



NS194B
Guidelines for Rotating Machines Connected to the Ausgrid
Network

October 2014



SUMMARY

Network Standard NS194B outlines the requirements other than control and protection that a rotating machine should fulfil when connecting to the Ausgrid's network.

ISSUE

For issue to all Ausgrid and Accredited Service Providers' staff involved with field recording of network assets.

Ausgrid maintains a copy of this and other Network Standards together with updates and amendments on www.ausgrid.com.au.

Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document.

DISCLAIMER

As Ausgrid's standards are subject to ongoing review, the information contained in this document may be amended by Ausgrid at any time.

It is possible that conflict may exist between standard documents. In this event, the most recent standard shall prevail.

This document has been developed using information available from field and other sources and is suitable for most situations encountered in Ausgrid. Particular conditions, projects or localities may require special or different practices. It is the responsibility of the local manager, supervisor, assured quality contractor and the individuals involved to ensure that a safe system of work is employed and that statutory requirements are met.

Ausgrid disclaims any and all liability to any person or persons for any procedure, process or any other thing done or not done, as a result of this Standard.

Note that compliance with this Network Standard does not automatically satisfy the requirements of a Designer Safety Report. The designer must comply with the provisions of the WHS Regulation 2011 (NSW - Part 6.2 Duties of designer of structure and person who commissions construction work) which requires the designer to provide a written safety report to the person who commissioned the design. This report must be provided to Ausgrid in all instances, including where the design was commissioned by or on behalf of a person who proposes to connect premises to Ausgrid's network, and will form part of the Designer Safety Report which must also be presented to Ausgrid. Further information is provided in Network Standard (NS) 212 *Integrated Support Requirements for Ausgrid Network Assets*.

INTERPRETATION

In the event that any user of this Standard considers that any of its provisions is uncertain, ambiguous or otherwise in need of interpretation, the user should request Ausgrid to clarify the provision. Ausgrid's interpretation shall then apply as though it was included in the Standard, and is final and binding. No correspondence will be entered into with any person disputing the meaning of the provision published in the Standard or the accuracy of Ausgrid's interpretation.

ACKNOWLEDGEMENT

The assistance of ActewAGL in providing material for this document and its companion document NS 194 A is gratefully acknowledged.

Network Standard
NS194B
Guidelines for Rotating Machines Connected to the Ausgrid Network
October 2014

CONTENTS

1	INTRODUCTION.....	1
2	SCOPE.....	2
3	OBJECTIVE.....	3
4	DEFINITIONS.....	4
5	REFERENCES.....	6
6	GENERAL REQUIREMENTS.....	8
6.1	Regulatory.....	8
6.2	Compliance with the National Electricity Rules (NER).....	8
6.3	Connection Limits.....	8
6.3.1	High Voltage.....	9
7	PRIMARY SWITCHING EQUIPMENT CONSIDERATIONS.....	10
8	INSTALLATION AND TECHNICAL REQUIREMENTS.....	11
8.1	General requirements.....	11
8.1.1	Labelling of the Rotating machine Installation.....	11
8.1.2	Safety.....	11
8.1.3	Connection arrangement.....	11
8.1.4	Permitted rotating machine installation capacity.....	11
8.1.5	Power supply reliability.....	12
8.1.6	Control and monitoring (SCADA).....	12
8.1.7	Metering.....	12
9	OPERATIONAL REQUIREMENTS FOR MEDIUM AND LARGER GENERATORS.....	14
10	NETWORK VOLTAGE MANAGEMENT.....	15
11	CUSTOMER INFORMATION CONTRACTS AND AGREEMENTS.....	16
12	OPERATION AND MAINTENANCE.....	17
12.1	Testing and Commissioning.....	17
12.2	Periodic Maintenance.....	17
12.3	Alteration to approved design.....	17
	APPENDIX 1 - NETWORK TECHNICAL STUDY SCOPE.....	18
	APPENDIX 2 - STANDARD INFORMATION REQUEST.....	19

1 INTRODUCTION

Under National Electricity Rules (NER) 5.3 and Chapter 5A, Ausgrid has an obligation to review and process applications to connect or modify a connection which are submitted to it and must enter into a connection agreement with the applicant. This requirement applies to both customer load and embedded generation plant.

