

Workgroup Report

GC0147: Last resort of Embedded Generation – enduring solution

Overview: This modification seeks to clarify the enduring arrangements for emergency instructions that the ESO can issue to Distribution Network Operators (DNOs) to disconnect embedded generators, as a last resort in an emergency situation, and after having exhausted all other commercially available options.

Modification process & timetable

- 1 • **Proposal form**
• 15 July 2020
- 2 • **Workgroup Consultation**
• 09 November 2020 - 30 November 2020
- 3 • **Workgroup Report**
• 15 January 2021
- 4 • **Code Administrator Consultation**
• 28 January 2021 - 01 March 2021
- 5 • **Draft Modification Report**
• 17 March 2021
- 6 • **Final Modification Report**
• 30 March 2021
- 7 • **Implementation**
• 30 April 2021

Have 5 minutes? Read our [Executive summary](#)

Have 20 minutes? Read the full [Workgroup Report](#) document

Have 30 minutes? Read the full Workgroup Report document and annexes

Status summary: The Workgroup have finalised the Proposer's solution. They are now seeking approval from the Panel that the Workgroup have met their Terms of Reference and can proceed to Code Administrator Consultation.

This modification is expected to have a: high impact on ESO, DNOs, Embedded generators and Consumers.

Modification drivers: System Security

Governance route	This modification has been assessed by a Workgroup and Ofgem will make the decision on whether it should be implemented.	
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Executive Summary

Unprecedented societal changes due to COVID-19 in early 2020 led to demands outturning up to 20% lower than predicted pre-COVID-19. This resulted in the need for the ESO to have access to an unambiguous last resort action to use in an emergency to control embedded generators when the volume of generation on the whole system outstripped demand (and in the absence of any other available actions either commercially or in the Balancing Mechanism (BM)). As a result, NGENSO raised Urgent modification GC0143¹ on 30 April 2020 to clarify the format of instructions and remove the ambiguity.

GC0143 was implemented ([decision letter](#)) on 7 May 2020 with an expiry date of 25 October 2020. The reason for the urgency was to achieve a solution before the anticipated low demand period of the Bank Holiday weekend on 8 May 2020.

This modification (GC0147) is seeking to clarify the enduring arrangements for emergency instructions and, responding to the points raised in Ofgem's decision² on GC0143, to engage and consult following normal Workgroup processes and to address the points raised in the GC0143 consultation. It will also ensure that consideration has been given to concerns from respondents on issues such as compensation, priority order, environmental impact, safety issues and impacts on industrial processes.

What is the issue?

Prior to the implementation of the Urgent modification GC0143, while there was a process for the ESO to instruct DNOs to take demand control actions to reduce import from the transmission system (NETS), it was felt that there was not the same detailed implementation clarity, structure and legally unambiguous ability for the ESO to instruct DNOs to disconnect embedded generators as a last resort in an emergency situation.

GC0143 clarified an ambiguous situation within the code on an interim basis. That expired on 25 October 2020, and as such there is a requirement for an enduring solution that continues to provide the necessary clarity around the last resort disconnection of embedded generation and will need to be in place to cover periods of very low demand such as those that may be anticipated from Spring 2021. Developing an enduring solution was also a commitment that the ESO made as part of GC0143 and was a requirement of Ofgem's decision on this.

GC0147 seeks to develop this enduring solution and as part of that, will address the points raised in Ofgem's decision letter, namely:

- Interaction with the Clean Energy Package (particularly including Article 13 paragraph 7 dealing with compensation arrangements)
- Commercial impacts, including
 - the nature of a 'last resort' on the exhaustion of commercial arrangements
 - the applicability of compensation and any arrangements for this
- How emergency instructions are expected to be implemented
- Transparency
- Safety and environment concerns
- Consequences for generators forming part of more complex industrial processes

¹ Full details available at: <https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0143-last-resort-disconnection-embedded>

- The priority order of disconnection, taking account of both the need to safeguard the wider impact on security of supply, whilst minimising safety and environmental risks associated with the disconnection of individual plant

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

Proposer's solution:

The changes proposed in GC0147 will give the ESO the clear and continued ability to instruct DNOs to disconnect embedded generation as a last resort in an emergency situation but add significantly to the solution approved in GC0143. As with GC0143, this would only be pursued as a last resort if no further actions were available to the ESO either in the Balancing Mechanism (BM) or through other commercial means.

It should be noted that during the Bank Holiday weekends in May 2020 up to 2GW of the newly created Optional Downward Flexibility Management (ODFM) commercial service was instructed, in total this being used on five occasions over summer 2020. This averted the need for the use of last resort actions as defined in GC0143.

The ESO is continuing to develop a view on likely demands and the tools available to manage the system throughout 2021; at this stage we anticipate a route to market for commercial services to help in low demand situations although it is not yet clear to what extent they will be required.

While the simplest solution would be to remove or extend the sunset clause from the text added to the code through GC0143, clearly this would not be acceptable or address the stipulations made by Ofgem. The ESO committed to developing an enduring solution with full consideration of the areas that could not be addressed in the time available previously which was also a requirement of the Ofgem decision on GC0143.

Implementation date:

Before May 2021 – in time for the next low demand periods anticipated in Spring 2021.

Summary of potential alternative solution(s) and implementation date(s):

Any alternative solution would also need to be in place before May 2021 for the same reason.

What is the impact if this change is made?

The changes proposed will address deficiencies in the current suite of emergency actions and provide a legally unambiguous process for the ESO to instruct Distribution Network Operators (DNOs) to disconnect embedded generation as a last resort and in an emergency situation.

This ultimately benefits consumers by helping to maintain security of supply and providing a last line of defence against an otherwise uncontrolled emergency situation.

