Workgroup Report

GC0148:

'Implementation of EU Emergency & Restoration Code Phase II'

Overview: This modification comprises of three parts, which include:

- The requirement to implement Article 15(5) – 15(8), Article 41 and Article 42 (1) (2) and (5) of the EU Emergency and Restoration Code which have completion dates of 18th December 2022;
- Addressing some outstanding issues from the implementation of the EU Emergency and Restoration Code in 2019 which relate to the treatment of storage under low frequency conditions and the treatment of how non-CUSC parties would fall under the remit of the EU Emergency and Restoration Code; and
- Consideration, if time permits as the Workgroup believe appropriate, the requirements relating to Distributed ReStart.

Modification process & timetable

1. **Proposal Form**
   30 July 2020
2. **Workgroup Consultation**
   28 March 2022 - 27 April 2022
3. **Workgroup Report**
   20 July 2022
4. **Code Administrator Consultation**
   03 August 2022 05 September 2022
5. **Draft Code Modification Report**
   21 September 2022
6. **Final Code Modification Report**
   04 October 2022
7. **Implementation**
   10 Working days after Authority decision

Have 5 minutes? Read our Executive summary

Have 45 minutes? Read the full Workgroup Report

Have 90 minutes? Read the full Workgroup Report and Annexes.

Status summary: The Workgroup has finalised the proposer's and two alternative solutions. It is now seeking approval from the Panel that the Workgroup has met its Terms of Reference and can proceed to the Code Administrator Consultation.

This modification is expected to have a: High impact on the ESO, Users (eg DNOs, Generators, Interconnectors, Non-Embedded Customers etc) Transmission Licensees, owners and operators of Electricity Storage Modules, non-CUSC Parties, Defence and Restoration Service Providers.

Modification drivers: EU network code and GB Grid Code compliance.

Governance route	This modification has been assessed by a Workgroup and Ofgem will make the decision on whether it should be implemented.	
Who can I talk to about the change?	**Proposer: Antony Johnson** Nationalgrid ESO Antony.johnson@nationalgrideso.com Phone: 07966 734856	**Code Administrator** **Chair**: Sally Musaka Sally.musaka@nationalgrideso.com Phone: 07790 778 560

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Executive summary

This modification will complete the GB implementation of the remaining articles under the EU Network Code Electricity Emergency and Restoration Code (NCER), which have not already been implemented or covered in earlier Grid Code modifications.

What is the issue?

The defect comprises of three main elements:

- The need to ensure the proper implementation of Articles 15(5) – 15(8), Articles 41 and 42(1), (2) and (5), Articles 50, 48(3) and 15(9) of the NCER.
- The need to consider how non-CUSC parties fall under the scope of the NCER and how electricity storage modules change from an import mode to an export mode of operation during low system frequencies.
- The need to consider the code changes necessary to accommodate the Distributed ReStart Project.

What is the solution and when will it come into effect?

Proposer's solution:
The Grid Code will need to be updated to be compliant with these requirements. This includes updates to low frequency demand disconnection, communications systems, critical tools and facilities, the System Defence Plan, System Restoration Plan, Test Plan, the inclusion of smaller non-CUSC Parties and requirements for electricity storage modules during low system frequencies.

The Workgroup started to develop the potential Grid Code requirements to support the Distributed ReStart Project, in accordance with its Terms of Reference (e)[1]. This is a Network Innovation Competition (NIC) project. It is not a mandatory requirement under the NCER but if the provisions of the Project were implemented in GB, the requirements of the NCER would apply to its provisions. However, following Workgroup consultation feedback the Proposer and Workgroup unanimously agreed that Distributed ReStart should be removed from the GC0148 solution. Any work done to date will be transferred over to the Grid Code modification GC0156 (Implementation of the Electricity System Restoration Standard)[2], where it can be more appropriately addressed.

Implementation date: 10 working days after the Authority's decision. The expected decision date from the Authority is 02 December 2022.

Summary of potential alternative solutions and implementation date(s):
Two Workgroup Alternatives were raised and taken forward post the Workgroup Consultation, which combined the original solution (including the implementation date) with compliance against Article 40 (2) – (4) ERNC. This article refers to the exchange of operationally necessary information from the ESO to stakeholders. Workgroup Alternative

[1] "where time allows and the Workgroup believe it is appropriate and efficient, then the Workgroup may consider if it is expedient to include those elements of the Distributed Restart Project that have been finalised and agreed by affected stakeholders in this modification".
[2] https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0156-implementation-electricity-system

Grid Code Modification 1 (WAGCM1) adds on the notification requirements for emergency, blackout and restoration system states. WAGCM2 is identical to WAGCM1, but also incorporates the definitions for normal and alert states.

Workgroup conclusions: The Workgroup unanimously concluded that the Original, and WAGCM2 and by majority WAGCM1 better facilitated the Applicable Grid Code Objectives than the Baseline.

What is the impact if this change is made?

This change will have a positive impact on consumers through greater clarity of the industry codes, improvements and governance of the System Defence Plan, the System Restoration Plan and Test Plan, in addition to the application of the NCER to non-CUSC parties. Another advantage to consumers is the greater resilience of the system during times of stress and the ability to restore supplies more quickly following a total or partial shutdown. By enhancing defensive measures placed on owners and operators of electricity storage modules operating during low system frequency conditions and making additional tools available to National Grid ESO in event of a total or partial system shutdown. Whilst it is acknowledged that this would result in higher capital investment costs, these are believed to be small in comparison with the benefits they yield.

Interactions

This proposal is likely to bring about consequential changes to the STC (including STCPs) which will be managed though the STC Panel. Changes to the Distribution Code, for Distributed ReStart, will now be progressed by the Distribution Code Review Panel, as part of the joint GC0156 Workgroup.

There is no expected impact on the Electricity Balancing Regulation Article 18 T&Cs.

What is the issue?

The EU Emergency and Restoration Code (NCER) is one of a suite of European Codes which was developed as a result of the European Energy Third Package. The Emergency and Restoration Code covers the process by which member states ensure appropriate measures are put in place to

i) prevent a black out from occurring (defensive measures); and
ii) restore the system (restoration measures) as quickly as possible in the event of a total or partial system shutdown.

Until the introduction of the Trade and Cooperation Agreement[3] and the UK's withdrawal from the EU in 2020, the UK was an EU member and therefore bound by the requirements of the Energy Third Package which included compliance with the NCER.

The NCER has several deadlines progressively implemented following it coming into force. Most of the requirements applied from 18 December 2018 for the implementation of the System Defence Plan, System Restoration and Test Plan to be in place by 18 December 2019. Therefore, GC0148 proposes to implement articles 15(5) to 15(8), article 41 and 42(1), (2) and (5) with deadlines of 2022 and 2024 respectively.

As part of the UK's withdrawal from the EU, the requirements of the NCER have been incorporated into GB law through Statutory Instrument SI 533 2019[4]. In January 2022 the ESO was made aware that Article 55 had been removed from SI 533 2019. The ESO discussed this issue with Ofgem in February 2022 in addition to further raising it with BEIS. Ofgem and BEIS advised that they will discuss it with their legal teams, but the general advice was to work to the current deadlines as provided for in the Emergency and Restoration Code. In the absence of further advice, the Workgroup have adopted the original timelines specified in the EU Emergency and Restoration Code.

