WESTERN POWER DISTRIBUTION

*Serving the Midlands, South West and Wales*

# G98/G99 Briefing

Webinar Event

2:00pm Friday 16th November 2018

# Agenda

- Who we are and our ambitions for today
- Background to implementation of ERECs G98/G99
- What it means to connecting customers
- Technical considerations
- G99 application process
- Compliance
- Summary – key points

# Our ambition for today

- We shall undertake a high level run through
- This is not a detailed technical analysis
- Ensure customers with existing connection offers and new applicants are aware of the forthcoming changes
- Specifically what it means for customers of WPD

## Who we are

- Tim Hughes
  Connection Policy Manager

- Andy Hood
  Technical Policy

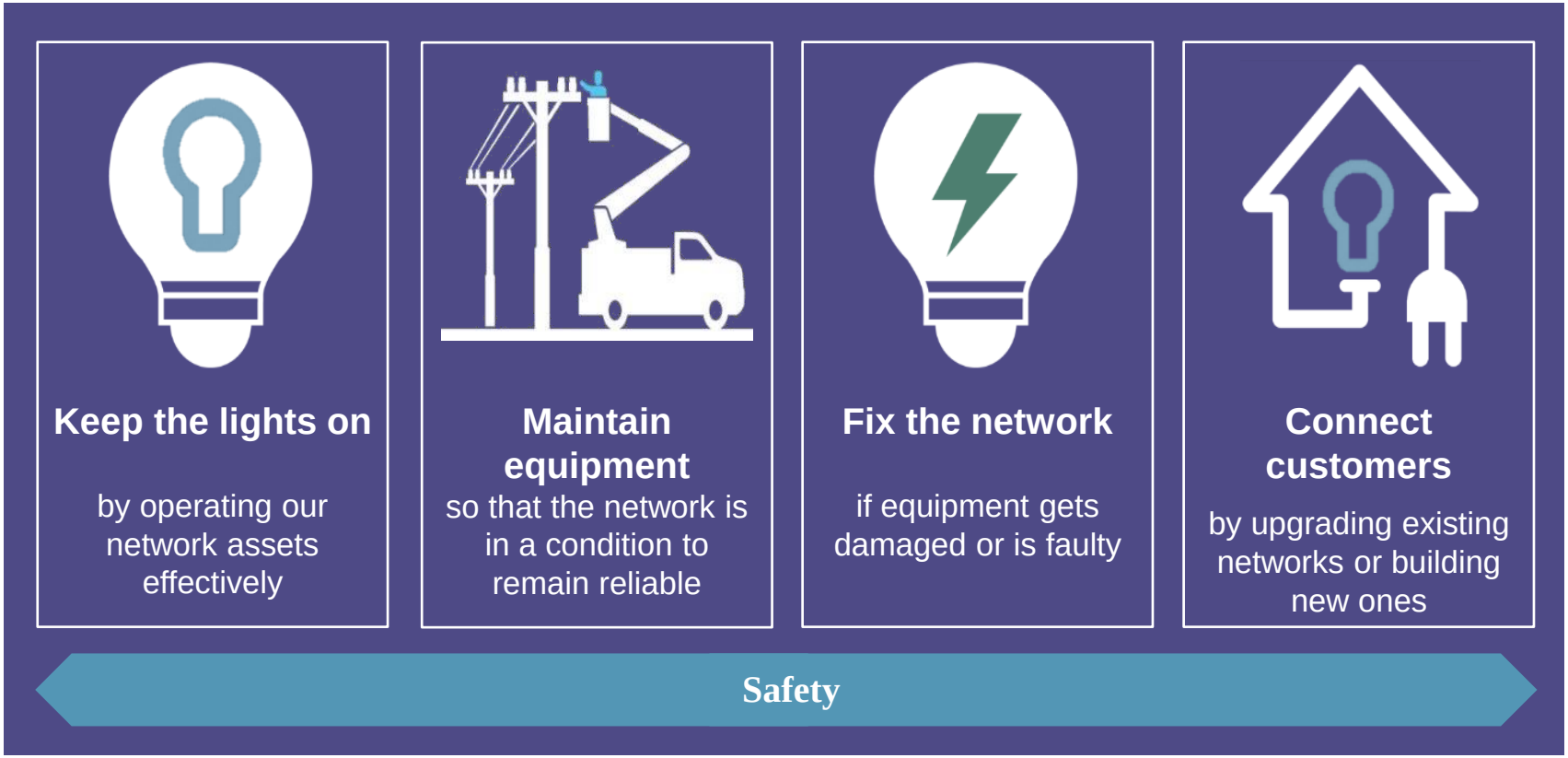
- Tony Berndes
  Primary System Design Manager

# Interaction

- We want to hear from you
- Raise questions during this Webinar
- A recording will be available
- Email us at: **wpdrfginfo@westernpower.co.uk**
- We will endeavour to answer all your questions

# What we do

- As a Distribution Network Operator we have four main tasks



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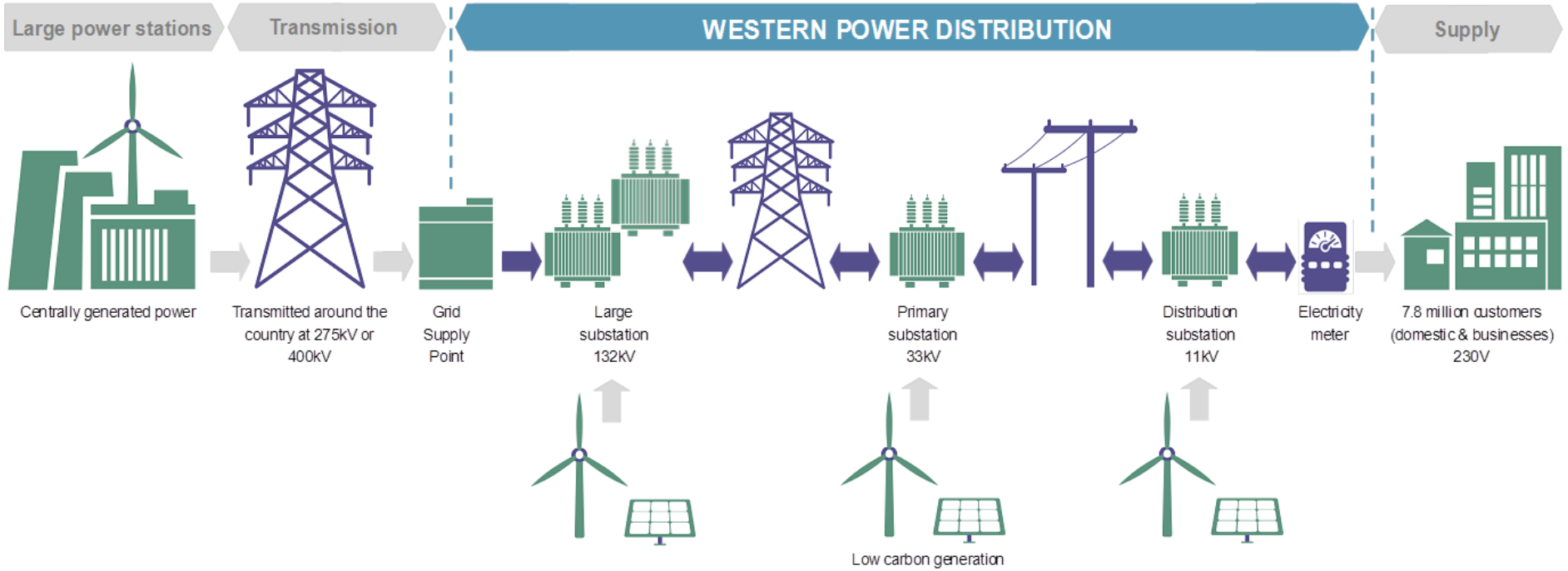
# Our role