The ESO will have fulfilled its commitment to Ofgem to work with the industry to develop an enduring solution, which will be carried out via the standard governance process (as opposed to the Urgent process that had to be followed for GC0143), allowing all relevant points of view to be taken into account.

The ESO will have addressed both the concerns raised by consultees during the development of GC0143 and the issues highlighted in Ofgem's decision letter on GC0143.

- There will be an impact on the ESO in operating the NETS by giving unambiguous access to a final last resort option to control the system in low demand situations.
- There will be an impact on DNOs in removing any legal ambiguity relating to relevant emergency instructions that could be given to them by the ESO.
- There will be an impact on embedded generators in potentially being disconnected as a last resort to maintain security of supply under emergency conditions.

Interactions

This modification will change the Terms & Conditions relating to Balancing Service Providers as it amends some clauses of the Grid Code as set out in the mapping provided in annex GR.B to the Governance Rules section. It will therefore require the modification process set out under Article 18 of the European Electricity Balancing Guideline (EBGL – EU Regulation 2017/2195) to be followed. This is as set out in Grid Code modification GC0132 which in fact stipulates that all Grid Code modifications will follow this process, the main consideration of which is that the modification must be consulted on for a minimum of 1 month. This will also satisfy the requirements of the NCER process.

EBGL guidelines

https://www.entsoe.eu/network_codes/eb/

EBGL Article 18 T&Cs

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2017.312.01.0006.01.ENG&toc=OJ:L:2017:312:TOC#d1e1745-6-1

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What is the issue?

Prior to the implementation of modification GC0143 while there was a process for the ESO to instruct DNOs to take demand control actions to reduce import from the NETS, it was felt that there was not the same detailed implementation clarity, structure and legally unambiguous ability for the ESO to instruct DNOs to disconnect embedded generation as a last resort and in an emergency situation.

A temporary solution to address this defect was put in place on 7 May 2020 via the implementation of Grid Code modification GC0143. However, that modification included a sunset clause that timed out on 25 October 2020 and therefore an enduring solution to address the same defect is required.

What is the solution?

Proposer's solution:

The changes proposed will give the ESO the ability to instruct DNOs to disconnect embedded generation as a last resort in an emergency situation when other commercial solutions have been exhausted.

While the simplest solution would be to remove or extend the sunset clause from the text added to the code through GC0143, clearly this would not be acceptable and the ESO has committed to a full consideration of the areas that could not be addressed previously which was also a requirement of the Ofgem decision on GC0143.

The proposed solution therefore includes the following:

Section	Changes
OC6B (new section)	<ul style="list-style-type: none"> New section added, OC6B: Embedded Generation Control, which outlines the procedures for Embedded Generation Control and Disconnection Broadly symmetrical with the current OC6: Demand Control
OC7	<ul style="list-style-type: none"> New System Warnings added to cover Embedded Generation Control.
Glossary & Definitions	<ul style="list-style-type: none"> Various new and amended defined terms including the new System Warnings
BC1.5.5 System And Localised NRAPM (Negative Reserve Active Power Margin)	<ul style="list-style-type: none"> Amended slightly to align with system warnings
BC2.6.3 Communication With Network Operators In Emergency Circumstances	<ul style="list-style-type: none"> Updated to include Embedded Generation Control (symmetry with Demand Control)
BC2.9.1 Emergency Actions	<ul style="list-style-type: none"> Timed out GC0143 solution with sunset clause removed Embedded Generation Control added to Emergency Actions

The key points are that it is envisaged by the proposer that the 'Embedded Generation Control' section will be broadly symmetrical to the long-standing 'Demand Control' process. The new sections are more detailed than the solution in GC0143 in setting out process and responsibilities, and as with Demand Control set out how the process will work, where possible, in conjunction with appropriate system warnings.

Workgroup Considerations

The Workgroup convened eight times between September 2020 and January 2021 to discuss the perceived issue, detail the scope of the proposed defect, consider the

proposed solution and alternatives and assess the proposal in terms of the Applicable Code Objectives. The Workgroup also met in December 2020 to discuss the Workgroup Consultation Responses and review legal text. There was a further Workgroup meeting in December 2020 to discuss the alternatives and to have a representative from Ofgem as requested by the Workgroup members. There was a final meeting in January 2021 to carry out the Workgroup Vote.

The key themes of Workgroup discussions are detailed below:-

Consideration of the proposer's solution

Emergency disconnection and interaction with other services

The Workgroup discussed the interaction between commercial services such as the now timed out Optional Downward Flexibility Management (ODFM) service as used over Spring/Summer 2020, and emergency disconnection. There was thought to be a risk that an embedded generator could provide a similar ODFM type services in the future but potentially be disconnected via an Emergency Instruction, which would not be an effective outcome.

Participation of distribution connected generators in other ancillary services was also noted. In general, while preferable not to disrupt other service provisions, in a last resort situation due to low demand/footroom issues, resolving the emergency and therefore averting severe risks to security of supply would take precedence over anything else². Maintaining system inertia (this is inherent for any synchronous generation) is a likely and notable exception as this is a particular concern during low demand periods. Some thought was given to the future-proofing of the solution against the time when it may be possible that a viable form of synthetic inertia is developed removing some of the need to retain synchronous generators on the system.

Clean Energy Package

The Clean Energy Package (CEP) is a framework proposed by the EU to steer energy companies towards cleaner, more sustainable operations. In the context of various provisions within the CEP, the Workgroup discussed that emergency disconnection would only be used in an emergency and as a last resort in the event that no other commercial options / Balancing Mechanism (BM) actions were available.