In GB, implementation of Phase I of the EU Emergency and Restoration Code was achieved through Grid Code modifications GC0125[5] (EU Emergency & Restoration: Black Start Testing Requirements for Interconnectors), GC0127[6] (EU Emergency & Restoration: Requirements Resulting from System Defence Plan) and GC0128[7] (EU Code Emergency & Restoration: Requirements Resulting from System Restoration Plan). These modifications were approved by the Authority on 5 February 2020.

This modification, GC0148, comprises of three parts, these being:

i) the requirement to implement articles 15(5) – 15(8) which relates to low frequency demand disconnection, article 41 which relates to commications systems and article 42(1), (2) and (5) which relates to critial tools and facilities. All of these requirements have a compliance date of 18 December 2022.

[3] https://ec.europa.eu/info/strategy/relations-non-eu-countries/relations-united-kingdom/eu-uk-trade-and-cooperation-agreement_en
[4] https://www.legislation.gov.uk/uksi/2019/533/contents
[5] https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0125-eu-code-emergency-restoration-black
[6] https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0127-eu-code-emergency-restoration
[7] https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0128-eu-code-emergency-restoration

ii) the requirement to address some outstanding issues from the implementation of Grid Code modifications GC0125, GC0127 and GC0128 which relate to:-

(a) How non-CUSC parties would fall under the framework of the NCER noting that the solution provided under Grid Code modifications GC0125, GC0127 and GC0128 applies only to CUSC parties.

(b) Clarity relating to the treatment of electricity storage modules during low system frequencies as provided for under article 15(3).

iii) To consider, if time permits and the Workgroup believes appropriate, the requirements relating to Distributed ReStart. Distributed ReStart is a Network Innovation Competition project which aims to explore the practicality of system restoration using embedded generation and embedded restoration service providers to restore supplies to parts of distribution network operators' (DNOs) systems. Which to date is an approach that has not been used in GB for overall system restoration purposes. As this project relates to system restoration actvities it falls under the provisions of the NCER. **Please note:** Distributed ReStart was considered by the Workgroup, this included discussions on the process and the preparation of draft legal text. However, based on the feedback from the Workgroup consultation, the Proposer and Workgroup unanimiously agreed that it was more appropriate for Distributed ReStart to be removed from the GC0148 solution and transferred in to Grid Code modification GC0156 (Implementation of the Electricity System Restoration Standard)[8].

In addition to the above, there is also the requirement to consider article 50 which relates to compliance testing and periodic review of the System Defence Plan and article 48(3) which relates to the requirement to define the Test Plan.

To address the defect, the Grid Code together with other documents (the System Defence Plan, System Restoration Plan and Test Plan) and other industry related codes, (i.e. the STC, and the Distribution Code need to be updated, where relevant, to reflect the NCER requirements (articles 15(5) – 15(8), article 41 and 42(1), (2) and (5)) which are effective from 18 December 2022. It is noted that articles 50, 48(3) and 15(9) are also related to articles 15(5) – 15(8), 41 and 42(1)(2) and (5), with article 48(3) having a date of legal effect of 18 December 2024.

In summary, these Articles relate to the following issues: -

- Articles 15(5) – 15(9) – Relate to low frequency demand disconnection including the need to avoid tripping embedded generation, especially generation which contributes to system inertia.
- Article 41 – Relates to communication systems resilience, equipment redundancy, backup power supplies for 24 hours, technical requirements for voice communication facilities. It also relates to transmission operator (TSO) to TSO voice communication systems, the ability of restoration service providers with type A[9] and B Power Generating Modules, in general, to only have data communication facilities

[8] https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0156-implementation-electricity-system

[9] As defined in the Network Code Requirements for Generators, and as used in the Grid Code.

instead of voice communication facilities and the use of additional communication systems to support the System Restoration Plan if required.

- Article 42 (1), (2) and (5) – Relate to TSOs having available critical tools and facilities such as monitoring, system state, telecommand systems, control room interaction operational security analysis and communications facilities to facilitate cross border trade for at least 24 hours in the case of primary power loss. DNOs, Users and restoration service providers are also required to make critical tools and facilities available for 24 hours in the event of primary power loss. In addition, substations identified as essential for the restoration plan are required to be operational in the case of primary power loss for 24 hours.
- Article 48(3) requires each TSO in consultation with other TSOs to define a Test Plan for testing inter-TSO communication which requires implementation by 18 December 2024.

Why change?

Although Brexit has had an impact on the relationship with the EU, there is still the need to comply with the implementation deadlines of the NCER as required under Statutory Instrument SI 533 2019.

During the latter stages of Phase I of the implementation of the NCER, through Grid Code modifications GC0127 and GC0128, two key outstanding issues were raised. These being:

- How would NCER apply to non-CUSC parties; and
- Further clarity was sought on the performance requirements of electricity storage modules when transiting from an import mode of operation to an export mode of operation during low system frequencies (NCER article 15(3)).

National Grid ESO together with other industry stakeholders, in particular the DNOs, are committed to addressing these issues and believes it appropriate to address these as part of this GC0148 modification.

Finally, the Distributed ReStart Project has been established to trial the concept of new providers of restoration services, connected to distribution systems, to contribute to a recovery in the event of either a total or partial system shutdown.

The aim is to encourage new providers of black start services (such as interconnectors, wind, solar and storage), where historically transmission connected thermal generation has been used. More importantly it is the use of embedded generation to restart sections of the distribution network which can be used to re-energise and contribute to the overall whole system restoration process that would enable the total system to be re-established quickly.

A further key enabler here is the introduction of “Grid Forming” plant. This was introduced through Grid Code modification GC0137[10] as a vehicle for renewable technologies to

[10] For the avoidance of doubt, GC0137 places no mandatory obligations on parties to provide ‘grid forming’ capabilities – it only applies to them if they choose to offer this service to the ESO.

provide restoration services where traditionally this has been more challenging in the past. This technology would be equally applicable to both transmission connected plant or distribution connected plant.

The Distributed ReStart Project recognises the changing system behaviour and the need to obtain black start and restoration services from a variety of embedded sources, for example; generation, storage or smart loads. As noted above, the overwhelming view of the Workgroup was that Distributed ReStart is not a requirement of the EU Emergency and Restoration Code, though it would fall under the framework of the Emergency and Restoration Code if introduced. In view of the early development of the Distributed ReStart Project and the ongoing live trials, the approach adopted by the Workgroup (post Workgroup consultation) is to propose that this is integrated into the Electricity System Restoration Standard (Grid Code modification GC0156), whilst acknowledging the progress made in this area.

What is the solution?

Proposer's solution

The solution comprises of the following:

- **Article 12**
  This article relates to the requirement for the TSO to notify SGU[11]s and DNOs of the measures to be implemented to fulfil the requirements of the System Defence Plan. This issue was raised in August 2019 as part of Grid Code modification GC0127 but could not be enacted as there was a need for approval of the SGU list. This issue was discussed amongst the GC0148 Workgroup and a draft notification letter in respect of System Defence Providers has been included in Annex 7(i). Comments on this letter were also sought through the workgroup consultation.

- **Articles 15(5) to 15(9)**
  These relate to the low frequency demand disconnection scheme and in particular the need to take account of the effect of embedded generation, which is to minimise the amount of such generation tripped. Although recent NGESO/DNO methodologies and initiatives do already minimise such losses, where reasonably practicable. It is anticipated that a review of CC/ECC.A.5 (these are the technical requirements for low frequency relays for the automatic disconnection of supplies at low frequency) and the low frequency demand disconnection scheme more generally, will be required in the near future.

