

Energy Networks Association

Distributed Generation Connection Guide

**A QUICK REFERENCE GUIDE FOR
CONNECTING GENERATION TO THE
DISTRIBUTION NETWORK THAT FALLS UNDER
G59/3 AND IS 50KW OR LESS 3-PHASE OR
17KW OR LESS SINGLE-PHASE**

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In the event that there is any conflict or contradiction between this Guide and the engineering standards and codes referenced in the Guide, the terms of the referenced documents will prevail. These include inter alia Engineering Recommendation G83/2, Engineering Recommendation G59/3, the Distribution Code, the Grid Code, the Connection and Use of System Code and the Balancing and Settlement Code.

Introduction

Who is this Guide for?

This Guide is intended to help you, as a developer or prospective owner of any form of **Distributed Generation**, to connect your generating unit to one of the UK's electricity distribution networks. This "summary" guide is written for the developers of distributed generation projects which are covered by **Engineering Recommendation (EREC) G59**.

This covers either:

- Projects with a capacity of **more than 16A per phase**; or
- Projects connected at a **higher voltage** than 230V (single phase), or 400V (three phase); or
- Any other projects that are **not type tested** under the requirements of EREC G83.

In particular, this Guide is written for projects within the scope of EREC G59, but which meet certain criteria that allow their connection process to be **significantly simpler**. These criteria are that the **generating capacity** of the generating units is less than or equal to 50kW three phase, or 17kW single phase, and the equipment to be installed is **type tested** according to EREC G59 or G83.

In addition, this Guide is aimed at generation projects where the connection requires only a minimum amount of network extension and makes use of the Feed-in Tariff (FITs) scheme (rather than Renewable Obligation Certificates or ROCs).

If your project is within the scope of EREC G83, there are **alternative guides** and summary guides you can read ('Distributed Generation Connection Guide—a guide for connecting generation to the distribution network in a single premises that falls under G83' and 'Distributed Generation Connection Guide—a guide for connecting generation to the distribution network in multiple premises that falls under G83').

What is the aim of the Guide?

This is a 'summary' form of a much more detailed guide, available on the Energy Networks Association (ENA) website. The purpose of this summary guide is to act as a **simplified 'route map'** of the processes for getting a generation project connected to the distribution network.

You should be aware that the process of getting connected described in this guide is **only part of the process** of developing your distributed generation. For example, this guide does not cover:

- Designing, installing and operating the generation units themselves;
- Planning and financing the project; and
- Resolving local planning issues.

The format of the Guide

This Guide has been written and formatted with you, the reader, in mind. We have tried to make this Guide as clear and easy to read as we can, bearing in mind that some of the issues discussed are technical and complex. In particular:

- Any acronyms and terms which may be unfamiliar are explained in the glossary.
- Text is **emboldened** for emphasis.
- Where necessary the Guide distinguishes between the arrangements that apply in Scotland and those which apply in England and Wales. This is indicated with a Scottish flag.
- There is a pointer on where to find more information at the end of the guide.

Because the topics covered here are technical and complex, it is necessary to refer to such concepts as voltage and power. Where possible, terms that may be unfamiliar have been defined.

Governance of the Guide

This Guide is a Distribution Code Review Panel (DCRP) document. The DCRP will update the Guide periodically.



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Acronym Guide

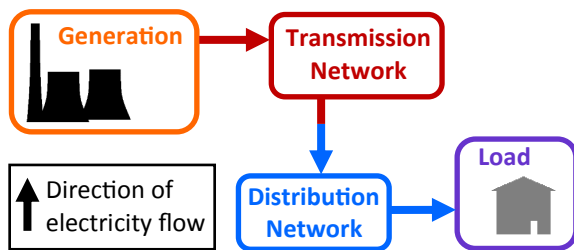
DNO	Distribution Network Operator
ENA	Energy Networks Association
EREC	Engineering Recommendation
FITs	Feed in Tariffs
HH	Half Hourly (meter)
ICP	Independent Connections Provider
IDNO	Independent Distribution Network Operator
NHH	Non-Half Hourly (meter)
NGET	National Grid Electricity Transmission
RO	Renewables Obligation
ROCs	Renewables Obligations Certificates

Note: Many of the terms used in this guide are defined in the Glossary.

