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DER Technical Forum

28 February 2024
10:00 – 12:00

Welcome, Housekeeping and Introductions

Agenda

10:00	Welcome, Introductions and Acceptance of Agenda.
10:05	Actions from previous meeting
10:10	Significant modification and G99 compliance
10:30	ABP queries and discussion points
10:50	IONs for Type C and D
11:00	Customer Islanding
11:05	Other outstanding issues:
11:15	BEGAs and G99
11:25	Minor technical update to G99
11:40	SAF Update
11:45	GC0117
11:50	EU update
11:55	AoB
12:00	Next meeting

Actions from previous meeting

Actions

All outstanding issues are covered on today's agenda

Significant Modifications to Generation Plant

Significant Modification and retrospective compliance

Consideration has been prompted by the numbers of G59 installations which are in the process of being replanted – and where the existing G99 approach is a little simplistic.

G99 is based in large part on the European Network Code Requirements for Generators (RfG)

In Europe, over the last few years, they have realised that the requirements in the RfG for bringing equipment up to modern standards are too vague to be applied consistently.

And Expert Group produced a report on how this issue should be tackled, and ACER have drafted its main recommendations into the next version of the RfG – which is due to be enacted at the end of this year.

https://www.entsoe.eu/documents/nc/GC%20ESC/CSM/220222_EG_CSM_final_report_incl_VGBE_annex.pdf

The G99 proposals are based on the legal text which ACER have put into the draft RfG, and adapted for the challenges of replanting existing generation in GB.

Criteria for a modification to be significant

20.3.5 If a Modification is significant then the Power Generation Module shall comply with the latest version of this EREC G99 in full.

20.3.6 The criteria that determine whether a Modification is significant are that the Generator is proposing to make a capital investment in the Power Generating Module and ;

a) The Registered Capacity of the Power Generating Module will increase by 20% or more compared to its Registered Capacity when first commissioned, whether in one Modification or cumulatively; or

b) The reactive power capability of the Power Generating Module will change by 20% or more compared to its reactive power capability when first commissioned, whether in one Modification or cumulatively; or

c) The frequency stability or Active Power management capabilities of the Power Generating Module is affected; or

d) The replacement of Generating Units and/or other components that individually or cumulatively comprise 80% or more of the Registered Capacity of the Power Generating Module Where the Generator has agreed an increase in Registered Capacity with the DNO, the 80% is of the final Registered Capacity agreed with the DNO.

Generally applicable rules for replacement

20.3.7 Where a component, a Generating Unit or a Power Generating Module is replaced the following shall apply irrespective of whether the Modification is significant or not:

(a) the replacement shall be compliant, or capable of being compliant, with this EREC G99, even if the original Power Generating Module was commissioned under EREC G59;

(b) the replacement shall be compliant, or capable of being compliant, with the requirements of this EREC G99 applicable to the Registered Capacity of the Power Generating Module. Where the replacement is part of a significant Modification, it is important to note that it is the final Registered Capacity of the modified Power Generating Module that determines the type of the Power Generating Module (ie Type A, Type B, Type C etc);

(c) compliance with the power quality requirements of EREC G5 and EREC P28 shall be maintained throughout the process of implementing the Modification;

(d) any changes that affect the requirements, or the contents, of the Connection Agreement shall be reflected in a revised Connection Agreement.

Generally applicable rules for replacement

20.3.8 Where the components, particularly Generating Units, of a Power Generating Module are proposed to be replaced progressively over a period, even potentially a multi-year period, the Generator shall discuss the planned programme with the DNO and agree:

(a) what compliance confirmation activities will be required at each stage of the programme;

(b) what the final Registered Capacity of the Power Generating Module will be when the Modification is complete;

(c) The date by which compliance will be achieved. This date must be within six months of when the capacity of the replacement has reached 80% of the final Registered Capacity of the Power Generating Module;

(d) How compliance with EREC G5 and EREC P28 will be maintained, and if necessary, demonstrated throughout the programme

Spare parts

20.3.9 Replacement of components, or even Generating Units, with spare parts manufactured at the time of original installation, or to the original specification, do not constitute a significant Modification. However if more than 20% of the number of Generating Units comprising the Power Generating Module are affected, or if the cumulative contribution of the affected Generating Units to the Power Generating Module's Registered Capacity is 20% or more, the DNO must be consulted before the work is commenced. Conversely where a component or Generating Unit is replaced with a modern equivalent, that replacement must be capable of being compliant with EREC G99.

DRAFT Examples in A.6 - 1

	Scenario	DNO position	Latest EREC G99?	Rationale
1	Existing EREC G59 PPM installation (eg solar PV or wind)– the Generator replaces a failed Generating Unit (ie Inverter or turbine) at a PPM comprising multiple Generating Units.	Like-for-like replacements do not immediately lead to EREC G99 compliance for the whole module. The new Inverter or Turbine does need to be compliant with the latest EREC G99.	×	This is a maintenance issue – the overall characteristics of the PPM are essentially unchanged – at least until 80% of the capacity of the PGM is replaced..
2	Existing EREC G59 PPM installation (eg solar PV or wind)– the Generator operates a planned replacement programme of Generating Units (ie Inverter or turbine) of the same capacity at a PPM comprising multiple Generating Units.	Like-for-like replacements do not immediately lead to EREC G99 compliance for the whole module, until 80% of the capacity of the PGM has been replaced. The new Inverter does need to be compliant with the latest EREC G99.	×	This is a maintenance issue – the overall characteristics of the PPM are essentially unchanged – at least until 80% of the capacity of the PGM is replaced.
3	Existing EREC G59 PPM installation (eg solar PV or wind)– the Generator completes 80% (by capacity) of planned replacement programme of Generating Units (ie Inverter or turbine) of the same capacity at a PPM comprising multiple Generating Units.	On completion, the PPM must comply fully with the latest version of EREC G99 by the date agreed with the DNO.	✓	The Generator has made significant investment in the site and as the whole of the PPM has been replaced, it must now comply with the latest version of EREC G59.
4	Existing EREC G59 PPM site, the Generator adds an additional PPM after 27/4/19.	The new PPM to be compliant with EREC G99.	✓	This is a new investment and cannot sensibly be integrated with the existing module (see figure 6.4 in EREC G99).

DRAFT Examples in A.6 - 2

	Scenario	DNO position	Latest EREC G99?	Rationale
5	EREC G59 installation – the Generator fully replaces a PGM (no increase in Registered Capacity) with a new module.	EREC G99 20.3.4: New PGM must be compliant with EREC G99. If there are other PGMs at the Generator's Installation that were installed under EREC G59, these do not need to be upgraded / replaced (in accordance with 20.3.7).	✓	There is significant capital investment in replacing a PGM with a new PGM.
6	EREC G59 installation – the Generator fully replaces a Type A or Type B PGM with a PGM that has previously been installed elsewhere under EREC G59. No increase of the PGM Registered Capacity at the destination site.	Provided the relocated unit is Type A or Type B and comes from an EREC G59 compliant site, the destination site is also EREC G59 compliant, and there is no increase in Registered Capacity at the destination site, then compliance with EREC G59 only is required.	×	This is a modest investment compared to the costs of a new PGM. There is no net change to the electrical characteristics at the destination site.
7	EREC G59 installation – the Generator installs an additional PGM that has previously been installed under EREC G59 but interlocked as a standby set to the existing PGM(s).	A variant of scenario 6 if the additional unit was connected under EREC G59, has been relocated to use as a standby/spare on the site, and is interlocked so it cannot run in parallel with the existing PGM(s) such that the effective Registered Capacity (and/or export capacity) of the site is unchanged compliance with EREC G59 only is required,	×	There is no effective change to the electrical characteristics of the site and no need to comply with EREC G99.
8	EREC G59 installation – the Generator fully replaces a PGM with a new PGM (ie scenarios 6 and 7 do not apply)	EREC G99 paragraph 20.6: The new PGM must be compliant with EREC G99. Other EREC G59 units that are not being replaced do not need to be upgraded.	✓	There is significant capital investment in replacing a PGM with a new PGM.
9	Existing EREC G59 installation – the Generator changes from Short Term Parallel, or Standby only, to Long- Term Parallel operation.	Does not need to be upgraded to comply with EREC G99. Does need to comply with the full EREC G59 requirements.	×	The PGM is already connected and is not being modified (although protection upgrades might be needed).

DRAFT Examples in A.6 - 3

	Scenario	DNO position	Latest EREC G99?	Rationale
10	Existing EREC G59 or G99 installation – the Generator moves the Interface Protection within the existing site.	The Generator does not need to upgrade the equipment to comply with the latest EREC G99. However, if the relay and generation equipment is capable of accepting up-to-date EREC G99 protection settings, the DNO shall ask the Generator to upgrade the settings to the latest version of EREC G99. The DNO would witness the moved Interface Protection if there have been any wiring or relay changes, and according to the witness thresholds in each license area.	×	This is just a maintenance issue – there is no change to generation characteristics etc.
11	Existing EREC G59 or G99 installation – the Generator replaces the Interface Protection but makes no change to PGM.	As 9 above.	×	As 9 above.
12	Existing EREC G59 or G99 installation – the Generator changes the fuel source (eg gas to bio-fuel, landfill gas to natural gas), with no change to main electrical equipment eg alternator or Inverter.	If no significant change to the electrical characteristics there is no need to upgrade to be compliant with the latest EREC G99,	×	The assumption is that the investment associated with the main plant to make this change is modest and that there is no significant effect on the relevant characteristics of the machine.
13	Existing EREC G59 or G99 installation – the Generator changes the prime mover (eg landfill gas site replaces landfill gas engine with a natural gas engine).	Assuming a new engine this is likely to be a significant Modification and the installation should comply with the latest version of EREC G99. Note – a replacement like for like engine would not require compliance with the latest version.	ü	Significant capital investment in the main plant. The change to the prime mover is likely to have a significant effect on key electrical characteristics – eg stability and fault current contribution.