  The Workgroup reviewed each element of articles 15(5) – 15(8) comparing them with the requirements of the current low frequency demand disconnection scheme as defined in Appendix 5 of the CCs and ECCs. The findings of these discussions are detailed in Table 1.0 below.

[11] Significant Grid Units as defined in NCER

Article Ref	E&R Requirement	Commentary
15(5)	*Each TSO shall design the scheme for the automatic low frequency demand disconnection in accordance with the parameters for shedding load in real-time laid down in the Annex*	This is requirement is already in place – see Table ECC.A.5.5.1a in Appendix 5 of the Grid Code European Connection Conditions. Similar arrangements are also in place in Appendix 5 of the Grid Code Connection Conditions.
15(5)	*The scheme shall include the disconnection of demand at different frequencies, from a 'starting mandatory level' to a 'final mandatory level', within an implementation range whilst respecting a minimum number and maximum size of steps*	This is requirement is also already in place – see Table ECC.A.5.5.1a in Appendix 5 of the Grid Code European Connection Conditions. Similar arrangements are also in place in Appendix 5 of the Grid Code Connection Conditions.
15(5)	*The implementation range shall define the maximum admissible deviation of netted demand to be disconnected from the target netted demand to be disconnected at a given frequency, calculated through a linear interpolation between starting and final mandatory levels*	This is the basis on which Table ECC.A.5.5.1a has been compiled and therefore the Grid Code is compliant. Similar arrangements are also in place in Appendix 5 of the Grid Code Connection Conditions.
15(5)	*The implementation range shall not allow the disconnection of less netted demand than the amount of netted demand to be disconnected at the starting mandatory level*	The GB Scheme as currently provided for in the Grid Code already satisfies this requirement and is compliant.
15(5)	*A step cannot be considered as such if no netted demand is disconnected when this step is reached*.	This is an implicit requirement. In GB, the scheme will only trip demand at pre-defined levels. The directional element in Appendix 5 of the European Connection Requirements will include this functionality.
15(6)	*Each TSO or DSO shall install the relays necessary for low frequency demand disconnection taking into account at least load behaviour and dispersed generation*.	For any new relay installed and which is caught by the requirements of Appendix 5 of the European Connection Conditions, the relay requires a directional element which would avoid tripping generation on exporting feeders and hence would be compliant. In the wider sense, the need to establish a Workgroup to understand the impact on the wider low frequency demand disconnection scheme would be useful to ensure

		continuing compliance as the volume of embedded generation continues to grow.
15(7)(a)	*When implementing the scheme or the automatic low frequency demand disconnection pursuant to the notification under Article 12(2), each TSO or DSO shall: avoid setting an intentional time delay in addition to the operating time of the relays and circuit breakers*;	This is already catered for in ECC.A.5.1.1(b) and ECC.A.5.3.2 which states other than in respect of relays installed prior to October 2009 “The total operating time of the scheme, including circuit breakers operating time, shall where reasonably practicable, be less than 200 ms. For the avoidance of doubt, the replacement of plant installed prior to October 2009 will not be required to achieve lower total scheme operating times”. Again, the Workgroup recommend this issue is addressed as a separate item.
15(7)(b)	*When implementing the scheme for the automatic low frequency demand disconnection pursuant to the notification under Article 12(2), each TSO or DSO shall: minimise the disconnection of power generating modules, especially those providing inertia; and*	Whilst new relays caught under Appendix 5 of the European Connection Conditions have a directional element, they do not distinguish between those with and without inertia. However, the bulk of the growth of embedded generation in the last decade has been renewables with no inertia. There is however an exception clause in the final paragraph of Art 15(7) which would be appropriate here if future compliance became an issue. In the case of relays not caught under Appendix 5 of the European Connection Conditions, DNOs currently configure the wider low frequency demand disconnection scheme to minimise, where reasonably practicable, the disconnection of power generating modules. Again, the Workgroup recommend this issue is addressed as a separate item.
15(7)(c)	*When implementing the scheme for the automatic low frequency demand disconnection pursuant to the notification under Article 12(2), each TSO or DSO*	This is currently not defined within the Grid Code, although it established practice for NGESO

	shall: limit the risk that the scheme leads to power flow deviations and voltage deviations outside operational security limits.	and DNOs to review these effects as part of routine planning liaison. There again is however an exception clause in the final paragraph of Art 15(7) which would be appropriate here.
15(7) Final Paragraph	*If a DSO cannot fulfil the requirements under points (b) and (c), it shall notify the TSO and propose which requirement shall apply. The TSO, in consultation with the DSO shall establish the applicable requirements based on a joint cost-benefit analysis*	The group discussed this issue and welcomed the scope for flexibility. However, it was agreed there were no current obvious deficiencies to accommodate in this way.
15(8)(a)(i)	*The scheme for the automatic low frequency demand disconnection of the system defence plan may provide for netted demand disconnection based on frequency gradient provided that: it is activated only: when the frequency deviation is higher than the maximum steady state frequency deviation and the frequency gradient is higher than the one produced by the reference incident;*	This requirement is not mandatory by virtue of the “may” statement and therefore can be discounted.
15(8)(a)(ii)	*The scheme for the automatic low frequency demand disconnection of the system defence plan may provide for netted demand disconnection based on frequency gradient provided that: it is activated only until the frequency reaches the frequency of the demand disconnection starting mandatory level;*	This requirement is not mandatory by virtue of the “may” statement and therefore can be discounted.
15(8)(b)	*The scheme for the automatic low frequency demand disconnection of the system defence plan may provide for netted demand disconnection based on frequency gradient provided that: it complies with the Annex and*	This requirement is not mandatory by virtue of the “may” statement and therefore can be discounted.
15(8)(c)	*The scheme for the automatic low frequency demand disconnection of the system defence plan may provide for netted demand disconnection based on frequency gradient provided that it is necessary and justified in order to maintain efficiently the operational security*	This requirement is not mandatory by virtue of the “may” statement and therefore can be discounted.
15(9)	*In case the scheme for the automatic low frequency demand disconnection of the system defence plan includes netted demand disconnection based on frequency gradient, as described in paragraph 8, the TSO shall submit, within 30 days of the implementation, a report containing a detailed explanation of the rationale, implementation and impact of this measure to the national regulatory authority*	This relates to Art 15(8) which is not mandatory and therefore it is not applicable and can be discounted.

Table 1.0

As part of this work the proposer also sought the views of Western Power Distribution (WPD) which has been extensively involved in the System HILP (High Impact Low Probability) Event Demand Disconnection (SHEDD) project which is a NIC project investigating the options for the re-design of the low frequency demand disconnection scheme, further details of which are available from the link below.

https://www.westernpower.co.uk/innovation/projects/system-hilp-event-demand-disconnection-shedd

The Workgroup discussed the NCER requirements at length, having reviewed each individual requirement of article 15(5) – 15(9) as summarised in Table 1.0. The Workgroup concluded after discussion and review that the current GB low frequency demand disconnection scheme already meets the requirements of the NCER. The Workgroup noted the ongoing challenges of continued compliance, particularly with article 15(7), and have concluded that this would be best achieved at a separate working group outside of the GC0148 Grid Code modification.

