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EREC G98 & G99 update workshop

27th January 2021

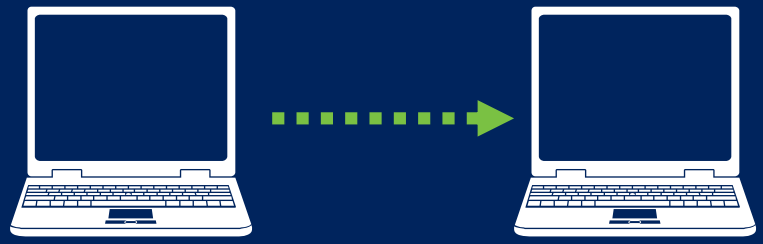
Stay connected...

www.enwl.co.uk

Webinar format

40 minutes presentation

20 minutes
questions & answers



Please raise your hand or
submit written questions
online during the webinar

Meet the Team

Ami Mathieson

Incentive on Connections Engagement Manager

Victoria Brown

Grid & Primary Programme Manager

Hannah Sharratt

Stakeholder engagement & regulatory manager

Gill Williamson

Strategic Planning Manager

Steffan Jones

Infrastructure Solutions Manager

Brian Hoy

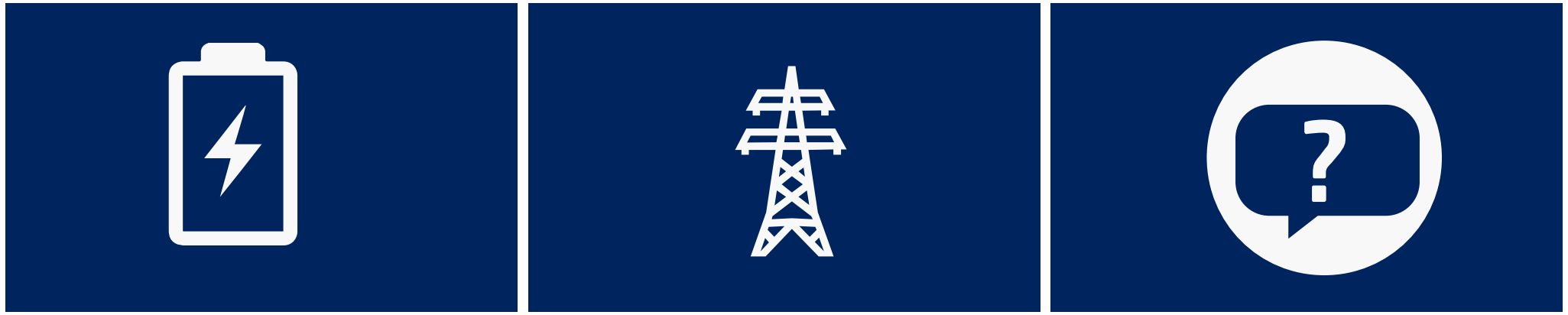
Head of Market Regulation

Agenda

Reminders, hints and tips

Power quality compliance

Type C & D pointers



Storage update

Industry update

Questions & Answers

Useful reminders, hints and tips

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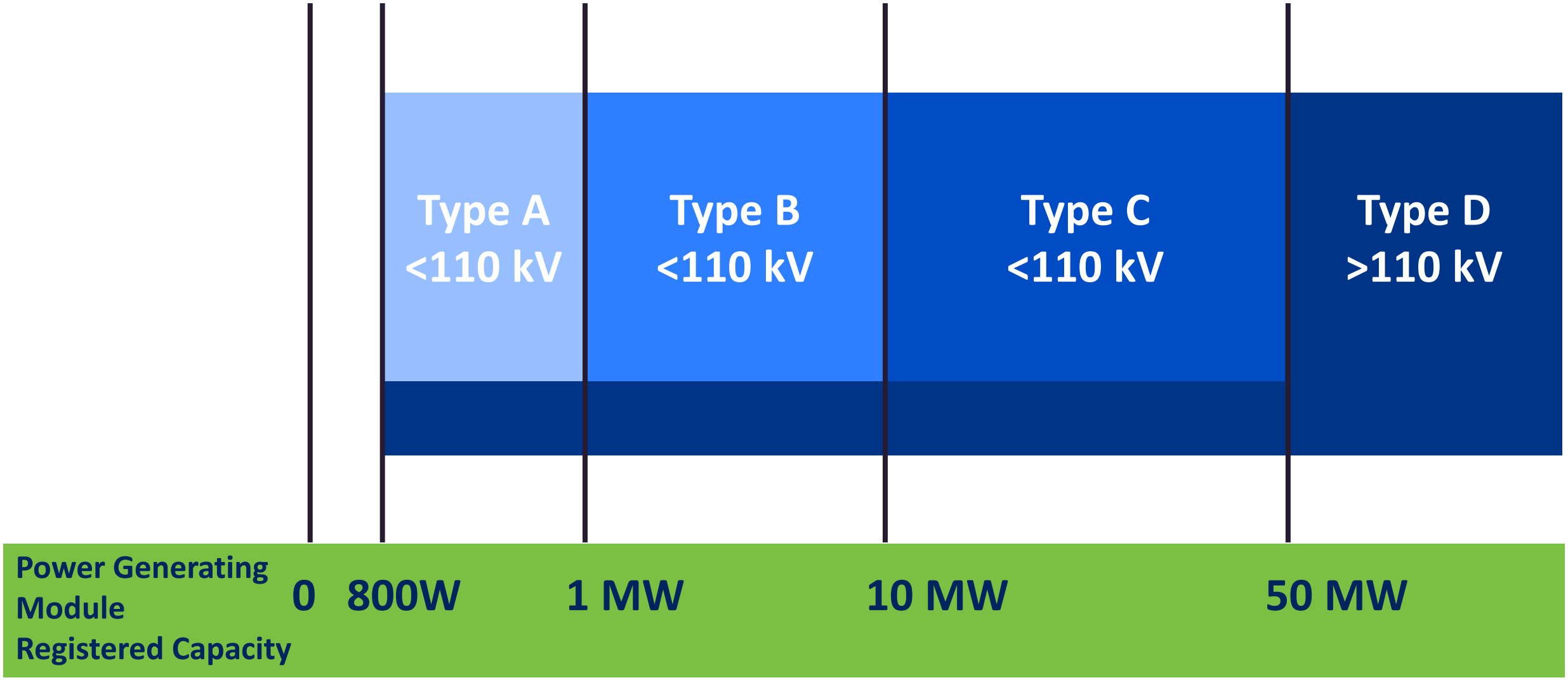
EREC G98 & G99 - G99 Types (GB)

- Types affect technical requirements and which forms you use



EREC G98 & G99 – Introduction and forms

https://www.enwl.co.uk/get-connected/apply-for-a-new-connection/generation-and-storage/g99/

Summary of G98 and G99 Forms

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro-generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- **Form C**	If fully type tested but not registered with the ENA- **Form C**	If not type tested – **Form A2-1** synchronous <50kW, **Form A2-2** synchronous >50kW or **Form A2-3** inverter connected gen	If not type tested – **Form A2-1** synchronous <50kW, **Form A2-2** synchronous >50kW or **Form A2-3** inverter connected gen	If not type tested- **Form A2-2** synchronous **Form A2-3** inverter connected gen	**PGMD**** **Form B2-1**	**PGMD**** **Form C2-1**	
Site Compliance and Commissioning Checks					**Form A2-4** if the Interface Protection is not Type Tested or for other site compliance tests	**Form B2-2** if the Interface Protection is not Type Tested or for other site compliance tests	**Form C2-2** if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						**Form B3**	**Form C3**	