DRAFT Examples in A.6 - 4

	Scenario	DNO position	Latest EREC G99?	Rationale
14	Existing EREC G59 or G99 installation – the Generator replaces / upgrades the control system (eg AVR, excitation system).	Replacement of components of a PGM with modern equivalent components would normally be considered to be maintenance work and therefore the PGM does not need to be upgraded to comply with the latest EREC G99, unless this, results in changes to the fundamental performance characteristics of generation. However any reduction in the specific reactive capability specified in the Connection Agreement greater than 20% could trigger the need for full compliance with the latest EREC G99. Similarly the control system might influence other technical issues eg system stability which may trigger the need for compliance with EREC G99.	×	In the main these sorts of changes are not likely to have significant effect on the electrical characteristics of importance to network operators.
15	Existing Synchronous PGM EREC G59 or G99 installation – the Generator replaces the alternator with a new non-identical unit.	Complete replacement of the alternator – the PGM needs to be compliant with the latest EREC G99.	✓	This is in effect a new PGM.
16	Existing Synchronous PGM EREC G59 or G99 installation –the Generator replaces the alternator with one of the same vintage and identical Manufacturers type (eg a reclaimed or spare unit).	Provided the replacement alternator is identical, the PGM does not need to be upgraded to be compliant with the latest EREC G99.	×	This is a maintenance issue – there is no change to generation characteristics etc. This covers the case of strategic spares – there is no change to electrical characteristics.
17	EREC G59 or G99 installation – the Generator replaces the transformer between the PGM terminals and the Connection Point with similar unit.	A like for like replacement has no effect on electrical characteristics. The PGM does not need to comply with the latest EREC G99.	×	This is a maintenance issue – there is no change to generation characteristics etc.

DRAFT Examples in A.6 - 5

	Scenario	DNO position	Latest EREC G99?	Rationale
18	EREC G59 or G99 installation – the Generator replaces the transformer between the PGM terminals and the Connection Point with one of significantly different impedance.	The replacement transformer will have an effect on fault level contribution and reactive capability. Any reduction in the reactive capability specified in the Connection Agreement >20% could trigger the need for full compliance with EREC G99 – but otherwise the PGM can remain as EREC G59.	×	This is a maintenance issue – there is no change to generation characteristics etc.
19	An existing EREC G99 installation where the Intrinsic Design Capacity has been restricted so that the Registered Capacity is below the Intrinsic Design Capacity for the purposes of meeting a restriction on maximum export capacity, and where maximum export capacity restriction is removed such that the Registered Capacity increases by 25%.	It will be necessary to demonstrate compliance with the EREC G99 requirements applicable when the PGM was commissioned based on the new Registered Capacity. Note that crossing a Type threshold will require to comply with the requirements applicable at that time to the higher Type.	×	There has been no new investment by the Generator; the relaxation of the maximum export capacity is occasioned by issues on the DNO's network, ie outside of the Generator's control. However compliance is still required with the version of EREC G99 in force when the PGM was commissioned.
20	An existing EREC G99 installation where the PGM is modified such that its Registered Capacity is increased by 10%, and which takes it over a type threshold (eg a 9.99MW Type B being increased to 10.9MW).	The PGM shall remain compliant with its original requirements. Not need to upgrade.	×	As the increase in Registered Capacity is less than the 20% threshold for being considered as significant Modification there is no need to comply with the requirements of the type above the existing type.

ABP Queries and Discussion Points
Edita Butkute

Application of SoW

DNOs appear to be applying the SoW thresholds inconsistently

Appendix G of the DNOs' BCAs has this wording:

For the purposes of CUSC Paragraph 6.5.1(b), Embedded Small Power Stations of [ ]MW and above will be deemed to be a Relevant Embedded Small Power Station unless otherwise notified by The Company in accordance with CUSC Paragraph 6.5.1(b).

The words do not state whether the capacity in MW is the Registered Capacity or the Maximum Export Capacity.

ABP's view is that basing it on Registered Capacity discriminates against sites with existing generation that wish to increase generation capacity without increasing exports.

ABP suggests that CUSC is changed to make the criterion based on MEC.

Appropriate treatment of diversity on large complex sites

DNOs do not seem to be considering diversity appropriately for large sites, assessing the generation output with zero local site load, when such loss of diversity is not realistic where there is no common mode behaviour.

Are internal DNO policies consistent with G100 section 4.4?

…

State 2 operation shall take account of the likely worst case situation that might arise, taking into account common mode failures and effects that may affect Devices. By way of an example if there are several significant separately controlled loads that are normally balancing the energy production from generation on site, the CLS will need to allow for the worst case in terms of those loads being switched off or tripped. If these loads are truly independent and no common mode failure, then the worst case will be the largest of these being switched off. However if there is a common mode failure, such as the loads all being supplied from the same distribution board or have a common cable between them and the generation, then the worst case is simultaneous loss of all of them.

….

Do DNOs have their internal approach to diversity assessment documented, especially for complex sites, and are these publicly available?

Firm Connexions, communication/control equipment for inter-tripping and RfG 13.6/14.2(a)

ABP is concerned that where an appropriate modification is made to their site so that G99 applies, DNOs are insisting on installation of communication/control equipment for inter-tripping as required by the RfG without an explicit explanation that such sites will be forced to listen to instructions and comply with constraints within seconds, or in effect subject to a form of active network management (ANM).

This communication/control equipment allows DNOs request sites to ramp down generation within 5s as stage 1 and trip/disconnect sites as stage 2 if stage 1 is not complied within the given 5s timeframe.

Under such arrangement, customers will need some form of ANM equipment installed in order to respond to phase 1 and avoid phase 2 (most basic equipment would be export limitation).

Do all DNOs require the installation of equipment to enable the generation to be ramped down or tripped, and do all DNOs arrange this to trip the whole site as a backup? What are the criteria for these requirements being applied?

As an extension of this, if the site owner has agreed a fully firm connexion with the DNO (ie both local and upstream assets) how can the operation of the arrangement describe above be consistent with a firm supply?

Fair management of congestion

LIFO and pro-rata regimes provide clear guidance on expected curtailments and when firm connections should replace non-firm offers.

Are DNOs similarly required to estimate curtailment impact under communication/control equipment for inter-tripping enforced under RfG 13.6? Is this document somewhere?

Is there a published list of priority criteria for utilising communication/control equipment for inter-tripping enforced under RfG 13.6, ie the hierarchy how the DNO would be choosing/ordering generators to ramp down ie enter stage 1?

IONs for Type C (and B)

Possible extension of ION to Type C (equivalent text in 17.3 for Type B)

18.3 Witnessing and Commissioning

18.3.1 The Generator is responsible for carrying out the commissioning tests and retains the responsibility for safety and personnel during the test.

18.3.2 The checks and tests as detailed in Section 15.2 and 15.3 shall be undertaken to the extent applicable.

18.3.3 Where Type Testing or Manufacturers' Information is not being used to demonstrate Interface Protection the tests detailed in Section 15.4 shall be undertaken.

18.3.4 The tests as detailed in the Power Generating Module Document shall be carried out by the Installer or Generator.

18.3.5 The tests and checks shall be carried out once the installation is complete, or, in the case of a phased installation (ie where Generating Units that comprise a Power Generating Module are installed in different phases), when that part of the installation has been completed. The results of these tests shall be recorded on the Power Generating Module Document Form C2-1 (Annex C.2) and the installation and commissioning document Form C3 (Annex C.3). The Installer or Generator, as appropriate, shall complete the declaration at the bottom of Form C3, sign and date it and provide a copy to the DNO at the time of commissioning.

18.3.6 If there are constraints on completing the necessary tests caused by circumstances outside the Generator's control, for example the availability of sufficient solar irradiance during the winter, the DNO and the Generator may agree an interim operating regime pending completion of all the necessary tests and data submission. In such cases the provisions of Section 19.3 shall be used as a guide to the formality required.

18.3.7 If compliance tests or simulations cannot be carried out as agreed between the DNO and the Generator due to reasons attributable to the DNO, then the DNO shall not unreasonably withhold the Final Operational Notification to be issued under Section 18.4.

Islanding of Customers' Generation

Definition of operating modes

The modes are proposed to be named:

- **OM1 - Long term parallel without islanding capability;**
- **OM2 - Long term parallel with islanding capability;**
- **OM3 – Infrequent short term paralleling (ie predominantly island operation);**
- **OM4 - Switched-alternative – ie no parallel operation.**

		Parallel Operation	
		No	Yes
Customer Island Operation	No	Not applicable	Long Term Parallel Operation without Islanding (OM1)
	Yes	Switched-alternative (OM4)	Long Term Parallel Operation with Islanding (OM2)
			Infrequent Short Term Parallel Operation (OM3)

Proposed change to G99 structure:

Existing structure:

Section 7

- 7.1 Operating Modes
  - Summary
- 7.2 Long Term Parallel
  - Summary
- 7.3 Infrequent Short Term Parallel
  - Detail
- 7.4 Switched Alternative
  - Detail

Section 9.6

- 9.6.1 Two Island Modes
  - Summary
- 9.6.2 Customer Island
  - Detail (sparse!)
- 9.6.3 DNO's Island
  - Detail

Proposed structure:

Section 7

- 7.1 Operating Modes
  - Summary
- 7.2 Long Term Parallel (OM1)
  - Summary
- 7.3 Infrequent Short Term Parallel (OM3)
  - Summary
- 7.4 Switched Alternative (OM4)
  - Detail

Section 9.6

- 9.6.1 Three Island Modes
  - Summary
- 9.6.2 Long Term Parallel with islanding (OM2)
  - Detail
- 9.6.3 Infrequent short term parallel operation (OM3)
  - Detail
- 9.6.4 – DNO's Island
  - Detail

Rationale:

- **Section 7 details with connexion requirements.**
- **Section 9 provides the detail for specific issues, in this case island operation**
- **Short Term Parallel is essentially island operation – so can be accommodated with other islanding details.**
- **All the detail for customer islanding, including short term parallel is in 9.6.**

Synchronizing

The WG discussed synchronizing at length, and came to the view that the important requirement was to maintain compliance with EREC P28 (ie voltage power quality) when synchronizing.

However the WG also thought that on balance it would be helpful to express a set of maximum out-of-synchronization conditions, beyond which synchronization should not be allowed.

The proposed limits between incoming and running voltages are:

	Limit
Voltage delta	10%
Frequency delta	400mHz
Phase angle delta	15º

This suggestion will be a specific question for stakeholders when the changes are consulted on.

Fault ride through

Some customers, particularly industrial customers, desire to trip their site from the DNO's network to become a self-sustaining island when the DNO's network suffers a disturbance.

This is potentially at odds, for sites with generation commissioned since April 2019, with the FRT requirements.

To accommodate customers' wishes and respect the FRT requirements it is proposed to allow customers to trip to their own island, when the system is disturbed, provided the net change in active power flow at their boundary is less than 10% of the maximum import capacity (or maximum export capacity if that is greater) and is also less than 5MW.

This will also be a specific consultation issue.

