

# Registered Embedded Generators Guideline

Part of NER Chapter 5 Information Pack



## SCOPE

This document provides information to assist proponents seeking to connect an embedded generating system under Chapter 5 of the National Electricity Rules (NER). This document forms part of the information pack required under Section 5.3A.3 in Chapter 5 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

Issue No.	Date	Approved By	Summary of Changes
1	September 2014	Manager Asset and Network Planning	Initial Issue
2	June 2015	Manager Asset and Network Planning	Structural and phrasing changes to improve clarity

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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 is designed to improve clarity and transparency of the connection process and allow connection applicants to participate more effectively in this process. It applies to embedded generator (EG) connections that will follow the process in Chapter 5 of the NER.

The Chapter 5 process generally applies to generators with a capacity greater than 5MW and that will be registered with the Australian Energy Market Operator (AEMO). More information on registration can be found on the AEMO website: [www.aemo.com.au](http://www.aemo.com.au)

This guideline, with other documents referenced within this guideline, satisfies Ausgrid's compliance obligations to publish an information pack under Section 5.3A.3 in Chapter 5 of the NER.

This document covers:

- 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 from Ausgrid's Information Pack Registered EG webpage on the Ausgrid website [www.ausgrid.com.au](http://www.ausgrid.com.au). This guideline is part of this information pack.

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>.

## 2 Connection Application Process

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The Ausgrid connection process for registered embedded generators is summarised in the flowchart in Appendix 1 – Chapter 5 EG Process Flowchart. The overall process comprises a preliminary enquiry followed by a detailed enquiry and finally a connection application and connection offer.

The design of connection assets is contestable and Ausgrid will offer the connection applicant a design contract for the services that Ausgrid provides the connection applicant during the design stage. Ausgrid's offer for a design contract is made in response the detailed enquiry. Contestable services are described in Section 3 of this guideline.

Ausgrid's response at each stage of the process will be as comprehensive as is necessary depending on the complexity of the application and the proposed installation.

Fees are payable at each of the preliminary enquiry, detailed enquiry and connection application stages. Submission of any payments should 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 applicant entity name, ABN, contact person, project reference and request for 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 to Ausgrid's response time frames stated in this information pack.

## 2.1 Preliminary Enquiry

The purpose of preliminary enquiry is to provide general, high level information to help the connection applicant understand their connection options. Therefore, Ausgrid strongly recommends that a connection applicant start with a preliminary enquiry as early as possible in the development of a project so that any significant project issues are defined early in the process. However, this step is optional, and the connection applicant can choose to skip this step and proceed directly to the Detailed Enquiry stage.

The preliminary enquiry form (NECF-01) and its guide specify the information that is to be included by the connection applicant at this preliminary enquiry stage. Instructions on how to submit the form are also included in the NECF01 guide. Both preliminary enquiry form and its guide are available on the Ausgrid website from the '**How Do I Connect to The Network**' page, as well as from the Information Pack Registered EG webpage.

This stage attracts a fee for service. The relevant fee is stated on the Preliminary Enquiry Form (NECF01).

### *Ausgrid Response to Preliminary Enquiry*

Ausgrid will acknowledge that it has received the enquiry form. If any information is missing Ausgrid will contact the connection applicant to clarify the missing information.

Within 15 days of receiving the preliminary enquiry Ausgrid will provide the information that is listed in Schedule 5.4A of the NER. The response will include:

- an assessment of the isolation, protection, interlocking, synchronising, control and monitoring requirements applicable to the embedded generator as specified in the relevant Ausgrid and Australian Standards;
- specific metering requirements that are not in Ausgrid network standards;
- insulation coordination and lightning protection requirements. These are also specified in Ausgrid and Australian Standards;
- existing maximum and minimum fault levels and fault clearance times of relevant local zone substations;
- information on network constraints relevant to the connection as well as a harmonic allocation;
- an indication of network augmentation or extension works that may be required. These works will need to be designed by the connection applicant's chosen Level 3 ASP.
- a list of other network service providers and network customers that may require to be involved in planning or developing the proposal;
- a list of additional information that will need to be submitted by the connection applicant to lodge a detailed enquiry;
- a contact at Ausgrid to continue developing the proposal to an application; and
- an estimate of the application fee that is payable when submitting an application to connect.

An example fee estimate for a preliminary enquiry is included in Appendix 3.

## 2.2 Detailed Enquiry

The purpose of this stage is to provide the connection applicant with a detailed, in-depth analysis on their proposed project and information to enable them to move towards progressing to an application. This stage attracts a fee for service. The relevant fee is stated on the Preliminary Enquiry Form (NECF01).

