Workgroup Consultation

GC0148:

‘Implementation of EU Emergency and 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 40 (1)(2) (4) 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 treatement of storage under low frequency conditions and the treament 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**
   18 May 2022
4. **Code Administrator Consultation**
   02 June 2022 - 04 July 2022
5. **Draft Code Modification Report**
   28 July 2022
6. **Final Code Modification Report**
   16 August 2022
7. **Implementation**
   10 Working days after Authority decision

Have 5 minutes? Read our Executive summary

Have 20 minutes? Read the full Workgroup Consultation

Have 30 minutes? Read the full Workgroup Consultation and Annexes.

This modification is expected to have a: High impact on the ESO, Users (e.g. 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 will be 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 Anthony.johnson@nationalgrideso.com Phone: 07966 734856	**Code Administrator Chair**: Sally Musaka Sally.musaka@nationalgrideso.com Phone: 07814 045448
How do I respond?	Send your response proforma to grid.code@nationalgrideso.com **by 5pm on 27 April 2022**	

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Executive summary

The EU Emergency and Restoration Code 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 prevent a black out from occurring (defensive measures) and in the event of a total or partial system shutdown, measures to restore the system (restoration measures) in the event this situation were to occur.

As part of the UK's withdrawal from the EU, the requirements of the EU Network Code on Electricity Emergency and Restoration (NCER) have been incorporated into GB law through Statutory Instrument SI 533 2019[1]. This modification will ensure compliance with these changes and promote the use of alternative options available to National Grid ESO in event of a total or partial system shutdown.

For the purposes of this document, terms such as black start, total or partial shutdown and system restoration are interchangeable.

For the avoidance of doubt, this modification is not addressing aspects to do with the electricity system restoration standard (ESRS) which is a subject of a separate modification GC0156.

What is the issue?

The proposer believes that this defect comprises of three main elements. These are summarised as follows:

- 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) and Article 48(3) 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:
To address the defects, the proposer believes that the Grid Code needs to be updated to be compliant with the updated requirements. Specifically, requirements for the following items should be applied through this modification: 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. This modification also includes the development of Grid Code requirements to support distributed restart.

[1] https://www.legislation.gov.uk/uksi/2019/533/contents

The Distributed Restart Project is a Network Innovation Competition (NIC) Project. Distributed restart is not a mandatory requirement under the NCER but if the provisions of the Distributed Restart Project were implemented in GB, the requirements of the NCER would apply to the distributed restart provisions. The GC0148 Terms of Reference do specifically allow for distributed restart to be considered as part of this modification, alongside the associated Distribution Code Changes, with the option for it to be removed if the Grid Code Review Panel and Distribution Code Review Panel believe there is insufficient time for it to be appropriately progressed. This issue is specifically brought out in this document and is raised as a specific consultation question below.

Implementation date: The proposed implementation date is 10 working days after the Authority's decision to approve.

Summary of potential alternative solution(s) and implementation date(s):
No formal alternatives have currently been raised as part of this modification. It has however been noted as part of the workgroup discussions that the distributed restart legal text is segregated from the other solutions prepared as part of this modification to allow Distributed Restart to be developed separately if stakeholder feedback suggests it is not appropriate to proceed with it within GC0148.

What is the impact if this change is made?

This modification will affect:

- Transmission Licensees;
- CUSC Parties (including generators (which includes owners and operators of electricity storage modules), HVDC system owners, distribution network operators and non-embedded customers);
- National Grid ESO;
- Defence service providers (including owners and operators of electricity storage modules) who are not CUSC parties but have a contract with National Grid ESO to provide a defence service; and
- Restoration service providers (including owners and operators of electricity storage modules) who are not CUSC parties but have a contract with National Grid ESO to provide a restoration service.

The proposer considers that this change will have a positive impact on consumers through the 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. In addition, positive benefits are realised through the enhanced defensive measures placed on owners and operators of electricity storage modules operating during low system frequency conditions whilst overall system restoration should be enhanced by the introduction of the distributed restart measures. The 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. 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.

This modification will ensure compliance with the NCER, provide greater system resilience during times of system stress, and promote the use of additional options available to National Grid ESO in event of a total or partial system shutdown. All these elements are positive in facilitating the Grid Code objectives.

Interactions

This proposal, particularly in respect of distributed restart is likely to bring about consequential changes to the STC (including STCPs) which will be manged though the STC Panel and changes to the Distribution Code which is been progressed by the Distribution Code Review Panel.