Previous Issues

Outstanding Issues – see appendix 1:

Delays associated with DNOs being able to submit Mod Apps to NGESO because of inadequate SAF data – 126 – The DNOs are still reviewing the SAF.

Initial P28 assessments for generation tripping and/or load rejection etc. – 127 – should be picked up in the guidance on P28 being developed by the ENA.

Meaning of "transient rating" wrt PPMs for fast fault current injection – 128 – awaiting feedback from the originator.

IONs or Type B and Type C – 129.

Older issues

Registered Capacity – 112

BESS connexions – issues 113, 114

5 minutes per month for Short Term Paralleling – 122

Clarification of G99 where BEGAs apply

Proposed G99 text to clarify responsibilities

6.1.6 Interaction with the NETSO

….

6.1.6.3 In the case where the Generator has a Bilateral Embedded Generation Agreement (BEGA) with the NETSO, the Generator shall demonstrate compliance with EREC G99 to the DNO, and any additional Grid Code compliance requirements shall be demonstrated by the Generator to the NETSO. In these cases the Generator will make the Generator's interim and final PGMD, and/or the Generator's FON, available to the NETSO on request. The NETSO may seek confirmation from the DNO of the compliance status of the Generators PGMD.

6.1.6.4 In the case of an embedded large power station, the NETSO will be responsible for confirming the Generator's compliance with all Grid Code requirements. In general this will mean that the requirements of Sections 12-13 and 17-19 will be superseded by the equivalent requirements in the Grid Code. The DNO will remain responsible for ensuring the Generator's compliance with the remaining parts of this EREC G99.

Minor technical updates and housekeeping

Current status

There are a few issues not yet included in the working draft of G99:

- The new requirements for storage for recovery from a low frequency excursion.
- Output from the Customer Islanding working group.
- The proposal for IONs for Type B and C.
- Clarification of BEGA responsibilities
- Significant Modernization
- Proposals for text for where generation export is shared between adjacent customer (ie in flats etc)

It is the current intention to include all of these – but timing, or assessed complexity, may militate against their inclusion.

Note there are still some formatting and referencing issues to resolve (not least the position of the old annex A.6 – probably will become A.7 and the existing A.7 will be fully renumbered).

The other points, which have largely been circulated to the Forum in the recent past, are attached again as Appendix 2.

Ideally, a consolidated version will be available for formal consultation in the Spring.

SAF Update

SAF

DNOs are still working on this, with a view to collecting more information from developers earlier in the life of a project.

GC0117

GC0117 – alignment of Large, Medium and Small across GB

This is now out for final consultation, with a response date of 26 March 2024

The three main options are:

- The baseline (ie existing arrangements unchanged)
- The original proposal (ie Large starts at 10MW in all of GB)
- WAGCM1 – extending the E&W arrangements (including Medium PSs) to GB

A majority of the Workgroup voted for the baseline.

The Grid Code Review Panel will vote on the Modification after the consultation responses have been analyzed. The Panel's vote is not binding on Ofgem, who will make the final decision.

EU Developments

EU Network Codes – ACER proposal

The key issues (at least for DNOs) are:

- Electromobility
- Certification
- Aggregation of generating units
- Storage
- Grid Forming
- Simulations and Models

The following slides give a little detail on the issues above – but only from a DNO perspective.

The EU Commission will process ACER's recommendations into EU law later this year – at least that is the current timetable. There will still be amendments to the draft text by the Commission, and there will be a 4 week public consutlation as part of the process.

Electromobility

ACER is proposing three classes of V2G:

<2.4kW – probably connected via a domestic plug/socket.

2.4kW – 50kW – probably the bulk of EVs, and many will be DC connected. Requirements similar to Type A

50kW – 1MW - requirements similar to Type B

The EU DSO Entity and ENTSO-e made a joint proposal to the June Grid Connexion European Stakeholder Committee that only two classes are required, split by connexion, ie AC or DC – but ACER have rejected this approach.

All EVs (and heat pumps) will have to have equipment certificates provided by the manufactuer – minimizing admin etc for both owners and DNOs

Certification –mandatory for EVs and heat pumps

Background (as MK understands it!)

The concept was introduced in the NC RfG, DC etc in 2016

The RfG drafting seems to be an EU description of the existing situation in Germany, Spain and possibly some other countries (although without the mandatory site certification that Germany requires)

An equipment certificate must be awarded by an authorised certifier.

The authorised certifier in turn must be accredited by a national authority in accordance with Regulation (EC) No 765/2008. (requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93)

Opportunities

A (complete) certificate for a PGM (or heat pump) would mean that there is no RfG compliance assessment needed on site.

This would allow the connexion of small scale generation to DSOs' networks with minimum DSO interaction.

This is particularly valuable for mass market developments such as domestic PV, and increasingly electric vehicles, domestic storage and heat pumps

ACER's proposal to the EC includes the legal text making certification mandatory for EVs and heat pumps.

Aggregation of generating units

It has always been the case that non-synchronous generating units on a site should be aggregated into a single power generating module.

ACER is proposing that this arrangement be stopped, and that aggregation would only be of like technologies – ie so this would stop the aggregation of, for example, PV and storage into a single PPM.

ENTSO-e is very against this, and the DNOs are supportive of ENTSO-e's position because of:

- The risk of owners gaming the technology boundaries to avoid being a higher Type (eg two Type B PPMs rather than a single Type C PPM)
- Perceived unfairness of existing post-RfG customers.

Currently this remains unresolved and is likely to remain so until the Commission decides.

Grid Forming

Imposition of grid forming likely to lead to unintended islands.

The risk is accepted by ENTSO-e & ACER.

The current drafting proposed by ACER is to allow mandatory GF capability for larger PGMs which are connected to a substation (or on a dedicated feeder) where 110kV or higher exists.

A few larger Type B PGMs (in some countries with a high B/C boundary) would be caught by the above, but smaller Type Bs and Type As would have to have GF capability starting from when a nationally agreed road map has allowed time etc for DNOs to have adapted their systems.

RoCoF as anti-islanding protection is excluded from the new 4Hzs^{-1} ride through requirements – although other frequency protection used for anti-islanding might need to be reviewed.

Simulations and models

To the extent that ACER's draft legal text follows the text in the ISSM EG report, there is probably little to comment on as part of the current consultation.

The RfG does not appear to specify how the TSO will receive models from DNO connected generation, if the TSO requests it – maybe this is something for local TSO/DSO agreement?

In the longer term it might be that DNOs either individually or collectively will need to develop expertise in EMT modelling.

Storage

The ACER text fully implements the Expert Group on Storage's recommendations.

Storage is just treated as part of the PGM, but with additional requirements for responding to emergency underfrequency conditions.

The proposed LFSM-U response is subtly different from that in the GB Grid Code – however as this is a current specific software setting, it makes sense to follow the GB Grid Code characteristic.

AOB and next meeting

Appendix – historic Forum issues

Outstanding Issues – 1

No	Issue	Assumed Status
112	A common issue that keeps coming up is Registered Capacity vs design install and grid agreements. I have a specific case where the G99 and connection agreement is for 9MW, the developer undersized the inverters slightly. So it can only produce 8.5MW (in round numbers) whilst operating in the 0.95 lag/lead range. This is what is shown when we do the G99 study, and we noted this shortfall. So the question arises, of what happens to the site now and what can it do. Specifically, 1) Is it's new official RC 9MW or 8.5MW ie do they retain their original agreed capacity, or is this list back to the DNO? This is a common sticking point, taking the above example it cannot meet the 9MW required, but they may upgrade an inverter later to give them more MVAr headroom and it could then operate at 9MW. 2) If the DNO doesn't want/need them to operate across the 0.95 lag/lead range can they then operate at 9MW active power and say unity or 0.98pf. In this case they are producing their official R, but their system design does not meet the required G99 standard for a 9MW site.	This is an issue that does re-appear from time to time. We have attempted to deal with it in the past in issues 40, 80 and 83. We went through it with slides at the 7 June 2022 DER TF. DNOs have summarized how they specify maximum capacities and power factors in their connexion agreements. We propose that we incorporate the material from the 7 June 2022 meeting into the next version of the DG guides

Outstanding Issues – 2

No	Issue	Assumed Status
113	P28 has the usual classifications of frequent events, infrequent events (4 per month) and very infrequent events (1 per 3 month)…. what should we be assessing a storage system performing a dynamic containment service as? The UK grid is reasonably stable, at the moment, but with more conventional plant dropping out, the power swings are going to get a bit more sever, and the DC type services will be getting worked more often. Classing it as a very infrequent event probably isn't realistic, but what about infrequent events? I could see that it is possible that you could get to around the 4 events per month, although probably not at the full power swing.	This is a good point, and one that probably would benefit from a consistent consideration by DNOs. It might be sensible to base the frequency on the observed incidence of frequency excursions, over the last 18 months say, that trigger a specific level of response from such services. The response level might be set locally, and the P28 "frequency of event" set by the historic track of frequency excursions triggering that level of response. This can be calculated from the information NGESO publish monthly. This should be picked up as part of ongoing work to develop a common approach to BESSs between the DNOs. However, note that in the BESS discussions on 18/11 it was pointed out that the 3% limit essentially applies at any time once the transients have died away, so for BESS power swings the 3% probably applies in all cases, irrespective of frequency of event. The DNOs work on reviewing customers' issues with P28 should pick thi

Outstanding Issues – 3

No	Issue	Assumed Status
114	We have concerns relating the voltage step change for Battery Energy Storage Systems (BESS) when the systems are designated for fast frequency response. A number of network operators define step change to be full declared export to full declared import for real power P and for reactive power Q. The FFR contracts do not have a contracted obligation to reverse the direction of reactive power flow and no obligation to match the fast MW response with a MVAr response. When importing, there is no obligation to operate at a particular power factor only to operate within a +/-0.95 range. If a full MW ramp has occurred, it is reasonable to assume the system is under stress. To reverse Q at this point would be the worst of all strategies at it would exacerbate the stress of the system by introducing an unnecessary voltage step. It is likely that EFR or FFR BESS is located at a point with a high X/R ratio (close to a BSP or GSP). Therefore a unit change in Q would have at least 10x the impact on at the voltage step that of a unit change in P. This Q reversal condition appears to be based on a false assumption about the default behaviour of inverters under FFR. We believe it is a matter for the customer to demonstrate through simulation the voltage step change under power reversal. It is a matter for the customer to produce a reactive power strategy that meets the constraints of the D Code and the connection offer. Confirmation of the simulation can be done via commissioning tests with frequency injection for smaller steps. The imposition of this requirement distorts the market by essentially limiting the capacity of a BESS scheme to around half the capacity of other technologies thus creating hidden barrier to the penetration of the technology. The customer should demonstrate how they meet the voltage step change challenge through modelling and if necessary to verify through commissioning demonstration, not for the network operator to impose a control philosophy.	To be picked up in the BESS sessions