The connection applicant may proceed to the detailed enquiry stage by:

- submitting enquiry form (NECF-01) and indicating in the comment area (section 4) of the form that it is for a detailed enquiry;

- providing the information requested within Ausgrid response to the preliminary enquiry if the connection applicant lodged a preliminary enquiry, or providing the information requested in the enquiry form if the connection applicant chose to skip the preliminary enquiry stage; and
- arranging payment of the detailed enquiry fee.

### ***Ausgrid Response to Detailed Enquiry***

Ausgrid will acknowledge the detailed enquiry and if any information is missing Ausgrid will contact the connection applicant to clarify the missing information.

After the required information is provided and the fees are paid Ausgrid will provide a detailed response within 30 business days. The Ausgrid response to the detailed enquiry will include details of the Ausgrid design contract as well as the information listed in Schedule 5.4B of the NER. The response will include:

- location of the connection including the voltage levels;
- details of all applicable Ausgrid Network Standards;
- levels of the existing power transfer capability of the network at the point of connection;
- details of automatic access standards and minimum access standards that apply to the proposed connection. Automatic access standards and minimum access standards are defined in Appendix 4 of this guideline. These are also stated in the Schedules attached to Chapter 5 of the NER;
- the process to request negotiated access standards in conjunction with AEMO;
- other technical details specific to the connection which will need to be included with the application;
- an itemised estimate of the Ausgrid connection charges. These charges are for Ausgrid services and do not include any connection asset, network extension or augmentation costs as these are contestable in NSW;
- a draft generator connection agreement that contains the proposed terms and conditions;
- where applicable Ausgrid's environmental planning assessment requirements subject to any related information provided by the applicant;
- any implications from other load enquiries, embedded generators, and changes to the regulatory environment or other practical constraints that Ausgrid may be aware of; and
- ancillary service fees associated with the Ausgrid design contract.

Ausgrid will require evidence of the financial viability of the proposing body (such as an annual report) and agreement to standard credit enquiries being completed by Ausgrid.

There will also be opportunities to discuss the project and any issues with Ausgrid staff.

An example fee estimate for a detailed enquiry is included in Appendix 3 – Fee Example for an Embedded Generator Connection.

## **2.3 Connection Application and Connection Offer**

The purpose of this stage is to assess the connection application and provide the connection applicant with a negotiated offer to connect the proposed embedded generator.

The Ausgrid generator connection application forms (NECF-03 and NECF-04) are on the Ausgrid website on the Network Connections page. There are also guides for completing the connection application forms on the same website page. The forms must be submitted with the information that was defined in the response to the detailed enquiry stage as well as the information defined in Schedule 5.5 of the NER. The application fee must also be paid.

The design of the connection assets by the connection applicant's chosen level 3 ASP must be completed and certified as the information in the certified design is a key component of the connection offer. In particular, the certified design will include details of any network extensions

and augmentations necessary for the generator connection. See section 3 for more details about network extension or augmentation and contestability work.

Ausgrid will acknowledge the connection application and if any information is missing we will contact the connection applicant to clarify the missing information.

At this stage, both Ausgrid and the connection applicant are entitled to initiate a negotiation if a negotiated access standard is required. The definition of a negotiated access standard is provided in Appendix 4. The process for determining a negotiated access standard is outlined in Appendix 2 of this document. The negotiated access standard is required to comply with NER Chapter 5.

### ***Connection Application Assessment***

Assessment of the proposed generator connection will take into account the following factors:

- **Safety.** Safety for Ausgrid staff, the generation plant staff and the public is a paramount priority. This will be influenced by items such as protection, switching, isolation, insulation, earthing, and anti-islanding requirements.
- **Network Impacts.** This includes the impact of the plant and any export on the performance of the network that could adversely affect the surrounding customers and network equipment. The certified design, prepared by the chosen Level 3 Accredited Service Provider is an important part of defining the network impacts. Any potential constraints on the proposed plant export will be defined.
- **Voltage Levels and Power Quality.** This includes voltage fluctuation, voltage rise, power factor restrictions, and any other relevant power quality issues.
- **Fault Levels.** Ausgrid will assess the combined fault current contribution of all sources, including the contribution from the proposed plant in order to assess the need for any network augmentation or fault level contribution mitigation.
- **Operation.** Ausgrid will assess protection, control and communications schemes.
- **Operation protocols.** Ausgrid will assess the proposed operational protocols, and, if required, arrange for an operating agreement with the plant operator.

### ***Connection Offer and Acceptance***

Ausgrid will make a connection offer within 4 months of receiving the complete application unless an extension has been agreed. The connection applicant has 20 business days to accept the connection offer and execute the generator connection agreement.

