



# **Non-Registered Embedded Generators Guideline**

**Part of NER Chapter 5A Information Pack**



## SCOPE

This document provides information to assist proponents seeking to connect a non-registered embedded generating system under Chapter 5A of the National Electricity Rules (NER). This document forms part of the information pack required under Section 5A.D.1 in Chapter 5A of the NER, and outlines the other components of this information pack and how they can be accessed.

## WARNING

It is the responsibility of the user of this document to ensure that only the current version is being used.

This document identifies specific information relevant to connecting non-registered Embedded Generators as identified by the NER; however all relevant requirements of Ausgrid's Network Standards and the energy law must be met when connecting an embedded generator to Ausgrid's network.

Ausgrid may amend this document at any time.

### Document and Amendment History

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All correspondence should be directed to:

Chief Engineer

Ausgrid

GPO Box 4009

SYDNEY NSW 2001

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# 1. Introduction

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This guideline applies to embedded generator (EG) connections that will follow the connection process regulated by Chapter 5A of the National Electricity Rules (NER), excluding those defined as micro-embedded generators. This process generally applies to generators with a capacity ranging from 30kW to 5MW that will not be registered with the Australian Energy Market Operator (AEMO). This document provides an overview of the requirements for these connection, including:

- the connection process and the requirements;
- contestable services;
- examples of relevant costs;
- minimum access standards that are applicable;
- technical requirements relevant to the assessment of an application to connection;
- how to make a connection enquiry and an application for connection to Ausgrid's distribution network;
- single line diagrams of the preferred connection arrangements;
- sample schematic diagram of the protection system and control system; and
- model connection agreements.

In some cases this guideline references detailed requirements within other sources. Any Ausgrid source document that is referenced can be found within Ausgrid's information pack for non-registered EG (information pack) on the Ausgrid website [www.ausgrid.com.au](http://www.ausgrid.com.au). This guideline is part of the information pack. This information pack satisfies Ausgrid's compliance obligations to publish information under clause 5A.D.1(a)(7) in Chapter 5A of the NER.

This guide also references requirements within the National Electricity Rules. A copy of the current rules is available from the Australian Energy Market Commission (AEMC) website <http://www.aemc.gov.au>.

For connection of micro-EG refer to the 'Solar Power' page on Ausgrid's website [www.ausgid.com.au](http://www.ausgid.com.au). This page provides information on installing and connecting small-scale solar systems and other forms of micro generation.

## 2. Connection Application Process and Charges

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The table below outlines the key elements of the connection process for embedded generators connecting via the Chapter 5A process, as identified by 5A.D.1(a).

NER Requirement	Information
Application forms (1)	Application forms are provided on the Ausgrid website both as a PDF and an online form. A copy is also provided within the information pack.
Description of how an application for a new connection or a connection alteration is to be made (2)	Information is provided on the Ausgrid website on how application forms are to be complete. Each form is accompanied by a guide explaining the use of the form.
Description of Ausgrid's basic connection services and standard connection services (3)	A model standing offer is available for customers wishing to connect a micro-EG system. Otherwise connection of EG is by negotiation.

<p>Explanation of the connection applicant's right to negotiate for a negotiated connection contract and a description of the negotiation process</p> <p>(4)</p>	<p>Customers are entitled to negotiate a connection offer even if an appropriate model standing offer is available. The negotiation process is described in Ausgrid's 'Connection Negotiation Process', which is included within the information pack..</p> <p>Ausgrid will charge you a fee to cover reasonable expenses incurred in assessing the connection application and making a connection offer. Ausgrid will typically make an offer within 65 business days following a connection application, although this period may be extended by mutual agreement. Once the negotiated connection offer is made, it is valid for 20 business days.</p>
<p>The requirement for an expedited connection</p> <p>(5)</p>	<p>Customers may choose to expedite their connection application where an applicable model standing offer for basic or standard services is available. The expedited connection process allows a customer to save time by skipping the offer and acceptance steps to a connection contract.</p> <p>It is not possible to expedite a negotiated connection contract.</p>
<p>The basis for calculation of connection charges</p> <p>(6)</p>	<p>Connection charges are determined based on Ausgrid's Connection Policy – Connection Charges, which is approved by the AER.</p> <p>This document is available on the Ausgrid website and is included within the information pack.</p>

### 3. Capital Contributions and Contestable Services

If safely connecting the applicant's EG will require the electricity network to be extended or its capacity needs to be increased, the connection applicant will be required to fund the costs. Ausgrid requires the connection applicant to fund the cost of any network extension required to connect the new EG as well as the cost of any shared network augmentation required to enable the generator connection. This policy is consistent with the Australian Energy Regulator's (AER) Connection Charge Guidelines.

A generator connection applicant is required to arrange for the necessary network connection assets designed and installed by an Accredited Service Provider (ASP) holding current accreditation under an accreditation scheme established by the Electricity Supply (General) Regulation 2014. The accreditation scheme, which establishes a competitive market for network connection works, is administered by NSW Trade and Investment.