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) put measures in place to prevent a black out from occurring (Defensive measures) and
ii) put measures in place to 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[2] 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 a number of deadlines progressively implemented following it coming into force. The majority of the requirements applied from 18 December 2018 with the requirements for implementation of the System Defence Plan, System Restoration Plan and Test Plan to be in place by 18 December 2019. NCER article 55 states that articles 15(5) to 15(8), article 41 and 42(1),(2) and (5) shall apply from 18 December 2022. In addition, it is noted that article 48(3) applies from 18 December 2024. Grid Code modification GC0148 proposes to implement those articles 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[3]. 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 in addition to further raising it with BEIS. Ofgem and BEIS have 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 GB, implementation of the Phase I of the EU Emergency and Restoration Code was achieved through Grid Code modifications GC0125 (EU Emergency & Restoration: Black Start testing requirements for Interconnectors), GC0127 (EU Emergency & Restoration: Requirements resulting from System Defence Plan) and GC0128 (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.

[2] https://ec.europa.eu/info/strategy/relations-non-eu-countries/relations-united-kingdom/eu-uk-trade-and-cooperation-agreement_en
[3] https://www.legislation.gov.uk/uksi/2019/533/contents

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 believe 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.

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 proposer believes that the Grid Code together with other documents (System Defence Plan, System Restoration Plan and Test Plan) and industry related codes, (the STC, and Distribution Code (for distributed restart)) need to be updated 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, transmission operator (TSO) to TSO voice communication systems, the ability of restoration service providers with type A[4] and B Power Generating Modules, in general, to only have data communication facilities 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) – Relates 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

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

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 is it an issue?

The proposer believes the defect is an issue as the NCER requirements in articles 15(5) – 15(8), article 41 and article 42 (1)(2) and (5) are to be implemented by 18 December 2022. As noted, the NCER now falls under UK law through Statutory Instrument SI 533 2019 and although it is acknowledged that article 55 of the NCER has been withdrawn by the SI, the working assumption is that implementation will continue to meet the original compliance deadlines in the NCER as suggested by Ofgem and BEIS. Consequently, the industry codes and associated documentation (for example – the System Defence Plan, System Restoration Plan and Test Plan) require to be updated to reflect this legal requirement.

The modification also addresses how non-CUSC Parties would (if they provided either a defence service or a restoration service) fall under the remit of the NCER, which is covered in the solution section of this consultation document.

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 Re-Start 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 not only to encourage new providers of black start services such as interconnectors, wind, solar and storage, where historically transmission connected thermal generation has been used, but more importantly the use of embedded generation to re-start sections of the distribution network which can be used to re-energise and contribute to the overall whole system

restoration process which would enable the total system to be re-established, more quickly. A further key enabler here is the introduction of "Grid Forming" plant as introduced through Grid Code modification GC0137[5] which provides a vehicle for renewable technologies to offer to 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 be for example; generation, storage or smart loads from embedded generators. The industry code changes developed, with some of the same stakeholders, for this work directly relate to the NCER, and therefore it is believed to be appropriate to include the Grid Code changes within the scope of this modification although the legal drafting has been segregated to enable it to be moved out of this modification should stakeholder feedback from this consultation indicate it is appropriate to do so, especially considering the development of this approach as a key component of the response to the electricity system Restoration Standard.

What is the solution?

Proposer's solution

The solution will require assessment by the Workgroup, however, in its broadest sense the solution currently comprises of the following:

- **Article 12**

  This article relates to the requirement for the TSO to notify SGU[6]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 are sought through a question in this 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 shed within the demand which is shed. Although recent NGESO/DNO methodologies and initiatives do already minimise such losses, where reasonably practicable, it is anticipated that a future 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.

[5] 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.
[6] Significant Grid Units as defined in NCER

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.

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, DNO 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 shall: limit the risk that the scheme leads to power flow deviations and voltage deviations outside operational security limits*.	This is currently not defined within the Grid Code, although it established practice for NGESO 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*	This relates to Art 15(8) which is not mandatory and therefore it is not applicable and can be

	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	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 also considered developing some legal text, however it was concluded after all the discussion and review that the current GB low frequency demand disconnection scheme does in fact meet 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. A separate consultation question has been raised in respect of this issue.

- **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 are sought through a consultation question.

- **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 situation as set out in the NCER Article 40, and that it may be necessary to ensure that these are addressed by GC0148; however, as this has only emerged just prior to the consultation being issued it was agreed to include details of this for information at this stage (with further analysis required after the Workgroup consultation).