*Standard Application Form

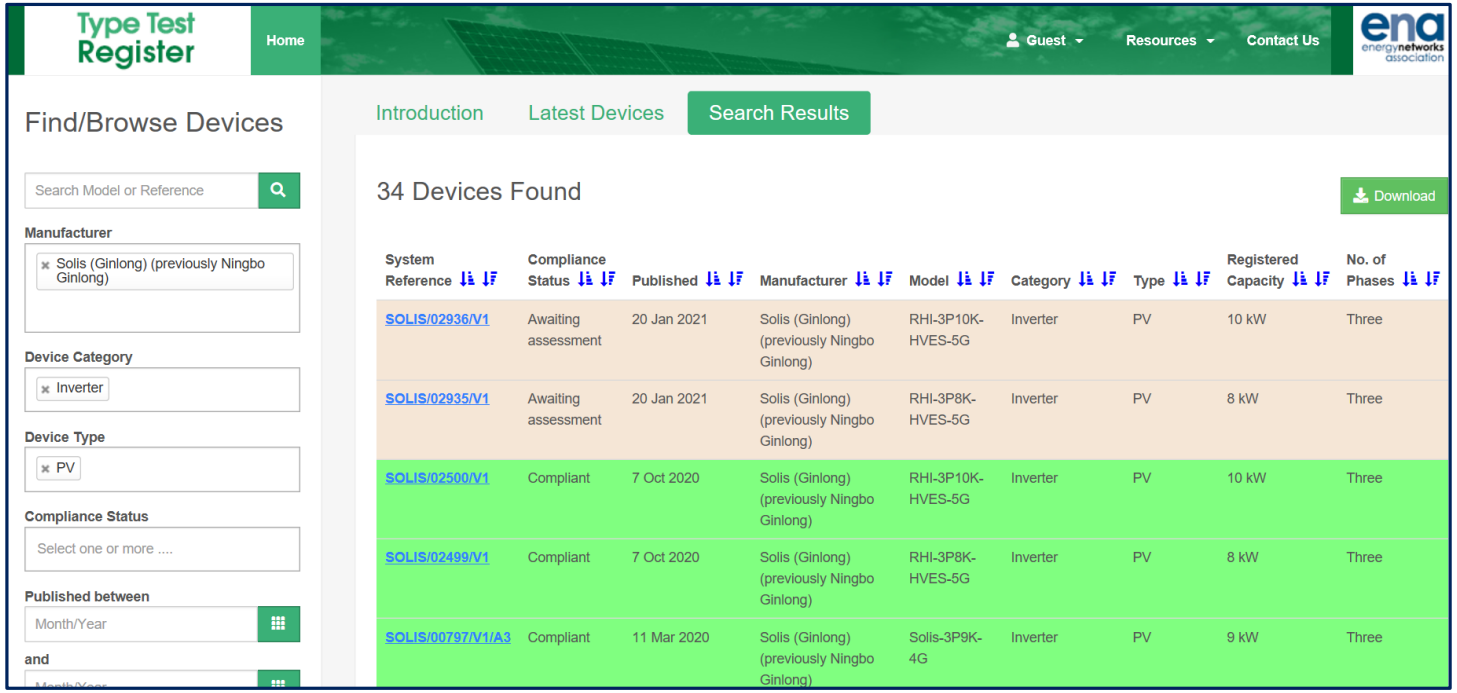
**Power Generating Module Document

EREC G98 & G99 - ENA type test register

ENA Type Test Register is available @ https://www.ena-eng.org/gen-ttr/

ENA now review manufacturers' data

- Approx. 1500 devices
- Colour coded
  - **Compliant**
  - **Awaiting assessment**
  - **Further information required**



- Good engagement with manufacturers, including large players such as Tesla
- Automated monthly reminders sent to manufacturers chasing outstanding information

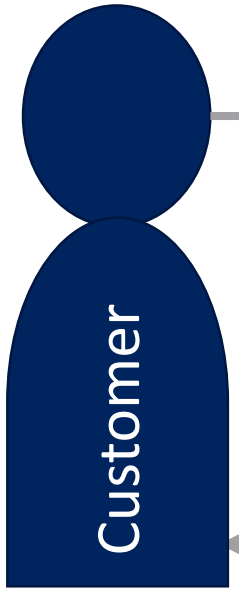
EREC G98 & G99 – Generator connection process

Generator

Initial synchronisation allowed after satisfactory review of initial submission

Temporary (up to 6 months) access to distribution network whilst finalising compliance

Permanent access to distribution network



Customer

PGMD Iterations

Final PGMD

FON

ENWL compliance checks

Connection agreement

Connection agreement inc. FON

EREC G98 & G99 – Generator connection process

Generator

Initial synchronisation allowed after satisfactory review of initial submission

Temporary (up to 6 months) access to distribution network whilst finalising compliance