The Clean Energy Package³ has a number of potentially relevant requirements that are pertinent to this modification namely:

Use of emergency curtailment

Article 13 paragraph 3 sets out that distribution connected generation that has not entered into market services will only be curtailed by the system operator⁴ after all market-based resources have been used:

² Whilst still ensuring that the system operator complies with the requirements of Article 13 (3) (a) and (b) of the Clean Energy Package.

³ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0943&from=EN>

⁴ In the context of the Clean Energy Package, 'system operator' can be either the TSO (NGESO for GB) or the DSO (currently known as DNOs in GB).

- 3. Non-market-based redispatching of generation, energy storage and demand response may only be used where:*
- (a) no market-based alternative is available;*
 - (b) all available market-based resources have been used;*

Maintaining renewables

Article 13 paragraph 6 sets out that every effort is to be made; by the system operator that activates the generation curtailment measure; to maintain renewable energy sources and generation involving high-efficiency cogeneration processes on the system:

- 6. Where non-market-based downward redispatching is used, the following principles shall apply:*
- (a) power-generating facilities using renewable energy sources shall only be subject to downward redispatching if no other alternative exists or if other solutions would result in significantly disproportionate costs or severe risks to network security;*
 - (b) electricity generated in a high-efficiency cogeneration process shall only be subject to downward redispatching if, other than downward redispatching of power-generating facilities using renewable energy sources, no other alternative exists or if other solutions would result in disproportionate costs or severe risks to network security;*

The Workgroup discussed the Proposer's view that the 'last resort' nature of this proposed solution meant that inherently actions under these circumstances were associated with severe risks to network security and that therefore restriction of renewable resources was allowable in these limited circumstances.

However, some Workgroup members reiterated the need for system operators to comply with the Clean Energy Package requirements as regards using all available market-based resources first. The Workgroup also considered whether this point needs to be included in the 'priority' order of disconnection as covered under this heading below.

Compensation

Within the Workgroup there were differing views on whether compensation should be paid to embedded generators that were disconnected as a last resort in an emergency after all commercially available options had been exhausted. Below are details of the different views and points discussed.

Article 13 paragraph 7 sets out that where non-market based redispatching takes place this should be subject to compensation:

- 7. Where non-market based redispatching is used, it shall be subject to financial compensation by the system operator requesting the redispatching to the operator of the redispatched generation, energy storage or demand response facility except in the case of producers that have accepted a connection agreement under which there is no guarantee of firm delivery of energy.*

Ofgem's decision letter⁵ for GC0143 stated that it encourages the ESO to consider further how, if at all, implementation of the modification interacts with Article 13 paragraph 7 of the Clean Energy Package. This requires that where non-market based redispatching is used, it shall be subject to financial compensation by the system operator requesting the

⁵ <https://www.nationalgrideso.com/document/168851/download>

redispatching to the operator of the redispatched generation, energy storage or demand response facility; apart from in the case of producers that have accepted a connection agreement under which there is no guarantee of firm delivery of energy. Ofgem considered that GC0143 (and by inferences this GC0147) did not allow parties to avoid any liability that may be incurred by Article 13 paragraph 7, if this clause was engaged.

Two opposing interpretations were discussed in the Workgroup. The proposer believes that Article 13 paragraph 7 is likely to not apply in the specific circumstances addressed by this modification. This is because an embedded generator not participating in the BM (therefore without Transmission Entry Capacity (TEC), which confers a right to use the transmission system and which is paid for through Transmission Network Use of System (TNUoS) charges), does not have firm access rights to the transmission system. Compensation implies payment for a right that has been curtailed and is clearer where this right has also been paid for.

Another Workgroup member felt that, firstly, the holding (or not) of TEC was not relevant for the purposes of compliance with Article 13 (7) of the Clean Energy Package as it could not have been envisaged that distribution connected generation also had to have a transmission connection agreement (as well as a distribution connection agreement) and that secondly, there was no reference in Article 13 (7) (a) or (b) to recompensing non-market based generation⁶ for the network charges they had paid which is what the proposer was inferring.

A Workgroup member stated that the connection agreement referred to in Article 13(7) should be the agreement that an embedded party has with the DNO and that any non-firmness would need to have been agreed by the embedded generator and specified in this. While connection agreements between the ESO and DNOs which often reference the non-firmness of any export at GSPs also exist, in that case it is not the “*producers that have accepted a connection agreement under which there is no guarantee of firm delivery of energy*”, rather it is the DSO who has. Notwithstanding that, if the TSO/DSO connection agreement was relevant to the embedded facility then in the view of the Workgroup member according to Article 13(7) compensation would still be payable by the system operator requesting the redispatching.⁷

In the context of the connection agreements between embedded parties and the DNOs, it was noted that these are made with reference to the national standard terms of connection⁸. A specific area of these dealing with a DNO's right to de-energise a connection point is as follows:

5.5 The Company may De-energise the Connection Point:

5.5.1 if it is necessary or reasonable for the Company to do so as part of a System Outage carried out in accordance with its statutory rights and obligations and Good Industry Practice; and

5.5.2 in order to permit other persons to connect to the Distribution System, in which case, the Company shall give the Customer such notice of the De-Energisation as is required by law (and shall use its reasonable endeavours to provide as long a notice as is practicable).

⁶ As well as storage and demand side response.

⁷ https://www.ofgem.gov.uk/system/files/docs/2020/05/gc143_d.pdf Ofgem noted “We do not consider that this modification allows parties to avoid any liability that may be incurred Article 13 paragraph 7, if it is engaged.”