Briefly paragraph (1) relates to what 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.

Paragraph 2 (along with paragraphs 4 and 5) relates to what 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 ESO agrees that this needs further consideration. Certain information will already be shared contractually and the ESO also notes that some of these matters relating to the GB system state have been looked at 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 but 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.

- **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 is little change required to the Grid Code legal text. The Grid Code legal text does however relate to the Control Telephony Relevant Electrical Standard and it is this document which has been substantially updated as a result of this GC0148 modification. Updates to the Control Telephony Relevant Electrical Standard are therefore included in Annex 10.

- **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. Proposed Grid Code legal text has been developed by the workgroup and forms part of this consultation.

- **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 are part of this consultation.

- **Article 48(3)**
  This is largely linked to Article 41 but will require a test plan for testing TSO communication systems. As part of this GC0148 consultation, 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. A consultation question has been raised on this issue.

  For the avoidance of doubt, the ESO will not contract with any non-CUSC Party for either defence services or restoration services except on the basis of the party concerned meeting the applicable requirements of the Grid Code (and thus ensures compliance with the requirements of the NCER)

- **Operation of Electricity Storage Modules under Low Frequency Conditions**
  This issue is being 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 solution is included in Annex 9 of this consultation.

  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. As part of the solution, consideration has been given to the requirements of the electricity storage module to respond following the recovery of system frequency and the compliance process.

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

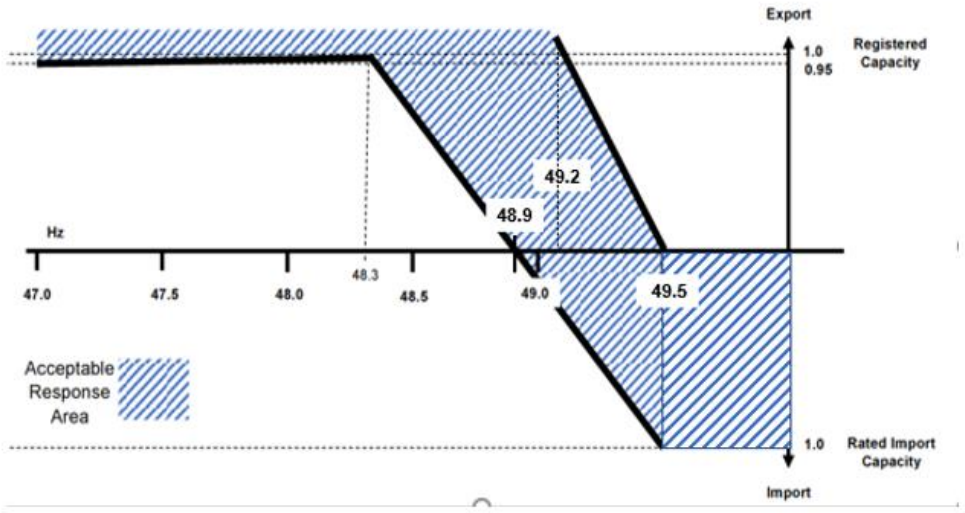

Figure 1.0

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 to both 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 in the draft legal text in Annex 9 and believed to address the issue.

- **The Distributed Restart Project**
  The Distributed 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 creation of distribution restoration zones (DRZs) and, if taken forward, this would bring active DRZ participants within the scope of the NCER as restoration service providers and therefore whilst the Grid Code is being updated it is appropriate to include this functionality within the scope of this GC0148 modification. The Distributed Restart Project, if implemented in GC0148, 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.

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 DZRP 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 consultation document). 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.