- To distribute electricity across our network area



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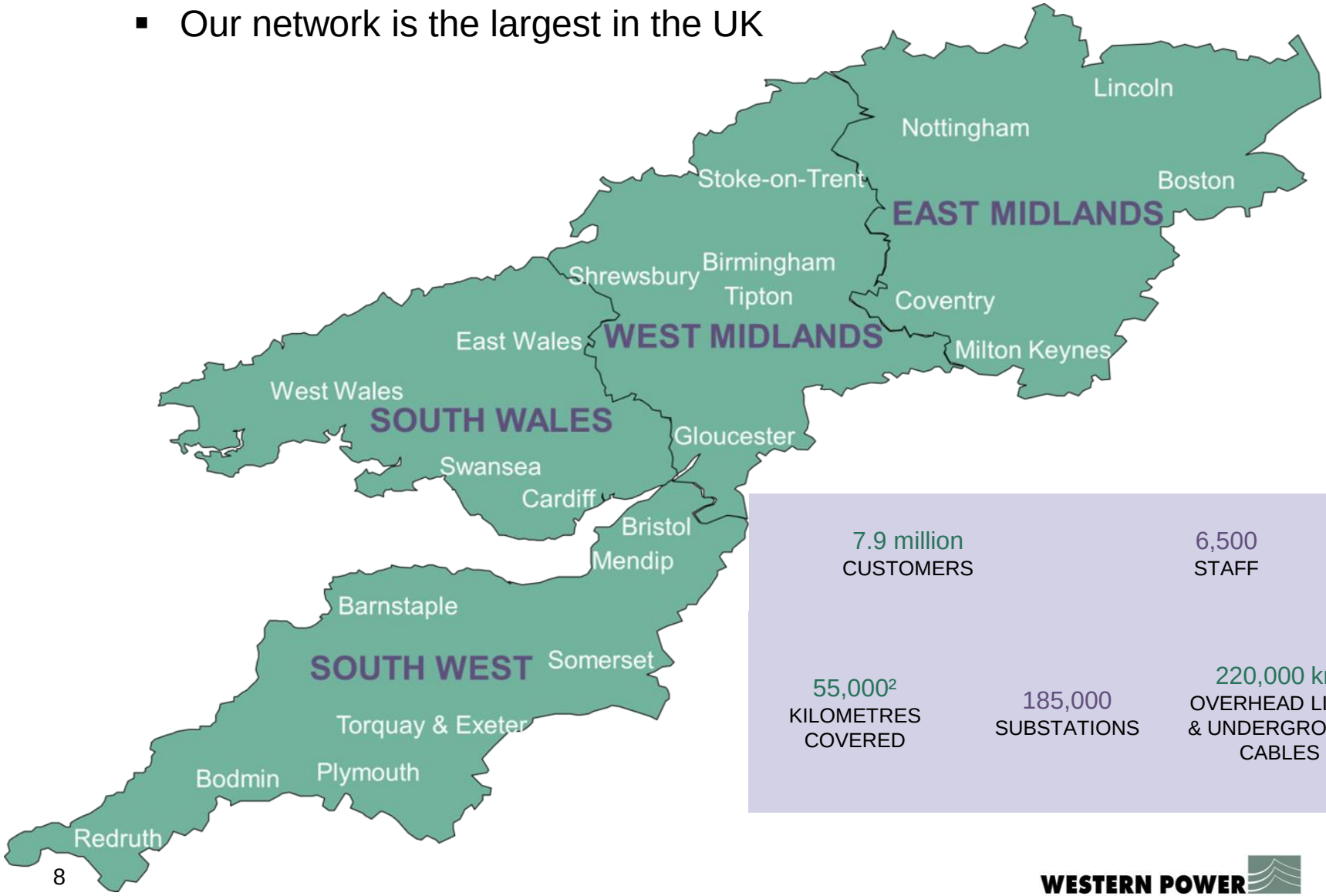
# Our network area

- Our network is the largest in the UK




| | | |
|---|---|---|
| 7.9 million CUSTOMERS | | 6,500 STAFF |
| 55,000² KILOMETRES COVERED | 185,000 SUBSTATIONS | 220,000 km OVERHEAD LINES & UNDERGROUND CABLES |



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# Background to implementation of G98/G99

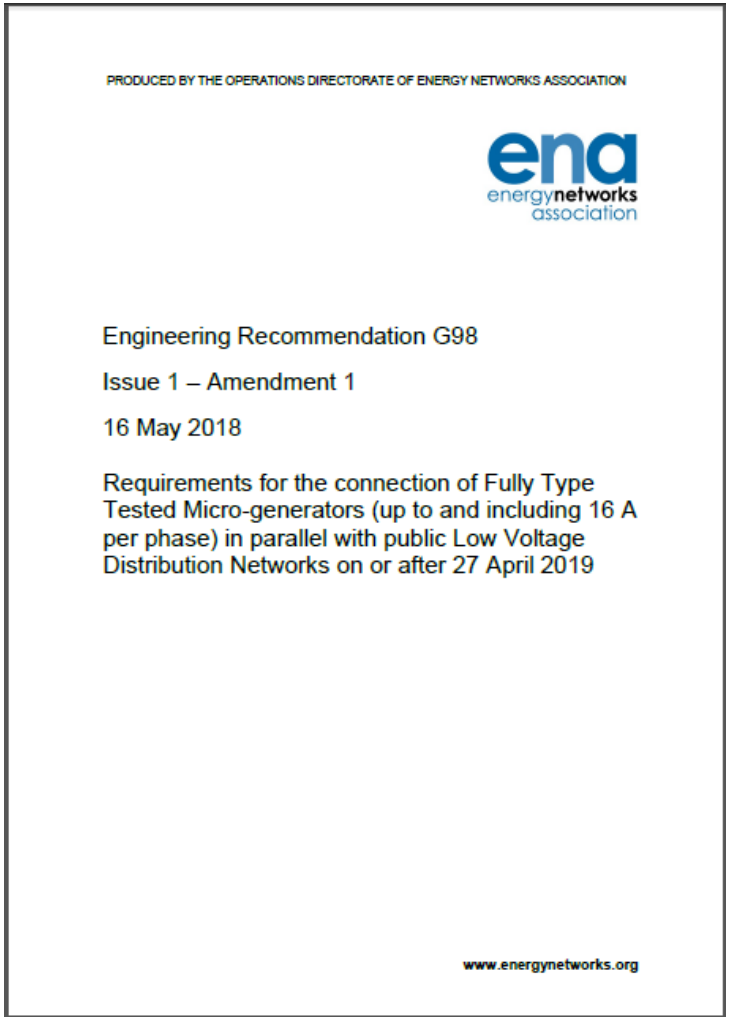
# Background to the change - EU Codes

- Driven by the latest requirements for generators connecting to the GB distribution system as a consequence of the introduction of new European Network Codes
- The EU Network Codes aim to harmonise the technical and market rules to provide a sustainable, secure and competitive electricity market across Europe
- We are focusing on impact on distribution network connections and requirements for generators (RfG)
- RfG will impose responsibilities on both DNOs and generators
- Latest requirements specified within two new Engineering Recommendations G98 & G99

# Background to implementation - ERECs G98/G99

**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 Networks on or after 27 April 2019



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ena energynetworks association

Engineering Recommendation G98

Issue 1 – Amendment 1

16 May 2018

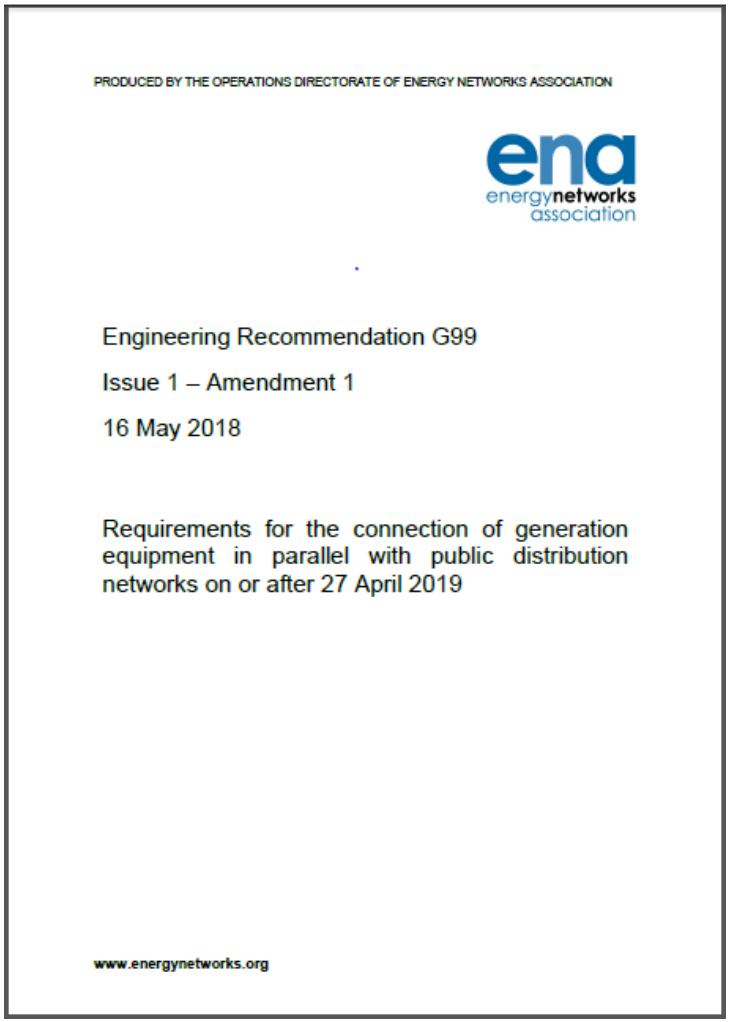
Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019

www.energynetworks.org

# Background to implementation - ERECs G98/G99

**G99:**

- Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019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Engineering Recommendation G99

Issue 1 – Amendment 1

16 May 2018

Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019

www.energynetworks.org

## What does it mean for connecting customers?

- Any generating unit commissioned and connected on or after **27th April 2019** must comply with G98/G99, as appropriate
- You can connect G98/G99 compliant plant in advance of 27th April 2019 as it will also comply with G83/G59
- Requirements for G98/G99 will only apply to new connections or significant replacement of plant/equipment
- Existing customers will have to comply with the requirements of G83/G59 that were applicable at the time of connection

