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. It may also be useful for installers or manufacturers of distributed generation equipment.

This "summary" guide is written for the developers of distributed generation projects which are covered by **Engineering Recommendation (EREC) G83**. This covers Project that are:

- Projects with a capacity of **16A per phase or less** (if there are multiple generation units connected at the same premises, then 16A is the maximum combined capacity per phase); and
- Projects connected at **low voltage** (230V single phase, or 400V three phase); and
- Technology which is **type tested** under the requirements of EREC G83.

This guide is best suited for those developers who are connecting Distributed Generation in a single property. If your are developing Distributed Generation in more than one premises within a 'close geographic region', then there are alternative Guides that are more suited to your project: ('Distributed Generation Connection Guide—a guide for connecting generation to the distribution network in multiple premises that falls under G83').

If your project is outside of the scope of EREC G83, there are **alternative guides** and you can read ('Distributed Generation Connection Guide—a guide for connecting generation to the distribution network that falls under G59').

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 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 described.

Governance of the Guide

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

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

Contents

Acronym Guide

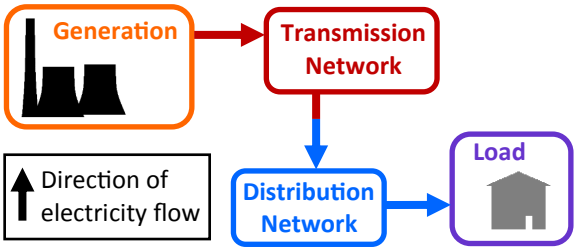
DNO	Distribution Network Operator
ENA	Energy Networks Association
EREC	Engineering Recommendation
FITs	Feed in Tariffs
HH	Half Hourly (meter)
ICP	Independent Connections Provider
IDNO	Independent Distribution Network Operator
NHH	Non-Half Hourly (meter)
NGET	National Grid Electricity Transmission
RO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

Note that this document covers the process for connecting generation to the distribution networks in Great Britain. Northern Ireland has different connection arrangements, for example different versions of Engineering Recommendations G83 and G59 are in use. For more information, refer to the Northern Ireland Electricity website: www.nie.co.uk

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 and dynamic. 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 voltage is 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 voltage is 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.

Elexon: 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 Gasses may be doing to our environment. Distributed Generation technologies are often renewable or low carbon means of generating electricity.

Government policy—The Department for Business, Energy and Industrial Strategy (BEIS), formally known as 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

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.

To incentivise innovation in energy networks, Ofgem runs two mechanisms: the **Network Innovation Allowance** (NIA, an allowance awarded to each network company) and **Network Innovation Competitions** (NIC, where network companies bid competitively to fund larger projects).

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

In most cases, the installation of small generating units into a single premises will have very little affect on the network. Therefore the connection process is relatively simple, and can be summarised as "fit and inform".

Opposite is a summary of the major tasks of the connection process. These are explained below.

1. FIND AN INSTALLER

2. CONSTRUCTION AND COMMISSIONING

3. INFORM THE DNO

4. 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. Construction and Commissioning

The construction and commissioning requirements are covered in Section 7 of EREC G83. Your installer should be aware of these requirements. During the commissioning, your installer will check that your equipment is working as it should.

3. Inform the DNO

Your installer must 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 3 of EREC G83. The form should include both generation and storage details as applicable. DNOs may have their own installation commissioning confirmation forms on their websites.

4. 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
- Periodic testing specified by the DNO

Health and Safety Considerations

Some of the safety requirements for Distributed Generation connections are set out in EREC G83, 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

You do not need to talk to your DNO before your generation equipment is up and running. Your installer needs to inform the DNO and provide a number of pieces of information **within 28 days of the date of commissioning**. This information is defined in a Commissioning Pro-forma, which is provided in Appendix 3 of EREC G83

The information required includes:

- details about the **site** where you are connecting your generating unit, including metering information;
- **contact details** for the owner of the generating unit;
- **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.

If you appoint a competent installer, they should know about the requirements set out in EREC G83, and make sure that your installation meets them. You should check that your installer is aware of all these requirements.

E: Costs and Charges

Generation Distribution Use of System (UoS) charges

UoS charges cover the operation and maintenance of the distribution network. They are levied by the DNO on 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 vary depending on:

- the voltage level you are connected to (if you are compliant with EREC G83, you are connecting to low voltage); and
- the type of meter you have—it is likely that you will have a Non-Half Hourly (NHH) meter, as only sites with a generation capacity greater than a certain threshold (currently 30kW) are required to have a Half Hourly (HH) Meter.

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 be 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 BEIS'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 energy efficiency of the property itself. The accreditation process for your generation project will depend on the generating technology you are using. FITs are subject to "**deployment caps**" - this is a limit on the capacity that can receive a particular FIT tariff, in a particular tariff period. **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 for Business, Energy and Industrial Strategy (BEIS) - For the most up to date information on relevant Government policy https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy

Energy Saving Trust—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.

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