Permanent access to distribution network

Customer

PGMD Iterations

Final PGMD

FON

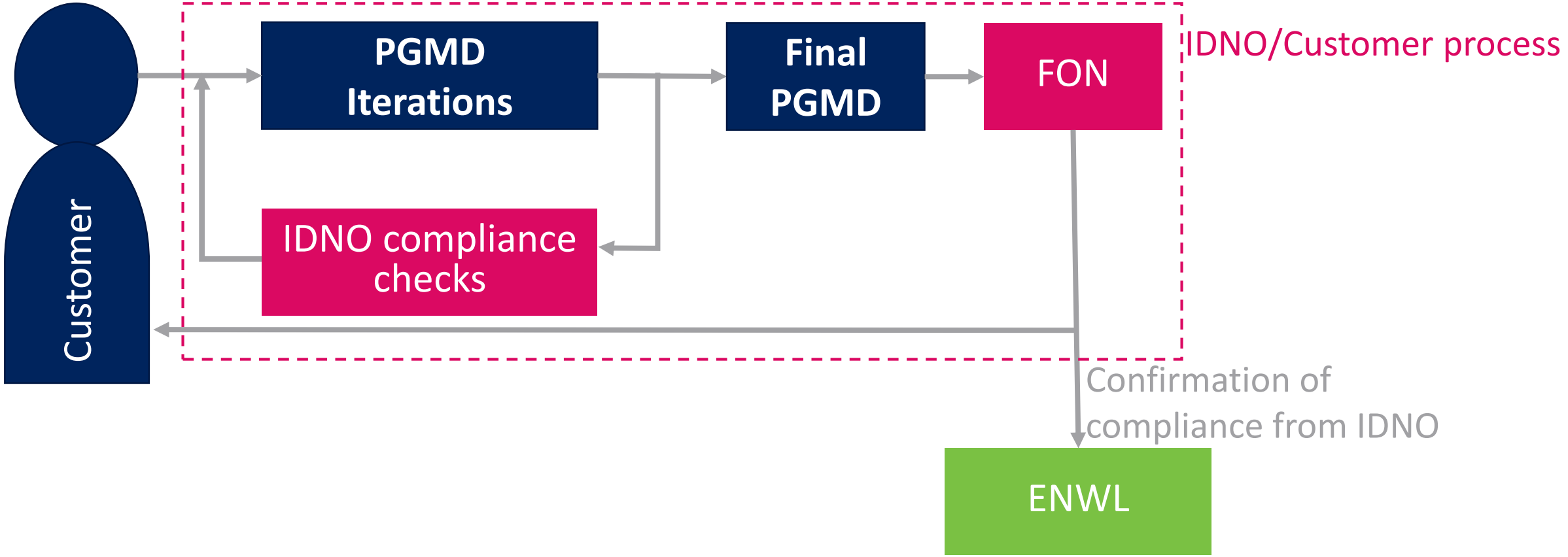
ENWL compliance checks

We recommend Generators start early to avoid delays to synchronisation

Connection agreement

Connection agreement inc. FON

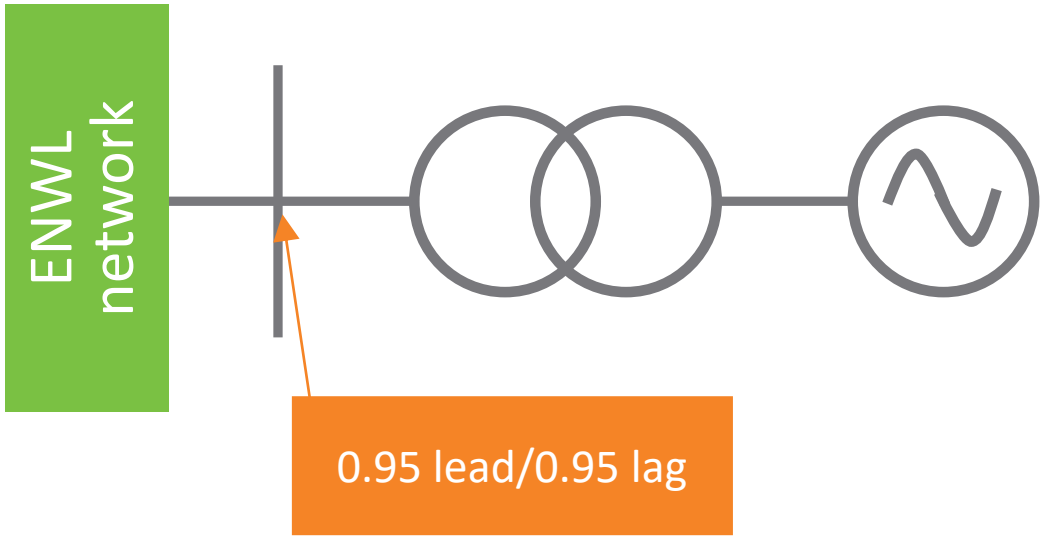
EREC G98 & G99 - IDNO connections



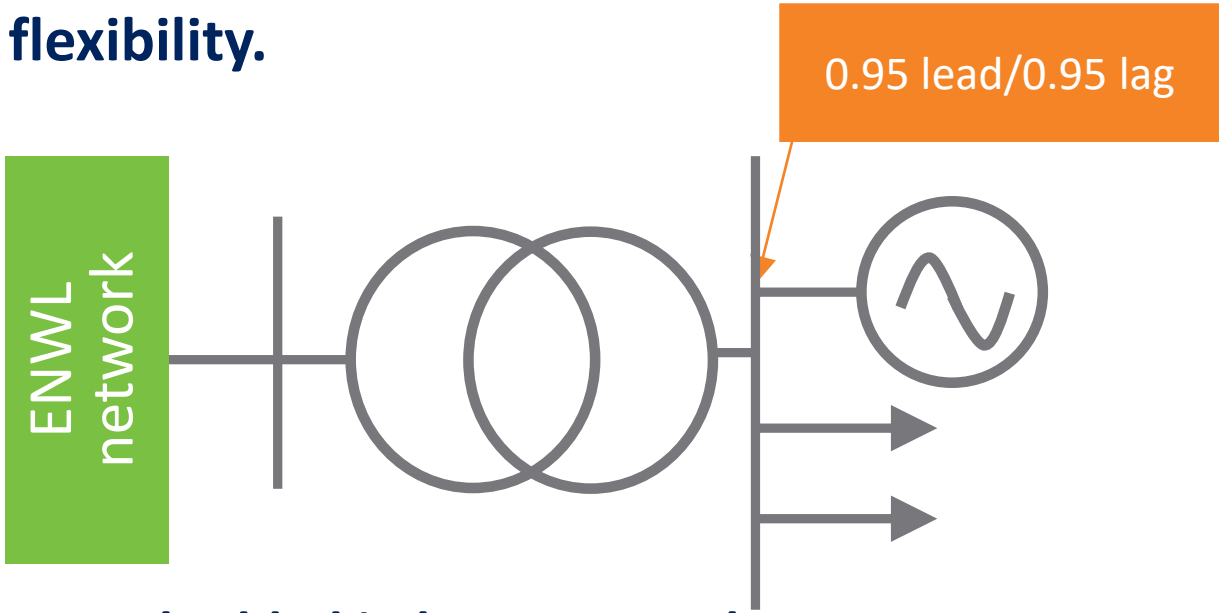
- The generator must still comply with EREC G99 when connecting to an IDNO network
- IDNO undertakes detailed checks on the compliance of generators connecting to an IDNO network
- ENWL don’t do detailed checks but seek/receive conformation of complete compliance

EREC G98 & G99 - Reactive power compliance

EREC G99 requires that generators comply with reactive power capabilities of 0.95 lead/0.95 lag at the point of connection, but there is some flexibility.



- **Dedicated network**
- A load flow study showing ±0.95 power factor at the point of connection is required
- A capability curve is not proof of compliance



- **Embedded in large network**
- It is possible to show compliance of 0.95 lead/0.95 lag at the generator terminals
- It is not necessary for the generator to compensate for reactive losses in a large transformer between the generator and the point of connection.

EREC G98 & G99 -
Site specific versus generic (Type B)

Site specific simulations

- Flicker
- Harmonics
- Reactive power (inc gen tx)
- Limited Frequency Sensitive – over frequency
- Fault ride through

Down to Generator
Manufacturers help with data

Generic tests acceptable

- Frequency ranges
- Frequency response tests (step and ramp)
- Output with falling frequency

Manufacturers information

Site specific tests

- B2-2 form tests
- B3 form tests
- Reconnection

Down to Generator

EREC G98 & G99 - Relay testing

Get ahead by testing your G99 relay early…

We recommend that you don't leave G99 relay testing to the last minute;

- G99 relays can be bench tested and do not need to be tested in-situ
- They can be tested by the Generator's commissioning engineer at any point throughout the construction stage
- Testing and witnessing can be arranged with our commissioning engineer well ahead of energisation