- **Article 24**
  This article relates to the requirement for the TSO to notify SGUs and DSOs of the measures to be implemented to fulfil the requirements of the System Restoration Plan. This issue was raised in August 2019 as part of Grid Code modification GC0128 but could not be enacted as there was a need for approval of the SGU list. This issue was discussed amongst the GC0148 Workgroup and a draft notification letter in respect of system restoration providers has been included in Annex 7(ii). Comments on this letter were also sought through the Workgroup consultation.

- **Article 40**
  It was noted by a Workgroup member that there may be additional requirements relating to the provision of information either by parties to the ESO or from the ESO to parties in the event of an emergency, blackout, or restoration situations as set out in the NCER Article 40, and that it may be necessary to ensure that these are addressed by GC0148.

  Briefly article 40(1) relates to information the ESO is entitled to ask from parties, such as SGUs and restoration service providers as well as DNOs. In the case of non-DNO parties this includes information about at least: (i) the current status of the installation; (ii) the operational limits; (iii) the full activation time and the time to increase generation; and (iv) the time critical processes.

  Article 40(2) (along with articles 40(4) and 40(5)) relate to the information the ESO shall provide to parties, if the GB transmission system is in an emergency, blackout, or restoration system state with this being stated as being in due time, for the purposes of the System Defence Plan procedures and restoration plan procedures, and where available.

  For example, in the case of SGUs and restoration service providers this includes information about at least: (i) the system state of the GB transmission system; (ii)

the ability and plans to re-energise couplings; and (iii) the scheduled measures that require their participation.

The Proposer's view was that certain information will already be shared contractually and that some of these matters relating to the GB system state have been reviewed recently as part of the GC0133 modification that sought to codify a requirement for the ESO to share this on Balancing Mechanism Reporting Service (BMRS). In their rejection of this modification, Ofgem noted the risk of misreporting, particularly without further commentary to explain the system state, and the lack of a demonstrable benefit. This modification included the 'alert' state that was designed primarily for TSO to TSO communications though; the ESO will share the 'emergency', 'blackout' and 'restoration' states on a reasonable endeavours' basis. The ESO continues to have reservations about codifying absolute requirements that might be difficult or counterproductive to meet during an actual emergency when the ESO's control room will be experiencing a period of severe stress.

Post the Workgroup consultation, Workgroup members decided to raise two different Workgroup alternatives which combined compliance with Article 40 into the original solution. This would then provide a route for the Authority to determine a solution which addresses all the outstanding requirements or NCER as the original solution or the alternatives which provides a solution for the outstanding issues of NCER in addition to the notification of emergency, blackout and restoration system states. As part of these discussions, it was noted that if the original or an alternative goes ahead, then maybe a non- consequential change might be required to the STC, which the ESO will consider and discuss at the STC Panel.

Further information on this can be found within the Workgroup Alternatives section of this report.

- **Article 41**
  This relates mainly to the resilience of the communications systems for voice and data which is provided (in the form of control telephony) by the ESO to the site(s) of SGUs, DNOs and relevant restoration service providers. The proposer has reviewed CC/ECC.6.5.1 to CC/ECC.6.5.5 of the Grid Code and believes there are only minor changes required to the Grid Code legal text. The Grid Code legal text does however relate to the Control Telephony Relevant Electrical Standard; it is this document which has been substantially updated as a part of the GC0148 modification. Proposed updates to the Control Telephony Relevant Electrical Standard are therefore included in Annex 11. **Please note**: Post Workgroup consultation, the Workgroup decided to remove Annex 1 from the Control Telephony Standard so that it can be addressed in more detail within GC0156.

- **Article 42 (1), (2) and (5)**
  These relate to critical tools and facilities, such as:
  - monitoring the state of the transmission system, including state estimation
  - the ability to operate items of plant remotely (e.g. switchgear)

- transformer tap changers and other equipment for the safe functioning of the transmission system, in addition to telemetry and alarm management
- the ability to communicate with control rooms and other TSOs for system operation and facilitating cross border operations, which are essential during a black out state.

National Grid ESO already has these capabilities which are detailed in internal procedures as referenced in the System Restoration Plan. The only outstanding issues are the tools and facilities that DNOs and those parties who fall under the NCER need in terms of their ability to receive instructions and operate their assets during a system shut down event for 24 hours. **Please note:** Post the Workgroup consultation, the Proposer decided to amend the mains independence resilience period from 24 to 72 hours. In addition, it was also noted that a consequential change will be required to the STC so that any obligations for critical tools and facilities can be provided by Transmission Licensees. Further information on this can be found within the Workgroup Consultation Summary section of this report. Proposed Grid Code legal text has also been developed by the Workgroup and included in Annex 8 of this report.

- **Article 50**
  Article 50 requires a review of the System Defence Plan. As part of this modification, extensive modifications have been made to the System Defence Plan, System Restoration Plan and Test Plan which can be found in Annexes 4, 5 and 6 of this report.

- **Article 48(3)**
  This is largely linked to Article 41 but will require a test plan for testing TSO communication systems. As part of GC0148, the Test Plan has been updated to include this requirement.

- **Inclusion of Non-CUSC Parties**
  Under the GC0127 and GC0128 modifications, the implemented solution is that the NCER only applied to CUSC parties. Within GC0148, it is proposed that the NCER would apply to all non-CUSC parties who provide either a contracted defence or a contracted restoration measure (ie they are a defence service provider or a restoration service provider). Hence their contracts will necessarily bind that defence service provider or restoration service provider to the applicable requirements of the Grid Code and therefore they would be caught by the requirements of the NCER.

  For the avoidance of doubt, the ESO will not contract with any non-CUSC party for either defence services or restoration services unless the party concerned meets the applicable requirements of the Grid Code (and thus ensures compliance with the requirements of the NCER). Feedback was sought on this through the workgroup consultation.

- **Operation of Electricity Storage Modules under Low Frequency Conditions**
  This issue is specifically raised in this GC0148 modification to address the requirements of Article 15(3)(a). Since the GC0127 modification was implemented, the technical requirements for electricity storage modules have been clarified in the Grid Code through Grid Code modification GC0096. In addition, further understanding has been gained through the European Expert Storage Group and Distribution Code storage modification DCRP/20/06/PC. The proposed legal text for this proposed improvement is included in Annex 8 of this report.

  Figure 1.0 below shows the performance requirements expected from an electricity storage module transitioning from an import mode of operation to an export mode of operation. As part of the solution, consideration has been given to the response requirements of the electricity storage module through the recovery of system frequency, and to the associated compliance process.

  Article 15(3)(a) and (b) applies to electricity storage modules owned and operated by users, defence or restoration service providers. This would include balancing service providers, balance responsible parties and any provider of a dispatching service.

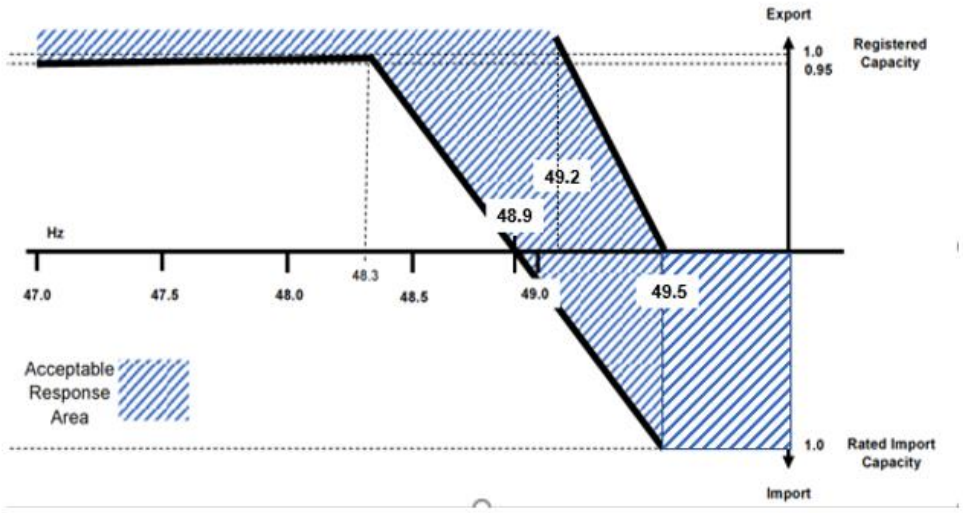

Figure 1.0 Shows the performance requirements expected from an electricity storage module transitioning from an import mode of operation to an export mode of operation.

