Connection of Power Generating Modules to DNO Distribution Networks in accordance with EREC G99

This form should be used by Customers connecting one of more Generating Unit's to the DNO Distribution Network. Customers with Generation are known as Generators in Distribution documentation and will be referred to as such in this document.
The form should be used by Generators connecting a new Generating Unit, or modifying plant in an existing Power Generating Facility. Note that Generating Units may comprise storage plant and hence a Customer connecting storage plant to the DNO Distribution Network is a Generator.

It is possible to connect almost any Power Generating Module[1] to the Distribution Network. In order for the connection to meet the requirements of a new Generator and the existing Customers it is important to ensure the new connection is properly designed and compliant with Engineering Recommendation G99. This means there is a need for information to be exchanged between you as the Generator and the local Distribution Network Operator (DNO). The Data Registration Code of the Distribution Code sets out the obligations on the Generator and DNO to exchange data as part of the design process and lists the data items that may need to be exchanged. The purpose of this application form is to simplify and clarify this data exchange process.

If the Power Generating Module that you are applying to connect is less than 16A per phase, you will probably be able to connect it using the far simpler connection process for Micro-generators complying with Engineering Recommendation G98.

If the Power Generating Module that you are applying to connect is greater than 16A per phase and less than 17kW (or less than 50kW three phase), you will probably be able to connect it using the simple connection process complying with Engineering Recommendation G99.

This Application Form is for all other generators and is in four parts.

The terms used in this form are aligned with those in Engineering Recommendation G99. Engineering Recommendation G99 contains a complete set of definitions and is available from the ENA website.

Parts 1 to 3

These parts collate the initial data that the DNO requires to assess the connection application and in some cases this information may be sufficient for the DNO to complete the connection design and make a connection offer. In this case there will be no need for you to provide additional information. However, for some Power Generating Module connection applications, depending on the size of the Power Generating Module and the proposed point of connection, this initial information may not be sufficient for the DNO to complete the connection design and make a connection offer. The DNO will advise you if you need to provide further information so that the connection design can be completed when the information provided in Parts 1-3 of the application form have been assessed by the DNO.

Part 4

If the DNO requires information in addition to that provided in Parts 1-3 of the application form, the DNO will request that Part 4 of the application form is completed. Generally you will need to complete all of Part 4 of the application form appropriate to the type of Power Generating Module although the DNO may indicate if not all of this information is required.

In some cases the DNO will require further information which is not included in any part of the application form to complete the connection design. The additional information that the DNO is entitled to request is defined in the Distribution Code, Distribution Data Registration Code, and would typically fall into the category 'Detailed Planning Data'. The DNO will advise you if such information is required.

There is the option for you to complete Parts 1 to 4 of the application form and return all of these as part of the initial data exchange. This will speed up the DNO design process as there is unlikely to be a need for additional information to be provided. However this may result in you providing information that is not required in order for the DNO to design the connection.

The application forms can be downloaded from the ENA website and when completed they should be sent to your local DNO. Their contact details can be found by following the link below, along with a postcode search facility to find out who your local DNO is:

http://www.energynetworks.org/info/faqs/who-is-my-network-operator.html

[1] Either a Synchronous Power Generating Module or a Power Park Module (made up of Generating Unit(s) which may comprise storage plant)

Guidance on completing the application form

The following section provides an overview of the information required to complete each part of the application form, which is divided into the following sections:

Part 1	Contact details, location and operational information
Part 1a	Supplementary contact details
Part 2	Site export and import characteristics
Part 3	Generating Unit general data
Part 4	Power Generating Module model data:
Part 4a	Synchronous Power Generating Modules
Part 4b	Power Park Module model data: Fixed speed induction Generating Units
Part 4c	Power Park Module model data: Doubly fed induction Generating Units
Part 4d	Power Park Module model data: Series inverter connected Generating Units
Part 4e	Storage plant
Part 4f	Transformer information

Part 1

This part of the application form is in two sections. Part 1 enables you to provide:

- Contact details for you and your consultant (if you have one)
- The location of your Power Generating Module.