Power Quality Compliance

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EREC G98 & G99 - Harmonic compliance

Engineering Recommendation G5

Issue 5 2020

Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom

Implementation – 17th June 2020

There are major changes affecting Electricity North West and our customers

G99 compliance checks require a site specific harmonic assessment to demonstrate compliance with G5/5

Only G98 < 16A/phase type testing means that there is no need for further assessment when connecting at LV

Type testing is not sufficient evidence of compliance in any other circumstance

EREC G98 & G99 - Harmonic compliance

	LV POC	HV POC	POC at 33kV and above
Assessment method	ENWL do checks Generator provides information Generator may need to do further assessments	Generator does assessment	Generator does stage 3 assessment
Background harmonic measurements	5th, 21st and 37th harmonic background voltages may be required We shall tell you and arrange measurements	Harmonic background voltages may be required Tell us and we arrange measurements	ENWL provide Harmonic Specification
Information from ENWL		Fault level	Harmonic Specification
Synchronous generators	Use ENWL guidance note	Use ENWL guidance note	Full assessment required

EREC G98 & G99 - Harmonic compliance

We have created a guidance note explaining a simplified approach for checking G5/5 compliance of LV and HV synchronous generators

Customer Guidance Note - Electricity North West's approach for assessing **G5/5 harmonic compliance of LV & HV synchronous generators** as required by G99

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Generator connections must comply with EREC G5/5 "Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom". Since the first substages of G5/5 Stages 1 and 2 only relate to the assessment of inverter equipment, it is recommended that **synchronous** generators are initially assessed based on their harmonic currents versus the limits tabulated below. Compliance with the tabulated limits should be evidenced by providing to Electricity North West the synchronous generator's harmonic current technical data and a comparison showing the harmonic currents to be less than or equal to the given limits.

Based on G5/5's harmonic voltage planning limits, the tabulated LV and HV current limits are determined assuming fault levels of 10MVA and 100MVA respectively that should be used to start with. If you find that given limits are exceeded, then please request Electricity North West to provide the fault level for your specific point of connection. Limits for other fault levels can be derived by scaling the given harmonic current limits up or down accordingly; for example, LV harmonic current limits corresponding to a fault level of 5MVA are derived by halving the tabulated LV current limits and doubling them for a fault level of 20MVA. HV limits corresponding to a fault level of 50MVA are calculated by halving the tabulated HV current limits, whilst limits corresponding to a fault level of 200MVA are double the tabulated HV current limits.

Use of the tabulated current limits for assessing the compliance of HV synchronous generators assumes that background harmonic distortion levels are less than 75% of planning limits and there is no need to measure background levels initially. **HV background harmonics only need to be measured if the tabulated harmonic current limits referred to the specific fault level are exceeded.**

h	LV Synchronous Generator Harmonic Current Limit (Amps)	HV Synchronous Generator Harmonic Current Limit (Amps)	h	LV Synchronous Generator Harmonic Current Limit (Amps)	HV Synchronous Generator Harmonic Current Limit (Amps)
2	28.87	4.92	26	1.47	0.27
3	48.11	6.56	27	1.41	0.26
4	9.02	1.64	28	1.36	0.25
5	52.48	7.16	29	5.68	1.03
6	5.47	0.99	30	1.27	0.23
7	37.48	5.11	31	4.97	0.90
8	6.56	0.60	32	1.19	0.22
9	17.49	3.18	33	1.16	0.21
10	5.25	0.95	34	1.12	0.20
11	52.07	6.31	35	3.90	0.71
12	3.18	0.58	36	1.06	0.19
13	36.72	5.34	37	3.49	0.63
14	2.73	0.50	38	1.00	0.18
15	6.36	0.93	39	0.98	0.18
16	2.39	0.43	40	0.95	0.17
17	17.97	3.27	41	2.84	0.52
18	2.12	0.39	42	0.91	0.17
19	12.06	2.74	43	2.58	0.47
20	1.91	0.35	44	0.87	0.16
21	1.82	0.33	45	0.85	0.15
22	1.74	0.32	46	0.83	0.15
23	9.96	1.81	47	2.16	0.39
24	1.59	0.29	48	0.80	0.14
25	7.64	1.39	49	1.99	0.36
			50	0.76	0.14