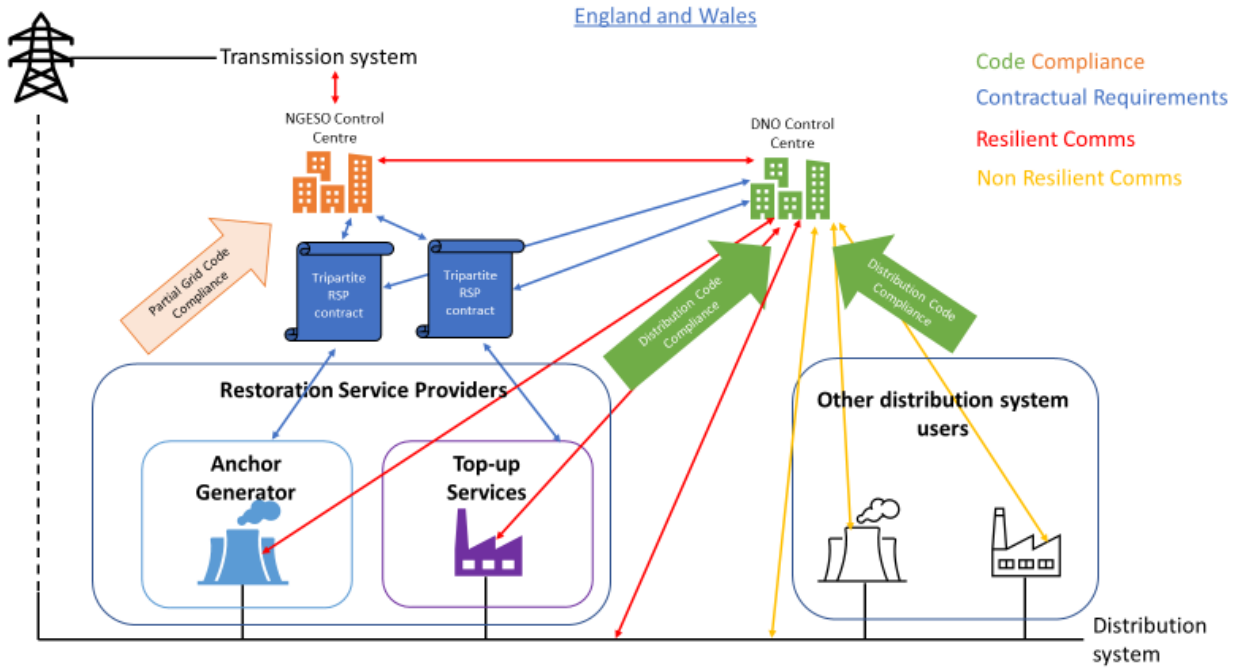

Figure 2.0

Figure 3,0

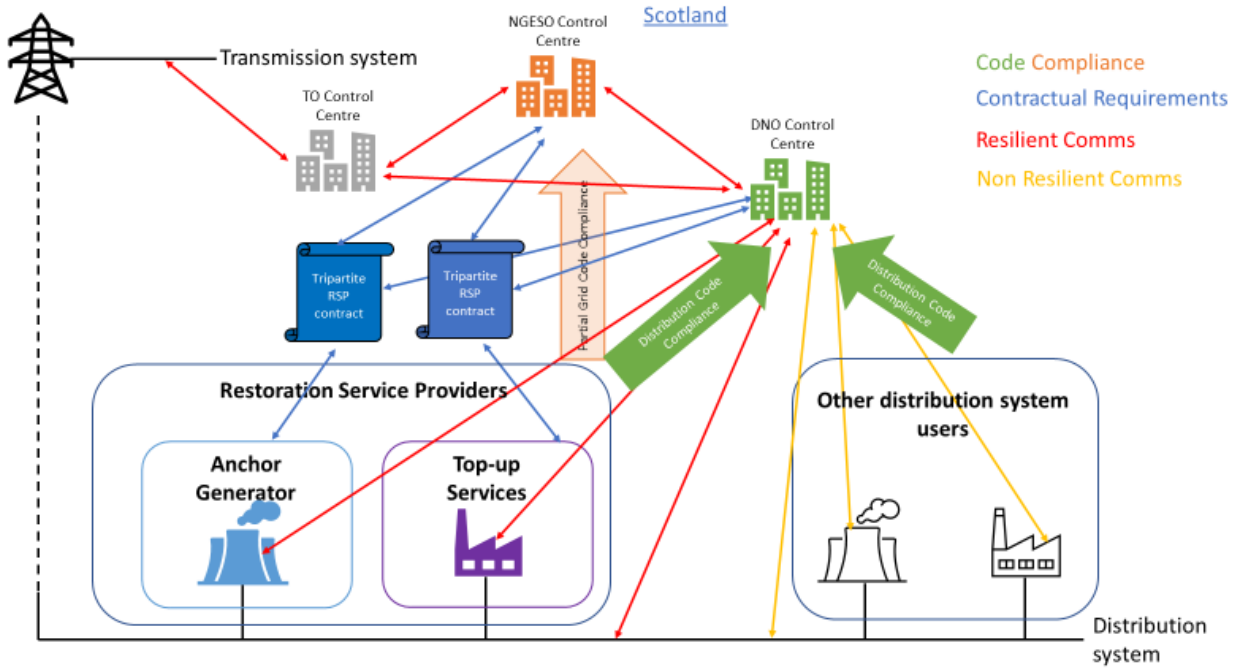

Figure 3.0

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 DRZ, 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 but stakeholders views on the design of the contractual arrangements and the relationship with the codes will be welcome.