⁸ National Terms of Connection:

<http://www.connectionterms.co.uk/Schedule%20B%20National%20Terms%20of%20Connection%20v10-min.pdf>

5.6 The Company may, at any time without the need to give prior notice to the Customer, De-energise the Connection Point if:

5.6.1 the Company is instructed or required to do so pursuant to the Act, its Electricity Distribution Licence, any Directive, the CUSC, the BSC, the DCUSA and/or the Electricity Supply Emergency Code (being the code of that name designated by the Secretary of State);

5.6.2 the Company reasonably considers it necessary to do so for safety reasons or for the security of the Distribution System or any other electrical system (including in order to avoid interference with the regularity or efficiency of the Distribution System);

Since a condition of the DNO's Distribution Licence is compliance with the Grid Code so where an instruction is given to the DNO under the Grid Code this will be covered by clause 5.6.1. Noting that there are various other reasons why a DNO may have to de-energise a customer's point of connection, in the proposer's view this highlights that embedded parties may not through their DNO connection agreements have firm access rights.

The definition of 'Re-dispatching'⁹ used in the Clean Energy Package was also discussed as it implies a *change* of output rather than disconnection. However, in the view of the proposer this is a grey area and is also difficult in fitting definitions of central/self-dispatch in the CEP to the workings of the GB markets. Another Workgroup member felt however, that the 're-dispatching' definition was clear and that this definition was done in consultation with Ofgem and BEIS at the time that the CEP was approved by the UK Government (and other Member States and the Commission) very recently, in 2019.

The Workgroup also noted concern that embedded generators might be incentivised to join the Balancing Mechanism and set their output to zero, to avoid facing the risk of emergency disconnection, however the ESO's view is that wider BM participation is ultimately a preferable solution and that in the case that outputs were reduced to zero through the BM this would be helpful in a low footroom situation and would at the least give the ESO greater visibility.

The Workgroup explored compensation payments for disconnection and agreed that in Article 13(7), the system operator requesting the redispatching is liable for the financial compensation: "*subject to financial compensation by the system operator requesting the redispatching*" if any other conditions for compensation to be applicable are also met.

Therefore, the Workgroup agreed that clarity of whether Article 13(7) is engaged (or not) is a key part of their work.

The funding of any compensation in a case where the ESO enacts the emergency instruction could, in principle, be made through BSUoS, although as the ESO cannot directly make payments to embedded parties with whom they do not have any agreement this would be complex and likely to involve a facing off of arrangements under the CUSC and DCUSA to ensure that:

- Under the CUSC, funds could be given by the ESO to DNOs
- Under the DCUSA, payments to embedded parties could be made by the DNOs

In the case of the DSO enacting emergency instructions, the Workgroup was not certain that such a mechanism currently exists although the liability under Article 13(7), where this is applicable, does. It was noted that with the planned change from the 'DNO' to the 'DSO'

⁹ According to Article 2 (26) of the Clean Energy Package, this is defined as: "*“redispatching” means a measure, including curtailment, that is activated by one or more transmission system operators or distribution system operators by altering the generation, load pattern, or both, in order to change physical flows in the electricity system and relieve a physical congestion or otherwise ensure system security*"

model, there could in the future be a mechanism for cost recovery of 'system operation' costs incurred at distribution. So when this is available it may be possible to use it to fund Article 13(7) financial compensation incurred by the DSO(s).

The Workgroup discussed the efficiency of the System Operator adopting a proactive approach. The ESO could simply issue out the compensation amount directly to the affected provider(s). The System Operator will know who (so either the DSO, or the TSO if informed by the DSO) has been impacted by the measure affecting generation or load pattern (or both). This proactive approach could be simplified further such as described below as the 'ODFM proxy' type approach.

Using an 'ODFM proxy' type approach, the use of a price known to the TSO (which could be published/shared with the DSOs et al) that is market based whilst being linked to the type of parties (namely distribution connected providers, i.e. generation, storage and demand side response; that would be impacted by non-market based redispatching) could be a more practical way to proceed. However, this is predicated on a similar replacement for ODFM being developed or a similar distribution connected providers market price being available, that could be utilised as part of the GC0147 solution.

A market-based price would potentially not compensate providers for any losses incurred due to a disconnection. Other options could be developed, such as allowing distribution connected providers impacted by non-market based redispatching to make a claim directly to the TSO and / or DSO based on their (each individual provider's) calculation; done according to what is set out in Article 13(7) (a) and (b) which cover loss of revenue and net operating costs. This could be considered to be a reactive approach. However, this, it would seem, may involve more work for the affected providers as well as for the TSO and or DSO to verify such calculations / claims. This may also require enhanced obligations on the networks to resolve and, as is already established under either code governance or licence condition C9 or Article 37 of the Third Package, Ofgem to adjudicate particularly in the case of disputes.

The proposer noted that compensation arrangements could not be made directly in the Grid Code. Also that for non-BM embedded generators this could not be achieved directly in either the CUSC or the BSC, although it could be possible to compensate suppliers for imbalance under the BSC. However, it was suggested that making an Article 13(7) payment to suppliers would not discharge the system operator's obligations to pay that compensation to the affected generators (as well as storage and demand side response parties). It was noted by the Workgroup though that in periods of very low demand it would be likely that the imbalance price would reverse and therefore that a shortfall in generation would result in a payment to suppliers rather than a liability. The proposer noted that any compensation arrangements would have to include a way of the ESO funding this, rather than it just being a liability to be paid from the ESO's bottom line. The proposer also noted that any generator should be able to be disconnected from the system at any point without serious damage, safety, environmental or other concerns as faults of generation equipment are a regular occurrence and are far more likely to be triggered by issues within the generator plant than a network problem.

As long as there were clear commercial alternatives available that did provide a route to compensation, the proposer wondered if this was sufficient to avoid having to put in place a complex solution that would probably never be used. It was also pointed out that demand control actions which are similarly a last resort are not compensated.