Embedded generation systems, of which rotating machines are one category, when connected to the Ausgrid network can impact the operating conditions, voltage profile and loading on the feeder/distributor. Ausgrid has in place specific minimum technical requirements that must be met in the design and installation of rotating machine systems to ensure that these impacts can be controlled to maintain safe and reliable operation of the network for operating personnel, customers and the general public.

These guidelines outline the technical requirements other than protection for the installation of rotating machine generation systems connecting and operating in parallel with Ausgrid's distribution network. For control and additional protection requirements the reader is referred to NS194 which is a companion document to this standard.

There may be additional requirements over and above those specified in this document for installations in unique situations. These requirements will be identified by Ausgrid at the initial enquiry processing stage or during the processing of the connection application

These guidelines only consider technical requirements other than control and protection from the utility network point of view. They do not specify requirements for the customer side of the machine system itself or any plant associated with its installation and operation.

2 SCOPE

This document covers issues specific to rotating machine installations. It should be noted that other embedded energy systems for example Photovoltaic systems are considered separately in NS194A.

This document applies to the rotating machine systems connecting to Ausgrid's low voltage (LV) and high voltage (HV) network:

This standard provides guidance on the requirements for connection of medium to large embedded generation installations and defined either as a pure generating installation or as part of a customers load installation. Typically these installations could be wind, gas, biomass or other fuelled rotating generating plant.

Generators of large capacity will often require extensive system studies with the studies increasing in duration and complexity as the generator size, connection voltage and other variables grow.

Customers who consider such generation should consult Ausgrid in the early stages of the planning process. The costs associated with required network augmentations at certain locations may severely impact on the viability of the generating scheme.

Also Ausgrid cautions proponents in proceeding to purchase any equipment prior to receiving Ausgrid approval as such equipment may prove to be unsuitable for connection to the network for the specific installation proposed.

All generators equal to and above 5MW must be registered with AEMO, but generators above 30 MW must also meet additional AEMO requirements with regards to connection to the network and scheduling of the generator output into the NEM.

The application of these requirements on individual embedded generators (EG) will be subject to negotiation on a case by case basis due to the number of variables involved in the technical integration of embedded generation and distribution networks.

In addition to the requirements outlined in this document, Generators in NSW are expected to comply with the regulations of the NSW Department of Water and Energy, the NER, the Australian Communications Authority and the relevant Australian Standards where applicable. Ausgrid's electricity standards ES 1 - ES11 apply to various aspects of the connection works outlined in this standard.

In Australia, embedded generation is generally seen as having different requirements depending on its scale relative to the rest of the system to which it is connected. The draft national Code of Practice proposes the following classifications:

Classification of Rotating Machines

Size*	Classification band
Having a nameplate (electrical) rating greater than 30 kW but not more than 1MW.	Small
Having a nameplate (electrical) rating greater than 1MW but not more than 5MW	Medium
Having a nameplate (electrical) rating 5MW and above	Large

[Note – Size* refers to the total electrical output of the site potentially available at the point of connection]

3 OBJECTIVE

Ausgrid is committed to facilitating connection of embedded generation to its network while ensuring at all times that power supply to ALL its customers is delivered in accordance with Ausgrid and industry safety and reliability standards. Ausgrid's prime directives are, in order of importance:

- 1) the safety of personnel who work on the electricity network and to the general public;
- 2) the safety and security of plant and equipment and
- 3) to minimise disruption to all customers (quality and reliability of supply) inclusive of the applicant's site.

The objective of this document and its companion document NS 194 is to outline Ausgrid's requirements for the connection to, and parallel operation with, Ausgrid's distribution network to proponents of embedded rotating machine generation systems.