A Workgroup member noted that the suggested approach necessitated by article 15(3) would be erroneous, in their view, in terms of ensuring legal compliance as the wording (in the article and the NCER) applies both to new and existing electricity storage modules. The proposer noted this issue and stated that in the proposer's opinion article 15(3) requires a deload capability from import to export (article 15(3)(a)), however, where a plant is unable to meet this requirement then article 15(3)(b) a trip function applies. This has been codified within the legal text in Annex 8 and is believed to have addressed this issue.

- **The Distributed ReStart Project**
  The Distributed ReStart Project examined if embedded assets (such as generation and batteries connected to distribution networks) can provide restoration services to the ESO. The project has proposed the concept of distribution restoration zones (DRZs) and, if taken forward, would bring active DRZ participants within the scope of the NCER as restoration service providers. The Distributed ReStart Project would provide this additional facility for the wider restoration process and has substantial changes to both the Grid Code and Distribution Code associated with it. However, Distributed ReStart is not a mandatory requirement for DNOs, or potential restoration service providers, as the necessary embedded generation facilities may not exist or there be an appropriate network topology. Nevertheless, following the live trials which have been established as part of the Distributed ReStart Project, the collateral exists for DNOs to consider developing these capabilities to help achieve the ESRS requirements.

  The traditional approach to System Restoration in GB is a top-down approach where black start stations are instructed to energise dead sections of transmission network to form a power island. Blocks of demand (block load) are then connected under the requirements of a Local Joint Restoration Plan (LJRP). The LJRP process runs in parallel across the transmission system to form a skeleton network whereby further power stations and demand are restored. Traditionally, black start stations have been drawn from the fleet of coal, hydro, pump storage and gas power stations with some input from HVDC Interconnectors. Going forward it is recognised that, primarily in terms of thermal plant which are generally carbon based, these providers are reducing in numbers as a result of the drive toward renewable technologies.

  The Distributed ReStart Project recognises the growth in embedded generation and from this, the pool of capability that could be used to energise sections of the distribution network to form a distribution restoration zone. In this scenario, the ESO would instruct the DNO (following formal agreement between the ESO and the DNO, including the DNO undertaking any necessary enabling works) to establish a DRZ which would be defined in an accompanying distribution restoration zone plan (DRZP), similar to an LJRP. The aim here is to run the traditional black start arrangements in parallel with the DRZs to restore the whole system to normal operation as soon as possible.

  The DRZ revolves around the new role of anchor generator, which is an embedded generator with grid forming capability. The anchor generator may be supported by one or more top-up service providers who can provide addition generation input, albeit not necessarily grid forming, or a range of ancillary services to assist with running a stable power island, such as reactive power capability, inertia etc, and even flexible demand. Collectively all these parties are referred to as restoration service providers. The Distributed ReStart Project considered the balance between requirements embodied in the industry codes and contractual requirements, the various models for both the structure of any necessary contracts, who the contracts should be between, and who the lead procurement party should be.

These considerations are covered in sections 10.1 and 3.3 of the project's report "Distribution Restoration future commercial structure and industry codes recommendations" (December 2021) (See Annex 14 of this report). The project's preferred approach is for tripartite agreements between the DNO, NGESO and the restoration service providers (be they either as an anchor generator or as a top-up service provider), with NGESO taking the procurement lead. This would require that restoration service providers enter a tripartite contract with NGESO and the relevant DNO. The contract would be procured by NGESO through a tendering process. Figures 2.0 and 3.0 below shows the proposed relationships in England & Wales and in Scotland respectively.