However, a Workgroup member noted that the liability to pay compensation; that is set out in Article 13(7) was based on paying *non market-based* assets being curtailed: compelling

parties to join the market in order to receive a payment if they were 'redispatched' by the system operator was not, in this Workgroup member's view, reasonable or proportionate.

The conclusion of the discussion was that the proposer highlighted how a solution within the Grid Code could be to put a 'hook' into the code setting out that compensation would be as set out in the CUSC and/or DCUSA. If this were approved as part of the GC0147 modification it would then need consequential modifications to the CUSC/DCUSA to clarify how this would work. The ESO felt that this was a key area to address within the Workgroup consultation questions and to think about whether it should form part of the original solution or an alternative. After the Workgroup consultation a range of alternatives were developed with this point in mind.

Frequency of disconnection

It was noted that a DNO might choose to enact multiple emergency instructions through "DNO scripts". These are pre-prepared scripts that would potentially be used by DNO operational control to automatically disconnect generators in order to meet the Grid Code timescales. The purpose of these is to ensure the safety and integrity of the relevant distribution network can be secured in a timely manner.

The Workgroup discussed the possibility that, given the operational constraints and use of scripts, in the unlikely event that emergency disconnection of embedded generation was carried out a number of times, some of the same embedded generators who were at the top of the priority list on a DNO script, might be disconnected repeatedly.

The option of cycling the scripts through which DNOs would implement an emergency instruction was discussed, although DNOs noted that use of scripts is dependent on the scale of any instruction and the lead time with which it was given.

The Workgroup noted that emergency embedded generator disconnection is a last resort and would not be a regular occurrence in the same way that demand control is hardly ever used but remains an important final line of defence.

The ESO does not want to be too prescriptive in instructions to DNOs as these are emergency instructions to be used as a last resort only. Guidance from the ESO should be as clear as possible whilst allowing DNOs the required flexibility to allow that in implementing an instruction they are able to act with sufficient impunity in an emergency to make the right decisions to avoid consequences to consumers.

However, a Workgroup member noted that there would remain a licence obligation on the DNO and the ESO to avoid discriminatory redispatching and that given the purported rarity of this disconnection arising in practice, it would be a simple step for a DNO to place those embedded generators who had been disconnected at the bottom of any 'list' / 'script' for the next time.

A consideration of the incidence of instructions has now also been included in the code text.

Notice period for DNOs & Generators

The Workgroup indicated that having as much notice as possible would mean that the DNOs would be better able to adhere to any guidelines.

The ESO view is that the notice period is likely to be at least half an hour, but in some circumstances, it might have to be less, for example if an exporting interconnector were to trip during a low demand period - although for such instantaneous issues this might instead

cause frequency excursions and operation of frequency sensitive mode (over-frequency) LFSM-O generator response or ultimately generator protection.

The Workgroup also discussed the notice period that generators would receive before disconnection and the potential safety risks if sufficient notice wasn't given before disconnection. It was noted this risk would not be unique to GC0147 as disconnection can already occur for reasons other than emergency disconnection and is an inherent issue with operating any equipment that it must have safe shutdown mechanisms.

Some of the consultation responses noted that advance warning (30 minutes) of a disconnection would be helpful for impacted parties. Also if the ESO could inform these parties of the anticipated length of time they might expect to remain disconnected, that would also be deemed as being helpful for them to plan for a smoother restart.

The Workgroup considered this theme and noted that it was set out in the legal text that notification of these details would be issued on a reasonable endeavours basis. Further to this, email notifications could be issued through the Balancing Mechanism Reporting Service (BMRS). It was also noted that the publication of the system warnings becomes an obligation on the ESO through BMRS (via the BSC).

ANM (Active Network Management)

The Workgroup discussed the likely increase in prevalence of ANM schemes and the potential risk that a DNO could comply with an instruction from the ESO, disconnect certain embedded generators, but not get the desired reduction in Active Power due to an ANM scheme automatically infilling the lost generation.

A question of whether emergency instructions could lock out the ANM scheme was discussed to avoid another generator in the ANM group ramping up to fill any spare capacity. It was also noted that if embedded generators in an ANM scheme were excluded then this could be unfair to generators without ANM schemes. The Workgroup considered whether an instruction could potentially refer to the required outcome of instructions in Mega Watt (MW) reduction (at present in the GC0143 temporary solution, the capacity to be disconnected is specified) therefore, if possible, keeping more flexibility to achieve the reduction without disconnection and potentially within an ANM scheme.

ODFM (Optional Downward Flexibility Management)

The Workgroup discussed the potential for use of an 'ODFM' type commercial service to reduce or remove the risk of emergency disconnection being required, as was the case over spring/summer 2020. Ultimately if a significant proportion of embedded generation participated in ODFM or other commercial mechanisms (and including wider access to the BM), then there would be no way that commercial mechanisms to resolve footroom issues could not be effective as generation would be reduced to below the minimum demand level.

The Workgroup discussed whether putting compensation arrangements in place as part of the last resort solution could remove an incentive from embedded generators to participate in commercial solutions. Several Workgroup members felt there was no risk that having a compensation obligation would remove an incentive for generators to participate in ODFM

type commercial solutions, as generators would always prefer to take commercial terms and know their position than risk being disconnected.

Some Workgroup members believed that the ESO should provide details of a new ODFM type service and other market-based solutions before seeking a decision on GC0147. The Proposer noted that an ODFM-type service could be developed relatively quickly and would be put in place by the ESO before Spring 2021 or at any other time if, in the ESO's view, there was a risk of low demand/footroom issues.