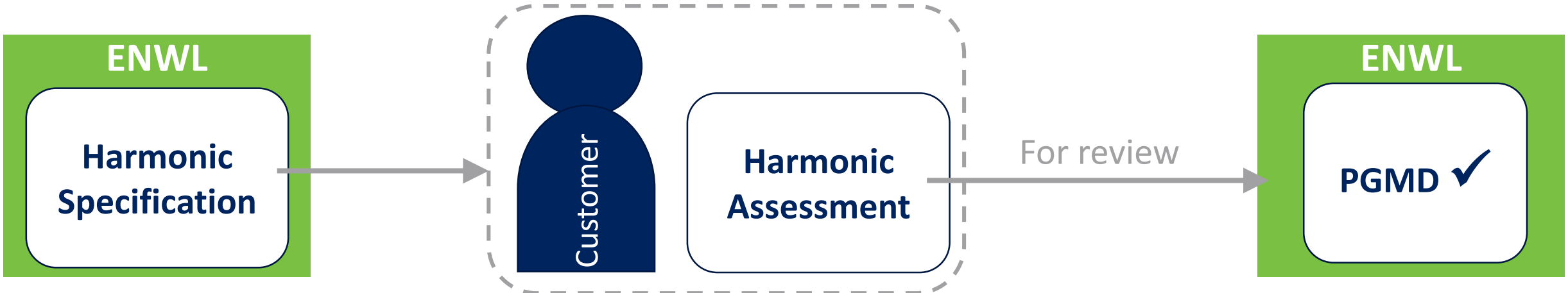
June 2020

EREC G98 & G99 - Harmonic compliance

G5/5 Stage 3 assessment is required for generator connections at 33kV and above, plus connections that fail Stage 2

Harmonic Specification =

- Impedance profile of the PCC
- Background harmonic level
- Incremental Harmonic Voltage Limit
- Total Harmonic Voltage Limit



Type C and D pointers

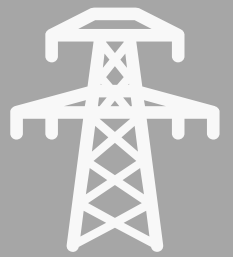
EREC G98 & G99 - Type C and D

C6 monitoring

Type C & D generators require fault and dynamic monitoring (C6)

ENWL are working with other DNOs and manufacturers to develop threshold settings

C6 is being modified to address detailed parameters after informal consultation



National Grid are changing the Grid Code in line with the proposed changes to C6

EREC G98 & G99 - Type C and D models

A simulation model is required (G99 6.3.9.3.)

Governor frequency control model &

Exciter voltage control model

Compatible with IPSA2

Model validation is required (C.7.8)

Necessary simulation studies are defined

Simulation results to be overlaid on top of test results

Storage update

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EREC G98 & G99 - Storage

G98/99 has limited application for storage, but the exclusions will be removed after approval

Changes to European law is requiring much more comprehensive application to storage after September 2022

Changes are coming to G99 and forms

A Distribution Code public consultation is seeking the views on proposed changes drafted to cover the increased requirement (Deadline: 17:00 Friday 12th February 2021)

DCRP/20/06/PC Consultation Pack

DCODE THE DISTRIBUTION CODE OF LICENSED DISTRIBUTION NETWORK OPERATORS OF GREAT BRITAIN

Distribution Code Consultation DCRP/20/06/PC

Storage Modification to G98 G99 amd DCode(v45)

Removal of Exclusions to Storage from DCode Dcoumentation

EREC G98 & G99 -
Proposed modifications for including storage

Terms & definitions changed

New Power Generating Facility / Power Park Module diagrams including storage are being added

Electric Vehicles operating in vehicle to grid mode (V2G) are included (G99 only)

Not applicable to non-controllable storage such as synchronous compensators and synchronous flywheels

Storage required to switch from import to export when system frequency falls below 49.5Hz

