQSS Panel vote and the SQSS Panel recommendation, and conclude that:

- implementation of the FRCR and its proposals will better facilitate the achievement of objective (i) and (ii) of the NETS SQSS;¹³ and
- approving the FRCR and its proposals is consistent with our principal objective and statutory duties.¹⁴

Reasons for our decision

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 49.8Hz) more transparent. It assesses the risk of a discrete list of single 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. In so doing, it is explicit in considering the consequential impacts on distributed generation resulting from such events. The mix of options available to the ESO to control frequency deviations assessed are variations to the ESO's current policy regarding these options. The analysis therefore quantitatively demonstrates why the FRCR proposals represent an appropriate balance between the cost and residual likelihood of frequency deviations. We consider that the FRCR and its recommendations better ensure that the costs of securing the system with respect to frequency deviations are appropriate with respect to their likelihood and the risks they pose. We therefore consider that the implementation of FRCR and its proposals is in the interest of consumers.

We note that chapter 13 of the FRCR lists items to be prioritised for future inclusion, including suggestions from consultation respondents. We agree with these and note in particular the inclusion of simultaneous events. The FRCR currently considers credible single events only. However, recent significant frequency events on the system (eg. the 9 August 2019 incident) involved rare near-simultaneous events. Whilst we acknowledge the step up in analysis required to consider simultaneous events, we see benefit in a more comprehensive assessment of such events.

We also note the inclusion of new causes of DER losses for future iterations. The current FRCR includes explicit consideration of consequential DER losses, a key driver for GSR027. We consider further DER losses to be an extension of this driver.

We further note that FRCR policy recommendations apply only to the discrete events considered. The FRCR gives the ESO latitude in managing system risk when events occur that

¹³ The NETS SQSS objectives are set out in chapter 3 of the NETS SQSS Industry Governance Framework: <https://www.nationalgrideso.com/sites/eso/files/documents/NETS%20SQSS%20Industry%20Governance%20Framework%20v1.0%20%2830-03-12%29.pdf>

¹⁴ 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.

are outwith the scenarios considered in the FRCR, such as severe weather etc. We expect transparency in ESO policy, to that end we expect the ESO to keep records of when they deviate from the FRCR and why. We expect an annual report to be provided by the ESO to us detailing the situations where they deviations occurred and that such instances feed into future iterations of the FRCR.

We note that one respondent to the FRCR consultation expressed that they see merit in applying individual loss risk controls to BMU+Vector Shift outage losses to prevent frequency decreasing below 49.2Hz (returning to 49.5Hz or above within 60s). FRCR analysis estimated this to cost an additional circa. £5m and reduce the likelihood of frequency diversion below 48.8Hz from 1-in-270 years to 1-in-460 years. The FRCR does not consider this to be good value for money. Also, to the extent that the risk of such losses might increase during adverse weather conditions, the FRCR provides flexibility for the ESO to apply individual risk controls to such events. We therefore agree with the FRCR recommendations.

We consider the FRCR 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 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 therefore consider it better facilitates this SQSS objective.

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

The FRCR 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. This decision takes effect immediately. We note that chapter 12.4 of the FRCR sets out the ESO's plan for implementing the FRCR proposals. We agree with the ESO's plan.

Peter Bingham

Chief Engineer, Systems and Networks

Signed for and on behalf of the Authority