The ESO noted that this modification was giving clarity to existing Grid Code arrangements for emergency instructions, rather than introducing a new mechanism. Whilst ODFM could be developed at relatively short notice, the modification process is much longer and therefore it is essential that GC0147 is developed now so that it will be in place before the next potential low demand risk period of May 2021. It would not be advisable to wait and monitor whether the risk increases or decreases as we get closer to Spring before deciding how urgently to implement GC0147.

In the final Workgroup meeting held on 13 January 2021, Workgroup members noted that they were frustrated that the ESO was unable to provide a satisfactory update on the development of a replacement for ODFM. The ESO Proposer noted that it remained the intention of the ESO to progress this in time for the next low demand periods expected in May 2021 when there would be a risk that it would be required. The ESO Proposer reminded the Workgroup members that during the previous meeting with Ofgem present, it had been agreed that it was still important to continue with this modification as the 'last resort' required to avert system security issues following the exhaustion of all other options but agreed that it would have been useful to have had an externally available update before members voted. As such, one member noted that they would be escalating their concern about this to senior ESO management.

Priority Order

The Workgroup gave consideration to the order in which generators would be disconnected. In particular, whether some of the detail included in the joint ESO/DNO guidance note (see below) that was produced to sit alongside the GC0143 solution and to provide detail on the expectation of how DNOs would implement an instruction, should be included in the code text proposed under GC0147. Some Workgroup members felt that incorporating the guidance note within the Grid Code would ensure transparency and regulatory approval of that guidance which would give stakeholders reassurance around this important matter.

The interaction with the Clean Energy Package Article 13 paragraph 6 as detailed above was also noted.

From these discussions the Proposer amended their solution to add considerations of priority to the code text but sought to maintain some flexibility to act in an emergency. The proposer noted that whilst the DNO/ESO guidance has no legal basis, any use of last resort disconnection measures impacting customers would be likely to be investigated by Ofgem, and if the DNOs or ESO were found to have ignored the guidance, then this would be likely to have serious repercussions.

Joint ESO/DNO guidance provided following approval of GC0143

An NRAPM will be issued at the earliest opportunity and prior to requesting EI
The NRAPM will detail total volume shortfall of downward regulation, applicable time period(s) and time of next review
Total volume of emergency instruction requested across GB will typically be in blocks of 500-700MW over a 30min period

Emergency instruction of embedded generation will be:

Equal across all DNO license areas
The aggregate registered capacity of the embedded generation associated with an EI will be the same for all DNO license areas
Likely to cover a whole DNO license area
The aggregate registered capacity of the embedded generation associated with an EI will be requested at a DNO GSP or GSP group level
Requested in 50MW blocks
The aggregate registered capacity of the embedded generation will be in 50MW blocks per GSP, GSP group or DNO license area
Unlikely to exceed 50% of the combined forecast of embedded wind and PV
The volume of EI requested per DNO license area is unlikely to exceed 50% of the combined forecast of embedded wind and PV within that area
Implemented by DNOs in pre-prepared blocks within 5 to 30 min
Emergency instructions should be implemented 'without delay' and using reasonable endeavours. Where a pre-prepared switching schedule is used this should take between 5 and 30 min. Implementation of a more specific emergency instructions via a bespoke switching routine could take longer but will still be on a best endeavours basis
Implemented by DNOs in such a way as to deliver a reduction in export, as a consequence of disconnection, as close to 50MW per block as is practicable (ideally between 80 and 100%)
Where practicable and recognising the real-time challenges of this since EIs are for disconnection of registered capacity and need to be implemented 'without delay', the reduction in export as a consequence of disconnection should be as close to 50MW per block as is practicable (ideally between 80 and 100%), preferably with reference to actual output where this can be established in reasonable timescales

The priority for maintaining connection to the network must consider whole system impact. These specific priorities will be kept under review in line with, for example, expectations for the season ahead. Priorities should reflect the general and specific information available to DNOs at the time with the aim of meeting the following objectives:

- 1) Maximising value to the total system and local networks by reducing the requirement for other balancing actions; and
- 2) Minimising plant, environmental or system impact on the local network and/or provider

The following guidance has been developed between NGESO and DNOs, taking into account system conditions this summer:

The order that embedded generation is disconnected will be at the discretion of the DNO
Under Grid Code BC2.9.3.3 (f) (i) NGESO may requested disconnection of a specific embedded generator
This will take into account, where practicable, the effectiveness of the disconnection to address the issues trying to be resolved, wider system issues and the potential consequences for the embedded generators
It will be broadly in line with the following:

ORDER	CATEGORY OF GENERATION	COMMENT
1	Non-synchronous generation	In order to maintain system inertia. The export from these technology types could be weather dependent. Although the instruction would be to disconnect 'registered capacity', it is still expected that this will deliver actual MW output change of between 80% and 100% of requested volume
2	Synchronous generators without any associated demand	Lower down the list due to the need to maintain system inertia wherever possible
3	Synchronous generators with associated demand	For example, CHP installation waste management facilities, other industrial facilities with substantial on-site demand
4	Critical DG support of COVID and CNI sites	

The reconnection of embedded generation will be:

Not completed until notified by NGESO
Delivered by a 'consent to reconnect' by NGESO, to be completed as soon as reasonably practicable
Recognising that the process to reconnect embedded generation may not be straightforward, NGESO will issue a consent to reconnect, and expect this to happen as soon as practicable

Safety and Environmental Considerations

Safety and Environmental considerations were of key importance in many of the consultation responses. Some respondents felt that safety considerations had been considered in the consultation questions but that environmental factors had not been explicitly mentioned. The responses noted that it would be important for industry to see that the Workgroup had considered the potential environmental impacts that this modification could bring about.