Part 1a enables you to provide supplementary contact details for the Generator, Generating Unit installer and Storage plant installer, if applicable.

Part 2

Part 2 enables you to provide:

- Details of the import and export requirements for your site. It is important to make sure that you consider the import requirements for any load that you have on your site in addition to the export from the generation plant
- Information about the fault level contribution from the Power Generating Module at the Connection Point, although you do not need to provide this information here if more detailed fault level information is provided in Part 3 of the application form.

Part 3

This part of the application form enables you to provide more detailed information on each of the Generating Units, including storage, that you are applying to connect. The form should be completed for each different type of Generating Unit.

Slightly more information is required if the connection is likely to be at high voltage rather than at low voltage. If the Power Generating Module that you are looking to connect is larger than 150 kW you should assume that your site may be connected at high voltage and provide this additional information.

If there are any items on the application form that you are unsure about, it would be worth contacting the company you are arranging to buy your generation plant from as they should be able to provide some of the more technical information. If you are unable to provide some of the technical details for example if you have not yet decided who to buy your generation plant from, you can provide estimated data provided that you clearly indicate on the application form which data is estimated. You will need to confirm this data as soon as possible and always before the Power Generating Module is commissioned.

Part 4

This part of the application form enables you to provide detailed technical information about the generation plant you are applying to connect. It is split into six sections. The first four sections relate to particular types of Power Generating Module. You only need to complete the section relating to the type of Power Generating Module that you are applying to connect i.e. Part 4a, 4b, 4c or 4d. Use one form for each type of Power Generating Module. Part 4e enables you to provide additional information about storage plant. Part 4f enables you to provide information about any transformers that you plan to use.

As when completing Parts 1-3, if you are unable to provide some of the technical details, if for example you have not yet decided who to buy your generation plant from, you can provide estimated data provided that you clearly indicate on the application form which data is estimated. You will need to confirm this data as soon as possible and always before the Power Generating Module is commissioned.

---------- **PART 1** ----------

Applicant's Details

Company Name:
Company registered No.
Postal Address:
Contact Name:
Email Address:
Telephone No.

Consultant or Agent's Details (if applicable)

Consultants Name:
Postal Address:
Contact Name:
Email Address:
Telephone No.

Issue #	1
Date	
Issue #	
Date	
Note re amendment	

Issue #	
Date	
Note re amendment	

Issue #	
Date	
Note re amendment	

---------- **PART 1** ----------

Power Generating Module location and operation

Power Generating Facility name:
Site Postal Address or site boundary plan (1:500):
Details of technology (e.g. Solar, Wind, Biomass, Diesel/CHP, Storage):
Details of any existing Connection Agreements held by the Customer at or in the vicinity of the proposed or existing Connection Point.:
Details of any existing MPAN numbers:
Import MPAN
Export MPAN
Target date for provision of connection / commissioning of Power Generating Module:

Connection Point (OS grid ref or description):	
Preferred connection point voltage :	V
Single line diagram of any on-site existing or proposed electrical plant or, where available, operation diagrams	Please attach
What security is required for the connection? (see Note 1) :	

No. of Generating Units in each Power Generating Module:	
Are all Generating Units of same design/rating?	Y/N
Will any Power Generating Module operate in island mode?	Y/N
Will any Power Generating Module supply electricity to on-site premises?	Y/N

PART 1a

Generator Details

If the Applicant is also the Generator then there is no need to complete this section :	
Generator Name :	
Company registered No.	
Postal Address:	
Contact Name :	
Email Address :	
Telephone No.	

Installer Details (if applicable)

Installer Name :	
Postal Address:	
Contact Name :	
Email Address :	
Telephone No.	