These guidelines should be read in conjunction with the Service and Installation Rules of NSW. The Service and Installation rules of NSW can be accessed on the NSW Department of Trade and Investment website at the following link:

<http://www.trade.nsw.gov.au/energy/electricity/network-connections/rules>

4 DEFINITIONS

For the purposes of NS194B the terms below have the following definitions:

Ausgrid	Refers to the Ausgrid Distribution and Sub Transmission network
AVR	Automatic Voltage Regulator
Accredited Service Provider (ASP)	A person accredited under Part 10 of the Electricity Supply (General) Regulation 2001(NSW)
Anti-islanding protection	A protection system to detect loss of grid supply which disconnects the rotating machine from the installation.
Bi-Directional Metering	A meter capable of registering energy supplied to the premises and energy exported from the premises as separate data streams.
Combined Heat and Power (CHP)	A plant that generates electricity and supplies thermal energy, typically steam, to an industrial or other heating or cooling requirement.
Distribution network	The apparatus, equipment, plant and buildings used to convey and control the conveyance of electricity to a customer's premises.
Embedded generating unit	A generating unit that is connected directly to the distribution network without direct access to the transmission network.
Embedded Generator	A person that owns, controls or operates an embedded generator unit
External protection	Means a protection device separate to the rotating machine
Gross metering	Means a Bi-Directional metering installation in which the total output of the generator is measured.
Internal protection	Means a protection device that is part of the rotating machine
"Must" and "Shall"	The words "must" and "shall" indicate a mandatory requirement.
Net Metering	Means a Bi-Directional metering installation in which the difference between the total amount of energy generated and the total amount of energy consumed by a customer is recorded by the meter. The result can have two forms, "net export" in which case the customer uses less energy than they generated or "net import" in which case the customer uses more energy than they generated.
National Metering Identifier (NMI)	A National Metering identifier as described in NER clause 7.3.1(d)
National Electricity	The Rules made under the National Electricity Law to control

Rules, (NER)	the operation of the National Electricity Market.
Network Technical Study	The connection of a rotating machine installation to a distribution network will inevitably result in some local changes to the characteristics of the network. To evaluate the possible consequences of these changes Ausgrid will carry out a network study with the installation included in the network model. This involves the use of detailed databases describing the electrical characteristics of Ausgrid's network and can be used to analyse how the networks will behave under different loading conditions or in the event of particular faults.
Point of Common Coupling (PCC)	The point on a distribution system, electrically nearest to a particular customer's load, at which other customer's loads are, or could be, connected (refer definition in the Service & Installation Rules of NSW)
Service and Installation Rules of NSW (SIR)	Means the document of that name published by the Department of Trade and Investment, as amended from time to time.
Spinning Reserve	The difference between the total available capacity of all generating sets already coupled to the power system and their total actual loading.
Supervisory Control and Data Acquisition (SCADA)	A computer system that remotely monitors and is capable of switching the synchronous machine connection to the electricity network.

5 REFERENCES

Electrical construction works on Ausgrid's low voltage and high voltage distribution systems must be carried out in accordance with Ausgrid's Supply Connection and Network Standards, Industry Codes and Australian Standards that include, but are not limited to, the following:

- ES 1, Customer Connection Information
- ES 3, Part A Metering Installations
- NS116, Design Standards for Distribution Earthing
- NS 194 Protection Requirements of Embedded Generators >30Kw
- NS 238 Supply Quality
- Generator Connection Agreement: General Conditions and Instrument of Agreement
- Service & Installation Rules of NSW,
- Ausgrid's Electrical Safety Rules,
- AEMO Metrology Procedure
- AS/NZS 3000 - Electrical Installations (Wiring Rules), 3010 – Electrical Installations – Generating Sets, 3017 – Testing Guidelines
- AS/NZS 3008 - Electrical Installations - Selection of Cables
- AS/NZS 3010 Electrical Installations Generator Sets
- AS 4049 Stand –alone power systems
- AS 2467 – Maintenance of Electrical Switchgear
- AS – 60038-2000 – Standard Voltages
- AS6100.3.2 - Electromagnetic Compatibility – Limits for Harmonic Current Emissions
- AS/NZS 61000.3.6 – Electromagnetic Compatibility (EMC) –Limits – Assessment of emission limits for distorting loads in MV and HV power systems.
- AS/NZS 61000.3.7 – Electromagnetic Compatibility (EMC) –Limits – Assessment of emission limits for fluctuating loads in MV and HV power systems
- AS/NZS 61000.3.12 - Electromagnetic compatibility (EMC) – Limits – Limits for harmonic currents produced by equipment connected to public low voltage systems with input current > 16A and <= 75A per phase
- ENA Guideline for the preparation for connection of Embedded Generation within Distribution Networks – May 2011
- ENA DOC 001-2008 National Electricity Network Safety Code
- ENA DOC Power Quality Guideline for Inverter Energy Systems for connection to Low Voltage Distribution Networks
- IEEE PSRC, Intertie protection of consumer-owned sources of generation, 3MVA or less
- IEE 519 Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
- IEEE 1547, Standard for interconnecting Distributed Resources with Electric Power Systems
- BCSE, Technical Guide for Connection of Renewable Generators to the local Electricity Network
- IEC 60909(1988) "Short Circuit Calculations in three –phase AC systems"
- IEC 61000-3-14, "Assessment of emission limits for the connection of disturbing installations to LV power system"
- Legislative and Electricity Market requirements:

- ENA Guideline for the preparation for connection of Embedded Generation within Distribution Networks – May 2011
- NER, National Electricity Rules, including Central despatch and Integration of Wind and Other Intermittent Generation Rule 2007.

6 GENERAL REQUIREMENTS

6.1 Regulatory

The rotating machine installation and its connection process shall implement the regulatory requirements and recommendations of the following:

- The National Electricity Rules (NER): Chapter 5 and 5A
- Note: Although the Chapter 5 connection process would not automatically apply to embedded generators that are not registered participants, the current provisions provide that any proponent who is not eligible for a basic or standard connection offer may elect to follow the connection procedures under Chapter 5 or Chapter 5A introduced as part of the National Electricity Customer Framework.
- Network Connection Contract - in accordance with the applicable regulations listed in Chapter 5 and 5A of the NER, customers will be required to enter into a Network Connection Contract. The Contract sets out the terms of connection of the embedded generation unit to Ausgrid's electricity network. For further information refer to the relevant Ausgrid documentation.

6.2 Compliance with the National Electricity Rules (NER)

The National Electricity Rules (NER) regulates the access of the distribution network to generators subject to the generating unit's capacity and the amount of energy generated.

Chapter 5 and 5A of the NER provides the framework for this access and aims to:

- establish the process to be followed;
- detail the guidelines and principles governing the connection and access to a network;
- address the Proponent's reasonable expectations of the level and standard of power transfer capability; and
- establish the process to ensure ongoing future compliance with the technical requirements of the connection with the network.

6.3 Connection Limits

Since existing Ausgrid network and substations were designed and constructed without consideration for embedded generation, additional sources of supply will affect the fault-level on the Ausgrid network. As the penetration of embedded generation continues, a point may be reached where additional sources of supply will result in the fault-level being greater than the switchgear and equipment rating.

Ausgrid therefore reserves the right to inhibit the output of a generator to ensure that the system is not compromised under high-fault level or abnormal conditions. This may be provided via a control signal from Ausgrid such that the generating unit is either taken off-line (i.e. a 'soft-trip') or inhibited from starting up.

Upon assessment of the proposed connection, Ausgrid will advise the customer if any fault level exist whereby scheduling may be required as part of the installation.

The calculation of short circuit current will be in accordance with AS 3851. All possible sources of supply should be taken into account during the calculation of the fault level contribution.