A: Background-The UK Power Sector

Traditional power system

In the traditional power system, electricity generally flows in one direction; from large power stations (mostly coal, gas and nuclear), into the transmission system, through to distribution systems and delivered to loads (such as homes, businesses and factories).



Changing power system

An increasing number of small electricity generating units are being developed, often connected to distribution networks. This is known as Distributed Generation, and can bring advantages such as low carbon energy sources and reduced transmission and distribution system costs.

However, it can result in the electricity flows in the network being less predictable. As this is not what the network was designed to deal with, this can cause issues around network control and protection.

Important terms

Transmission Network / Transmission System: Transports electricity over long distances across the country. Electricity is transported at a high voltage to reduce losses. Transmission voltages are 275kV or 400kV. In Scotland, 132kV is also used.

Distribution Network / Distribution System: Transports electricity from the Transmission System (and from Distributed Generation) to loads like homes and businesses. The voltage is reduced to the correct supply voltage for the loads. Distribution voltages are 132kV and lower in England and Wales, and less than 132kV in Scotland. Most domestic customers are supplied at 230V.

Key organisations

National Grid Electricity Transmission (NGET): The System Operator for Great Britain, and also the Transmission Owner for England and Wales.

The Transmission Owner for northern Scotland is **Scottish Hydro-Electric Transmission Ltd**, and for southern Scotland, **Scottish Power Transmission Ltd**.

Distribution Network Operator (DNO): Owns and maintains public electricity distribution networks. There are six DNOs in Great Britain.

Note: You may be connected to an Independent DNO's (IDNO) network or a private network rather than the DNO's network. In this Guide when we refer to DNOs, this also applies to IDNOs.

Suppliers: Buy electricity in bulk from generators, and then sell to consumers. They are responsible for providing bills and customer services, and arranging metering and meter reading. Electricity supply is a competitive market so you can choose and change your electricity supplier.

Elxon: The Balancing Settlement Code company for Great Britain.

Ofgem (Office of Gas and Electricity Markets): The regulator of the power system in Great Britain.

B. The Role of Distributed Generation

What is driving Distributed Generation?

Environmental concerns—The increased concern over the damage that Greenhouse Gases may be doing to our environment. Distributed Generation technologies are often renewable or low carbon means of generating electricity.

Government policy—The Department of Energy and Climate Change (DECC) is developing policy to ensure that in the UK energy supplies are secure, low carbon, and fuelled from a diverse mix of energy supplies. This includes supporting Distributed Generation.

Security of Supply—The need for secure and reliable sources of energy, both now and into the future.

Technological innovation

Technology is developing all the time, and there are more generating technologies and network techniques available now than there were when the national grid was being developed.

Ofgem has introduced the **Low Carbon Networks Fund** (LCNF, which aims to drive innovation in distribution networks), and **Network Innovation Allowance** and **Network Innovation Competitions** (NIA and NICs, to incentivise innovation in transmission networks).

For more information, and details about individual projects, refer to the Smarter Networks Portal, hosted by the Energy Networks Association: www.smarternetworks.org/

Benefits of Distributed Generation

The benefits that increased Distributed Generation has on the UK and its electricity system include:

- **Increased energy mix** —often lower carbon; and
- If Distributed Generation is connected close to the point of use,
 - **Reduced need for network infrastructure**
 - **Reduction in transmission and distribution losses.**

The commercial benefits to having Distributed Generation include:

- **Lower electricity bills**—through using your own energy onsite instead of importing from the grid;
- **Selling energy** that you generate, and gaining from **incentives** like FITs and ROCs; and
- **Participation in Ancillary Services**—Larger units (more than around 3MW) may be able to participate.