Point of Contact for the DNO

Delete as appropriate	Applicant / Generator / Installer / Consultant or Agent /

PART 2

Site standby import requirements (see Note 2

Maximum Active Power import	MW
Maximum Reactive Power import (lagging)	MVAr
Maximum Reactive Power export (leading)	MVAr

Site top-up import requirements (see Note 3)

Maximum Active Power import	MW
Maximum Reactive Power import (lagging)	MVAr
Maximum Reactive Power export (leading)	MVAr

Site export requirements (net of auxiliary loads) (see Note 4):

Firm export requirements:

Maximum Active Power export (Registered Capacity)	MW
Maximum Reactive Power export (lagging)	MVAr
Maximum Reactive Power export (leading)	MVAr

Non-firm export requirements:

Maximum Active Power export	MW
Maximum Reactive Power export (lagging)	MVAr
Maximum Reactive Power export (leading)	MVAr

Storage Plant Firm import requirements:

Maximum Active Power import	MW
Maximum Reactive Power import (lagging)	MVAr
Maximum Reactive Power export (leading)	MVAr

Storage Plant Non-firm import requirements:

Maximum Active Power import	MW
Maximum Reactive Power import (lagging)	MVAr
Maximum Reactive Power export (leading)	MVAr

---------- PART 2 ----------

Total Site maximum fault current contribution (see Note 5)

Peak asymmetrical short circuit current at 10ms (i_p) for a 3φ short circuit fault at the connection point	kA
RMS value of the initial symmetrical short circuit current (I_k") for a 3φ short circuit fault at the connection point	kA
RMS value of the symmetrical short circuit current at 100ms ($I_{k(100)}$) for a 3φ short circuit fault at the connection point	kA

Power Generating Module interface arrangements (see Note 6)

Means of connection, disconnection and synchronising between the DNO and the Generator	

---------- PART 2 ----------

Commercial Service (applicable to Storage Plant for each commercial service / mode of operation)

Name of Commercial service and company name :	
Contact details for service operator :	
Is this a service which involves co-ordinated response with other storage plant either on the Distribution Network, Transmission System, Private Network or aggregator?	Y/N If yes please provide further details on a separate sheet.
If not a commercial service please describe the operational mode (e.g. float charge)	

Note 1 – The DNO will assume a single circuit connection to the Power Generating Module is required unless otherwise stated. Options include:

(a) single circuit connection
(b) manually switched alternative connection
(c) automatic switched alternative connection
(d) firm connection (secure for first circuit outage)
(e) a flexible or Active Network Management connection (discussion with DNO required)

Note 2 – This section relates to operating conditions when the site is importing Active Power. The maximum Active Power import requirement and the associated maximum Reactive Power import and/or export requirements should be stated

Note 3 - This section relates to operating conditions when the site is importing active power, typically when it is generating, but is not generating sufficient power to cater for all the on-site demand

Note 4 – This section relates to operating conditions when the Power Generating Module is exporting Active Power. The Active Power export and associated maximum Reactive Power export and/or import should be stated for operation at registered capacity.

Note 5 - See Engineering Recommendation G74, ETR 120 and IEC 60909 for guidance on fault current data. Additionally, fault current contribution data may be provided in the form of detailed graphs, waveforms and/or tables. Note that induction motors can contribute to the peak asymmetrical short circuit current at 10ms. If the fault current contribution is solely from Generating Units then this information need not be provided where detailed fault level contribution / impedance data is provided for each Generating Unit in Part 3 or Part 4 of this application form.

Note 6 - The interface arrangements need to be agreed and implemented between the User and DNO before energisation. Engineering Recommendation G99 6.4.2 refers.

---------- **PART 3** ----------

Generating Unit general data

Number of Generating Units to which this data applies:		
Type of Generating Unit (please all applicable tick boxes)	Synchronous Generating Unit	□
	Fixed speed induction Generating Unit	□
	Double fed induction Generating Unit	□
	Series inverter connected Generating Unit	□
	Storage Generating Unit	□
	Other (provide details)	□
Type of prime mover:		
Energy Source Availability (see Note 7). Please tick box	Intermittent	□
	Non-intermittent	□