6.3.1 High Voltage

Ausgrid network consists of voltages levels:

- 400V;
- 11kV;
- 33kV;
- 66kV;
- 132kV;

Embedded generators below 2MW would typically be encouraged to connect to the LV network, subject to local network conditions or constraints;

Embedded generators greater than 2MW would typically be difficult to connect on the LV network and would require detailed feasibility studies.

Embedded generator connections in the CBD will typically be exclusively connected on the LV network. Connection of embedded generation on the 11kV network in the CBD is highly complex and will require a detailed feasibility study.

7 PRIMARY SWITCHING EQUIPMENT CONSIDERATIONS

Connection of an embedded generator may impose duties on switchgear beyond those present without generation. These requirements may include the following;

- Interrupting Capability
- Synchronizing Capability
- Out-of-Phase Interrupting Capability
- Conductor Thermal Ratings

Switchgear shall be operated within the manufacturers ratings at all times.

It is unacceptable for network conditions to exceed switchgear ratings, even momentarily.

8 INSTALLATION AND TECHNICAL REQUIREMENTS

8.1 General requirements

Ausgrid will assess the proposal for connection of the rotating machine energy system based on a number of criteria. These include:

- 1) Network disturbances (e.g. voltage and current harmonics and fluctuations)
- 2) Steady state voltage rise (on LV and /or 11 kV network)
- 3) Protection for anti-islanding (see NS 194)
- 4) Total connected Embedded Generation
- 5) Fault level studies
- 6) Current-carrying capacity of the LV network

8.1.1 Labelling of the Rotating machine Installation

The rotating machine installation shall meet the labelling requirements outlined in the Service and Installation Rules of NSW. Additional labelling requirements may be necessary in complex or unusual installations.

8.1.2 Safety

The rotating machine installation shall not impose a safety hazard to personnel working on the network, Ausgrid customers and members of the public. The installation must meet AS3000 and AS2067 where relevant.

8.1.3 Connection arrangement

The network supply arrangements will be determined by Ausgrid and can be either:

- Shared low voltage circuit – connection to overhead or underground low voltage network shared with other customers.
- Dedicated low voltage circuit – for example a dedicated circuit supplied from the low voltage board of a shared transformer, or a dedicated overhead line or underground cable, feeding the Proponent only, directly from the terminals of a shared pole transformer. In this instance voltage rise and disturbance from the rotating machine generation has less impact to other customers fed from this transformer.
- Dedicated low voltage supply – a single transformer dedicated to the Proponent. In this scenario the effect of generation on supply voltage is confined generally to the Proponent only.

8.1.4 Permitted rotating machine installation capacity

Ausgrid is limited by its network topology as to the maximum generation capacity that can be connected to a local LV network. This is largely driven by the thermal capacity of the distributor feeders, the impedance of the feeder (causing voltage rise), the distribution transformer rating and the combined effect of the connected generation plant on Ausgrid network performance, operation and safety. The network study will determine the maximum rotating machine installation capacity that may be connected. There may also be cases where the proposed installation may be required to connect at a reduced capacity or where no connection is allowed.

In some instances, depending on the location of the proposed installation, network augmentation and or additional protection and control functions (for either or both Ausgrid network and the rotating machine installation) may be required to ensure network safety and performance standards are not compromised. Ausgrid will identify these as part of the network study and advise the applicant if additional work is required. The funding arrangement for the work will be determined in accordance with Ausgrid's *Connection Policy – Connection Charges* available from Ausgrid's website.

As an example

The network study will determine the steady state voltage rise introduced by the rotating machine installation. If the contribution of the proposed rotating machine installation alone to the steady state voltage rise on the LV distribution mains between the Point of Common Coupling (as defined in the NSW SIRs) and Ausgrid's distribution transformer is greater than 1% of the nominal voltage, and if the steady state voltage rise on the distributor due to all embedded generation connected is greater than 2% of the nominal voltage, network augmentation will be required.