In addition, the contractual arrangements being developed as part of the Distributed Re-Start project need to recognise that restoration service providers who fall under a DRZP would fall under the Terms and Conditions of the Emergency and Restoration Code (Annex 13). In addition, appropriate contracts for restoration service providers (both anchor plant and top up services) will be required which interface with the NCER Terms and Conditions (Annex 13). Sample contracts for anchor generators and top up services are included in Annex 15 and views on these contracts is sought through one of the consultation questions.

- **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 Considerations

The Workgroup convened 8 times to discuss the issues, agree the scope of the proposed defect, devise potential solutions, and start to assess the proposal in terms of the Applicable Grid Code Objectives.

Consideration of the proposer's solution

The workgroup has been briefed on all aspects of the proposer's solution with regular updates on each section. There have been presentations on distributed restart, control telephony, updates to the System Defence Plan, System Restoration Plan, Test Plan, storage requirements and notification letter. 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.

It is recognised that the findings from the Distributed Restart Project are also relevant to the Grid Code Modification Proposal GC0156 relating to the ESRS, formal work on which is expected to start in April 2022 i.e. during the consultation period of GC0148.
A workgroup member raised a concern that the distributed restart legal text developed may need to be further changed as part of GC0156 and suggested that it would be more efficient for the distributed restart legal text developed in GC0148 to be transferred to GC0156 so that it could continue to be developed by the GC0156 in the context of ESRS.

Consideration of other options
Currently no alternatives have been raised to the original modification. One suggestion has been the option of separating out the distributed restart legal text, so it allows the Authority to consider it separately, unconstrained by the EU Compliance deadline of December 2022.

A specific consultation question has been posed with respect to this issue, however, if the decision were taken to remove distributed restart from GC0148 it would also require the System Defence Plan, System Restoration Plan and Test Plan to be revised to remove any references to distributed restart at this time.

Draft legal text

The current draft of the proposed Legal Text for this modification is separated into the following sections and included in the Annexes within this Consultation.

1) Draft legal text in respect of critical tools and facilities and the governance arrangements associated with the System Defence Plan, System Restoration Plan and Test Plan
2) Draft legal text in respect of storage
3) Draft legal text in respect of distributed restart.

Note that the draft legal text for the Distribution Code is being consulted on separately by the Distribution Code Review Panel in parallel with this GC0148 consultation.

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, none Embedded customers, SGUs, defence service providers and restoration service providers.

Transmission Licensees

- There will also be an impact on transmission licensees, but such impacts will have to be assessed separately through the STC Panel. This is particularly true of the changes required to introduce distributed restart.

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 Code Objectives

Grid Code Objectives

Impact of the modification on the 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 as a total solution (which includes distributed restart) 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).

Standard Workgroup consultation question: Do you believe that GC0148 Original proposal better facilitates the Applicable Objectives?

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. However, the DNOs, defence service providers and restoration service providers will have a 12-month period, starting from the date they receive formal notification, to implement the measures on their equipment

Standard Workgroup consultation question: Do you support the implementation approach?

Interactions

☐Grid Code	☐BSC	☒STC	☐SQSS
☒European Network Codes	☐ EBR Article 18 T&Cs[7]	☐Other modifications	☒Other (D Code)

This proposal, particularly in respect of distributed restart is likely to bring about consequential changes to the STC (and STCPs (especially STCP 06-1 (Black Start), STCP 08-3 (Operational Tests and System Tests, STCP 18-1 (Connection and Modification Application) and STCP 19-3 (Operational Notification and Compliance Testing). These changes would need to be undertaken through the framework of the STC Panel. Changes to the Distribution Code, in particular Distribution Operating Code 9 (Contingency Planning)

[7] 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.

and Engineering Recommendations G59 and G99 will be implemented through the Distribution Code Review Panel consultation associated with this joint GC0148 Grid Code / Distribution Code Working Group.

How to respond

Standard Workgroup consultation questions

1. Do you believe that GC0148 Original Proposal better facilitates the Applicable Grid Code Objectives?
2. Do you support the proposed implementation approach?
3. Do you have any other comments?
4. Do you wish to raise a Workgroup Consultation Alternative request for the Workgroup to consider?