# What you need to do if you are connecting to the distribution system after the date of compliance under G59

- If you entered a binding contract for your generating units before 17th May 2018, you must notify WPD no later than 17th November 2018

- You need to include the following as a minimum:

  (i) The contract title for the main plant

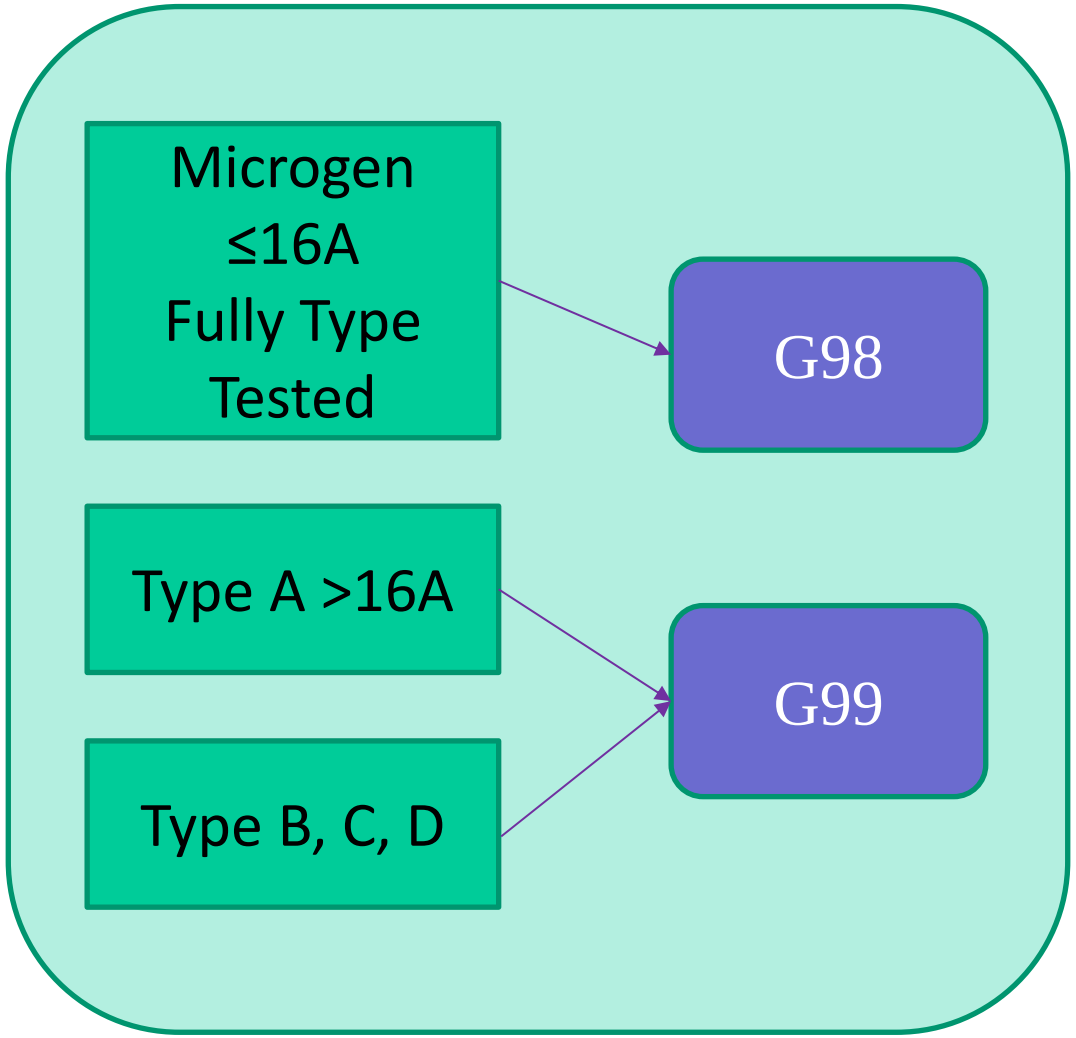
  (ii) Evidence of the date of signature of the contract for the main plant

  (iii) The technical specification applicable to the contract for the main plant

- We will acknowledge receipt and contact you if we require more information.

# Technical Considerations

# G98 or G99




G98 applies to parallel operating **Generating Units** only.

**Generating Units** that can be used in standby mode must comply with G99

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# EREC G98

- G98 is almost identical to G83 but incorporates the relevant parts of the RfG

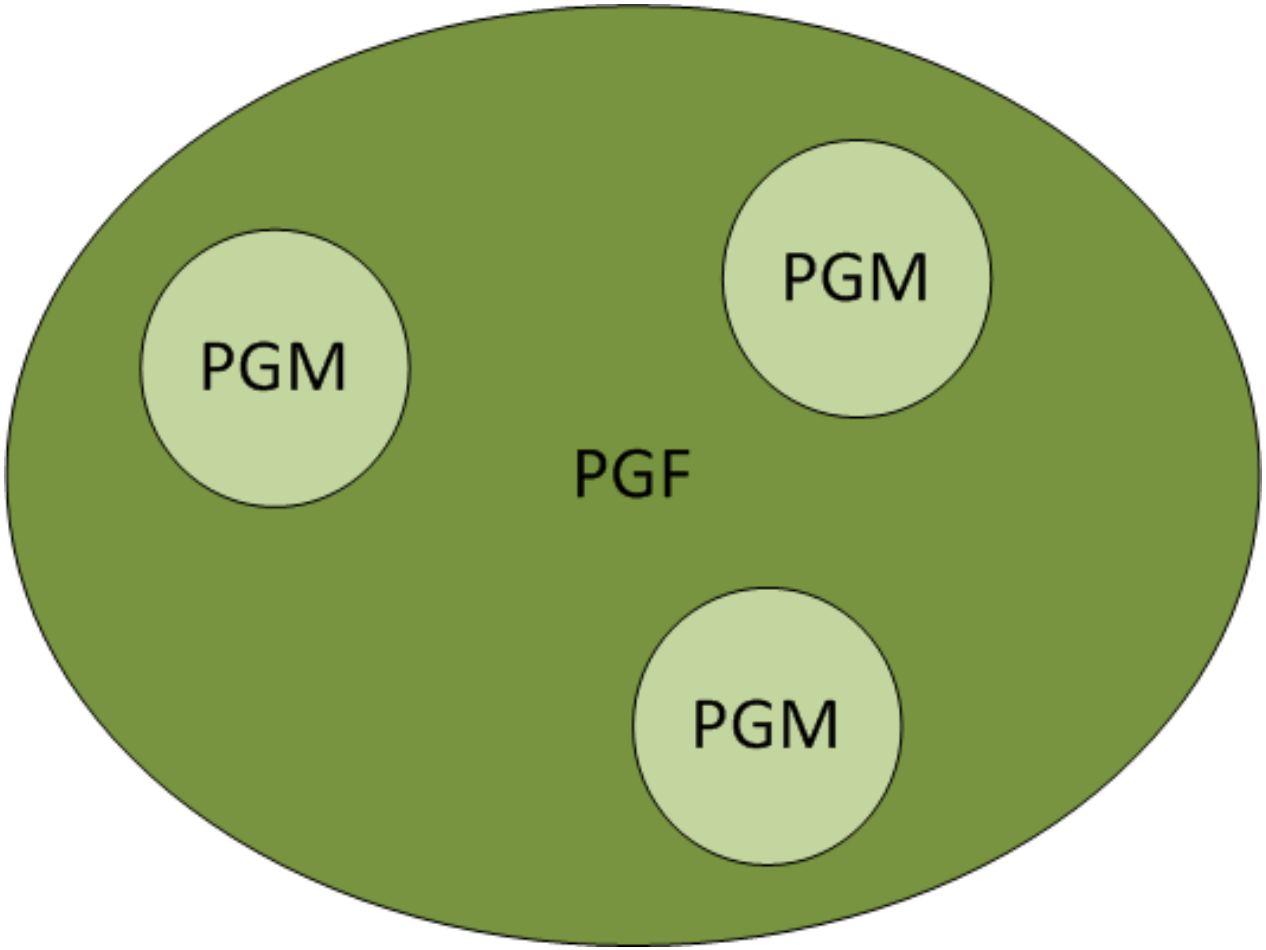
- The term **Micro-generator** replaces SSEG

- The following technical requirements have been added:
  - Frequency withstand
  - RoCoF withstand (1.0Hz/s)
  - Limited Frequency Sensitive Mode - Over-frequency
  - Active power output
  - Protection settings have been changed

# EREC G99

- G99 is based on G59 but incorporates new RfG requirements
- 
- Definitions for **Power Generating Module, Synchronous Power Generating Module, Power Park Module, Generating Unit** and **Power Generating Facility** have been added
- Four different Power Generating Module sizes (**Type A to Type D**) are specified
- The technical requirements depend on the Type
- **Generators** can demonstrate compliance by Type Testing, Simulation Studies and by carrying out Commissioning Tests