Outstanding Issues – 4

No	Issue	Assumed Status
122	I represent a UK water industry working group responsible for the development and maintenance of electrical specifications. During recent work to update a specification for low voltage diesel generator sets, I was asked by the group to lobby the ENA technical committee responsible for G99 to consider relaxing the following clause in EREC G99: 7.3.3.1 parallel operation	7.3.3.1 The Power Generating Module may be permitted to operate in parallel with the Distribution Network for no more than 5 minutes in any month, and no more frequently than once per week. If the duration of parallel connection exceeds this period, or this frequency, then the Power Generating Module shall be considered as if it is, or can be, operated in long-term parallel operation mode. An alternative frequency and duration may be agreed between the DNO and the Generator taking account of particular site circumstances and Power Generating Module design. An electrical time interlock should be installed to ensure that the period of parallel operation does not exceed the agreed period. The timer should be a separate device from the changeover control system such that failure of the auto changeover system will not prevent the parallel being broken. Notice that the highlighted text already allows for an agreement between the DNO and Generator to agree an appropriate testing regime, subject to there being a valid reason to do so. An alternative would be to fit full LoM protection and address any relevant points from 7.3.3.4, in which case the PGM would be treated as LTP. To be reviewed as part of the next update to G99.

Outstanding Issues – 5

No	Issue	Current Status
126	Customers are still seeing very long delays for DNOs to submit a Modification Application to National Grid for the appropriate GSP. A developer accepted a scheme Sept 2020 and only had the Mod App response back August 2022 (even with pushing for a Mod App to be done with escalation). This is not an isolated experience. One part of the delay occurred as the DNO informed us they are allowing customers to only fill in sections 1 -3 before receiving a distribution offer, but required customers to fill in section 4 before they were able to submit the Mod App. Whilst the customer UBGC represented had filled in Part 4 when the scheme was applied for, others which accepted before had not and a Mod App was further delayed, to allow customers who accepted ahead to fill in the form. This would have been 14+ months after they had initially accepted their offers. If Part 4 is a requirement for a Mod App but the DNO feels comfortable making a distribution offer without part 4, can it be agreed that part 4 it is filled in within a set period, I.e. 2-3 months of acceptance to prevent further delays in Modification Applications in the future or that the Mod App is submitted based only on the information within parts 1-3.	The timing of the provision of data is prescribed in DPC1 of the Distribution Code – needs review to see how this suggestion might be accommodated. Need to set up some discussions with appropriate DNO experts as soon as possible. Following a meeting between Philip and DNO experts from NGED and Electricity North West it is suggested that Part 4 of the SAF becomes mandatory.

Outstanding Issues – 6

No	Issue	Current Status
127	There is a requirement in ENA P28/2 (Although fairly sketchily defined) that we are supposed to consider what happens if a generator trips under full load conditions at different power factors ie 0.95 lag, unity and 0.95 lead. We have had a fairly large number of these sites come up that have a problem on them, and when we carry out the studies, we get a fail (ie the SVC is greater than +/-3%). When we hit this point there isn't really much we can do to help, as the SVC results are really just a function of the MW, MVAr flow and system strength – the only option is to constrain the generator MW output if it is at a problem PF – this causes headaches for developers Some general thoughts would be • A generator tripping on full load conditions would be relatively unusual – although with G99 LoM protection I guess it can and does happen, so I can see why its there. • Is it really realistic to consider it against minimum (outage) fault condition? • Should the developer really be doing this and finding problems - it is such a simple assessment the DNO should really do this, and check before issuing an offer. In reality just a simple loadflow of before and after.	DNOs broadly agree that the DNO should undertake these checks early in the application process. It is appropriate (and necessary in P28) to consider outages. To be investigated further as part of the refinement of BESS processes.

Outstanding Issues – 7

No	Issue	Current Status
128	In the case of the unbalanced fault, each power park module shall be required to inject reactive current (IR) which shall as a minimum increase with the fall in the retained unbalanced voltage up to its maximum reactive current without exceeding the transient rating of the power park module. In summary this seems to point at a necessary response from the inverter to provide supporting reactive current (i.e. some response but somehow less than the more clearly defined 3 phase fault condition). There is also a confirmation required that the other phases do not generate overvoltage although this is really a statement and I suggest this is demonstrated by graphing the other non-faulted phases in the study results. I'm interested in what the "transient rating of the power park module" actually is?	Awaiting feedback from the originator.

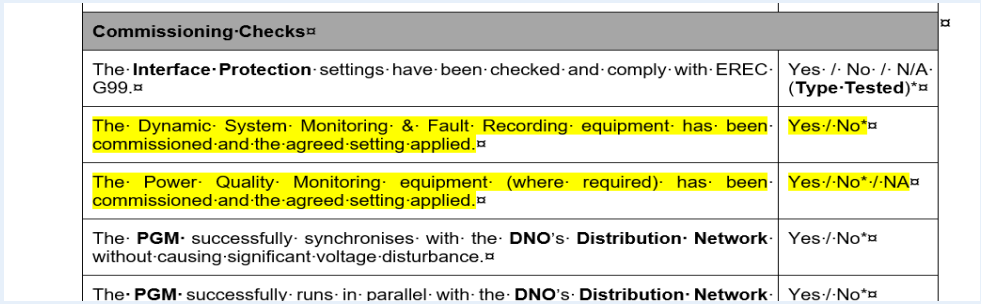
Outstanding Issues – 8

No	Issue	Current Status
129	Our issue is specifically regarding Type C PPMs. We have a number of Type C (solar) sites across different DNOs. Looking at G99 section 18.2 there is no EON or ION in the connection process for Type C PPMs, and to achieve FON we need to complete tests that require at least 65% (full voltage control) or 85% (reactive power and frequency response tests) of the maximum export capacity to be generated. For solar sites that energise over the winter months, it is unlikely that they would have such irradiation needed to achieve the required export to complete those tests until spring/summer the following year. For Type D PPMs there is the ION to cover this type of situation and allow export during this period until testing can be completed and FON achieved. Having discussed this with other developers there seems to be a consistent inconsistency. We have had varying processes for achieving FON from different DNOs as well as confusion and variance within the DNOs. I outline two examples: 1. DNO A issues a Nil Export Connection Agreement (export allowed for testing purposes only) and following all the tests that could be completed at the time, issued an ION and vary the Connection Agreement to allow full export. Following successful completion of the outstanding compliance tests the FON is then issued. This approach seems a pragmatic approach. 2. DNO B have stated that they require FON to be completed before they will counter sign the Connection Agreement and allow full export. This leads to a lot of confusion and questions over how we are going to be able to complete the testing which requires connection to the network and export without a Connection Agreement in place – they won't offer a Nil Export initially but only the final Connection Agreement with the full requested Export Capacity. Further, this will result in our site that is due to energise in December, not being able to export until March/April when we have the required irradiation to complete the remaining testing and achieve FON.	Suggested that a new clause is introduced into 17.3.6 and 18.3.6: "To aid completing the necessary tests, and to allow the interim export of energy for the Generator's commercial purposes, at the discretion of the DNO, the DNO and the Generator may agree an interim operating regime, including issuing and Interim Operational Notification, pending completion of all the necessary tests and data submission. In such cases the provisions of Section 18.4 shall be respected and Section 19.3 shall be used as a guide to the formality required."

Appendix 2– G98 and G99 draft minor technical changes.

Date of update 23/08/23

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
1	10/02/21	AMC	G99 6.3.7	Need to be more specific about which models are being referred to. In G99 reference is made to 'detailed models', 'simulation models' and 'control system and prime mover models'. There may be merit in trying to add further clarity of the different models required for PGMs and which need to be verified.	In general detailed models of a **Type A** or **Type B Power Generating Module** are not required. Where the **DNO** deems it necessary to ensure **System Stability** and security appropriately detailed models of **Type A** or **Type B Power Generating Module**s and their control systems shall be supplied. Detailed models, including control systems, are always required for **Type C** and **Type D Power Generating Module**s. **Generator**s shall submit detailed models in respect of **Generating Units** which are aggregated into a **Power Park Module**.	Have extended modification to cover all types. Complete	Y
2	22/03/21	AH	G98 forms	Form D, Decommissioning: "I enclose a copy of the system schematic which has been left on site at the Customer's incoming meter location." This requirement should also be in Form B, Installation document	I declare that the relevant **Micro-generators** and the installation which together form a **Micro-generating Plant** within the scope of EREC G98 at the above address, conform to the requirements of EREC G98. This declaration of compliance is confined to **Micro-generating Plant** tested to EREC G98 or EREC G83 as applicable at the time of commissioning. I enclose a copy of the system schematic which has been left on site at the Customer's incoming meter location.	Form D already included in amendment 7. Added for Form B.	Y
3	31/01/21	AH	G99 Form C3 Part Installation and Commissioning Confirmation Form for Type C and Type D PGMs	Check proposed that the Dynamic System Monitoring & Fault Recorders and PQ monitoring equipment has been commissioned (Type C&D)		Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
4	07/06/21	DER Tech forum #101	G99 C.7.6	Following discussion with National Grid it is recognised that the studies requested in G99 are appropriate if the Generator is intending to operate the PGM in island mode, otherwise the standard ramp response simulations as for Type B are sufficient for distribution connected plant.	Para C.7.6.1 amended: Paragraphs C.7.6.2 to C.7.6.6 apply to **Power Generating Modules** which have the capability to run in island mode, to demonstrate the capability to modulate **Active Power** at high frequency as required by paragraph 9.6.3.3 and Section 13.2.4. Where the **Generator** will not operate the **Power Generating Module** in island mode simulation studies as required by Section B.4.5 shall be undertaken to demonstrate the capability to modulate **Active Power** at high frequency as required by Section 13.2.4.	Note the para ref to 9.6.3.3 may change with island mode amendments Complete- SC	Y
5	10/11/21	DNO SG	G98, G99 and SAF data requirements	Energy conversation technology tables - rows 30-32 are not electricity storage – they should not be in this list	Remove rows 30-32	Removed thermal storage, left the numbers and stated “not used” Complete	Y
6	10/12/21	AC		Amend G98 to allow devices suitable for island mode operation eg storage & PV combination, so that a house could operate in island mode ‘easily’ in the event of an extended power outage. G98 points to G99 for island mode – which allows it if it’s appropriately designed	In progress	No changes needed for this. G98 already points to G99	Y
7	14/01/22	MK/LB	G98 Additional clause	Small (G98) PV installation where the DNO connection is HV metered. Should it be accepted by DNO as G98 notification only or go through G99 simple less than 50kW route?	New 2.18 The approach detailed in this EREC G98 should be used for a single **Fully Type Tested Micro-generator** connecting to a **Customer Installation** at **LV**, where the customer is supplied at HV and where there is no other generation.	Complete	Y