Specific Workgroup consultation questions

5. Do you think it is appropriate to include the distributed restart amendments within this modification bearing in mind such proposals would fall under the NCER, or do you think that the distributed restart legal text should be transferred to GC0156, so that it can be finalised in the context of the ERSR requirements? Please provide a rationale for your response.

6a) The distributed restart legal text has been drafted on the basis that i) there will be a connection agreement with the DNO that binds an embedded restoration service provider to the Distribution Code and ii) a tripartite agreement that binds the embedded restoration service provider to the relevant parts of the Grid and Distribution Codes. Do you see any difficulties with this proposed contractual arrangement?

6b) The distributed restart legal text has been drafted on the basis that NGESO will lead on the procurement of restoration services. This is one of the three implementation methods developed in the Distributed Restart Project as described in Annex 14 of this consultation. Do you agree that this is the most appropriate way to implement distributed restart, or should one of the alternative approaches be developed? Please provide a rationale for your response.

7. Do you believe DNOs, SGUs, defence service providers and restoration service providers have adequate resilience of their critical tools and facilities as detailed in NCER articles 42(1)(2) and (5) as drafted in the legal text in Annex 8. Please provide your rationale. Do you believe that the NCER requirements have been correctly interpreted in the proposed legal text?

8. Do you believe it is appropriate to have a mains independence minimum resilience period of 24 hours as required by the NCER or 72 hours as is generally standard in GB for existing black start purposes and is being proposed as part of the ESRS work?

9. Do you believe the approach proposed of introducing non-CUSC parties under the framework of the NCER (i.e. non-CUSC parties who have a contract with the ESO as defence service providers and/or restoration service providers) is an appropriate solution going forward? If not please explain why you believe this is the case.

10. Do you have any comments on the draft distributed restart contracts in Annex 15?

11. Do you have any comments on the notification letters in Annex 7?

The Workgroup is seeking the views of Grid Code Users and other interested parties in relation to the issues noted in this document and specifically in response to the questions above. Please send your response to grid.code@nationalgrideso.com using the response pro-forma which can be found on the National Grid ESO website via the following link: GC0148: Implementation of EU Emergency and Restoration Code Phase II | National Grid ESO

The Distribution Code Review Panel will also be consulting formally on the proposed changes to the Distribution Code, G59 and G99 to enable distributed restart. Comments on the drafting of those documents etc should be made to the Distribution Code Review Panel's consultation which will be available at www.dcode.org.uk.

In accordance with governance rules if you wish to raise a Workgroup Consultation Alternative Request please fill in the form which you can find at the above link or get in contact with us via email at grid.code@nationalgrideso.com

https://www.nationalgrideso.com/industry-information/codes/grid-code

If you wish to submit a confidential response, mark the relevant box on your consultation proforma. Confidential responses will be disclosed to the Authority in full but, unless agreed otherwise, will not be shared with the Panel, workgroup or the industry and may therefore not influence the debate to the same extent as a non-confidential response.

Acronyms, key terms and reference material

Acronym / key term	Meaning
BMRS	Balancing Mechanism Reporting Service
STC	System Operator Transmission Owner Code
SQSS	Security and Quality of Supply Standards
DRZ	Distributed Re-Start Zone
DCRP	Distribution Code Review Panel
DSO	Distribution System Operator
DNO	Distribution Network Operator
ESO	National Grid Electricity System Operator
EU	European Union
G99	Engineering Recommendation G99
HVDC	High Voltage Direct Current
LJRP	Local Joint Restoration Plan
NIC	National Innovation Competition

LFDD	Low Frequency Demand Disconnection
NCER	Network Code Emergency and Restoration
SGU	Significant Grid User
TSO	Transmission System Operator
SHEDD	System HILP Event Demand Disconnection
WPD	Western Power Distribution

Reference material

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
Annex 8	Legal text for critical tools and facilities and governance of the System Defence Plan, System Restoration Plan and Test Plan
Annex 9	Legal text for storage – operation under low system frequencies – during importing modes of operation
Annex 10	Control telephony standard
Annex 11	Legal text for distributed restart (Grid Code text only- Distribution Code legal text to be provided in corresponding Distribution Code consultation)
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
Annex 15	Draft distributed restart contracts to include; i) distributed restart service- anchor generator outline draft ii) distributed restart service top up service terms

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.