Generating Unit Active Power capability

Rated terminal voltage (Generating Unit)	V
Rated terminal current (Generating Unit)	A
Generating Unit registered capacity (net)	MW
Generating Unit apparent power rating (to be used as base for generator parameters)	MVA
Generating Unit rated Active Power (gross at generator terminals)	MW
Generating Unit minimum Active Power (minimum generation)	MW
(see Note 8) Frequency response Droop setting in LFSM	%
Frequency response Droop setting in FSM (if applicable)	%
Frequency response mode ie FSM or LFSM	

Generating Unit Reactive Power capability at rated Active Power (gross, at Generating Unit terminals)

Maximum Reactive Power export (lagging).	MVAr
Maximum Reactive Power import (leading).	MVAr

---------- **PART 3** ----------

Generating Unit maximum fault current contribution (see Note 9)

Peak asymmetrical short circuit current at 10ms (i_p) for a 3φ short circuit fault at the Generating Unit terminals (HV connected generators only)	kA
RMS value of the initial symmetrical short circuit current (I_k") for a 3φ short circuit fault at the Generating Unit terminals (HV connected only)	kA
RMS value of the symmetrical short circuit current at 100ms ($I_{k(100)}$) for a 3φ short circuit fault at the Generating Unit terminals	kA

Generating Unit Voltage Control (to be agreed with the DNO)

If operating in Power Factor control mode, preferred Power Factor	
When operating in voltage control mode, voltage set point	V
Generating Unit Performance Chart attached	Y/N

Type C and Type D Power Generating Module (see note 10 for Type definition and Note 11 for model data)

Governor and prime mover model attached	Y/N
AVR / excitation model attached	Y/N
Short circuit ratio	

Note 7 - Intermittent and Non-intermittent Generation is defined in Engineering Recommendation P2/6 as follows:
Intermittent Generation: Generation plant where the energy source for the prime mover can not be made available on demand.
Non-intermittent Generation: Generation plant where the energy source for the prime mover can be made available on demand.

Note 8 –All Power Generating Modules must operate in Limited Frequency Sensitive Mode (LFSM). Generating Units may elect to operate in Frequency Sensitive Mode as agreed in an Ancillary Service agreement with the National Electricity Transmission System Operator. FSM capability is mandatory for Type C and Type D (see Note 10)

Note 9 See Engineering Recommendation G74, ETR 120 and IEC 60909 for guidance on fault current data. Additionally, fault current contribution data may be provided in the form of detailed graphs, waveforms and/or tables.

Note 10 - Types are defined in Engineering Recommendation G99 and repeated for Type B, Type C and Type D below:

Type B: A Power Generating Module with a Connection Point below 110 kV and Registered Capacity of 1MW or greater but less than 10MW.

Type C: A Power Generating Module with a Connection Point below 110 kV and a Registered Capacity of 10MW or greater but less than 50MW.

Type D: A Power Generating Module with a Connection Point at, or greater than, 110 kV; or with a Connection Point below 110 kV and with Registered Capacity of 50MW or greater.

Note 11 - Sufficient data should be provided in order to build up a suitable Power Generating Module dynamic model for analysis. Alternatively a 'Black Box' dynamic model of the Power Generating Module may be provided. All models should be suitable for the software analysis package used by the DNO.

282 **---------- PART 3 ----------**

283 **Storage Plant Energy capability**

284

Electricity storage capacity	MWh

285 **Storage Plant characteristics**

286

Does this application form relate to storage plant only or storage plant combined with another Generating Unit technology?	
For the storage element please confirm the technology. (e.g. battery, flywheel, other):	
If combined with another technology please confirm the other generation technology/ies (e.g. Solar, Wind, Biomass, Diesel/CHP):	
If the storage plant is co-located with other Generating Unit(s) please describe how the two will work together e.g. will the storage plant be used to reduce maximum export from a PV Power Generating Module to the DNO Network?	
If you intend to contract with third parties to provide services to a System Operator or a Supplier, please describe the type of services (e.g. frequency response, STOR, Triad avoidance). Further details are required below in respect of commercial services	
Import windows (period of time over 24 hrs if known)	
Export windows (period of time over 24 hrs if known)	
How do you expect your Site import and export profile to differ across the different seasons? e.g. for winter months vs summer months?	