	Energy Conversion Technology
1	Engine (combustion / reciprocating)
2	Fuel Cell
..	…
..	…
30	Storage - Thermal - Latent Heat Storage
31	Storage - Thermal - Thermochemical Storage
32	Storage - Thermal - Sensible Heat Storage

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
8a	31/01/22	MK	G99 2.15	Clarity of validity of type tests needed	**2.15 Validity of Type Tests** 2.15.1 **Power Generating Module**s that have been **Type Tested** to demonstrate compliance with previous amendments of EREC G99, and already connected to the **Customer's Installation,** remain valid for this current version of EREC G99. Where compliance of an item of plant and/or apparatus is demonstrated using **Manufacturers' Information** or Equipment Certificate(s) the compliance should be with the version of this EREC G99 that is current at the time of acceptance of the connection offer, or with any later version of this EREC G99. 2.15.2 Where a new amendment to EREC G99 changes a requirement which a **Manufacturer** has previously certified as compliant, that certification becomes invalid from the date that the revised requirement in the new amendment becomes operative. **Manufacturer**s will need to submit updated certifications for EREC G99 compliance for any relevant **Power Generating Module** which is connected on or after the date the revised requirement becomes operative. 2.15.3 For **Type Tested Power Generating Module**s, the relevant requirements are those that are principally laid out in sections 9 to 14 of this EREC G99 and which are generally expected to be demonstrated in accordance with the provisions of sections 15 to 19 of EREC G99. Minor updates to EREC G99 which are clarifications and do not change the underlying requirements are not classed as changed requirements and therefore do not need **Manufacturer**s to repeat tests and re-certify.	Complete. Now 2.16	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
8b	31/01/22	MK	G98 2.15	Clarity of validity of type tests needed	2.17 **Micro-generator**s that have been **Fully Type Tested** to demonstrate compliance with previous amendments of EREC G98 and are already connected to the **Customer's Installation,** remain valid for this current version of EREC G98. 2.18 Where a new amendment to EREC G98 changes a requirement which invalidates a **Micro-generator's Fully Type Tested** status, that certification becomes invalid from the date that the revised requirement in the new amendment becomes operative. **Manufacturer**s will need to submit updated certifications for **Fully Type Tested** status for any **Micro-generator** which is connected on or after the date the revised requirement becomes operative. 2.19 The relevant requirements are those that are principally laid out in sections 9 to 11 of this EREC G98 and which are generally expected to be demonstrated in accordance with the provisions annexes A1 or A2 of EREC G98. Minor updates to EREC G98 which are clarifications and do not change the underlying requirements are not classed as changed requirements and therefore do not need **Manufacturer**s to repeat tests and re-certify.	Complete	Y
9	16/02/22	MK	G99	G100 Type test device might be incorporated into G99 equipment. Consider allowing this to be noted on G99 forms	Opportunity on forms to check that there is an export limiting device that is integral to this G99 device for which the G100 type test form will also be submitted. Reference of G100 form.	Was covered in amendment 9. Does not need to be implemented for other types.	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
10	Current	MK/SC	G98 & G99	GC0148 outcome Storage response to rising freq after a fall (System recovery)	Refer to NG words once finalised. Currently draft (15/02/22) on GC0148 website.	Proposed wording was drafted. SO to implement in G99 as per Word document (ie pending)	N
11	21/04/22	LF	G99 Form A2-3	See emails Different approach between G98 and G99 wrt requirement for evidence for output power with falling frequency (G98 Form C). Should output power with falling frequency be in G98 Form C? It is appropriate in A2 – as this is a rotating machine phenomenon. Don't think a BESS manufacturer should be looking at A.7.2.3 in G99 as this is for rotating machines. And which is why it's not in A2-3.	Remove requirement from G98 Form C Check consistency in G99	EN50549 part 10 – confirms that inverter output not affected by frequency In case of full converter based generating technology where under frequency is not expected to have an effect on the active power capability of the generating unit, it is acceptable to conduct the test at a power level above 50 % Pn. However whilst form G98 C will mainly apply to inverters it could be a synchronous microgenerator e.g micro CHP. Suggest no mod required - leave output power with falling frequency in G98. SO to implement.	N
12	21/4/22	SG	G99	Usually prototypes do not have any pre-certificate or compliance report to connect to the grid. Currently a derogation is required for such builds to connect to grid as they don't fulfil G99 requirements and require testing to be done against grid to obtain certification. Can an allowance be made for the connection of prototypes as in the VDE4110 2018 standard	To be developed following agreement in principal by DNOs	DNOs will deal with this on a case-by-case basis. The stakeholder who was championing this has left. No change needed.	Y
13	05/07/22	MK/DNOs	G99	Compliance of exisiting generators involved in private wire schemes see 07 July 2022 DNO mtg ppt for discussion	New 20.3.6 (and renumber the existing as 20.3.7) In cases where an existing G59 PGM is to be connected to another customer's installation via a private wire, the PGM does not need to be upgraded to meet G99 provided the it retains its long term parallel arrangements at its original site.	Refer to mod 19 (duplicate). Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
14	05/07/22	DNO EU Code mtg	General And G83	EU housekeeping modifications	See mods approved by Ofgem, e-mail CMC 04/07/22	This was done in Amendment 9 – 3/10/2022.	Y
15	06/07/22	SS/MK	FFCI	The wording is ambiguous in the Appendices (B.4 and C.7) compared to the main body of the text. SS interpretation: is that FFCI is only applicable to a 3-phase fault on the system – and not applicable to the other faults GC0155 mod FFCI is required for all faults, not just symmetrical. SS response : G99 section 12.6 a) refers specifically to faults on the transmission that appear on the distribution system as a Low Voltage and b) refers to everything being in the positive phase sequence – which very much indicates it is a symmetrical fault or a low voltage event they are trying to support. My view, is perhaps this is better expressed as a study result by creating a Low Voltage event on the upstream network, and demonstrating the inverter produces reactive current to support it.. Sept 23 SC: G99 12.6.2 (h) In the case of an unbalanced fault, each **Park Module** or each **Generating Unit** within a **Power Park Module** shall be required to inject maximum reactive current without exceeding the transient rating of the **Power Park Module** (or constituent element thereof).	Refer to GCode text following GC0155 conclusion	Suggest no mod atm. Re-visit when GC0155 concludes. MK to review.	Y
16	31/8/22	Eckhard Schwendemann	G99 11.2.4 LFSM-O	Clarity required in respect of 11.2.4.1.(c) and 11.2.4.1(d). A7.9 demonstrates what is expected for 11.2.4.1.(d) and A7.10 demonstrates what is expected for 11.2.4.1(c). A7.9 demonstrates that the response should be at 0.5% per second, and allows for a 2s delay in the response starting. A7.10 shows that for excursions above 50.4 the response must achieve half the required reduction within 10s, again allowing for a 2s delay. I think it is implicit that after 10s the reduction should be linear – it's obvious from the graphs – but I suspect it might be useful to make it explicit in 11.2.4.1(c).	Modify text of 11.2.4 to refer to figures A.7.9 and A.7.10	Complete	Y
17	31/8/22	Eckhard Schwendemann		A.7.3.1 Domestic CHP and A.7.3.3 Fuel Cell. Consideration of the dynamic characteristics of the SOFC (high temperature fuel cell) Technology which can offer modified dynamic requirements in the area of change of active power to lower gradients.		Suggest no mod atm. Not in DER tech forum log	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
18	08/08/22 Discussed at tech forum 21/09/22	NS	G99 2.1 G99 2.4	G99 was conceived as not allowing non-type tested units < 16 A to be connected. However are some micro-hydro PGMs below 16A, designed to meet a specific location and are not amenable to type testing	2.1 This EREC provides the technical requirements for the connection of **Type A**, **Type B**, **Type C** and **Type D Power Generating Module**s to the **Distribution Network**s of licensed **DNO**s in **Great Britain**. For the purposes of this EREC, a **Power Generating Module** is any source of electrical energy, irrespective of the generating technology and **Power Generating Module** type. This EREC applies to all **Power Generating Module**s which are not in the scope of EREC G98, Requirements for the connection of **Fully Type Tested** Micro-generators (up to and including 16 A per phase) in parallel with public **Low Voltage Distribution Network**s on or after 27 April 2019, or which would be in the scope of EREC G98 but are not suitable for type testing ~~are not compatible with EREC G98~~. 2.4 Specific separate requirements apply to **Power Generating Facilities** connected at **LV** comprising **Fully Type Tested, Type A, Power Generating Module**s 16 A/phase or less (micro-generators) and these are covered in EREC G98. All **Power Generating Module**s 16 A/phase or less connecting to the **DNO**'s **Distribution Network** shall be **Fully Type Tested** unless the **DNO** agrees that it is impractical where a **Power Generating Module** is being designed specifically for that location, such as is sometimes appropriate for micro hydro installations, etc.	Complete	Y
19	DER tech forum 07/06/22	MK	G99 20.3.6	For the situation where two existing and separate G59 generation sites A and B, supplied by the same 11kV DNO feeder, are to be connected by a private wire, leading to an increase in export capacity at site A, should the generator on site B (contributing to the increased export from site A) be made G99 compliant?	In cases where an existing G59 **Power Generating Module** is to be connected to another **Customer's Installation** via a private wire, the **Power Generating Module** does not need to be upgraded to meet G99 provided that it retains its long term parallel arrangements at its original site with appropriate interlocking to prevent paralleling of the **DNO Distribution Network**.	Related to mod 13. Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
20	07/12/22	DNO SG mtg	6.2.2 Small gen installation procedures	G100 expectation is that devices connecting under this procedure would be fully type tested, but this could be a requirement in G99	G100 refs to include fully type tested	Need to include the wording " and fully type tested" wherever it says "G100 compliant". Note: note bold, no capital letters. Is this the change that the DNOs want? MK to confirm. SO implemented as below: 6.2.2.3 (6) An EREC G100 ~~compliant and~~ fully type tested export limitation scheme is present that limits the export from the Generator's Installation to the Distribution Network to no more than 16 A per phase. 6.2.2.3 (d) the export limitation scheme shall be Fully Type Tested and registered with the Energy Networks Association Type Test Verification Report Register and the application should include the Manufacturer's reference number (the system reference). ~~In addition to Form A3-2, an EREC G100 export limitation scheme Installation and Commissioning Tests form shall be submitted to the DNO. Confirmation shall be provided in a format as shown in EREC G100 Appendix B.~~	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
21	11/12/22	MK/ Arenko	Compliance	Compliance monitoring details missing Consider including ECC.6.6.3 from GC	ECC.6.6.3 Compliance Monitoring ECC.6.6.3.1 For all on site monitoring by **The Company** of witnessed tests pursuant to the **CP** or **OC5** or **ECP** the **User** shall provide suitable test signals as outlined in either OC5.A.1or **ECP.A.4** (as applicable). ECC.6.6.3.2 The signals which shall be provided by the **User** to **The Company** for onsite monitoring shall be of the following resolution, unless otherwise agreed by **The Company**: (i) 1 Hz for reactive range tests (ii) 10 Hz for frequency control tests (iii) 100 Hz for voltage control tests (iv) 1 kHz for **Grid Forming Plant** signals including fast fault current measurements (v) 100Hz for the other **Grid Forming Plant** tests carried out in accordance with ECC.6.6.1.9	ECC.6.6 is Monitoring, 6.6.1 and 6.6.2 are covered in G99 13.9. But this is Compliance not operational monitoring so I don't think 13.9 is necessarily the right place. 15.4 in G99 would be better. Resolution levels given seem very large – 10 Hz for frequency tests?. SO to implement (ie still pending).	Y
22	30/01/23	NGED Matt Pope	G99 Forms	Clarity about manufacturers ref number / ENA database needed	Make a change as per G98 in Forms A1-1 and A1-2: *the **Manufacturer's** Ref No (this number should be registered on the ENA Type Test Register as the system reference)* in G99 Forms A1-1 and A2-2. *Blue box at front of form:* *If the **Power Generating Module** is **Fully Type Tested** and registered in the ENA Type Test Verification Report Register, this application form should include the **Manufacturer**'s reference number (the Product ID). A full list of the compliant device system reference numbers are available through the Type Test Register portal at ENA Type Test Register (ena-eng.org)*	Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
23	22/02/23 DNO mtg	MK	Revision of definition of Intrinsic Design Capacity and amendment to G99 A2 forms	As text in mod. Note an amendment to the TTR is also needed:	**Intrinsic Design Capacity** The designed maximum **Active Power** capacity of a **Generating Unit** or a **Power Generating Module**. In general this will be identical to the **Registered Capacity**, but can be a higher value where the **Manufacturer** has made specific provision for the maximum **Active Power** output to be limited to a defined value less than the designed maximum **Active Power** capacity. Such a limitation will be semi-permanent and designed in by the **Manufacturer**. It will not be amenable to adjustment by the **Generator**; any such adjustment shall be undertaken by personnel specifically empowered and equipped for that task by the **Manufacturer.** Where a **Manufacturer** offers **a Generating Unit** or **Power Generating Module** with a **Registered Capacity** that is less than the **Generating Unit's** or **Power Generating Module's Intrinsic Design Capacity**, all certification, especially type testing, must be done at the **Registered Capacity** (or fractions of it as required by the various tests). Form A2 mod: **Registered Capacity** - Where the Registered Capacity is lower than the Intrinsic Design Capacity, all results of tests must be based on the Registered Capacity, and not on the Intrinsic Design Capacity.	Complete	Y