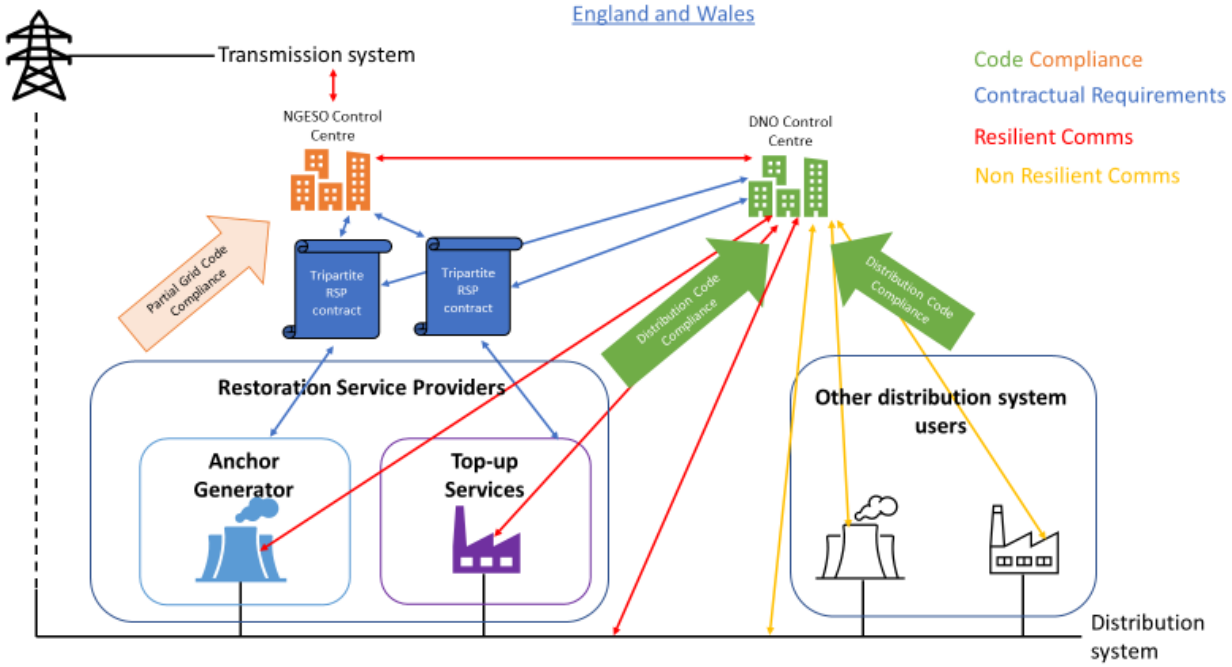

Figure 2.0 shows the proposed relationships in England and Wales

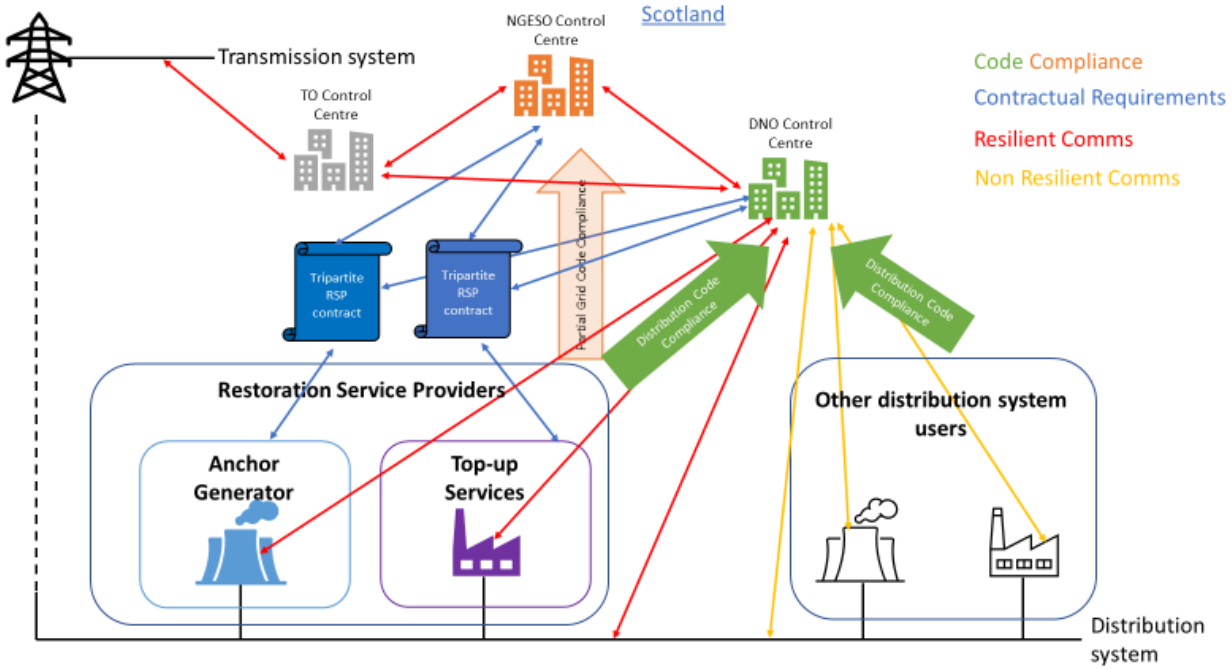

Figure 3.0 shows the proposed relationships in Scotland

NGESO has the licence obligation and the income stream to remunerate the services and therefore the technical requirements need to be placed in the Grid Code. The Grid Code text encapsulates the whole distribution restoration process through a DRZP, and specifically covers the requirements on DNOs and restoration service providers. As the restoration service provider is connected to the distribution system, and is bound by the Distribution Code, the project believes it is appropriate to put the key requirements into the Distribution Code for the restoration service provider to conform to. Although contractually the restoration service providers can and should be bound to the Grid Code, it is not straightforward to apply Grid Code drafting to embedded parties, not least because the context of the drafting is subtly different and, for example, some of the key definitions are necessarily different. Hence it might be appropriate to assign a contractual hierarchy such that the requirements of the Distribution Code have primacy for restoration service providers, followed by the tripartite contract and then the Grid Code. The Workgroup discussed this issue indicating the NCER should take precedence followed by the Grid Code, Distribution Code and then the contract.

Please note: The work completed on Distributed ReStart to date, will be removed from the GC0148 solution and transferred into Grid Code Modification GC0156 Implementation of the Electricity System Restoration Standard. This means any Cross Code Impacts from Distributed ReStart which may result in changes for the STC, CUSC and BSC can also now be considered at a later stage. The Workgroup unanimously agreed (based on feedback to the Workgroup Consultation), that this was the best way for Distributed ReStart to proceed.

- **Further Considerations**
  In view of the high level of interaction between National Grid ESO and DNOs, this modification has been established as a combined Grid Code Review Panel / Distribution Code Review Panel Workgroup.

Workgroup Consideration for GC0148

The Workgroup convened 13 times to discuss the perceived issue, agree the scope of the proposed defect, devise potential solutions, and assess the proposal in terms of the Applicable Grid Code Objectives.

Workgroup discussions on the proposer's solution

The Workgroup was briefed on all aspects of the proposer's solution with regular updates on each section, including presentations on Distributed ReStart, Control Telephony, updates to the System Defence Plan, System Restoration Plan, Test Plan, Storage Requirements and Notification Letters. A summary of the meetings and presentations are available on the ESO GC0148 Grid Code modification page which is available from the following link.

https://www.nationalgrideso.com/uk/electricity-transmission/industry-information/codes/grid-code-old/modifications/gc0148-implementation-eu-emergency-and-0

A Workgroup member noted that the Proposer seemed to have made an error in their suggestion that the Gas and Electricity Markets Authority (GEMA) had approved the terms

and conditions for defence service providers, as well as for restoration service providers, and the list of SGUs. The Workgroup member also noted that the decision letter of 13 July 2021 appeared to be from Ofgem rather than on behalf of GEMA.

Workgroup Consultation Summary

The Workgroup held its Workgroup Consultation between 28 March 2022 and 27 April 2022 and received **7** responses, none of which were confidential. A summary of the responses and the full responses can be found in Annexes 15 and 16 respectively.

The Workgroup met to discuss and consider all the responses received and noted the following trends and key points within the industry's responses:

- All respondents believed that the Original proposal better facilitated the Applicable Grid Code Objectives. As this would ensure that the requirements of the Emergency and Restoration Network Code were properly reflected in the Grid Code and complied with by the relevant parties.

- 6 respondents (including the Proposer) supported the proposed implementation approach as it satisfied the requirements of the EU Emergency and Restoration Code. But they felt that the Distributed ReStart provisions should be moved from GC0148 to Grid Code modification GC0156 (Implementation of the Electricity System Restoration Standard).

  One respondent made the point that the Distributed ReStart Project was largely conducted in Scotland using non-embedded generators connected at 11/33 kV. It shows that the Distributed ReStart concept could also be applied to small/medium transmission connected generators though this would need further work and amendments to the contractual and commercial arrangements in addition to changes to Local Joint Restoration Plans (LJRPs).

  The Proposer and Workgroup unanimously agreed following the Workgroup Consultation that anything related to Distributed ReStart (including the proposed Distributed ReStart Contracts), would be best addressed through Grid Code modification GC0156. The workgroup noted that this seemed particularly appropriate in view of the ESRS work streams that have preceded the formal establishment of GC0156 and noting that the Distributed Restart live trials are still to be completed. This will also mean that the System Defence, Restoration and Test plans will, in the short term, no longer need to refer to Distributed ReStart.

- One respondent suggested aligning the governance arrangements of the System Defence Plan and System Restoration Plan with the Test Plan. The Proposer agreed with this approach and has amended the legal text to reflect this.

- There was support for non-CUSC parties falling into the framework of the E&R through contracts as service providers with the ESO. As long as they are transparent, consistent, and treated holistically in terms of the "Total System"

- The majority of respondents supported the 72 hour mains independence resilience period (rather than the minimum 24 hour period in E&R). Though a number of questions were raised as to how this would fit with the requirement to restore 100% of the demand in 5 days (120 hours). One respondent noted the 72 hour requirement

was very onerous with another suggesting it should be codified rather than placed in an electrical standard.

Based on the majority support for the 72 hour mains independence resilience period, the Proposer decided to amend his solution to adopt this approach and has updated the legal text accordingly.