Industry update

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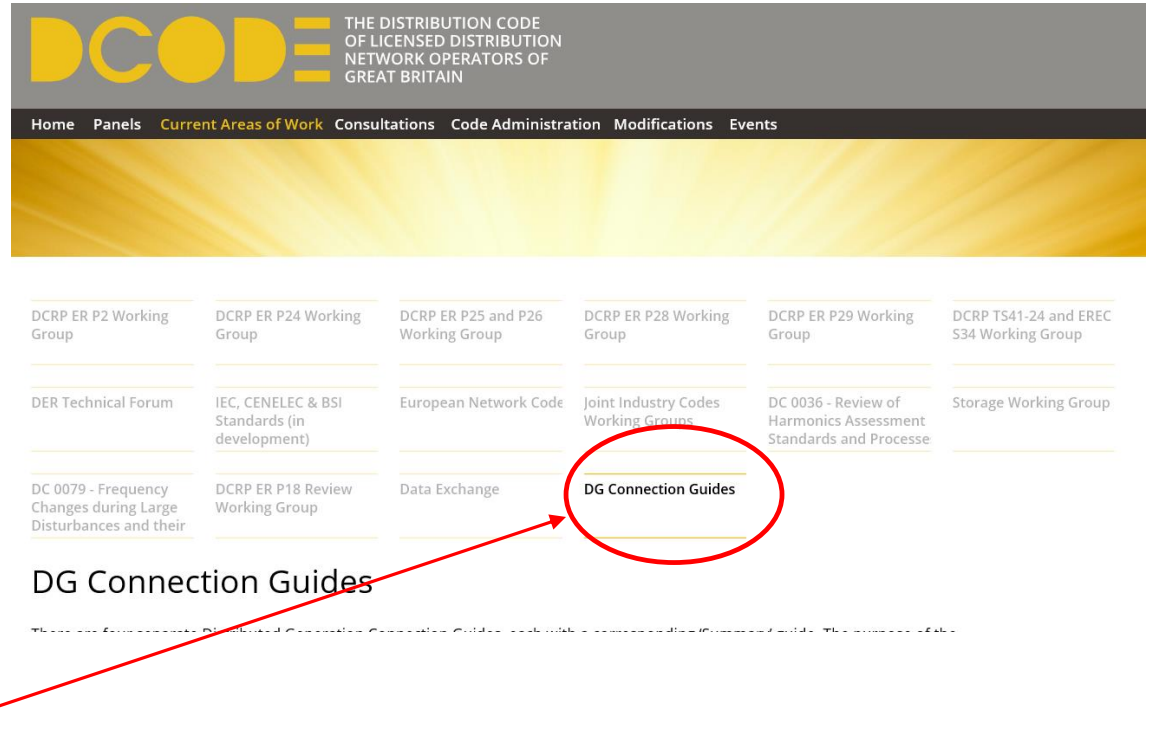
EREC G98 & G99 - DG Connection Guide

In October 2020, Connection guides were updated to ensure that they were an accurate reflection of G98 and G99 processes and requirements.

The below guides have been revised;

- G98 Multiple Premises
- G98 Multiple Summary Guide
- G98 Single Premises
- G98 Single Summary
- G99 Type A
- G99 Type A Final Summary
- G99 Type B-D Final Summary



Detailed revisions can be found at http://www.dcode.org.uk/current-areas-of-work/dg-connection-guides.html

Further updates expected including exemplars of completed forms and evidence

EREC G98 & G99 - Housekeeping modifications

Minor technical/housekeeping modifications to G98 and G99 are in the pipeline

G98 Amendment 5 and G99 Amendment 7 will be issued after consultation and approval

- Need to comply with cyber security requirements
- Formal allowing of a family approach to type testing
- Clarification of processes for compliance checking of infrequent short term parallel generators
- Changes to forms reflecting feedback on their use such as “E” for exempt
- Introduction of a minimum fault level for simulations
- Modifications to C6
- DNO option to request detailed models for Types A&B
- Modifications to C6
- Numerous clarifications

Any questions?

EREC G98 & G99 - Further information

Electricity North West Website

https://www.enwl.co.uk/get-connected/new-connection/generation-connection/engineering-recommendation-g99

ENA Website

http://www.energynetworks.org/electricity/engineering/distributed-generation/engineering-recommendation-g59.html

DG Connection Guides

http://www.energynetworks.org/electricity/engineering/distributed-generation/dg-connection-guides.html

Distribution Code DPC7

covers requirements for embedded generator including G99

http://www.dcode.org.uk/

EREC G98 & G99 - ENWL website

FAQs on website

Meet with our experts

Webinar recordings on our website

Webinar 1 Introduction to G99 Processes

Webinar 2 Technical Compliance

EREC G98 & G99 - Housekeeping

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Please contact us if you have any questions
Webinar slides will be circulated to all registered delegates

Thank you for your participation in today’s session