# Synchronous Generation




**PGM = Power Generating Module = Generating Unit**

**PGF = Power Generating Facility**

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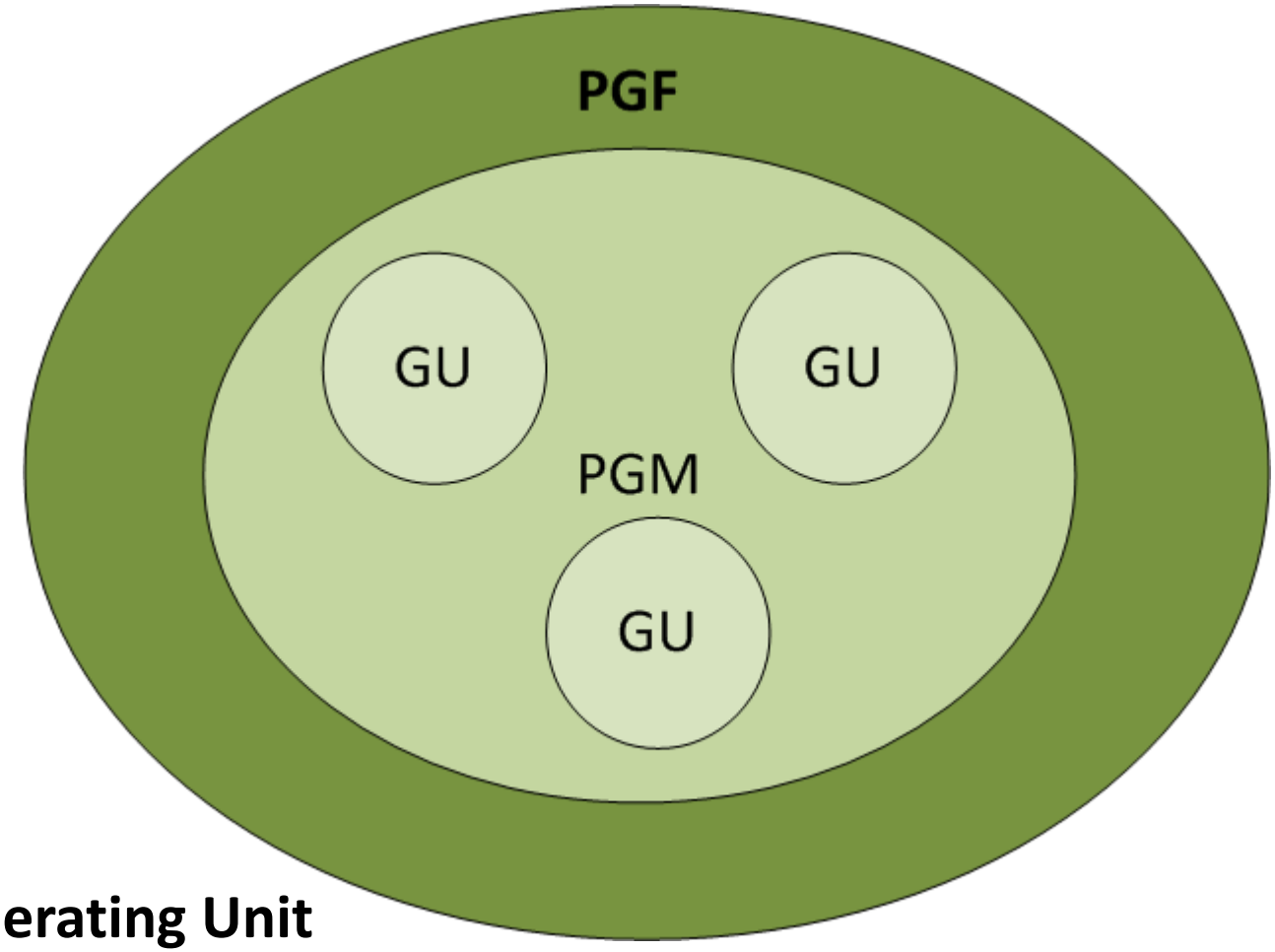
# Non-synchronous Generation




**GU = Generating Unit**

**PGM = Power Generating Module = Power Park Module**

**PGF = Power Generating Facility**

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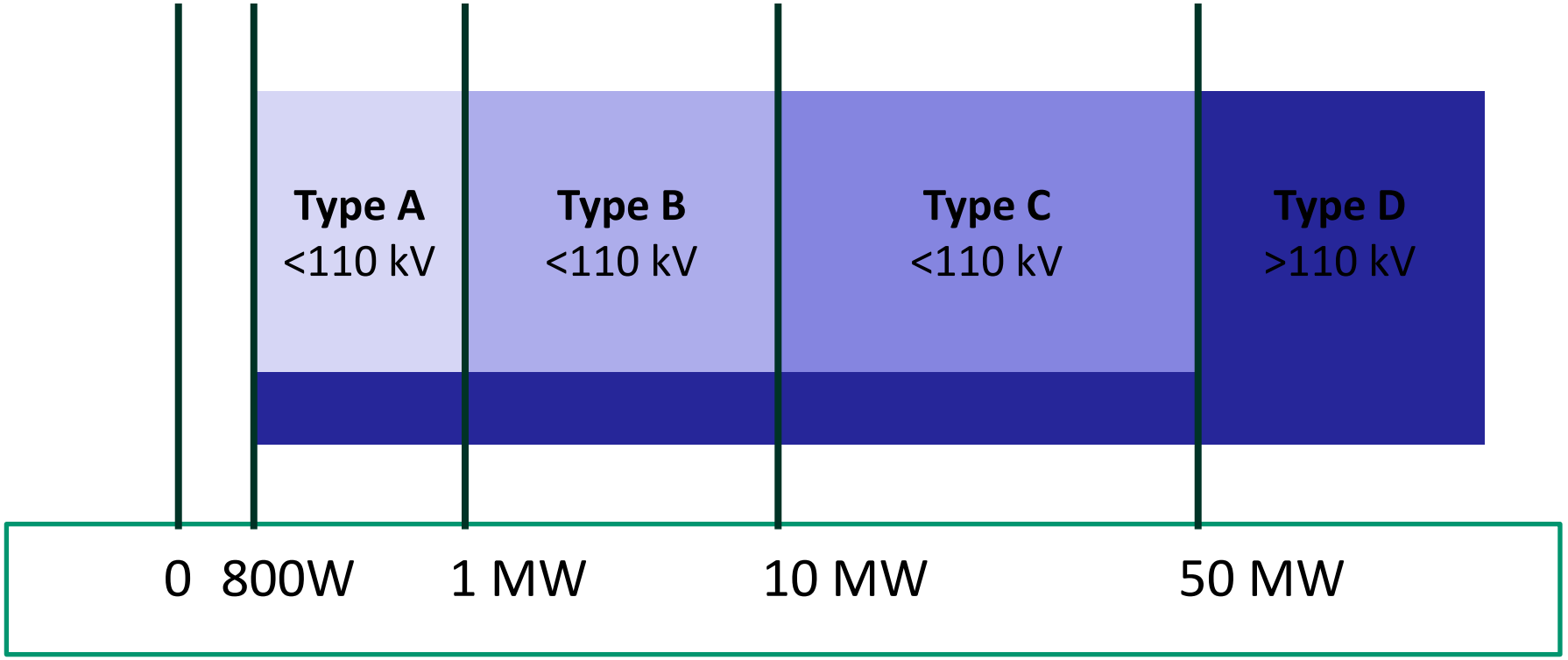
# Power Generating Module Types (A to D)




- Note, any Power Generating Module connected at 132kV or above is deemed to be Type D

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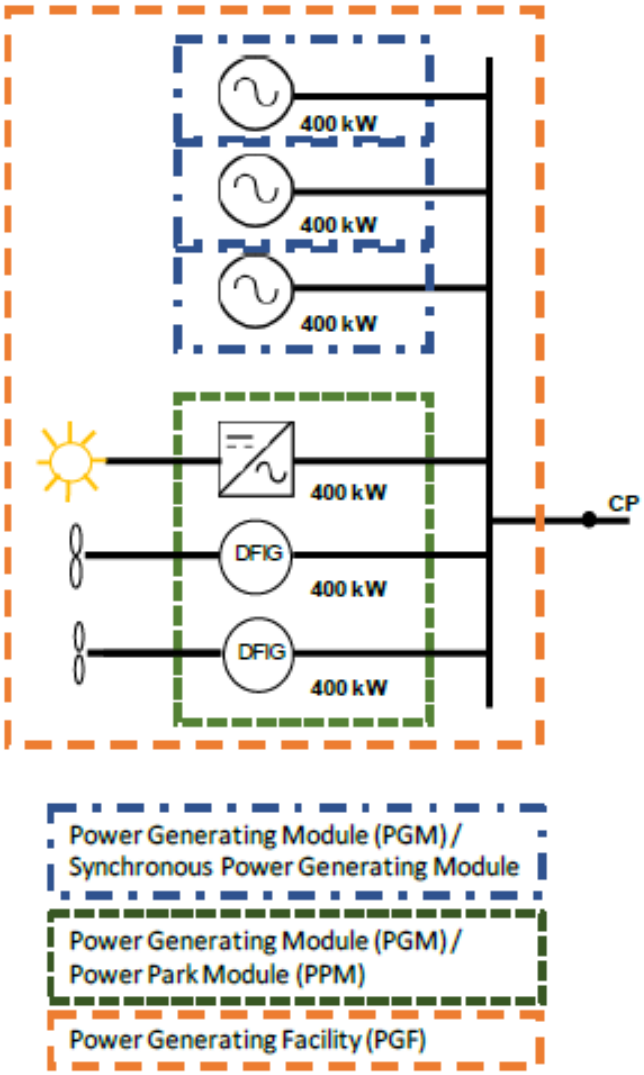
# Generating Module Example