There are three levels of accreditation for the performance of contestable connection services in New South Wales:

- **Level 1 ASP** involves the contestable construction of transmission and distribution works such as the installation of high and low voltage distribution cables and substations.
- **Level 2 ASP** involves the contestable installation of overhead and underground service mains and metering equipment, the disconnection and reconnection of electricity to enable work to be carried out on an electrical installation, and electrifying installations.
- **Level 3 ASP** or accredited designer involves the contestable design of electrical distribution systems.

A list of level 1, 2 and 3 ASPs may be is obtained from NSW Trade and Investment:

<http://www.resourcesandenergy.nsw.gov.au/energy-supply-industry/pipelines-electricity-gas-networks/network-connections/contestable-works>

## 4. General Technical Requirements Applicable to All Connections

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There are general requirements that govern the overall design, construction and operation of network assets that all connection customers must comply with. These are specified in:

- Ausgrid Network Standards, published on the Ausgrid website;
- the NSW Service and Installation Rules. In particular, the NSW Service and Installation Rules has specific requirements for a customer operating high voltage equipment; and
- relevant Australian Standards.

The generator has a responsibility to ensure compliance with the NER, planning and environmental laws and Ausgrid's reasonable technical requirements.

## 5. Generator Technical Requirements

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Within the general technical requirements provided in the previous section, there are a number of documents that contain specific technical requirements that are of particular relevance to Embedded Generators. These are:

- The following Ausgrid documents. These documents are provided on the Ausgrid website within the 'Information Pack: Non-Micro Embedded Generators' (of which this guideline is part):
  - Network Standard 194 Protection Requirements of Embedded Generators > 30kW
  - Network Standard 194A Guidelines for Photovoltaic Installations up to 200kW Connected via Inverters to the Ausgrid Network
  - Network Standard 194B Guidelines for Rotating machines connected to the Ausgrid Network
  - Network Standard 195 High Voltage Customer Connections
  - Network Standard 238 Power Quality
  - Network Standard 178 Secondary System Requirements for Major Substations
- Schedules contained within Chapter 5 of the NER.
  - Schedule 5.2 Conditions for Connection Of Generators.
  - Schedule 5.5 Technical Details to Support Application for Connection and Connection Agreement.

The technical requirements that apply to a particular EG installation will depend on the scale, location and complexity of the installation. This will be determined during connection negotiations. In general, the technical requirements for generators provided within Chapter 5 of the NER will form the starting point for connecting EG under the Chapter 5A process.

## 5.1. Key Technical Requirements

The table below outlines the key technical requirements to be met by a embedded generator connection under the Chapter 5 process, as identified by NER 5A.D.1(a)(7).

Technical Requirement	Information
Minimum Access Standards NER 5.3A3(b)(5)	A Minimum Access Standard defines the lowest (ie worst) level of performance that can be tolerated for a specific technical aspect of a network connection. Refer to Chapter 5 of the NER
Protection systems and protection schemes (i)	Ausgrid Network Standard 194 Protection Requirements of Embedded Generators > 30kW
Fault level management principles (ii)	It is imperative for maintaining safety that the combined fault current contribution of all sources, including the contribution from EG, does not exceed the level that can be interrupted by the installed protection and switchgear, or withstood by system assets. The EG connection agreement specifies the maximum design fault level and allocates the maximum permissible fault level contribution for that EG proponent.
Reactive power capability and power factor correction (iii)	NER Chapter 5 S5.2.5.1 Reactive power capability
Power quality and how limits are allocated (iv)	Ausgrid Network Standard 238 Power Quality Appendix 2
Responses to frequency and voltage disturbance (v)	NER Chapter 5 S5.2.5.3 Generating unit response to frequency disturbances and S5.2.5.4 Generating system response to voltage disturbances
Voltage control and regulation (vi)	Ausgrid Network Standard 194 Protection Requirements of Embedded Generators > 30kW Ausgrid Network Standard 194B Guidelines for Rotating machines connected to the Ausgrid Network NER Chapter 5 S5.2.5.13 Voltage and reactive power control
Remote monitoring equipment control and communication requirements (vii)	Ausgrid Network Standard 178 Secondary system Requirements for Major Substations Ausgrid Network Standard 194B Guidelines for Rotating machines connected to the Ausgrid Network Also refer to NER Chapter 5 S5.2.6.1 and S5.2.6.2
Earthing requirements and other relevant safety requirements (viii)	Ausgrid Network Standard 194 Protection Requirements of Embedded Generators > 30kW Ausgrid Network Standard 195 High Voltage Customer Connections
Circumstances in which augmentation may be required to facilitate integration of an embedded generating unit into the network (ix)	Described in Section 2 in this document
Commissioning and testing requirements (x)	Ausgrid Network Standard 194 Protection Requirements of Embedded Generators > 30kW Ausgrid Network Standard 194B Guidelines for Rotating machines connected to the Ausgrid Network

## 6. Examples of Connection Requirements

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The following table outlines the sources where examples of various elements of the connection requirements can be found. This is provided in accordance with the NER requirements of clause 5A.D.1(a)(7).