Note in the guidance document – and on the portal:

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
24	29/03/23	IN/ DER technical forum #111	G99 A.6	Do new connexion arrangements to an existing generation site trigger retrospective compliance of the existing generation on the site with G99? For the example described, where the site is in the same ownership, and the power generating module is unchanged, there is no reason to consider retrospective applicability of G99. This case does not trigger any of the three key criteria for retrospective compliance; namely it does not meet the legal need of the RfG (ie it is not a Type C or D installation), it does not meet the long standing GB driver of significant investment in the power generating module and the electrical characteristics of the power generating module are unchanged.	Add this example to Appendix A.6	Complete	Y
25	31/05/23	DNO SG	G98	Generation sharing devices (e.g.Solshare) have been installed in several networks and G98 and G99 require updating to reflect this	Insert a new section 2.5 and renumber the rest of section 2 and check subsequent para references 2.5 This document does not apply in any case where a **Micro-generating Plant** is supplying two or more independent **Customers** via a sharing agreement. All such installations should be applied for under the requirements of EREC G99.	Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
26	31/05/23	DNO SG	G99	Generation sharing devices (e.g.Solshare) have been installed in several networks and G98 and G99 require updating to reflect this	Proposed amendments to G99 – new 7.8, new A.8 and "new" forms A1-3 and A3-4 – cloned from existing forms 7.8 **Power Generating Module Sharing Systems** 7.8.1 This section describes the requirements where a **Generator** supplies generated electricity to two or more independent **Customers** via a sharing arrangement. 7.8.2 In the design of these arrangements the output from the **Power Generating Module**(s) will be directly connected to each separate **Customers' Installation** and arranged such that output is shared between them. 7.8.3 The owner of the **Power Generating Module** is, for the purposes of EREC G99, the **Generator**. The **Generator** need not have a direct electrical connection to the **DNO's Distribution Network**. In some cases the connection will only be via the relevant **Customers' Installations**. In all case the **Generator** shall have a suitable contract with the **DNO** for the installation and operation of the **Power Generating Module**. 7.8.4 All **Customers** served by a **Power Generating Module** sharing system must be connected to the same **DNO's Distribution Network** and also have the same earthing arrangements (ie all be PME or all be SNE for example). 7.8.5 The **Power Generating Module** sharing system shall be monitored for correct operation etc, in accordance with the requirements of 10.3.8.	Complete Updated this text as per email dated 10/11/2023.	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes
26 cont					7.8.6 Any instance where **Power Generating Module** output sharing is intended shall address the following requirements: 7.8.6.1 The **Generator** is responsible for ensuring compliance with all the relevant requirements of EREC G99. 7.8.6.2 The equipment/installation shall be designed such that all protection in each **Customers' Installation** and the **Generator's Installation** will operate correctly by design for faults anywhere on the **Generator's Installation** and **Customers' Installation**. Such protection shall also comply with the requirements of BS 7671. 7.8.6.3 The equipment/installation shall be designed such that no **Active Power** can flow from any **Customer's Installation** towards the **Power Generating Module**. 7.8.6.4 Synchronizing facilities/checks shall exist that check for correct phasing each and every time a **Customer's Installation** is connected to and/or energized from the **Generator's Installation**. 7.8.6.5 If reverse **Active Power** flow, or out of phase conditions, as described in 7.8.6.3 and 7.8.6.4, are detected an alarm shall be raised and communicated to the **Generator**. 7.8.6.6 In addition to the requirements of paragraph 14.3 ownership and operational boundaries, and means of isolation, must be clear for every **Customer**, the **Generator** and for any operator of the network in a shared building. Appropriate labels shall be affixed at each **Customer's** service position. A single line diagram of the overall installations shall be posted in the **Generator's Installation** and shall be made available to every **Customer**. 7.8.6.7 Earthing arrangements must be in accordance with BS 7671. 7.8.6.8 The **Power Generating Module** sharing system shall be capable of being switched off by the **Generator** and disconnected from all **Customers' Installations**.	Complete Updated this text as per email dated 10/11/2023.

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes
26 cont					**A.8 Requirements for Testing of Power Generation Module Sharing Systems** This annex describes the general requirements for the tests necessary to be undertaken on **Power Generating Module** sharing devices, whether performed by the **Manufacturer** or by the **Installer** on site. These tests relate only to the **Power Generating Module** sharing device; the **Power Generating Module** shall be subject to the relevant commissioning and other tests as described elsewhere in this EREC G99. A.8.1 Tests shall be undertaken to demonstrate that when the sharing device is energised by the **Power Generating Module** a fault and the combination of any two faults on the sharing device or on the **Customers' Installations** fed from it, are correctly identified and disconnected, whether by fuses or circuit breakers, or combination thereof. A.8.2 Tests shall be undertaken to detect any reverse power flow on any of the connections from the sharing device to the **Customers' Installations**. The test shall be passed if the flow is interrupted and the appropriate alarm initiated. A.8.3 When the sharing device is energised by the **Power Generating Module**, and some or all of the **Customers**' circuits are not being supplied with **Active Power**, it shall be proved that the sharing device detects whether there is an out-of-phase condition present (ie phase shift of more than [90º]) and that it is not possible to then attempt to share **Active Power** to that **Customer** and that the appropriate alarm is initiated.	Complete Updated this text as per email dated 10/11/2023.

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification
26 cont					

Form A1-3 : Application for connection of Power Generating Module(s) with Total Aggregate Capacity <50 kW 3-phase or 17 kW single-phase where the output is shared with two or more customers

For **Power Generating Modules** with an aggregate capacity <50 kW 3-phase or 17 kW single-phase supplying multiple Customers this simplified application form can be used. For **Power Generating Modules** with an aggregate capacity >50 kW 3-phase, the connection application should be made using the Standard Application Form (generally available from the **DNO** website).

If the **Power Generating Module** is **Fully Type Tested** and registered in the ENA Type Test Verification Report Register, this application form should include the **Manufacturer**'s reference number (the Product ID).

If part of the **Power Generating Module** is **Type Tested** and registered with the ENA Type Test Verification Report Register, this application form should include the **Manufacturer**'s reference number (the Product ID) and Form A2-1 or A2-2 or A2-3 (as appropriate) should be submitted to the **DNO** with this form.

If the **Power Generating Module** is neither **Fully Type Tested** or **Type Tested** then and Form A2-1 or A2-2 or A2-3 should be submitted to the **DNO** with this form. Alternatively the Standard Application Form should be submitted instead of this form.

For the purposes of this form the **Generator** is the party owning the **Power Generating Module**(s). The **Generator** may or may not have a direct connection to the **DNO's Distribution** System at the installation address.

Form A3-4 : Installation Document for Type A Power Generating Modules where the output is shared between two or more customers

The **Generator** (ie the owner of the **Power Generating Module(s)**) must complete and provide this document for every **Power Generating Facility** were the output of one or more **Power Generating Modules** is shared between separate **Customers**.