8.1.5 Power supply reliability

Connection of the rotating machine system shall not create a situation where the reliability of the supply network is degraded. Refer to NS 238.

8.1.6 Control and monitoring (SCADA)

For Embedded Generators installations greater than 30kW Ausgrid reserves the right to have control of the generator to trip or inhibit the output to ensure that the Ausgrid's network is not compromised. This may be provided via a control signal from Ausgrid such that the generating unit is either taken off-line (i.e. a 'soft-trip') or inhibited from starting up.

Ausgrid will not monitor the alarms or the status of the embedded generators but may record them for network performance analysis and historical reasons.

The customer shall use either modbus or DNP3 where communication signals are used.

Upon application the customer must provide an index of points and other details regarding their SCADA including communication protocols.

8.1.7 Metering

A NER compliant metering Installation is required for all connections to the Ausgrid Network. Where the NMI has the capability or potential capability of generating energy back into the local Network, the metering installation must be capable of separately registering and recording energy flows in each direction.

Where the energy consumption/output of the Metering Installation is greater than 160MWh pa. a Type 1-4 metering installation must be installed. Type 1-4 metering installations are contestable and it is the responsibility of the customer's electricity Retailer to nominate a responsible person to oversee the installation and maintenance of the metering installation, in accordance with the NER.

If the installation consumes less than 160MWh pa. and a Type 4 metering installation is not installed, it is Ausgrid's current metering policy that a Type 5 metering installation must be installed.

The metering installation must be fully compliant with the NERs, AEMO Metrology Procedure and Ausgrid Metering Policy document ES 3 Part A – Metering Installations.

Current and voltage transformers are required where the metering point(s) load is in excess of 100 amps and/or 400 volts respectively.

It is a requirement that the metering installation is located as close as practicable to the connection point (or Point of Supply as defined by the Service and Installation Rules of NSW). No Part of the metering installation is to be located within Ausgrid's substation or assets.

Any current and voltage transformers required for metering and/or protection of high voltage installations also shall be located on the customer's side of the connection point and comply with the NERs and Ausgrid metering policy document ES3 Part A – Metering Installations. Current copies of NER compliant type test certificates and routine test certificates from an ILAC traceable laboratory must be provided to Ausgrid for all instrument transformers before the installation can be connected to the Ausgrid Network.

If the generator is >30MW then additional metering installation requirements are necessary to comply with the NER.

Detailed metering requirements are contained within the Service and Installation Rules of NSW, Ausgrid's ES3 Part A - Metering Installations and other related documents.

All Bi Directional Metering must be installed and registered in NEM systems prior to the energising of the new or altered embedded generation system.

9 OPERATIONAL REQUIREMENTS FOR MEDIUM AND LARGER GENERATORS

The introduction of embedded generation into distribution networks places additional responsibilities on network operators and the owners and operators of the generation plant. It requires DNSP's operators to liaise with, and provide information to customers about operation of the distribution network. Particularly during times of network emergencies, this is important so as to avoid undesirable situations. The mandatory Operating Agreement that is required by Ausgrid will define and delineate the roles and responsibilities of both parties.

Reference may be made to Ausgrid's requirements for *Operating, Access Testing & Maintenance Protocols*. An "Operating Protocol" may be established initially to identify responsibilities for on-going operations and maintenance.

10 NETWORK VOLTAGE MANAGEMENT

Network voltage management in a typical DNSP's sub-transmission and distribution network is designed for power to flow through the network from the higher voltage levels to the customers connected at the lower levels.

The DNSP operator will require that under all conditions of real and reactive power transfer that the variation in voltage seen by the other customers remains within acceptable limits.

The need for voltage control may place particular requirements on the capability curve of the generator and the regulating equipment used. Voltage control must be agreed with Ausgrid prior to equipment purchase.