Requirement	Specified within
Single line diagram of the preferred connection arrangements NER 5.3A3(b)(2)	Ausgrid Network Standard 194 Protection Requirements of Embedded Generators > 30kW  There are a large number of possible combinations of generation type, size and connection voltage hence only a representative sample is illustrated. These examples are for information only, and details may be modified as required for specific site conditions.
Sample schematic diagram of the protection system and control system NER 5.3A3(b)(3)	Appendix 1 of Ausgrid Network Standard 194 Protection Requirements of Embedded Generators > 30kW  There are a large number of possible combinations of generation type, size and connection voltage and only a representative sample is illustrated. These examples are for information only, and details may be modified as required for specific site conditions.
Example of connection service charges NER 5.3A3(b)(4)	Appendix 1 of this guideline
Model connection agreements NER 5.3A3(b)(7)	Currently Ausgrid does not offer model connection agreements for connection of embedded generators that are not micro-embedded generators under Chapter 5A. These connections are negotiated.



## Appendix 1 – Fee Example For an Embedded Generator Connection

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Submission of any payments related to embedded generation on the Ausgrid network should also comply with Ausgrid's Connection Policy Connection Charges document which is available on Ausgrid's website. Payments by cheque or purchase order will require additional information such as the connection applicant entity name, ABN, contact person, project reference and a request for an invoice to be able to be successfully processed. A lack of any of the above will result in the determination of an incomplete payment by Ausgrid and may have an impact Ausgrid's response time frames stated in this information pack.

Information related to any fees or charges for any applicable contestable augmentation and or extension works are not considered here. This information is found in Ausgrid's Connection Policy Connection Charges document available on Ausgrid's website.

All hours below are stated as Ancillary Control Service engineering hours as defined in Ausgrid's Connection Policy Connection Charges document available on Ausgrid's website.

The quoted costs are excluding GST and are the 2015 regulated rates (R5 Senior Engineer) as defined in Ausgrid's Connection Policy Connection Charges document available on Ausgrid's website.

### ***Example Detailed Enquiry Fees***

Coordinating, processing and assessing the connection enquiry	40 hours	(\$8,742.40)
Development of feasible connection options (Connection feasibility investigations and review of system constraints)	60 hours	(\$13,113.60)
<b>Detailed enquiry fee total</b>	<b>100 hours</b>	<b>(\$21,856.00)</b>

### ***Example Connection Application Fees***

Coordinating, processing and assessing the connection application	60 hours	(\$13,116.60)
Development of the agreed options dynamic and steady study	120 hours	(\$26,227.20)
Development of the agreed options protection fault and settings study	100 hours	(\$21,856.00)
Development of the draft offer to connect and agreements	16 hours	(\$3,496.96)
Development of any applicable design information packages	60 hours	(\$13,113.60)
<b>Connection application fee total</b>	<b>356 hours</b>	<b>(\$77,807.36)</b>

These fees exclude :

1. Any reports or consultation with other Distribution or Transmission Network Service Providers.
2. Ancillary Service Fees associated with connection applicant's Level 3 ASP design work.

## Appendix 2 – Power Quality Limits and Allocations

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Clause S5.2.5.2 of the NER specifies the access standards (automatic, minimum and negotiated) applicable for connection of generating equipment. These standards stipulate that the generator must not produce at the connection point voltage fluctuation (flicker), harmonic voltage distortion and voltage unbalance greater than the limits specified in the clauses.

Access standard limits for the power quality parameters are determined by following the requirements as outlined in the following schedules and standards:

- Overall: Ausgrid Standard Network Standard 238 Power Quality
- Voltage fluctuations: NER S5.2.5.2.(a), NER S5.1.5 and Australian Standard AS/NZS 61000.3.7
- Harmonic voltage distortion: NER S5.1.6 and Australian Standard AS/NZS 61000.3.6
- Voltage unbalance: NER S5.1.7

Ausgrid will calculate the automatic and minimum access limits based on the methodologies outlined in the above schedules and standards (and supporting handbooks). Negotiated access limits will be set so that Ausgrid can keep the level of emissions on the network below the planning levels.

Where a negotiated access standard is provided for a Generator, Ausgrid reserves the right to issue new access standard limits at a future time to accommodate new customers and/or changed network conditions.

## Glossary

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<b>AEMO</b>	Australia Energy Market Operator
<b>AER</b>	Australia Energy Regulator
<b>ASP</b>	Accredited Service Provider
<b>EG</b>	Embedded Generator
<b>information pack</b>	<p>In this document, Ausgrid’s Information Pack for Non-Registered EG connections provided to assist customers connect under the Chapter 5A process in the NER.</p> <p>Note that Ausgrid also publishes an information pack for Registered EG connecting under the Chapter 5 process.</p> <p>Both information packs are published on the Ausgrid website <a href="http://www.ausgrid.com.au">www.ausgrid.com.au</a></p>
<b>micro EG</b>	Micro Embedded Generator – means an <i>embedded generating unit</i> of the kind contemplated by Australian Standard AS 4777 ( <u>Grid connection of energy systems via inverters</u> )
<b>NER</b>	National Electricity Rules
<b>NS</b>	Network Standard