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---------- **PART 4a** ----------

Power Generating Module model data: Synchronous Power Generating Modules

Generating Unit identifier:	
Type of Generating Unit (wound rotor, salient pole)	
Positive sequence (armature) resistance (HV connected generators only)	per unit
Inertia constant (Generating Unit and prime mover). (HV connected generators only)	MWsec/MVA
Direct axis reactances;	
Sub-transient (X''_d) – unsaturated / saturated	per unit
Transient (X'_d) – unsaturated / saturated (HV connected generators only)	per unit
Synchronous (X_d) – unsaturated / saturated (HV connected generators only)	per unit
Time constants:	
State whether time constants are open or short circuit (HV connected only)	
D-axis sub-transient – unsaturated / saturated (HV connected generators only)	s
D-axis transient – unsaturated / saturated (HV connected generators only)	s

---------- **PART 4b** ----------

Power Park Module model data: Fixed speed induction Generating Units (see Notes 12 and 13)

Magnetising reactance (HV connected generators only)	per unit
Stator resistance (HV connected generators only)	per unit
Stator reactance (HV connected generators only)	per unit
Inner cage or running rotor resistance (HV connected generators only)	per unit
Outer cage or standstill rotor reactance (HV connected generators only)	per unit
State whether data is inner-outer cage or running-standstill (HV generators connected only)	
Slip at rated output (HV connected generators only)	%
Total effective inertia constant (generator and prime mover). HV connected generators only	MWsec/MVA
Shunt capacitance connected in parallel at % of rated output:	
Starting	kVAr or graph
20%	kVAr or graph
40%	kVAr or graph
60%	kVAr or graph
80%	kVAr or graph
100%	kVAr or graph
Active power and reactive power import during start-up	MW-MVAr / time graphs
Active power and reactive power import during switching operations e.g. '6 to 4 pole' change-over (HV connected generators only)	MW-MVAr / time graphs
Under voltage protection setting & time delay	puV, s

Note 12 – Asynchronous generators may be represented by an equivalent synchronous data set

Note 13 – You will need to provide the above data for each asynchronous generation set based on the number of pole sets (i.e. two data sets for dual speed 4/6 pole machines)

---------- **PART 4c**----------

Power Park Module model data: Doubly fed induction Generating Units

Magnetising reactance (HV connected generators only)	per unit
Stator reactance (HV connected generators only)	per unit
Running rotor resistance (HV connected generators only)	per unit
Running rotor reactance (HV connected generators only)	per unit
Standstill rotor resistance (HV connected generators only)	per unit
Standstill rotor reactance (HV connected generators only)	per unit
State whether data is inner-outer cage or running-standstill (HV generators connected only)	

Generator rotor speed range – Minimum to rated speed (HV connected generators only)	rpm
Total effective inertia constant at rated speed (generator and prime mover). HV connected generators only	MWsec/MVA
Number of operations of fast fault current injection that can be sequentially accomplished and any limitations on time, thermal limitations, protection etc.	

---------- **PART 4d**----------

Power Park Module model data: Series inverter connected Generating Units (non Storage)

Generator rotor speed range (HV connected generators only)	rpm
Total effective inertia constant (generator and prime mover). HV connected generators only	MWsec/MVA
Number of operations of fast fault current injection that can be sequentially accomplished and any limitations on time, thermal limitations, protection etc.	