Part 1 shall be completed for the **Power Generating Facility**.

Part 2 shall be completed for each of the **Power Generating Modules** being commissioned. Where the installation is phased the form should be completed on a per **Generating Unit** basis as each part of the installation is completed in accordance with EREC G99 paragraph 15.3.3. For phased installations reference to **PGM** in this form should be read as reference to **Generating Units**.

Part 3 shall be completed, giving the address and MPAN of each **Customer** who has a connection to the **Generator's Installation**.

Form A3-4 Part 1

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
27	31/01/23 (email MK / CMC/ AP/ AJ)	An Phan PSE2consulting / MK	G99 figure 13.5	Clarify that figure 13.5 is a minimum response, and not a maximum. The diagram is a lift from the EU Network Code – but (a) we could redraw it and (b) tweak the text in Chapter 13 to clarify. However a drawback of making such a modification is a divergence with the Grid Code drafting	13.2.6.4 is clear that the requirements are minimum, however could add minimum in Table 13.1: Minimum **Active Power** as a percentage of **Registered Capacity** ($\frac{\lvert\Delta P_1\rvert}{P_{max}}$)	Complete	Y
28	July 23	SS / MK email discussion	G99 figure C.5.2 and C.5.3	Confusion in Grid Code between CC and ECC Figure A.7.2.2b. The equivalent graph in the RfG has Q/Pmax, the CC has Q and the ECC has power factor.	G99 figure C.5.2 and C.5.3 Remove “Power factor” from x-axis (abscissa) and change 1 to 0 where x and axis cross	Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
29	26/09/23	SS/MK email and # 100 from DER tech forum	G99 C.7.5.2	SS: In G99 section C7.5.2 i) the requirement is for a bolted, symmetrical 3-phase fault with of duration 140ms, and with a retained voltage of 10% for inverters or synchronous machines and 0% in other cases. However, in bullet ii) it lists the various unbalanced fault types and talks about retained voltages. With unbalanced faults, the voltage will not always drop to 0 (particularly with Ph-Ph faults), and there is also an issue about what you are measuring i.e. phase voltages or positive sequence voltage. In particular Ph-Ph faults will never drop to less than 0.5pu – so this means trying to define a retained voltage for this is a bit nonsensical. For the other cases you can sort of cover it if you just think about phase voltages. MK: This requirement is a parallel requirement to one of long standing in the Grid Code. We have discussed the issue with NGESO and have agreed that the wording in both the Grid Code and in G99 is slightly deficient in suggesting that phase to earth voltages will be zero for phase-phase faults when this will not be the case. NGESO have confirmed their expectation that provided a successful simulation of a zero impedance phase-phase fault is undertaken, the phase to earth voltage in this case is irrelevant. Note 13.3.1.2 states The voltage against time curves defined in Table 13.3 to Table 13.6 expresses the lower limit (expressed as the ratio of its actual value and its reference 1 pu) of the actual course of the phase to phase voltages (or phase to earth voltage in the case of asymmetrical/unbalanced faults) on the network voltage level at Connection Point during a symmetrical or asymmetrical/unbalanced fault, as a function of time before, during and after the fault.	Words from 13.3.1.2 to use used in C.7.~~5~~7.2 Heading in table: Retained voltage expressed as the ratio of its actual value and its reference 1 pu of the actual course of the phase to phase voltages or phase to earth voltage in the case of asymmetrical/unbalanced faults	For review by MK – to await resolution of GC0155 Could change qualifier to expressed as the ratio of its actual value and its reference 1 pu of the phase to phase voltages for faults not involving earth or phase to earth voltages for faults involving earth If change this in annex consider also changing in 13.3.1.2	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification		Drafting notes	Housekeeping (Y/N)
30	23/10/23	MK	G99 18.3	DER TF issue 129 Our issue is specifically regarding Type C PPMs. We have a number of Type C (solar) sites across different DNOs. Looking at G99 section 18.2 there is no EON or ION in the connection process for Type C PPMs, and to achieve FON we need to complete tests that require at least 65% (full voltage control) or 85% (reactive power and frequency response tests) of the maximum export capacity to be generated. For solar sites that energise over the winter months, it is unlikely that they would have such irradiation needed to achieve the required export to complete those tests until spring/summer the following year. For Type D PPMs there is the ION to cover this type of situation and allow export during this period until testing can be completed and FON achieved	17.3 … 17.3.6 17.3.7 18.3 … 18.3.6 18.3.7	Witnessing and Commissioning To aid completing the necessary tests, and to allow the interim export of energy for the Generator's commercial purposes, at the discretion of the DNO, the DNO and the Generator may agree an interim operating regime, including issuing an Interim Operational Notification, pending completion of all the necessary tests and data submission. In such cases the provisions of Section 17.4 shall be respected and Section 19.3 shall be used as a guide to the formality required. If compliance tests or simulations cannot be carried out as agreed between the **DNO** and the **Generator** due to reasons attributable to the **DNO**, then the **DNO** shall not unreasonably withhold **the Final Operational Notification** to be issued under Section 17.4. Witnessing and Commissioning To aid completing the necessary tests, and to allow the interim export of energy for the Generator's commercial purposes, at the discretion of the DNO, the DNO and the Generator may agree an interim operating regime, including issuing an Interim Operational Notification, pending completion of all the necessary tests and data submission. In such cases the provisions of Section 18.4 shall be respected and Section 19.3 shall be used as a guide to the formality required. If compliance tests or simulations cannot be carried out as agreed between the **DNO** and the **Generator** due to reasons attributable to the **DNO**, then the **DNO** shall not unreasonably withhold **the Final Operational Notification** to be issued under Section 18.4.	Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
31	12/10/23	MK	G99	Suggested G99 amendments for BEGAs – assuming the DNO provides the documentation to NGESO	5.19 Generators wishing to trade ancillary services for ~~National Grid~~ the NETSO's purposes will need appropriate contracts in place with ~~National Grid~~the NETSO in its role as Great Britain System Operator. 6.1.6 Interaction with the NETSO 6.1.6.1 It should be noted that if the Registered Capacity of all Power Generating Module (synchronous together with asynchronous) on one or more sites in common ownership is >50 MW, then the Generator becomes licensable. 6.1.6.2 Generators with an agreement with the NETSO may be required to comply with applicable requirements of the Grid Code. Where Grid Code requirements apply, it is the Generator's responsibility to comply with the relevant parts of both the Distribution Code and Grid Code.	Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
31 cont.	12/10/23	MK	G99	Suggested G99 amendments for BEGAs – assuming the Generator provides the documentation to NGESO	6.1.6.3 In the case where the Generator has a Bilateral Embedded Generation Agreement (BEGA) with the NETSO, the Generator shall demonstrate compliance with EREC G99 to the DNO, and any additional Grid Code compliance requirements shall be demonstrated by the Generator to the NETSO. In these cases the Generator will make the Generator's interim and final PGMD, and/or the Generator's FON, available to the NETSO on request. The NETSO may seek confirmation from the DNO of the compliance status of the Generators PGMD. ~~*[Alternative 6.1.6.3:*~~ ~~*6.1.6.3 In the case where the Generator has a Bilateral Embedded Generation Agreement (BEGA) with the NETSO, the Generator shall demonstrate compliance with EREC G99 to the DNO, and any additional Grid Code compliance requirements shall be demonstrated by the Generator to the NETSO. In these cases the DNO will make the Generator's interim and final PGMD, and the Generator's FON, available to the NETSO.]*~~ 6.1.6.4 In the case of an embedded large power station, the NETSO will be responsible for confirming the Generator's compliance with all Grid Code requirements. In general this will mean that the requirements of Sections 12-13 and 17-19 will be superseded by the equivalent requirements in the Grid Code. The DNO will remain responsible for ensuring the Generator's compliance with the remaining parts of this EREC G99.	Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
31 cont.	12/10/23	MK	G99	Suggested G99 amendments for BEGAs – assuming the DNO provides the documentation to NGESO	17.1 General 17.1.1 Where the Generator has entered into a Bilateral Embedded Generation Agreement with the NETSO, please refer to the guidance in Section 6.1.6. 18.1 General 18.1.1 Where the Power Generating Facility constitutes a large power station, or where the Generator has entered into a Bilateral Embedded Generation Agreement with the NETSO, please refer to the guidance in Section 6.1.6. 19.1.2 Where the Power Generating Facility constitutes a large power station, or where the Generator has entered into a Bilateral Embedded Generation Agreement with the NETSO, please refer to the guidance in Section 6.1.6.	Complete	Y

G98/G99 list of outstanding modifications - significant

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes	Housekeeping (Y/N)
31	12/10/23	MK	G99 A.6 additional example 13a	It has been suggested that more clarity could be given for the case where one inverter from many forming a pre-G99 PPM is replaced. The existing closest scenario is 13 but this refers to a SPGM.	13a | Existing PPM EREC G59 solar installation –the Generator replaces one inverter with one of the same vintage similar electrical characteristics (eg a reclaimed or spare unit manufactured before April 2019). | Provided the replacement inverter is electrically similar, the PGM does not need to be upgraded to be compliant with EREC G99. | No | This is a maintenance issue – there is no change to generation characteristics etc.	Complete	Y
32	08/12/23	AH	G99 7.5.3	NGED install 3 phase cut-outs/cables at all new housing developments although it is up to the house builder whether they wire out all 3 phases or not. If we were to follow the existing requirements to the letter this would effectively prevent three phase domestic properties installing single phase Generating Units rated above 16A, including battery storage. This doesn't make sense to me, particularly as we allow up to 17kW (73.91A) of generation connected to single phase properties. In practice NGED do not rigidly enforce the 16A requirement but it would be much better if the words reflected what we actually do. Please could you (or Chris) arrange for this to be included within the next housekeeping modification	AH suggested that the unbalanced limit should be increased to 32A per phase. To be confirmed at ENA EU NC SG meeting on 11/01/24. Where single phase Power Generating Modules are being used the Generator should design the installation on a maximum unbalance output of 32 A between the highest and lowest phase. Where there are a mixture of different technologies, or technologies which may be operational at different times (eg wind and solar) Power Generating Modules shall be connected to give a total imbalance of less than 16 A based on assumed worst case conditions, those being:	To be discussed at 11/01/24 SG meeting.	Y