In response to this feedback, the Proposer updated the Original to include the requirement for Network Operators to consider 'potential consequences for Users, including environmental and safety concerns' (OC6B..6.1(d)) when implementing any such instruction. The proposer also noted, however, that any generation equipment could be subject to a fault at any time and that as this is entirely foreseeable should not ever result in serious consequences. Network faults or conditions causing a disconnection are far less frequent than faults within the generation equipment itself.

What form should instructions take

The highest number of consultation respondents recommended that the instruction should take the form of a reduction in the volume of Active Power output, with some respondents

preferring for it to be based on Registered Capacity. The Workgroup discussed this theme and noted that in the legal text, Active Power reduction is being sought through de-energisation. The instruction is for Active Power reduction but still allows for disconnection of Registered Capacity to fulfil an instruction where there is insufficient time to do otherwise.

It was also noted that the form of instruction would also depend on the size of the disconnection. Further that action should only be taken for relevant sites.

The original solution was developed to express that the goal was a reduction in Active Power output but to give some flexibility in how this was achieved dependent on the amount of notice given, with the preference being for deloading rather than de-energisation or disconnection.

Ofgem guidance

At the request of the Workgroup, an Ofgem representative attended the Workgroup on 15 December 2020 to provide guidance on some of the key issues.

Market-based solutions

Ofgem noted that it would be important to see details of market-based solutions before making a decision on GC0147 and that the ESO would also need to demonstrate what other commercial options it has considered.

Compensation and application of Article 13 of the Clean Energy Package

Ofgem confirmed that they would make the decision on whether compensation applies in the case of GC0147 according to Article 13 of the CEP when the modification was submitted.

Consequential modifications

The Workgroup discussed the potential need for CUSC, DCUSA or BSC modifications to be developed to detail compensation mechanisms in some of the WAGCMs. There were conflicting views on whether:

- a) these modifications should be developed at the same time as GC0147, so that all of the modifications could be submitted to The Authority for a decision simultaneously
- b) whether a decision should be sought on the Grid Code modification without delay, in which case the CUSC and DCUSA modifications could be developed subsequently, if required

Ofgem provided the following guidance:

- a) Ofgem noted that the main focus of the Grid Code modification was technical requirements and operational processes and that the question of whether other modifications were required to deal with potential compensation would need to be raised at the relevant Panels (CUSC and DCUSA).
- b) Ofgem noted that GC0147 should proceed without delay as it was required to solve a system security issue. Whilst presenting all of the related modifications for a decision concurrently was a possibility and sometimes for other modifications this

had been the preferred approach, ultimately this Grid Code modification should be progressed without delay and a decision on GC0147 could be made independently of other modifications. If CUSC & DCUSA modifications were developed, decisions on those could be made at a later date and allowing for these to be developed in a more considered way but their status should not delay GC0147.

Workgroup Consultation Summary

The Workgroup held the Workgroup Consultation between 09 November 2020 and 30 November 2020 and received 21 responses. The full responses and a summary of the responses can be found in the Annexes.

Overall – Respondents were by majority supportive of the proposed changes with key concerns in relation to disconnection as follows:

- Compensation arrangements in the event of last resort disconnection and how this will be funded and operated through CUSC/DCUSA Codes
- Timing and notices of last resort disconnection
- Safety and environmental concerns in relation to fuelled and biomass plants
- Priority order for disconnection in the event of an emergency
- Form of the instructions - MW Active Power output was suggested by the highest number of respondents, with some preferring registered capacity emergency
- ODFM service and any replacement commercial services

Workgroup Alternatives – GC0147

Following review of the Workgroup Consultation responses, the Workgroup brought forward 4 potential solutions for GC0147.

After the Workgroup consultation stage there were seven alternatives raised.

Alternative WAGCM 1 (ESO): Compensation for Embedded Generators subject to emergency disconnection

The first alternative requires compensation to be provided as per arrangements in the CUSC and DCUSA. The wording ensures that data will be captured for any event that happens after GC0147 is implemented so that compensation arrangements can be applied retrospectively once they are in place.

Alternative WAGCM 2 (ESO): Compensation re-opener for Embedded Generators subject to emergency disconnection

The second alternative sets out that the need for compensation arrangements will be referred back to the Grid Code Panel if there is ever more than one event in any 12-month period, and that for this and any subsequent event data will be captured so that compensation arrangements can be applied retrospectively once they are in place.

Alternative WAGCM 3 (SSE): Compensation for Embedded Generators subject to emergency disconnection

This alternative sets out that compensation as detailed in the Clean Energy Package Regulation 2019/943 is to be payable to embedded generators that are affected by DNO implementation of emergency instructions received from the ESO as described in the GC0147 original solution. To facilitate the payment of compensation by The Company, provisions are indicated to capture the data associated with any event and apply arrangements retrospectively in the unlikely event of the 'last resort' being used.

Alternative WAGCM 4 (EON): Original + obligation to develop market mechanism if last resort solution is to be implemented

This alternative is a variation on the Original proposal. It requires that the provision of a 'last resort' mechanism through GC0147 is only implemented when a relevant market mechanism (such as an enduring ODFM or something similar) has been agreed and implemented. If no such market mechanism is deemed necessary by the NGESO (and therefore not implemented), then the last resort measures (as defined by GC0147) cannot be implemented.