---------- PART 4e----------

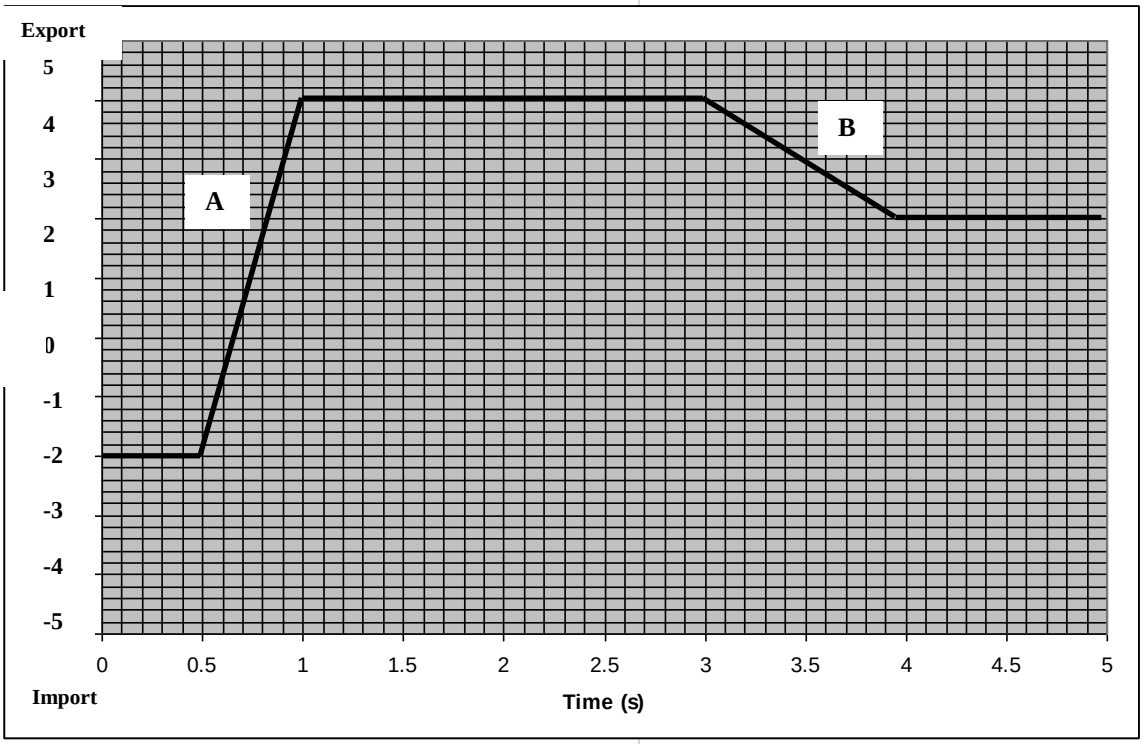
Power Park Module data: Storage plant data

Total effective inertia constant (generator and prime mover).	MWsec/MVA

Description of Dynamic Requirements (Active Power)

Import: power ramp rate (positive) :	MW / sec
: Import: power ramp rate (negative) :	MW / sec
Export: power ramp rate (positive) :	MW / sec
Export: power ramp rate (negative) :	MW / sec
If the power swing will transition from import to export or vice-versa please state the total magnitude of the power swing :	MW Up/down/both
For the intended control mode or to meet a specific commercial service, are there any known technical or operational requirements For example the scheme may be required to operate at a Power Factor other than that which might be required by the DNO as measured at the POC?	Y/N If yes please provide further details on a separate sheet.

Example of Ramp Rate / Total Power Swing



A - Example of ramp which transitions from import to export
Ramp rate (Positive) = (2+4) MW / 0.5sec = 12 MW per sec
Total power swing = (2+4) MW = 6 MW

B - Example of ramp during export
Ramp rate (Negative) = (4-2) MW / 1 sec= 2 MW per sec
Total power swing = (4-2) MW = 2 MW

---------- **PART 4f** ----------

Transformer information

Transformer identifier	
Transformer type (Unit/Station)	
Number of identical units	
Type of cooling	
Rated (apparent) power	MVA
Rated voltage ratio (on principal tap)	kV/kV
Positive sequence resistance (HV connected only)	per unit
Positive sequence reactance at principal tap	per unit
Winding configuration (e.g. Dyn11). HV connected only	
Type of tap changer (on load / off circuit)	
Tap step size	%
Maximum ratio tap	%
Minimum ratio tap	%
Method of voltage control (HV connected only)	

Method of earthing of high-voltage winding	
Method of earthing of low-voltage winding	