3 x 400kW **Synchronous Power Generating Modules** and 3x non-synchronous **Generating Units**

= 3x 400kW **Type A Synchronous Power Generating Modules** and one 1.2 MW **Type B Power Park Module**

= 2.4MW **Power Generating Facility**

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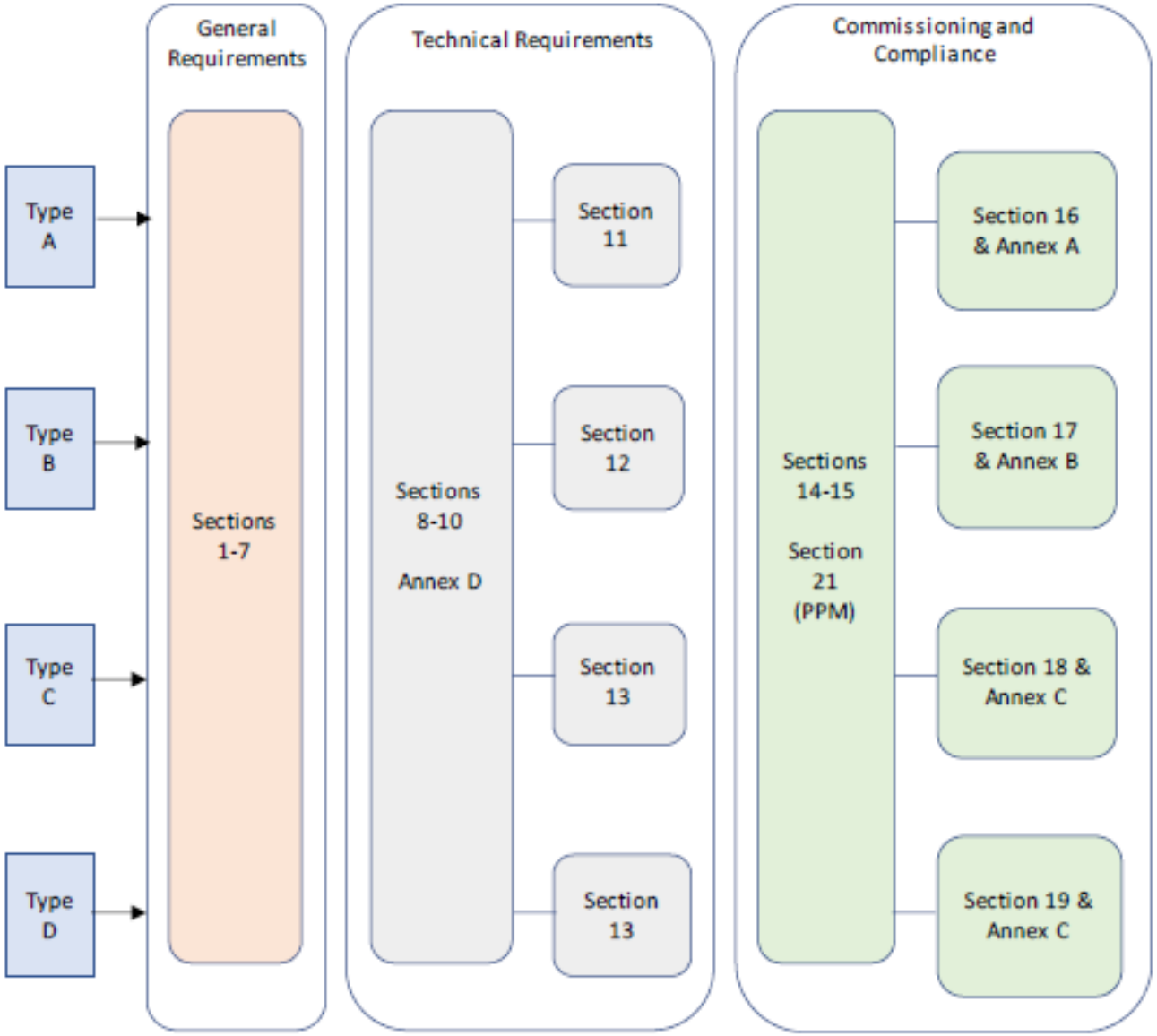
# G99 Structure



# EREC G99 Technical Changes

- The following technical requirements have been modified or added:
  - Interface Protection Settings (Type A, B, C and D)
  - Logic Interface to allow DNO to constrain output (Type A only)
  - Communication Interface to allow DNO to constrain output (Type B, C and D)
  - Frequency withstand (Type A, B, C and D)
  - RoCoF withstand - 1Hz/s (Type A, B, C and D)
  - Minimum active power output at low frequency (Type A, B, C and D)
  - Limited Frequency Sensitive Mode - Over-frequency (Type A, B, C and D)

# EREC G99 Technical Changes

- The following technical requirements have been modified or added (continued):
  - Fault ride through (Type B, C and D)
  - Voltage / power factor control capability (Type B, C and D)
  - Reactive Power Capability (Type B, C and D)
  - Fast Fault Current Injection (Type B, C and D Power Park Modules)
  - Low Frequency Sensitive Mode - Under-frequency (Type C and D)
  - Frequency Sensitive Mode (Type C and D)
  - Operational Monitoring (Type C and D)

# Exemptions

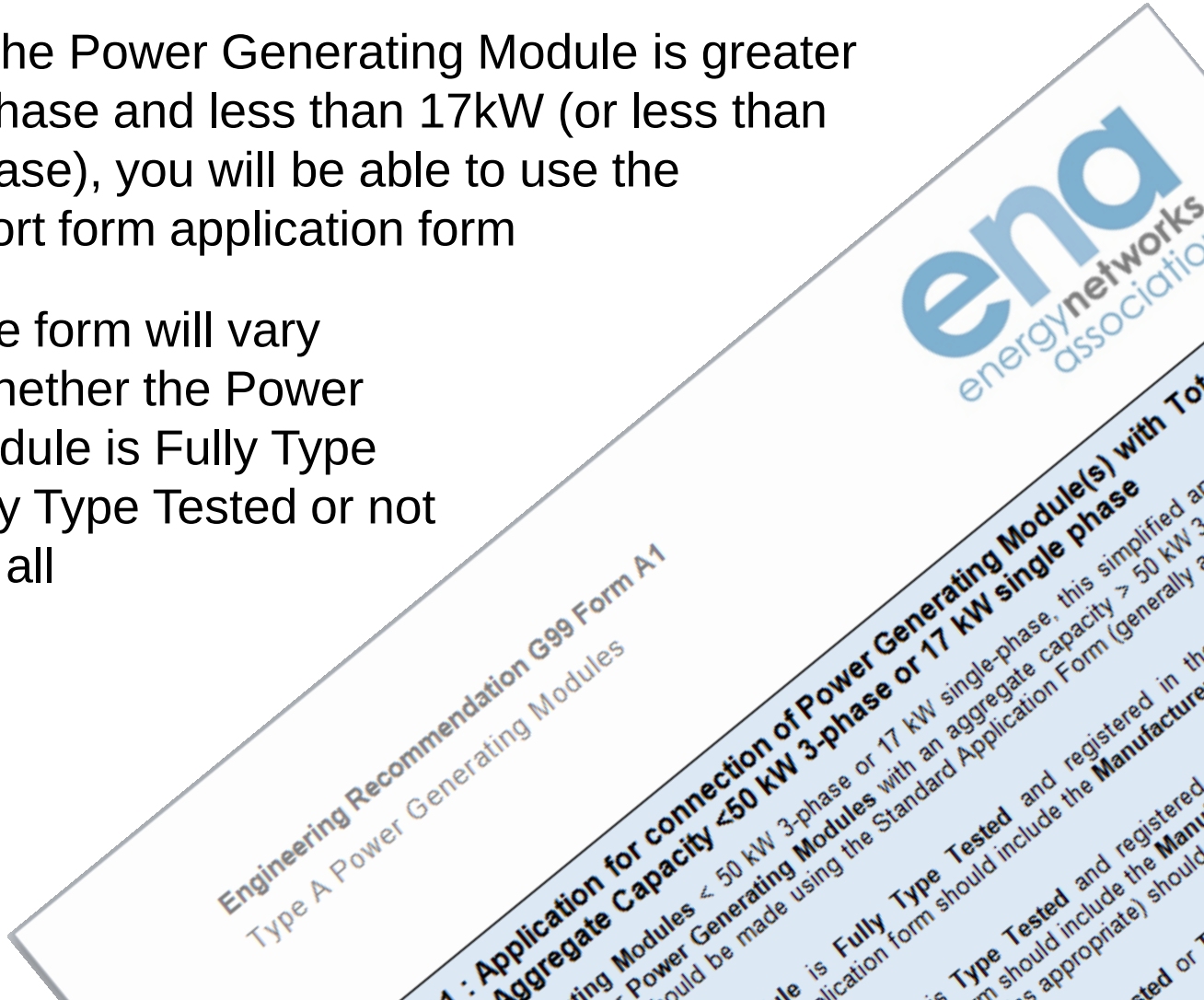
There will be exemptions from RfG for generators connecting to the distribution system:

- Energy storage
- Generating modules < 800 W
- Emerging Technologies (e.g. micro-CHP) - OFGEM Decision 2017
- Infrequent short term parallel operation

# G99 Application Process

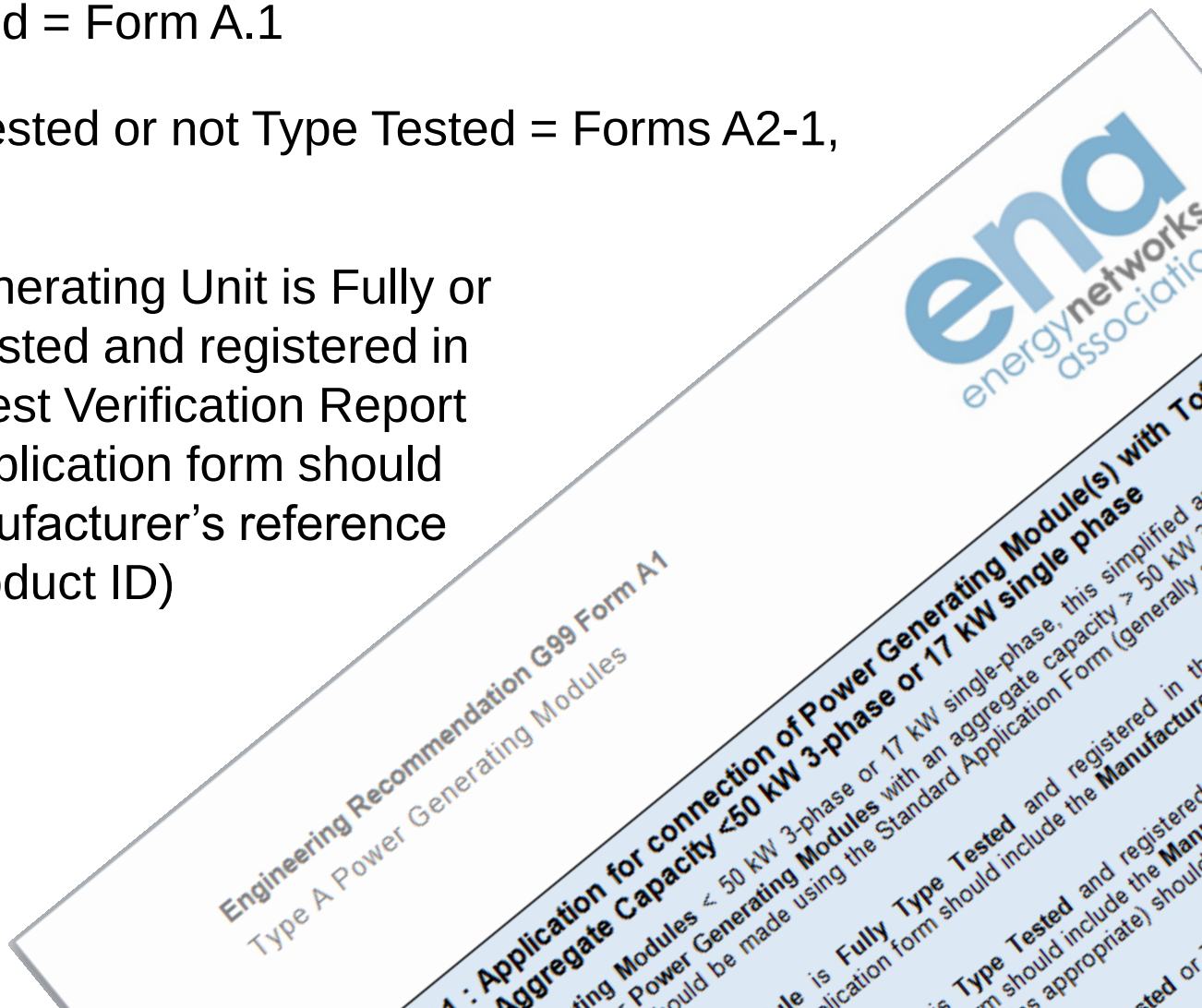
# Applying under G99

- If the rating of the Power Generating Module is greater than 16A per phase and less than 17kW (or less than 50kW three phase), you will be able to use the appropriate short form application form
- The appropriate form will vary according to whether the Power Generating Module is Fully Type Tested, Partially Type Tested or not Type Tested at all

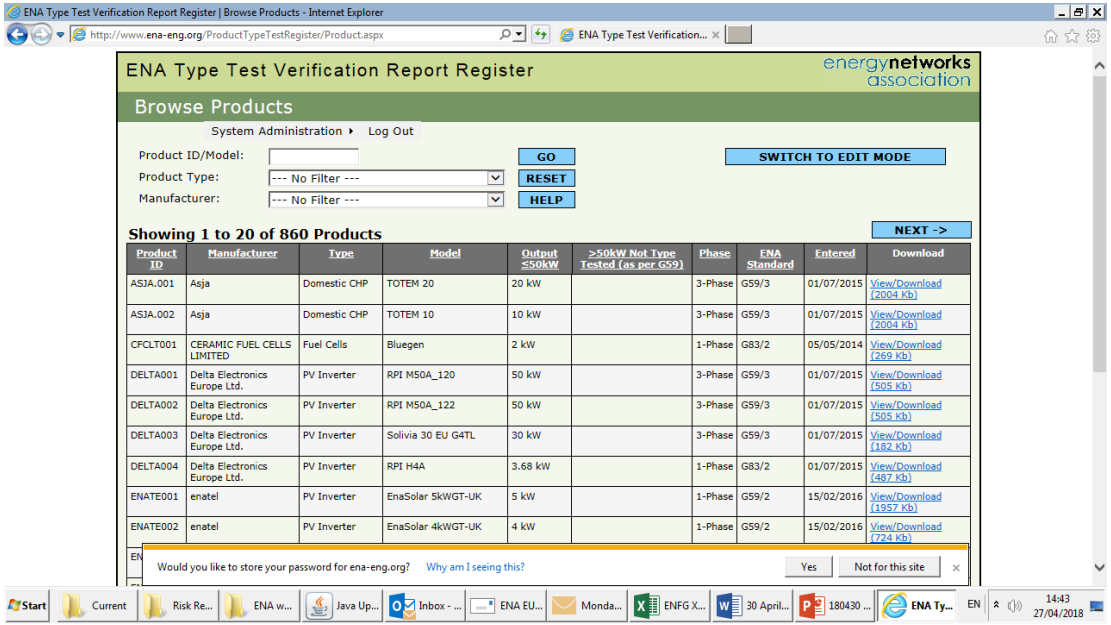


# Applying under G99

- Fully Type Tested = Form A.1
- Partially Type Tested or not Type Tested = Forms A2-1, A2-2 or A2-3
- If the Power Generating Unit is Fully or Partially Type tested and registered in the ENA Type Test Verification Report Register, the application form should include the Manufacturer's reference number (the Product ID)



# ENA Type Test Verification Register




| Product ID | Manufacturer | Type | Model | Output ≤50kW | >50kW Not Type Tested (as per G59) | Phase | ENA Standard | Entered | Download |
|---|---|---|---|---|---|---|---|---|---|
| ASJA.001 | Asja | Domestic CHP | TOTEM 20 | 20 kW | | 3-Phase | G59/3 | 01/07/2015 | View/Download (2004 Kb) |
| ASJA.002 | Asja | Domestic CHP | TOTEM 10 | 10 kW | | 3-Phase | G59/3 | 01/07/2015 | View/Download (2004 Kb) |
| CFCLT001 | CERAMIC FUEL CELLS LIMITED | Fuel Cells | Bluegen | 2 kW | | 1-Phase | G83/2 | 05/05/2014 | View/Download (269 Kb) |
| DELTA001 | Delta Electronics Europe Ltd. | PV Inverter | RPI M50A_120 | 50 kW | | 3-Phase | G59/3 | 01/07/2015 | View/Download (505 Kb) |
| DELTA002 | Delta Electronics Europe Ltd. | PV Inverter | RPI M50A_122 | 50 kW | | 3-Phase | G59/3 | 01/07/2015 | View/Download (505 Kb) |
| DELTA003 | Delta Electronics Europe Ltd. | PV Inverter | Solivia 30 EU G4TL | 30 kW | | 3-Phase | G59/3 | 01/07/2015 | View/Download (182 Kb) |
| DELTA004 | Delta Electronics Europe Ltd. | PV Inverter | RPI H4A | 3.68 kW | | 1-Phase | G83/2 | 01/07/2015 | View/Download (487 Kb) |
| ENATE001 | enatel | PV Inverter | EnaSolar 5kWGT-UK | 5 kW | | 1-Phase | G59/2 | 15/02/2016 | View/Download (1957 Kb) |
| ENATE002 | enatel | PV Inverter | EnaSolar 4kWGT-UK | 4 kW | | 1-Phase | G59/2 | 15/02/2016 | View/Download (724 Kb) |