Alternative WAGCM 5 (EON): WAGCM 1 + obligation to develop market mechanism if last resort solution is to be implemented

Rationale as per WAGCM 4

Alternative WAGCM 6 (EON): WAGCM 2 + obligation to develop market mechanism if last resort solution is to be implemented

Rationale as per WAGCM 4

Alternative WAGCM 7 (EON): WAGCM 3 + obligation to develop market mechanism if last resort solution is to be implemented

Rationale as per WAGCM 4

Legal text

The Legal text for the GC0147 Original Proposal and WAGCM1, WAGCM2, WAGCM3, WAGCM4, WAGCM5, WAGCM6 and WAGCM7 can be found in Annex 7.

As part of the Workgroup discussion and development of the modification, the proposer made a number of amendments to their initial text as follows:

- Added options for 'deload' (but only if time allows) or de-energisation to the definition of Embedded Generation Control.
- Removed the section (OC6B.4) dealing with Embedded Generation Control initiated by a System Operator (rather than due to ESO instruction). This was included for symmetry with OC6 Demand Control it was agreed is not really required. A few consequential simplifications were also made stemming from this to OC6B.1.2 and the Embedded Generation Control definition.

- Changed the way an instruction is made to refer to a reduction in Active Power output, rather than Registered Capacity. It was agreed that this was probably better as it would be more accurate and DNO representatives in the Workgroup felt it was generally achievable. A clause was also added to still allow disconnection of Registered Capacity to fulfil an instruction where there is insufficient time to do otherwise (OC6B.3.2.3).
- Amended OC6B.6.1 to include a reference to the incidence of instructions (to cover not always selecting the same party; although if the last resort become a regular occurrence this would in any case not be acceptable).
- Amended the priority order table in OC6B.6.1(d) to make it more future-proof against changes in system inertia needs.
- Changed the order of the System Warnings in OC7 to make this more logical – the existing demand control ones are now followed by the ones for generation control and then the one for system disturbances. Note that all Grid Code system warnings are already shared through BMRS.
- Alternative WAGCM 2 was amended to refer to two incidents in any 12-month period, rather than one calendar year.

What is the impact of this change?

- There will be an impact on the ESO in operating the NETS
- DNOs in potentially being required to take emergency actions
- Embedded generators in being disconnected under emergency conditions
- Consumers, in helping to mitigate the risk of security of supply issues

Workgroup vote

The Workgroup met on 13 January 2021 to carry out their Workgroup vote. The full Workgroup vote can be found in Annex 6 and WAGCMs in Annex 7. The table below provides a summary of the Workgroup members view on the best option to implement this change.

The Applicable Grid Code Objectives are:

Grid code

- a) To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity
- 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);
- 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;
- 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
- e) To promote efficiency in the implementation and administration of the Grid Code arrangements

The Workgroup concluded by majority that the WAGCM7 better facilitated the Applicable Objectives than the Baseline.

Option	Number of voters that voted this option as better than the Baseline
Original	1
WAGCM1	1
WAGCM2	4
WAGCM3	2
WAGCM4	0

WAGCM5	0
WAGCM6	0
WAGCM7	5

Workgroup Member	Company	BEST Option?	Which objective(s) does the change better facilitate? (if baseline not applicable)
Andrew McLeod	Northern Power Grid	WAGCM2	C
Brian Morrissey	SHEPD	WAGCM2	A,C,E
Garth Graham	SSE	WAGCM3	B,C,D
Graham Bone	Infinis	WAGCM1	C
Grant McBeath	SPEN	WAGCM2	A,C,E
Lisa Waters	Waters Wye Associates	WAGCM7	B,C,D
Mark Meyrick	The Renewable Energy Company	WAGCM7	A,B,C,E
Matthew Cullen	EON	WAGCM7	A,B,C,D
Paul Graham	Sembcorp	WAGCM7	C
Paul Youngman/Joshua Logan	DRA X	WAGCM7	B,C,D
Richard Wilson	UK Power Networks	WAGCM2	A,D,E
Rob Wilson	ESO	Original	C
Robert Longden	Cornwall Insight	WAGCM3	A,C,D

When will this change take place?

Implementation date:

The modification will be implemented around April 2021 as it is required in time for the May 2021 Bank Holiday anticipated low demand periods.

Date decision required by:

An Authority decision is required by April 2021 in order to adhere to May 2021 Bank holiday anticipated low demand periods.

Implementation approach:

No significant costs are expected in implementation and this solution is only to be used in a last resort emergency scenario.

Acronyms, key terms and reference material

Acronym / key term	Meaning
ANM	Active Network Management
Baseline	The code/standard as it is currently
BM	Balancing Mechanism
BMRS	Balancing Mechanism Reporting Service
BSUoS	Balancing Services Use of System
DCUSA	Distribution Connection and Use of System Agreement
DNO	Distribution Network Operator
DSO	Distribution System Operator
LFSM-O	Limited frequency sensitive mode – overfrequency
NCER	Network Code on Emergency & Restoration
NETS	National Electricity Transmission System
ODFM	Optional Downward Flexibility Management, an opt-in service through which small scale renewable generators can receive payments from NGESO if NGESO ask them to turn down or turn off their generation of electricity.
TSO	Transmission System Operator

Reference material:

1. [ODFM: Managing reduced demand for electricity - what is our new ODFM service, and why do we need it?](#)
2. [GC0143: Last resort disconnection of Embedded Generation](#)
3. [Ofgem's decision letter on GC0143](#)
4. [Guidance for Emergency Instruction of Embedded Generation under BC2.9 Emergency Circumstances](#)

Annexes

Annex	Information
Annex 1	Legal Text for Original solution
Annex 2	Terms of Reference
Annex 3a	Proposer's Presentation – GC0147
Annex 3b	Workgroup Member emails on GC0147
Annex 4	Legal position on Clean Energy Package
Annex 5	ESO Presentation on ODFM
Annex 6	Workgroup Vote
Annex 7	WAGCMs