Workgroup Alternatives

Two Workgroup alternative solutions were raised post Workgroup Consultation. The Workgroup debated them and unanimously agreed that they were within the scope of the defect. The Workgroup was also unanimous that they may better facilitate the Grid Code Objectives then the original, and that they should be taken forward as a Workgroup Alternative Grid Code Modifications (WAGCMs). The full results from this vote are set out in Annex 19.

WAGCM1 (SSE): Original + compliance with Article 40 ERNC

This is as per the original solution, plus compliance with ERNC Article 40 (2) – (4), which refers to the exchange of operationally necessary information from the ESO to stakeholders, and adds in the additional notification requirements for emergency, blackout and restoration system states. Further details on this can be found in Annex 17.

WAGCM2 (ESO): WAGCM1 + Definitions for Normal and Alert states

This is identical to WAGCM1, but also adds in the definitions for normal and alert states. This is to ensure that it is clear what state the system is in, when it is not in an emergency/blackout or restoration state. Further details on this can be found in Annex 18.

Legal Text

The Legal Text for this modification is included in Annexes 4,5,6,7,8,9,10 and 11 of this report.

What is the impact of this change?

To satisfy the requirements of articles 15(5) – 15(9), article 41 and 42(1), (2) and (5) which becomes effective on 18 December 2022, it is expected to result in additional requirements on Grid Code parties in particular but not limited to generators (including generators who own and operate electricity storage modules), HVDC system owners, National Grid ESO, other transmission licensees, DNOs, non-embedded customers, SGUs, defence service providers and restoration service providers.

In terms of WAGCM1 and 2, if approved, this would place additional requirements on the ESO to notify parties through BMRS of an emergency, blackout or restoration system state.

Transmission Licensees

There will also be an impact on transmission licensees, but such impacts will have to be assessed separately through the STC Panel.

Wider

In addition, there will be an impact on non-CUSC parties who are, or become, defence service providers and/or restoration service providers.

Proposer's assessment against Grid Code Objectives

Proposers' assessment - Impact of the modification on the Grid Code objectives:	
Relevant Objective	**Identified impact**
(a) To permit the development, maintenance, and operation of an efficient, coordinated, and economical system for the transmission of electricity	Positive
(b) Facilitating effective competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);	Positive
(c) Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;	Positive
(d) To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and	Positive
(e) To promote efficiency in the implementation and administration of the Grid Code arrangements	Neutral

Proposer's view of GC0148 Original against the Grid Code Objectives

The Proposer notes that the GC0148 solution aims to provide greater robustness and resilience measures to protect the system in the event of distress and to provide additional measures to restore the system in the event of a total or partial system shutdown. It also gives opportunities to smaller parties (who otherwise would not traditionally have been considered for these services) to provide system defence and system restoration services and therefore provide greater competition. In this respect, this modification is seen as positive in respect of Grid Code objectives (a), (b) and (c). This modification is also required to achieve compliance with the NCER and therefore positive in respect of Grid Code objective (d).

Workgroup Vote

The Workgroup met on 27 May 2022 to agree that the Terms of Reference (TOR) had been met and conduct the workgroup vote. Full details on the TOR and how these have been met can be found in Annex 3. 7 Workgroup members voted; details of the full Workgroup vote can be found in Annex 19. The tables below provide:

- A summary of how many Workgroup members believed the Original, WAGCM1 and WAGCM2 were better than the Baseline; and

- A summary of the Workgroup members views on the best option to implement this change.

Assessment of the Original, WAGCM1 and WAGCM2 vs Baseline

The Workgroup unanimously concluded that the Original and WAGCM2 and the Workgroup by a majority also agreed that WAGCM1 better facilitated the Applicable Grid Code Objectives than the Baseline.

Option	Number of voters that voted this option is better than Baseline
Original	7
WAGCM1	6
WAGCM2	7

Best Option

Workgroup Member	Company	BEST Option?	Which objective(s) does the change better facilitate? (if baseline not applicable)
Alan Creighton	**Northern Powergrid**	**WAGCM1**	**a, c, d**
Alastair Frew	**Drax Generation Enterprise Ltd**	**WAGCM2**	**c, d**
Garth Graham	**SSE Generation**	**WAGCM1**	**d**
Tony Johnson	**ESO**	**Original**	**a, b, c, d**
Julie Richmond /Priyanka Mohapatra (Alternate)	**Scottish Power Renewables (UK) Limited**	**WAGCM2**	**d**
Graeme Vincent	**SP Energy Networks**	**WAGCM1**	**a, c, d**
Richard Wilson/Bill D'Albertson (Alternate)	**UK Power Networks**	**WAGCM1**	**a, c, d**

When will this change take place

Implementation date
The proposed Implementation date is 10 working days after the Authority's decision.

Date decision required by
02 December 2022.

Implementation approach
No system or process changes required. There may be some costs in terms of comms resilience and critical tools and facilities, but most Users have these already, so it is considered relatively low. There will be additional costs with regards to communications, infrastructure but this is more of an issue relating to Electricity System Restoration Standard (ESRS) and will be picked up as part of GC0156.

Interactions

☐Grid Code ☒European Network Codes	☐BSC ☐ EBR Article 18 T&Cs[12]	☒STC ☐Other modifications	☐SQSS ☒Other (D Code)

This proposal is likely to bring about consequential changes to the STC and STCPs. These changes will need to be undertaken through the framework of the STC Panel.

Acronyms, key terms and reference material

Acronym / key term	Meaning
BEIS	Department for Business, Energy and Industrial Strategy
BMRS	Balancing Mechanism Reporting Service
CC	Connection Conditions
DCRP	Distribution Code Review Panel
DNO	Distribution Network Operator
DRZ	Distributed ReStart Zone
DSO	Distribution System Operator
EBR	Electricity Balancing Regulation
ECC	European Connection Conditions
ESO	National Grid Electricity System Operator
ESRS	Electricity System Restoration Standard
EU	European Union
G99	Engineering Recommendation G99
GEMA	Gas and Electricity Markets Authority
HVDC	High Voltage Direct Current
LFDD	Low Frequency Demand Disconnection
LJRP	Local Joint Restoration Plan
NCER	Network Code Emergency and Restoration
NGESO	National Grid Electricity System Operator
NIC	National Innovation Competition
SGU	Significant Grid User
SHEDD	System HILP Event Demand Disconnection
SQSS	Security and Quality of Supply Standards
STC	System Operator Transmission Owner Code
TSO	Transmission System Operator
WAGCM	Workgroup Alternative Grid Code Modification
WPD	Western Power Distribution

Reference material

- None

[12] If the modification has an impact on Article 18 T&Cs, it will need to follow the process set out in Article 18 of the Electricity Balancing Regulation (EBR – EU Regulation 2017/2195) – the main aspect of this is that the modification will need to be consulted on for 1 month in the Code Administrator Consultation phase. N.B. This will also satisfy the requirements of the NCER process.