An example fee estimate for a connection application is included in Appendix 3.

## **3 Capital Contributions and Contestable Services**

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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 some physical 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. In particular the Generator must implement a program to monitor compliance with the performance standards in accordance with the NER to confirm ongoing compliance with the Rules and maintain auditable records of such compliance.

## 5 Generator Specific 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 Registered Embedded Generators' (of which this guideline is part):
  - Network Standard 194 Protection Requirements of Embedded Generators > 30kW
  - Network Standard 194B Guidelines for Rotating machines connected to the Ausgrid Network
  - Network Standard 238 Power Quality
  - Network Standard 178 Secondary System Requirements for Major Substations
  - Connection Policy – Connection Charges



- 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.

## 5.1 Key Technical Requirements

The table below outlines the key technical requirements to be met by an embedded generator connection under the Chapter 5 process, as identified by NER 5.3A.3(b)(6).

Technical Requirement	Refer to...
Protection systems and protection schemes (i)	Ausgrid Network Standard 194 Protection Requirements of Embedded Generators > 30kW
Fault level management principles (ii)	The EG connection agreement specifies the maximum design fault level and allocates the maximum permissible fault level contribution for that EG proponent.  It is imperative for maintaining safety that the combined fault current contribution of all sources, including the contribution from embedded generators, does not exceed the level that can be interrupted by the installed protection and switchgear, or withstood by system assets.
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 NER Chapter 5 S5.2.5.2 Quality of electricity generated
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 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 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
Circumstances in which augmentation may be required to facilitate integration of an embedded generating unit into the network (ix)	Described in Section 3 of this document

Commissioning and testing requirements	Ausgrid Network Standard 194 Protection Requirements of Embedded Generators > 30kW
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(x)

## 5.2 Access Standards

Automatic and Minimum Access Standards that apply to registered embedded generators are as described in Schedule 5 of the National Electricity Rules. The domain between these two standards is where negotiated access is possible. For illustration, the following figure shows how this applies to power quality emissions from a customer installation.

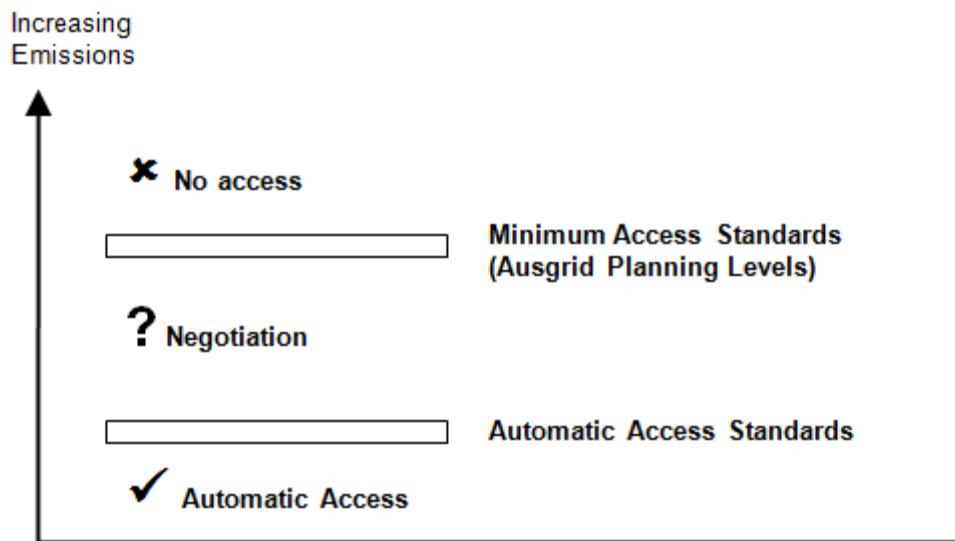


Figure 1: Illustration of the place of Automatic and Minimum Access Standards

An **Automatic Access Standard** defines the highest level of performance that can be required for a specific technical aspect of a network connection. For example, if a customer meets the Automatic Access Standards for all their power quality emissions, then they cannot be denied access to the network based on those emissions.

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. For example, if a customer's emissions are greater than the maximum allowable, then they fail to meet the minimum standard and they must be denied access to the network. Technical requirements in S5.2.5 all include Access Standards requirements.

**Negotiated Access Standard** - If a customer's emissions fall between Automatic and Minimum access standards, then access to the network can be allowed under a set of emission levels negotiated between the customer and Ausgrid. The negotiated standard should be as close as possible to the automatic standard.