Impacts of Distributed Generation

As well as introducing benefits, the increased penetration of Distributed Generation in UK distribution networks also poses challenges, including:

- **Thermal ratings** being exceeded;
- **System voltage** rising beyond the acceptable limits;
- **Reverse power flows**, i.e. power flows in the opposite direction to which the system has been designed;
- **Fault level** rising above the rating of equipment; and
- **Power quality** being affected, e.g. flicker, voltage unbalance or harmonics.

C: An Overview of Getting Connected

Below is a summary of the major tasks of the connection process. These tasks are described in more depth in this section of the guide.

1. FIND AN INSTALLER

Installers must be competent

2. DISCUSS WITH THE DNO

Hold meetings with your DNO

3. SUBMIT APPLICATION FORM

4. APPLICATION ACCEPTANCE

Accept a Connection Offer from your DNO

5. CONSTRUCTION AND COMMISSIONING

Infrastructure is installed and tested

6. INFORM THE DNO

Submit the Installation and Commissioning form

7. ONGOING RESPONSIBILITIES

1. Find an installer

The first task is to find a competent installer. Certified generation products and installers can be found on the following website:

www.microgenerationcertification.org

2. Discuss with the DNO

You must discuss your plans with the DNO before starting work. You should do this as soon as possible in your planning, as the DNO's response may have a significant impact on how you plan your project. You may discuss the feasibility of your connection, and if there will be any charges for connection.

3. Submit Application Form

Once you have planned the project and exchanged information about your plans with the DNO, it is time to submit an application form. The format of the application form is given in Appendix 13.5 of EREC G59, which is available free of charge on the Energy Network Association's website. Your installer should submit the application form on your behalf.

4. Application Acceptance

When you submit your application form the DNO will assess the impact that your generating equipment may have on the network. Once the DNO has conducted these assessments, they will produce a Connection Offer. This will specify the conditions for your connection, and inform you of any connection charge that you may be asked to pay.

You should ensure that you fully understand this offer before accepting it. You should discuss questions with your DNO if you are unsure.

General Tip: Communication with the DNO

Communication with the DNO from an early stage and throughout the project means you can discuss potential issues early, and allows you to plan your project effectively. You can also request additional information like budget estimates and feasibility studies, though some DNOs will charge for this.

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5. Construction and Commissioning

The construction and commissioning requirements are covered in Section 12.3 of EREC G59. Your installer should be aware of these requirements. Your DNO will also complete any work required on the network. Close communication with the DNO throughout this process will allow coordinated planning of construction and connection.

Your DNO may wish to witness the commissioning of your equipment. In this case, you should inform them of the details of the commissioning at least 15 days in advance.

6. Inform the DNO

Your installer should notify the DNO **within 28 days** of commissioning the generating unit, and provide them with information on the installation. This information is captured on an “**installation commissioning confirmation**” form, which is given in Appendix 13.2 in EREC G59. DNOs may have their own installation commissioning confirmation forms on their websites.

7. Ongoing Responsibilities

Ongoing commitments are outside of the scope of this Guide, but you should be aware of them. They include:

- maintenance of the equipment;
- informing the DNO of significant changes to your units or of unusual events; and
- periodic testing specified by the DNO.

Health and Safety Considerations

Some of the safety requirements for Distributed Generation connections are set out in EREC G59, which reflects Regulations and Acts such as the Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002, and also the relevant British Standards.

Dealing with Disputes

If you have a dispute during the connection process which you cannot resolve with the party directly, you can contact the Energy Ombudsman:

www.ombudsman-services.org/energy

As a last resort it can then be referred to Ofgem.

D: The Connection Notification

There are two formal documents that you need to submit to your DNO throughout the connection process. Both of these are mentioned in the previous section of this Guide, and described in further detail here:

The Application for Connection Pro-forma

The Application for Connection Pro-forma is provided in Appendix 13.5 of EREC G83, and needs to be submitted to your DNO **before you begin installation**. Connection of the generation equipment will only be allowed to proceed after the DNO has approved the application, and any facilitating works for the connection have been completed.

The information required includes:

- details of the **installer** of the generating units, including their qualifications; and
- **information on the proposed equipment**, including the address, meter number, capacity and type testing reference number.