Annexes

Annex	Information
Annex 1	Relevant Extracts from NCER
Annex 2	Proposal form
Annex 3	Terms of Reference
Annex 4	System Defence Plan
Annex 5	System Restoration Plan
Annex 6	Test Plan
Annex 7	Notification Letters i) in respect of defence service providers and ii) in respect of restoration service providers **Please note:** the ESO anticipates issuing these letters imminently
Annex 8	Legal Texts
Annex 9	Additional Legal Text WAGCM1 - compliance with Article 40 NCER
Annex 10	Additional Legal Text WAGCM2 - compliance with Article 40 NCER + definitions for normal and alert states.
Annex 11	11 i) Control Telephony Standard 11 ii) Removal of Annex 1 from the Control Telephony Standard **Please note:** Annex 11 ii) has been included within this report for information purposes only, as the Workgroup decided to remove this table from the Control Telephony Standard so that it can be addressed in more detail within GC0156.
Annex 12	Mapping table
Annex 13	Terms and conditions related to ERNC https://www.nationalgrideso.com/document/160021/download
Annex 14	Distributed ReStart, Distribution Restoration, Future Commercial Structure, and Industry Codes Recommendations (procurement and compliance workstream) 20 December 2021 https://www.nationalgrideso.com/document/226916/download **Please note:** Annex 14 has been included here for information purposes only. As the Workgroup decided post the Workgroup consultation, that any work related to Distributed ReStart will now be transferred over and picked up by the GC0156 Workgroup.
Annex 15	Workgroup Consultation Response Summary
Annex 16	Workgroup Consultation Responses
Annex 17	Workgroup Alternative Grid Code Modification (WAGCM) 1
Annex 18	Workgroup Alternative Grid Code Modification (WAGCM) 2
Annex 19	Alternate and Workgroup Vote

Annex 1 Relevant Extracts from NCER

Articles 15(5) – 15(9)

5. *Each TSO shall design the scheme for the automatic low frequency demand disconnection in accordance with the parameters for shedding load in real-time laid down in the Annex. The scheme shall include the disconnection of demand at different frequencies, from a 'starting mandatory level' to a 'final mandatory level', within an implementation range whilst respecting a minimum number and maximum size of steps. The implementation range shall define the maximum admissible deviation of netted demand to be disconnected from the target netted demand to be disconnected at a given frequency, calculated through a linear interpolation between starting and final mandatory levels. The implementation range shall not allow the disconnection of less netted demand than the amount of netted demand to be disconnected at the starting mandatory level. A step cannot be considered as such if no netted demand is disconnected when this step is reached.*

6. *Each TSO or DSO shall install the relays necessary for low frequency demand disconnection taking into account at least load behaviour and dispersed generation.*

7. *When implementing the scheme for the automatic low frequency demand disconnection pursuant to the notification under Article 12(2), each TSO or DSO shall:*

   (a) avoid setting an intentional time delay in addition to the operating time of the relays and circuit breakers;

   (b) minimise the disconnection of power generating modules, especially those providing inertia; and

   (c) limit the risk that the scheme leads to power flow deviations and voltage deviations outside operational security limits.

   If a DSO cannot fulfil the requirements under points (b) and (c), it shall notify the TSO and propose which requirement shall apply. The TSO, in consultation with the DSO shall establish the applicable requirements based on a joint cost-benefit analysis.

8. *The scheme for the automatic low frequency demand disconnection of the system defence plan may provide for netted demand disconnection based on frequency gradient provided that:*

   (a) it is activated only:

   (i) when the frequency deviation is higher than the maximum steady state frequency deviation and the frequency gradient is higher than the one produced by the reference incident;

   (ii) until the frequency reaches the frequency of the demand disconnection starting mandatory level;

   (b) it complies with the Annex; and

   (c) it is necessary and justified to maintain efficiently the operational security.

9. *In case the scheme for the automatic low frequency demand disconnection of the system defence plan includes netted demand disconnection based on frequency gradient, as described in paragraph 8, the TSO shall submit, within 30 days of the implementation, a report containing a detailed explanation of the rationale, implementation and impact of this measure to the national regulatory authority.*

Article 41

1. *Each DSO and SGU identified in accordance with points (b) and (c) of Article 23(4), each restoration service provider and each TSO shall have a voice communication system in place with sufficient equipment redundancy and backup power supply sources to allow the exchange of the information needed for the restoration plan for at least 24 hours, in case of total absence of external electrical energy supply or in case of failure of any individual voice communication system equipment. Member States may require a minimum backup power capacity higher than 24 hours.*

2. *Each TSO shall establish, in consultation with the DSOs and SGUs identified in accordance with Article 23(4) and with restoration service providers, the technical requirements to be fulfilled by their voice communication systems as well as by the TSO's own voice communication system in order to allow their interoperability and to guarantee that the TSO's incoming call can be identified by the other party and answered immediately.*

3. *Each TSO shall establish, in consultation with its neighbouring TSOs and the other TSOs of its synchronous area, the technical requirements to be fulfilled by their voice communication systems as well as by the TSO's own voice communication system in order to allow their interoperability and to guarantee that the TSO's incoming call can be identified by the other party and answered immediately.*

4. *Notwithstanding paragraph 1, those SGUs identified in accordance with Article 23(4) that are type B power generating modules and those restoration service providers that are type A or B power generating modules, shall have the possibility to have only a data communication system, instead of a voice communication system, if agreed upon with the TSO. This data communication system shall fulfil the requirements laid down in paragraphs 1 and 2.*

5. *Member States may require that, in addition to the voice communication system, a complementary communication system be used to support the restoration plan; in that case, the complementary communication system shall fulfil the requirements laid down in paragraph 1.*

Article 42 (1), (2) and (5)

1. *Each TSO shall make available critical tools and facilities referred to in Article 24 of Regulation (EU) 2017/1485 for at least 24 hours in case of loss of primary power supply.*

2. *Each DSO and SGU identified pursuant to Article 23(4) as well as restoration service provider shall make available critical tools and facilities referred to in Article 24 of Regulation (EU) 2017/1485 and used in the restoration plan for at least 24 hours in case of loss of primary power supply, as defined by the TSO.*

5. *5. Substations identified as essential for the restoration plan procedures pursuant to Article 23(4) shall be operational in case of loss of primary power supply for at least 24 hours. For substations in the synchronous area Ireland and Latvia, the duration of operation in case of loss of primary power supply may be lower than 24 hours and shall be approved by the regulatory authority or other competent authority of the Member State, on proposal of the TSO.*

Article 48(3)

3. By 18 December 2024 each TSO, in consultation with other TSOs, shall define a test plan for testing the inter-TSO communication.

Article 50

1. Each DSO concerned by the implementation of the low frequency demand disconnection on its installations shall update once a year the communication to the notifying system operator provided for in point (b) of Article 12(6). This communication shall include the frequency settings at which netted demand disconnection is initiated and the percentage of netted demand disconnected at every such setting.

2. Each TSO shall monitor the proper implementation of the low frequency demand disconnection on the basis of the yearly written communication referred to in paragraph 1 and on the basis of implementation details of TSOs' installations where applicable.

3. Each TSO shall review, at least every five years, its complete system defence plan to assess its effectiveness. The TSO shall in this review take into account at least: (a) the development and evolution of its network since the last review or first design; (b) the capabilities of new equipment installed on the transmission and distribution systems since the last review or first design; (c) the SGUs commissioned since the last review or first design, their capabilities and relevant services offered; (d) the tests carried out and the analysis of system incidents pursuant to Article 56(5) of Regulation (EU) 2017/1485; and (e) the operational data collected during normal operation and after disturbance.

4. Each TSO shall review the relevant measures of its system defence plan in accordance with paragraph 3 before any substantial change in the configuration of the grid.

5. When the TSO identifies the need to adapt the system defence plan, it shall amend its system defence plan and implement these amendments in accordance with points (c) and (d) of Article 4(2) and Articles 11 and 12.