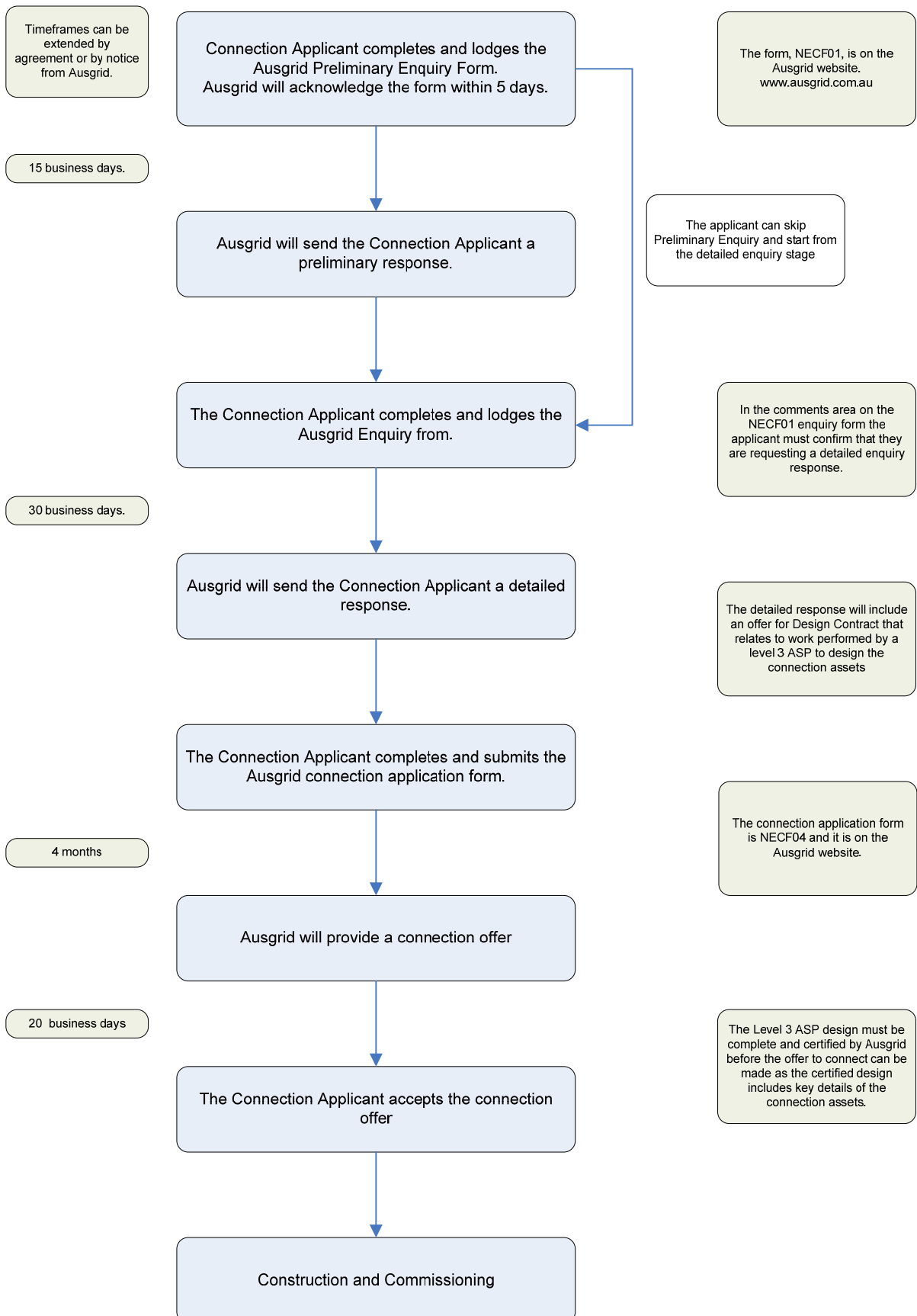
## 6 Examples of Connection Requirements

A number of examples illustrating connection details and charges are provided to assist EG proponents. These are outlined in the following table:

Description	Refer to...
Single line diagram of the preferred	Refer to Network Standard 194 Protection Requirements of

<p>connection arrangements</p> <p>5.3A3(b)(2)</p>	<p>Embedded Generators &gt; 30kW</p> <p>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.</p>
<p>Sample schematic diagram of the protection system and control system</p> <p>5.3A3(b)(3)</p>	<p>Refer to the Ausgrid's Information Pack Registered Embedded Generators webpage</p>
<p>Example of connection service charges</p> <p>5.3A3(b)(4)</p>	<p>Appendix 3</p>
<p>Model connection agreement</p> <p>5.3A3(b)(7)</p>	<p>All registered EG connections are processed with negotiated offers, Ausgrid uses a Generator Connection Agreement as a template of connection agreement, it is available on the Ausgrid's Information Pack Registered Embedded Generators webpage</p>
<p>A register of completed embedded generation projects</p> <p>5.3A3(a)(2)</p>	<p>Accessible from Ausgrid's Information Pack Registered Embedded Generators webpage on the Ausgrid website <a href="http://www.ausgrid.com.au">www.ausgrid.com.au</a>.</p>