The Commissioning Pro-forma

The Commissioning Pro-forma is provided in Appendix 13.2 of EREC G83, and needs to be filled in and given to your DNO **within 28 days of the date of commissioning**. The information required includes:

- **contact details** for the owner of the generating unit;
- details about the **site** where you are connecting your generating unit, including metering information;
- **technical information** about the generating unit itself, including the generating capacity, type test reference and primary energy source;
- details of the **installer** of the generating unit, including the party's accreditation and qualifications;
- **supporting information**, e.g. circuit diagrams; and
- a **signed declaration** as to the compliance of the generating unit with the requirements of EREC G83.

E: Costs and Charges

Costs and charges can be divided into two categories:

CONNECTION CHARGES

ONGOING CHARGES

DNOs are obliged to publish documents about their charges, which can be found on their websites. These contain the **DNO's charging methodology** (i.e. how they calculate their charges), the **DNO's charging statement** (i.e. what the charges are), and other relevant information for connecting customers.

Connection charge

This is a one-off charge made by the DNO to cover the cost of your connection, which may contain charges for:

- **Infrastructure:** new equipment and reinforcement to the existing network necessary to accommodate your generation. You will be charged for:
 - Extension to the network
 - A **portion** of reinforcement costs
- **Budget Estimates and Feasibility Studies** (optional).
- Others, including: Administration, additional meetings or site visits, provision of Wayleaves, substation locks and notices.

Note that not all DNOs apply charges for all of these items, and that not all of these items will be relevant for your project.

To obtain a more accurate picture of the connection costs for your project, you can get a budget estimate from either the DNO, or from a specialist engineering consultant. You must be aware that this will be an estimate, and may not accurately reflect what you will be charged. It is likely that you will need to pay for this estimate.

Ongoing Charges

Use of System (UoS) charges cover the operation and maintenance of the distribution network. They are levied by the DNO to the supplier, so you will not be charged these directly. However, they may appear as an item on your bill.

DNOs are obliged to publish documents about their Use of System charges. You can find these on DNOs' websites.

UoS charges change depending on:

- the **voltage level** you are connected to; and
- the **type of meter** you have. All projects with a capacity greater than a certain threshold (currently 30kW) must have a Half Hourly (HH) meter. If you have an HH meter, it is your responsibility to appoint a Meter Operator to install, maintain and collect data from your meter. If you have a Non-Half Hourly (NHH) meter, then it is the responsibility of the supplier to install, maintain and collect data.

With the Common Distribution Charging Methodology charges for LV generation customers with NHH meters are in the form of a single unit rate (p/kWh).

F: Selling Electricity-Incentive Schemes

FEED-IN TARIFFS (FITs)

FITs are a financial incentive to support distributed renewable energy generation **up to 5 MW**. FITs are available for the following generation technologies:

- Anaerobic digestion
- Combined Heat and Power (CHP)*
- Solar PV
- Wind
- Hydro

*Up to 30,000 domestic Combined Heat and Power (CHP) units are supported through FITs under a Micro CHP pilot scheme. These units must have a capacity of no greater than 2 kW each.

There are three sources of financial benefit from a Generation project receiving FITs:

1. Generation tariff (FITs):

A fixed price for each unit of electricity **generated**, depending on the generation technology. The tariffs are reviewed regularly, and can be found on Ofgem's webpage. The tariff level that your generator will receive will remain the same throughout the eligible lifetime of the project, which for most technologies is 20 years.

2. Export tariff:

A **guaranteed price** for each unit of electricity **exported** to the grid. The tariffs are reviewed regularly, and can be found on DECC's or Ofgem's webpages.

3. Import Reduction:

Reducing your electricity bill by using your own electricity rather than importing from the grid.