G98/G99 list of outstanding modifications– minor editorial

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes
1	14/10/21	SC	C.6.3	Mod ref to G5/4 in C.6.3 to just G5		Complete
2	14/10/21	SC	G99 21.4	21.4 …..The DNO will consider the suitability of Manufacturers' Information in place of DDRC data submissions such as a mathematical model suitable for representation of the entire Power Park Module as per Annex B.4.4 or Annex C.7.4.5 as applicable. Site specific parameters will still need to be submitted by the Generator. References to Annexes need correcting	21.4 …..The DNO will consider the suitability of Manufacturers' Information in place of DDRC data submissions such as a mathematical model suitable for representation of the entire Power Park Module as per Annex B.4.4.5, Annex C.7.4.5, or Annex C.7.5.5 as applicable. Site specific parameters will still need to be submitted by the Generator.	Complete
3	3/11/21	MK	G99 figures 12.7	Graphs detached from captions	Formatting	Complete
4	24/11/21	AC	G98 Form B G99: Form A3-1 Form A3-2 Form B2-1 Form B3 Form C2-1 Form C3	Use of technology type	G98 Form B Use a separate line for new and existing installations and for each micro-generator . G99 Modify forms in line with Form A-1-2 Energy source and energy conversion technology (enter codes from tables 1 and 2 see Form A1-2)	Complete

G98/G99 list of outstanding modifications– minor editorial

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes
5	1/02/22	VH	G99 Annex A.6	This table is applicable to all Generator Types, not just type A	Could move to Annex D, or ensure it is clear that this table is also applicable to Types B, C &D	Added a note to clarify that this table applies to all types of PGMs.
6	29/03/22	MK	G99 A.7.2.1	Storage words should be removed in line with removal of storage exclusions	Remove: A.7.2.1 This Annex also applies to any **Synchronous Power Generating Module**s that are powered by stored energy (eg compressed air), but the requirement to demonstrate the **LFSM-O** will not be required.	Complete
7	04/05/22	AC	G99 11.1.1, 12.1.1 and 13.1.1	G99 A.4.3 states that for 'infrequent short-term parallel operation' for a Type X PGMD, then none of Section Y applies. E.g G99 13.1.1 (a) states that the 'requirements of this Section 13 do not apply in full', implying that some parts of section 13 apply, which doesn't align with the statement in A.4.3.	Check which way to go- exclude everything in S 11,12 13 or use storage derogations.…	Superseded by islanding mods.
8	23/06/22	SC	G98 A .1.3.2	Reference to "full load" should be Registered Capacity	The test set up shall be such that the **Inverter** supplies ~~full load~~ **Registered Capacity** to the **DNO**'s **Distribution Network** via the power factor (pf) meter	Complete

G98/G99 list of outstanding modifications– minor editorial

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes
9	28/06/22	LF	G99 A2-3	Does not have Output power on falling frequency tests	See Forms A2-1 or Form C in G98. Check Annex Ensure alignment with storage operating mode switch Replicate A.7.2.3.1 (using ref to Figure A.7.7 etc) in Annex A.1 after A.7.1.2.6, easiest for the numbering if it is A.7.1.2.7 if not altogether logical.	Not required
10	30/06/22	Emanuelle Lelli Aton Storage	G99	E-mail from 30/6/22 Muddle in G98/G99 re source impedance	Modify note : • Applies to three phase **Micro-generators** and two phase **Micro-generators** in split phase system Similar for G99 A2-1 and A2-3 * Applies to three phase **Power Generating Module**s and two phase **Power Generating Module**s in split phase system.	Complete
11	09/08/22	SC	G99 A.7.2.6.1	Ref to export capacity should be RC	The tests should be carried out as specified in BS EN 61000-3-12 and can be undertaken with a fixed source of energy at two power levels firstly between 45 and 55% and at 100% of maximum export capacity. Note that if the suggested output level is below the **Power Generating Module**'s **Minimum Stable Operating Level** the test should be carried out at 100%, and at least one stable output level below 100%, of **Registered Capacity**. It is recommended that an output level is chosen that is 5% of the difference between the **Registered Capacity** and the **Minimum Stable Operating Level** above the **Minimum Stable Operating Level**:	Change implemented was: The tests should be carried out as specified in BS EN 61000-3-12 and can be undertaken with a fixed source of energy at two power levels firstly between 45 and 55% and at 100% of ~~maximum export capacity~~ **Registered Capacity**.
12	31/8/22	Eckhard Schwendemann	G99 A.7.2.5.1	In correct reference to paragraphs wrt A.7.1.3 and A.7.2.5.1.	A7.1.3 The frequency at each step should be maintained for at least one minute as illustrated in figure A.7.3 and the **Active Power** reduction in the form of a gradient determined and assessed for compliance with paragraph 11.2.4. A.7.2.5.1 This paragraph is applicable to all **Synchronous Power Generating Module**s other than slow acting micro hydro **Synchronous Power Generating Module**s which should refer to paragraph A.7.2.5.2.	Complete

G98/G99 list of outstanding modifications– minor editorial

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes
13	20/09/22	MK	G99 4	V2G definition should consider export onto the Customer's Installation not just the DNO network.	**Vehicle to Grid Electric Vehicle** An electric vehicle and any associated internal or external charging devices that can import electricity from and export electricity to the ~~**Distribution Network**~~ **Customer's Installation**.	Complete
14	26/10/22	MK	G98/G99	Consider use of "for the avoidance of doubt" in the documents	Review where this has been used and determine if this is appropriate. Only to be used where there is possible confusion.	Done (MK)
15	11/12/22	MK/Arenko	G99 C.9.6	Reference to para 13.2.3.3 should be 13.2.3.2	13.2.3.2	Complete
16	21/06/23	SC	G99 Figure 13.6	Reference to figure 12.5 needs amending ~~should be to "figure 13.7 – 13.10 as applicable"~~	12.3.1.1 Each **Synchronous Power Generating Module** and **Power Park Module** is required to remain connected and stable for any balanced and unbalanced fault where the voltage at the **Connection Point** remains on or above the heavy black line shown in Figures 12.4 and 12.5 below.	Complete
17	22/06/23	SC	G99 C.9.5.2	C.9.5.2 Ref to C.9.5.6 should be to C.9.5.4		Complete

G98/G99 list of outstanding modifications– minor editorial

#	Date raised	Raised by	G98/G99 reference	Discussion	Specific modification	Drafting notes
18	22/06/23	SC	G99 C.9.3.2	Ref to C.10.4.5 should be to C.9.3.3		Complete
19	27/06/23	SC	G99 Para 2.14	Sub para numbering needs correcting		Complete
20	26/09/23	SC	G99 Para A.7.1.3	Ref to Alternative approach in A.7.2.4, should be A.7.2.5	The alternative approach is covered in A.7.2.5.	Complete

D Code modifications – for note / ENA

#	Date raised	Raised by	D Code	Discussion	Specific modification
1	25/01/22	MK/CMC	DDRC	SAF Amendments for BESS should be added to DDRC	
2	14/04/22	AH/MK	G100 and DPC6.7.8 – Access to DNOs' Current and Voltage Signals		
3	06/06/23	AC	DPC5.1.2 DPC5.1.3 DPC5.2	changes to clarify the information that the DNO needs from a LV connected user to design the distribution system. Including this information in the D Code will: 1.Clarify the DNOs requirements for Users 2.Provide a contractual basis for DNOs requesting that users provide relevant information 3.Provide a contractual basis for the ENA Digitisation of connection application process 4.Provide a contractual basis for the DESNZ AAR project 5.Demonstrate Ofgem's support for DNOs requiring the information	DPC5.1.2 Data exchange requirements specified in this **Distribution Planning and Connection Code** apply to any **User Development**, which has or could reasonably be expected to have an impact on the **DNO's Distribution System.** DPC5.1.3 DPC5.2 specifies the information required from **Users** by the **DNO** in order to ensure that adequate technical provision is made for new supplies or increases in existing load; DPC5.2 also applies to **Embedded Generators** (including Users who operate energy storage devices) who operate in parallel with the **DNO's Distribution System**, where a supply is required from the **DNO** under normal or emergency conditions. Information required from **Embedded Generators**, with connections at **HV** or **Low Voltage**, in respect of the import of energy to the **DNO's Distribution System**, is covered in DPC7 for generation connected before 27 April 2019 and in EREC G99 for generation connected on or after 27 April 2019. Transfer of Planning Data for **Users** connected at **HV** is set out in DPC 8. DPC5.2.1 For supplies at **Low Voltage** under terms in the **Supply Agreement** it is possible in most cases to assess whether a proposed connection is acceptable, and to determine the necessary supply arrangements, from analysis of the following limited data:- (a)Maximum power requirements (kVA or kW) of the installation; (b)Type and electrical loading of **Equipment** to be connected where the loading could be significant in that **Customer's** installation, eg number and size of dedicated electric vehicle charge points, heat pumps, any appliance rated at more than 7kW, including motors, cookers, showers, other space and water electrical heating equipment, and including details of any equipment which is subject to switching in accordance with a contract with a **Supplier** or any other party; and **Users**, shall contact the **DNO** in advance if it is proposed to make any significant change to the connection, electric lines or electrical **Equipment**, install or operate any demand or generating equipment or do anything else that could affect the **DNO's Distribution System** or require alterations to the connection. In this case **Users** shall provide the **DNO** with information specified in DPC5.2.1 (a), (b), and (c) above and any information the DNO asks for about the nature, or use by the **User**, of electrical equipment on the **User's** premises ~~(including that~~

D Code modifications

#	Date raised	Raised by	D Code	Discussion	Specific modification
4	30/06/23	MK/RW	DPC7.1.4	Should also include ref to Other Authorised Distributors as clause 7.1.2	**Power Generating Module**s commissioned on or after 27 April 2019, or which have been substantially modified after that date, must meet the requirements of Engineering Recommendation G98 or Engineering Recommendation G99 as applicable. Such **Power Generating Module**s do not need to comply with the requirements of the rest of DPC7. Other **Authorised Distributors** having **Power Generating Modules** operating or capable of operating in parallel with the **DNO's Distribution System** on or after 27 April 2019, must meet the requirements of Engineering Recommendation G98 or Engineering Recommendation G99 as applicable
5	26/09/23	SC/MK		Review use of SPD and DPD in DCode in light of SAF Part 4 changes.	
6	27/11/23	MK	Note 1 to schedule 5b	Error in note 1 to schedule 5b	*For all new connection applications submitted on or after 1 September 2021 the energy source should be selected from Table 1 and the energy conversion technology should be selected from Table 2. For example a solar PV power generating module would have an energy source A and an energy conversion technology of 11):* The highlighted A should be R.

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