## Appendix 1 – Chapter 5 EG Process Flowchart



## Appendix 2 – Negotiation Process for Access Standards

Information Phase	
Need for a negotiated access standard first identified	<p>a) The connection applicant applies to Ausgrid to negotiate an access standard.</p> <p>OR</p> <p>b) Ausgrid determines that a negotiated access standard is required on the basis of the provided information</p>
Initial meeting	<p>Ausgrid will arrange an initial meeting with the connection applicant as soon as practical to review and discuss:</p> <ul style="list-style-type: none"> <li>• Contact arrangements.</li> <li>• AEMO involvement in the process.</li> <li>• Negotiation principles including the need for good faith on both sides and confidentiality requirements.</li> <li>• The negotiation process described in this document.</li> <li>• The specific matters under consideration for the negotiations.</li> </ul> <p>Additional information that Ausgrid may provide and that may assist the connection applicant to negotiate on an informed basis.</p> <p>A preliminary negotiation program will also be discussed and determined at this initial meeting. In the case of complex negotiations this schedule may include a series of regular meetings and a set of key milestones.</p>
Information request	<p>In some cases Ausgrid may require additional information from the connection applicant in order to continue with the negotiations on an informed basis. Ausgrid will (if practicable) request this additional information in writing.</p> <p>Note, however, that throughout the negotiations, Ausgrid may reasonably require additional information and there is no limit on the number of information requests it may make.</p>
Information disclosure	<p>Ausgrid provides any remaining information requested by the connection applicant as soon as practical.</p> <p>The connection applicant also prepares and provides the information requested by Ausgrid as soon as practical.</p> <p>A meeting between Ausgrid with the connection applicant may be needed at this stage to review and clarify the information each party has requested and received. Where Ausgrid considers it to be necessary or at the connection applicant's request, Ausgrid will arrange such a meeting.</p>

Negotiation Phase	
Negotiations commence	Ausgrid will arrange a meeting to further discuss and refine the negotiation program based on the information provided and target date for completion. Negotiation may also commence at this meeting, facilitated by the Ausgrid representative. In straightforward cases agreement may also be able to be reached at this meeting.
Negotiations	Interactions including meetings and/or discussions proceed in line with the negotiation program. By agreement, Ausgrid will generally record these interactions through meeting minutes and file notes to clearly document the key issues and actions required to reach an effective outcome. Subject to progress, adjustments to the negotiation program may be required.
Negotiations conclude	Agreement is reached for all matters under negotiation allowing a negotiated access standard to be finalised.

## Appendix 3 – Fee Example for an Embedded Generator Connection

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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 Preliminary Enquiry Fees***

Coordinating, processing and assessing the connection enquiry	8 hours	(\$1674.72)
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### ***Example Detailed Enquiry Fees***

Coordinating, processing and assessing the connection enquiry	40 hours	(\$8,742.40)
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Development and collection of detailed system information (Such as harmonic allocations, system models, protection settings)	24 hours	(\$5,245.44)
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Development of feasible connection options (Connection feasibility investigations and review of system constraints)	52 hours	(\$11,365.12)
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<b>Detailed enquiry fee total</b>	<b>116 hours</b>	<b>(\$25,352.96)</b>
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### ***Example Connection Application Fees***

Coordinating, processing and assessing the connection application	60 hours	(\$13,113.60)
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Review of the submitted dynamic and steady analysis	75 hours	(\$16,392.00)
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Review of the protection fault and discrimination analysis	90 hours	(\$19,670.40)
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Development of the draft offer to connect and agreements	16 hours	(\$3,496.96)
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Development of any applicable design information packages	60 hours	(\$13,113.60)
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<b>Connection application fee total</b>	<b>301 hours</b>	<b>(\$65,786.56)</b>
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The fees exclude :

1. Any reports or consultation with other Distribution or Transmission Network Service providers.
2. Ancillary service fees associated with your ASP3 level 3 design work.

## 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 Registered EG connections provided to assist customers connect under the Chapter 5 process in the NER.</p> <p>Note that Ausgrid also publishes an information pack for non-registered EG connecting under the Chapter 5A 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>NER</b>	National Electricity Rules
<b>NS</b>	Network Standard