In the case of solar PV, your tariff will also be dependent on the number of PV installations that you are receiving FIT payments from, and the energy efficiency of the property itself. The accreditation process for your generation project will depend on the generating technology you are using. **To find out more, please see Ofgem's website.**

Where to Find More Information

Relevant Organisations:

Energy Networks Association —the industry body for UK energy transmission and distribution licence holders and operators: www.energynetworks.org

Ofgem—www.ofgem.gov.uk is a good source of up to date information about **Feed in Tariffs and Renewables Obligations**

National Grid Electricity Transmission (NGET)—The Great Britain System Operator and Transmission System Owner in England and Wales: www.nationalgrid.com/uk/Electricity/
Has a lot of useful information available, including the National Grid Electricity Transmission Ten Year Statement and more information about connection and agreements

Department of Energy and Climate Change (DECC) - For the most up to date information on relevant Government policy www.decc.gov.uk

Energy Saving Trust—<http://www.energysavingtrust.org.uk/Generate-your-own-energy>

Some Useful References:

Engineering Recommendation G59 and G83—available to buy on the ENA Document Catalogue System: www.ena-eng.org/ENA-Docs/
Some of the appendices are available for free from the ENA website.

The Grid Code of Great Britain — available free of charge on NGET's website:
www.nationalgrid.com/uk/Electricity/Codes/gridcode/

The Distribution Code of Great Britain—available free of charge on the Distribution Code website: www.dcode.org.uk/

Metering Codes of Practice: www.elexon.co.uk/bsc-related-documents/related-documents/codes-of-practice/

Certified generation products and installers: www.microgenerationcertification.org

Ofgem is a good source of up to date information about **Feed in Tariffs and Renewables Obligations**—www.ofgem.gov.uk/environmental-programmes
Note that your electricity supplier is your point of contact for the FIT scheme.

Where to Find More Information

There is a great deal of published information that your DNO **can** provide that will be helpful for your project planning. Some of the most useful sources are summarised here, and links to the DNO websites are in the table below. You should also contact your DNO from an early stage in your project, and they will be able to advise you with information specific to your situation.

Long Term Development Statement (LTDS)

Covers the development plans for the network, and other information useful for prospective developers. An introductory chapter is generally available on the DNO's website and DNOs will give access to the full document on request. These documents are updated annually.

Connection Charge Documents

Statements and methodologies will be given for both connection charges and Use of System (UoS) charges. This information may be included in a single document, or in several, and are updated regularly. These are available on your DNO's websites.

Standards of Performance

Ofgem has set minimum performance standards for the provision and performance of connections, and if your DNO fails to meet these standards, you may be entitled to receive payment. The ENA has guidance documents about these Standards on their website: www.energynetworks.org/electricity/regulation/electricity-standards-of-performance.html

DG (Distributed Generation) Forums

Ofgem held a series of regional events ("DG forums") to explore issues and concerns around Distributed Generation connections, including barriers to Distributed Generation and process issues. DNOs responded to these concerns in a number of ways, including:

- Providing a more detailed **breakdown of costs**;
- Making improvements to the **provision of information** (e.g. web portals and capacity "heat maps", indicating areas that can more readily facilitate connections);
- Holding **stakeholder workshops** and **customer events** (e.g. some DNOs host "open surgeries" for Distributed Generation customers); and
- Utilising **new technologies and techniques** in connection offers.

The ENA has taken on running these forums on behalf of the DNOs.

Region	DNO	Website
North Scotland, Southern England	SSE Power Distribution	www.ssepd.co.uk
South Scotland, Cheshire, Merseyside and North Wales	SP Energy Networks	www.spenergynetworks.com
North East England	Northern Power Grid	www.northernpowergrid.com
North West	Electricity North West	www.enwl.co.uk
Yorkshire	Northern Power Grid	www.northernpowergrid.com
East Midlands, West Midlands, Southern Wales, South West England	Western Power Distribution	www.westernpower.co.uk
Eastern England, South East England, London	UK Power Networks	www.ukpowernetworks.co.uk

Glossary of Terms

Balancing and Settlement Code company: Governs the operation of the balancing mechanism. They charge generators and suppliers for the cost to the System Operator to balance the market. The Balancing and Settlement Code company for Great Britain is Elexon.

Close Geographic Region: Typically, an area which is fed by the same part of the distribution network, from a single feeder or distribution transformer. A general rule of thumb is that if your installations are within 500 meters of each other, then they are likely to be within a close geographic region.