- Work underway to produce new ENA Type Test Verification Register
- Will be enhanced (compared with the existing Database)
- No kW limits, unlike existing database
- Information will be audited / validated by ENA

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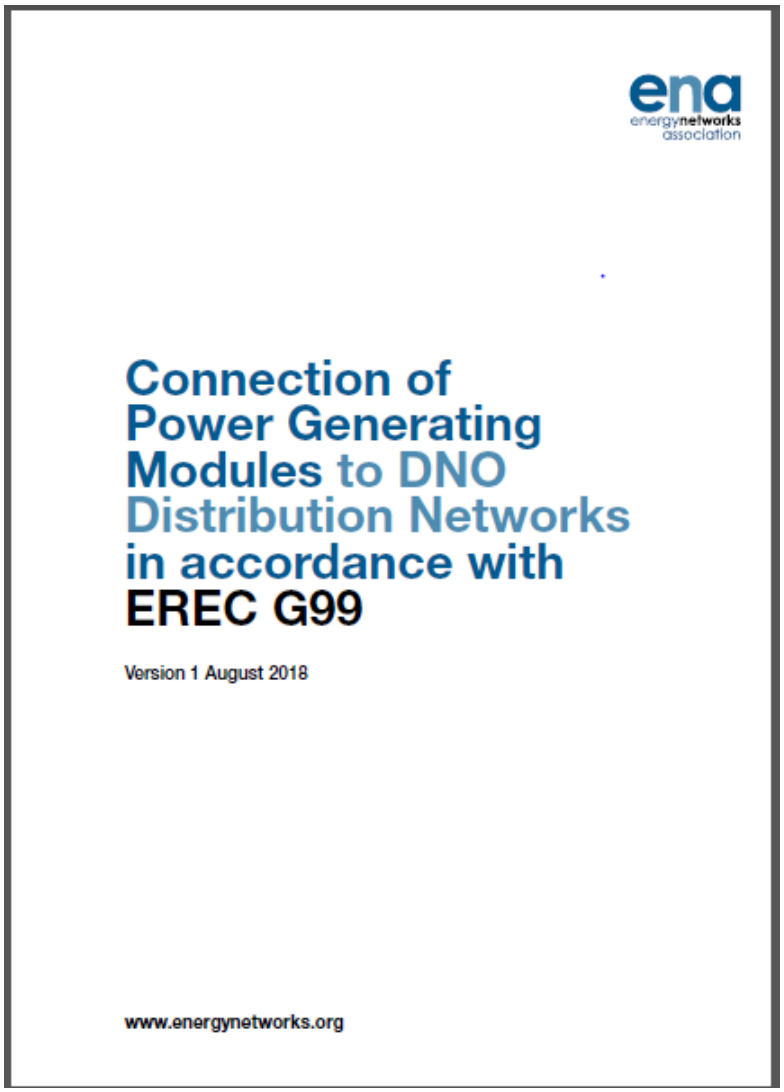
# Applying under G99 ≥50kW

- Applications should be made using the ENA application Form
- It can be accessed from both the ENA and WPD websites:

www.westernpower.co.uk

www.energynetworks.org



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# Minimum Information provisions

- Parts 1 – 3 and relevant sections of Part 4 must be completed

| | | |
|---|---|---|
| Part 1 | Contact details, location and operational information | Initial submission |
| Part 1a | Supplementary contact details | Initial submission |
| Part 2 | Power Generating Facility general data | Initial submission |
| Part 3 | Power Generating Module model data | Initial submission |
| Part 4a | Synchronous Power Generating Modules | Prior to synchronising |
| Part 4b | Power Park Module model data: Fixed speed induction Generating Units | Prior to synchronising |
| Part 4c | Power Park Module model data: Doubly fed induction Generating Units | Prior to synchronising |
| Part 4d | Power Park Module model data: Series inverter connected Generating Units | Prior to synchronising |
| Part 4e | Power Park Module model data: Electricity Storage plant | Prior to synchronising |
| Part 4f | Transformer information | Prior to synchronising |
| Part 5 | Additional data which may be required by the DNO | Prior to synchronising |

# Additional information

We will also need some additional information if we are to prepare a Connection Offer:

- ✓ Location Plan indicating the geographic area
- ✓ Site plan (suitable scale indicating the development boundary and the Connection Point)
- ✓ SLD showing electrical arrangement and protection

# Compliance

# G99 Compliance

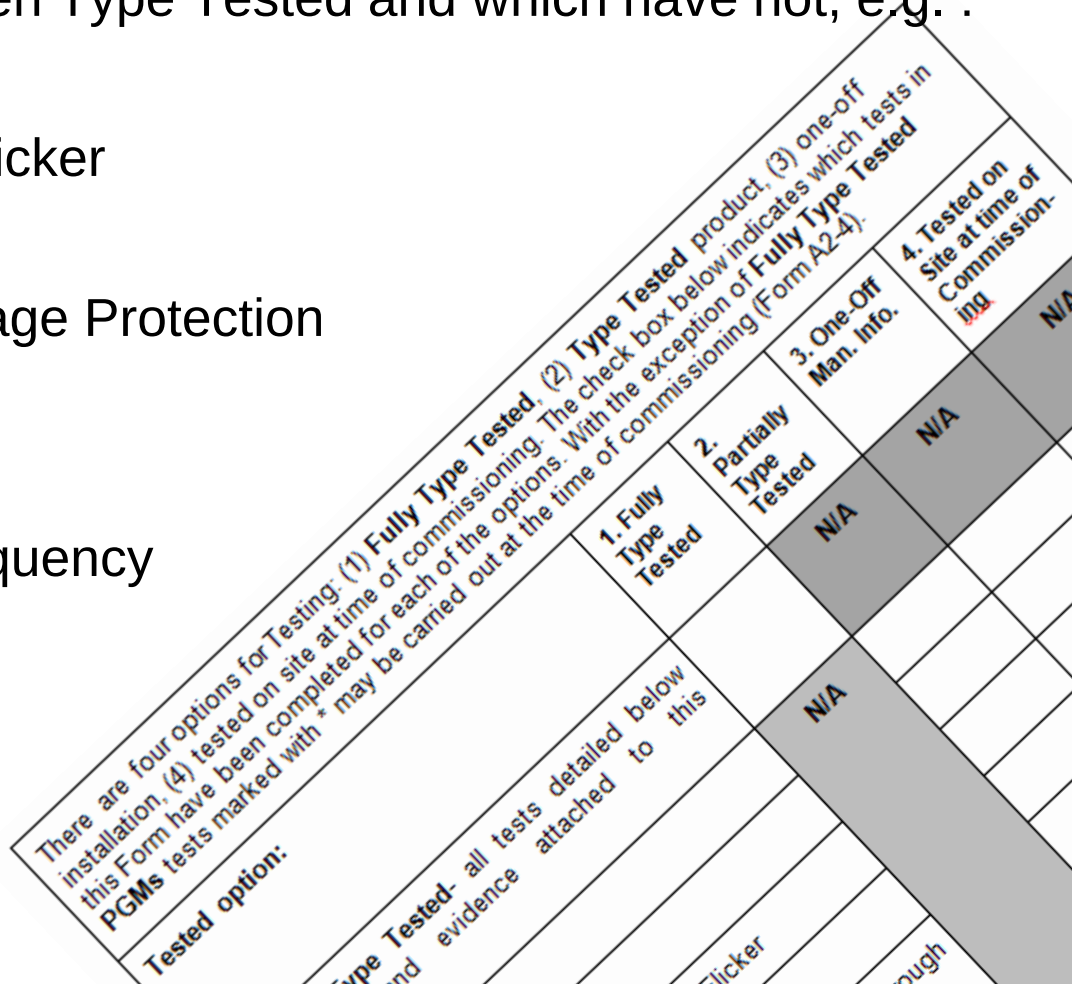
- The Generator is responsible for demonstrating compliance
- Compliance may be demonstrated using the following methods:
  - ✓ Provision of Manufacturer's Data / Information
  - ✓ Type Verification Tests
  - ✓ Simulation Studies
  - ✓ On-site Commissioning Tests
- WPD may elect to witness commissioning tests

# G99 Compliance

## Compliance Forms

The Type A compliance forms include a page that requires the installer to declare which aspects have been Type Tested and which have not, e.g. :

- PQ harmonics
- PQ voltage fluctuation and flicker
- Power factor
- U/O frequency and U/O voltage Protection
- Loss of mains protection
- LFSM-O
- Power output with falling frequency
- Reconnection Timer
- Fault Level Contribution
- Wiring functional tests
- Logic / Comms interface



# G99 Compliance

## Compliance Forms

For Type A, functions / requirements that are not Type Tested must either be demonstrated by provision of:

- One-off manufacturer's information (including data, simulation studies etc), or;
- On-site testing

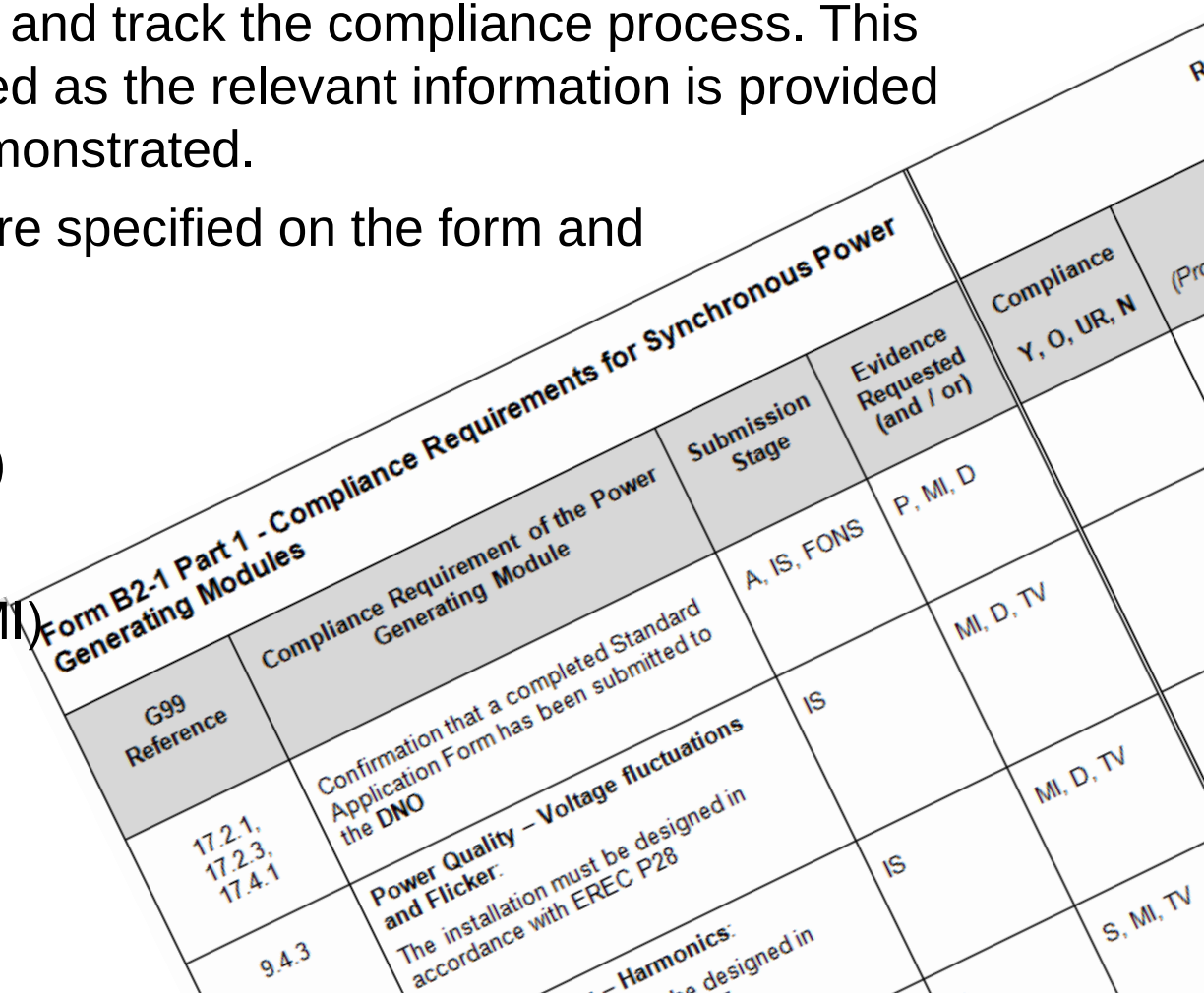
# G99 Compliance

## Compliance Forms

For Type B, C and D a Power Generating Module Document (PGMD) is filled in to demonstrate and track the compliance process. This form is amended / updated as the relevant information is provided and the functions are demonstrated.

Options for compliance are specified on the form and include:

- Type verification (TV)
- Simulation Studies (S)
- Design Data (P)
- Manufacturer's Info (MI)
- Correspondence (D)
- On-site testing (T)



**Form B2-1 Part 1 - Compliance Requirements for Synchronous Power Generating Modules**

| G99 Reference | Compliance Requirement of the Power Generating Module | Submission Stage | Evidence Requested (and / or) | Compliance Y, O, UR, N |
|---|---|---|---|---|
| | Confirmation that a completed Standard Application Form has been submitted to the **DNO** | A, IS, FONS | P, MI, D | |
| 17.2.1, 17.2.3, 17.4.1 | **Power Quality – Voltage fluctuations and Flicker**: The installation must be designed in accordance with EREC P28 | IS | MI, D, TV | |
| 9.4.3 | **Harmonics**: | IS | MI, D, TV | |
| | | | | S, MI, TV |

# G99 Compliance

**Tests / Checks Required at all Power Generating Facilities:**

- Inspection of plant, equipment, protection, earthing/bonding
- Verification that the agreed plant and equipment types have been installed
- Check suitable points of isolation have been provided
- Check required labels have been installed and operational diagrams are available
- Check interlocking
- Check correct protection settings have been applied
- Complete functional tests (synchronisation, disconnection and running without inadvertent tripping/disconnection)

# G99 Compliance

**Tests / Checks Required at all Power Generating Facilities:**

- Complete protection functional tests
- Check automatic restoration systems, where applicable. At least 20s shall elapse (following restoration of all phases) before the PGMs re-connect.

**Tests / Checks Required for Non-type Tested Protection:**

- Protection Calibration and Stability Tests for all of the protection functions, including:
  - Under and Over Voltage Protection
  - Under and Over Frequency Protection
  - Rate of Change of Frequency (RoCoF) Protection
- RoCoF and Vector Shift stability tests shall be carried out on all protection elements / functions

# Summary – key points

# DER Technical Forum

- The ENA is to facilitate a Distributed Energy Resource (DER) Technical Forum concerning distributed generation connection issues associated with G98 and G99

- The purpose of this DER Technical Forum is to provide a platform for ENA Members and stakeholders to review current understanding and facilitate the development of a common approach

- The forum will only deal with technical related issues that are not already dealt with by other industry standing working groups, committees or Code Panels

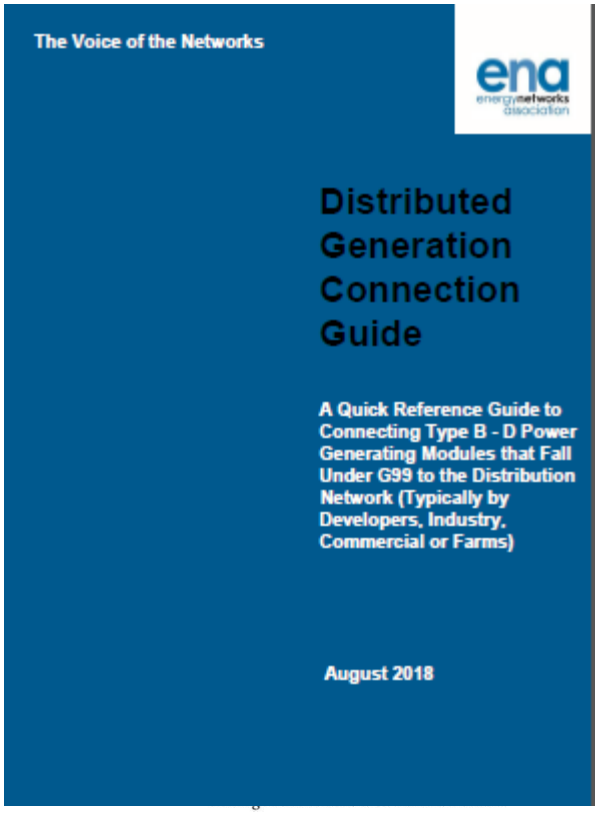
# Summary - Key Points

- Any generating unit commissioned and connected on or after **27th April 2019** must comply with G98/G99, as appropriate
- G98/G99 are based on G83/G59 respectively but incorporate new RfG technical requirements
- For requests to connect Power Generating Modules the new ENA G99 Application Form should be used
- The DNO is under a legal obligation to disallow the connection of generating plant unless it complies with the relevant EREC and legal requirements such as the Distribution Code
- If your installation is not compliant you will not be able to connect

# Sources of reference

New procedures are covered by various updated documentation:

- Distribution Code
  - ✓ DPC7 substantially amended (i.e. relevant requirements only now in G99)
- ENA Website
  - ✓ G98 & G99 Documents
  - ✓ Revised Standard Application Form
  - ✓ Compliance Forms
  - ✓ Revised DG Guides



# Questions?

- We will address some now
- Those that we don't have time to address now, we will respond via email
- You can also email us at: wpdrfginfo@westernpower.co.uk
- We will produce a Q&A document
- Recording of the Webinar will be available on WPD's website

# Thank you