Commissioning: A set of visual inspections and tests performed on equipment after installation, renovation or maintenance, and before it goes into full operation. Commissioning aims to ensure the equipment is working safely and as it should.

Distribution Code: The code required to be prepared by a DNO pursuant to condition 21 (Distribution Code) of a Distribution Licence and approved by the Authority (The Gas and Electricity Markets Authority - Ofgem) as revised from time to time with the approval of, or by the direction of, the Authority.

Distributed Generation: A generation project is classed as Distributed Generation if it operates while electrically connected to the distribution network. Also known as 'Embedded Generation'.

Distribution Network (System): Transports electricity from the Transmission System to loads like homes and businesses. The voltage is reduced to the correct supply voltage for the loads. The voltage is 132kV and lower. Most customers are supplied at 230V.

Distribution Network Operator (DNO): Owns and maintains public electricity distribution networks. They must hold a Distribution Network Operator Licence. These are regulated monopoly businesses which recover their costs by levying use of system charges on electricity traded using their network. There are six DNOs in Great Britain.

Engineering Recommendation (EREC) G59: EREC G59 is called "Recommendations for the Connection of Generating Plant to the Distribution Systems of Licensed Distribution Network Operators." The purpose of the document is to provide guidance to you and to DNOs on all aspects of the connection process.

Engineering Recommendation (EREC) G83: EREC G83 is called "Recommendations for the Connection of Type Tested Small-scale Embedded Generators (Up to 16 A per Phase) in Parallel with Low-Voltage Distribution Systems." It sets out the requirements you must meet before your generating unit can be connected to the network. The document is aimed at the manufacturers and installers of your generating unit.

Feed-in Tariffs (FITs): A financial incentive to support distributed and small-scale renewable energy generation, up to 5 MW.

Generating Unit: Any apparatus which produces electricity. Is a synonym of a generation set as defined in the Distribution Code.

Generator: A person who generates electricity under licence or exemption under the Electricity Act 1989.

Glossary of Terms

Independent Distribution Network Operator (IDNO): A holder of a distribution licence, an IDNO designs, builds, owns and operates a distribution network, which is an extension to existing DNO network. They typically build network for new developments such as business parks, retail and residential areas and leisure facilities. Your local DNO will be able to inform you if you are connected to an IDNO's network or a private network rather than the DNO's network.

Office of Gas and Electricity Markets (Ofgem): The regulator of the electricity system. They are responsible for regulating prices and performance in the monopoly elements of the electricity supply industry, resolving disputes between different parties when necessary, and granting the various licences in the power sector, including generation licences.

Renewables Obligation (RO): The main support mechanism for renewable electricity projects over 50kW, and those that are not eligible for FITs due to the type of technology.

Suppliers: Buy electricity in bulk from generators, and then sell to consumers. They are responsible for providing bills and customer services, and arranging metering and meter reading.

System Operator: responsible for balancing demand with generation on a second by second basis. National Grid Electricity Transmission (NGET) is the System Operator in Great Britain.

Transmission Network (System): Transports electricity over long distances across the country. Electricity is transported at a high voltage to reduce losses. The voltage is 275kV or 400kV. In Scotland, 132kV is also used.

Transmission Owner (TO): Owns and maintains the high voltage transmission system. The Transmission Owners are as follows:

- National Grid Electricity Transmission (NGET) in England and Wales
- Scottish Power in southern Scotland (SP Transmission Ltd)
- Scottish and Southern Energy (SSE) in northern Scotland (Scottish Hydro Electric Transmission Ltd, or SHETL)

Type tested equipment: Defined in G83 as equipment that "has been tested by the Manufacturer, component manufacturer or supplier, or a third party, to ensure that the design meets the requirements of this Engineering Recommendation". The following generation types fall under G83, as they have a type testing appendix:

- Hydro
- Wind
- Fuel Cells
- Domestic Combined Heat and Power (CHP)
- Photovoltaic (PV)
- Energy Storage Device