11 CUSTOMER INFORMATION CONTRACTS AND AGREEMENTS

Ausgrid will negotiate with the proponent the terms and conditions under which the embedded generating unit(s) will be permitted to be connected to its distribution network. A connection offer will be made based on the outcome of the negotiations. In order to proceed with the connection, the proponent will need to accept the connection offer.

On acceptance by the proponent, the terms of the offer becomes the terms of the connection contract. Ausgrid will provide the services and the proponent will need to fulfil its obligations under the contract to allow the connection to take place.

Further details on negotiation process can be found in our publication *Connection Negotiation Process* available on our website:

<http://www.ausgrid.com.au/Common/Our-network/Connecting-to-the-network/Connection-services-and-offers/Negotiating-a-connection-offer.aspx>

I

12 OPERATION AND MAINTENANCE

12.1 Testing and Commissioning

Before carrying out commissioning, the customer shall provide the test procedure to Ausgrid. Commissioning shall be carried out by the customer and Ausgrid and the commissioning dates will need to be agreed on at least 5 days prior to the commissioning taking place. Further details are to be found in the companion document NS 194.

12.2 Periodic Maintenance

All protection, control systems and equipment associated with the rotating machine system and its connection to the Ausgrid distribution network shall be periodically tested to demonstrate operation. The owner of the rotating machine system must keep records of all such tests and provide Ausgrid with a certified copy of the test results.

Failure to comply with the testing requirements may result in Ausgrid disconnecting the rotating machine installation from the network.

Where the generator fails to disconnect automatically when required or where nuisance or unexpected operations of the generator occurs, then Ausgrid will disconnect the generator. Ausgrid will only allow reconnection once a satisfactory report from a suitably qualified and experienced engineer (as defined by Engineers Australia) is received. The report will detail the investigations carried out, the cause of the fault, details of any rectification required or carried out and procedural /process changes instituted to prevent re-occurrences. Any retesting required will also be detailed and the results included in the report.

12.3 Alteration to approved design

The owner of the embedded generation facility must not modify the approved design of the rotating machine control and protection system without informing and receiving prior written authorisation from Ausgrid.

Settings of the protection relays and control equipment must not be modified without informing Ausgrid and receiving prior written authorisation from Ausgrid.

Upon receipt of a written request to modify the approved design and/or settings, Ausgrid will advise the proponent if it is considered necessary to undertake a new assessment on the impact on Ausgrid's network, the associated costs involved and the timeframe expected to complete the study and associated report.

APPENDIX 1 - NETWORK TECHNICAL STUDY SCOPE

The scope of the network technical study is as follows:

Task	Description	Procedure	Activity
1	Review enquiry Form	1	Location, capacity, voltage, connection and timing details provided?
		2	Manufacturer's certificate available
		3	Witness Testing if required
2	Model LV Network	1	Obtain data on connected load - minimum, maximum estimates OR
		2	Confirm network data - feeder and service type, length, substation details
		3	Model LV network including new connection downstream of distribution transformer
3	Network Studies	1	Check 11kV feeder loading level (% thermal rating) under minimum local load demand conditions
		2	Check LV distributor loading level (% thermal rating) under minimum local load demand conditions
		3	Check distribution transformer loading level (% thermal rating) under maximum and minimum local load demand conditions
		4	Check voltage (% Vn) under minimum load at PCC
		5	Check voltage (%Vn) under maximum load at PCC
		6	Check Fault Level i.e. kA at MSB and upstream of customer's MCB
		7	Check voltage/current disturbance and harmonics against limits for compliance
		8	Check protection methodology and satisfactory operation for all types of network faults

APPENDIX 2 - STANDARD INFORMATION REQUEST

Sample Connection Application Form

Given below is typical information that may be required from Embedded Generators (EG) for the Initial Meeting with Ausgrid. Sample pro forma lists may also be obtained from the AEMO web site www.aemo.com.au.

Submission Date			
1. Project Name			
2. Project Dates	Proposed Start of Construction		
	Proposed in Service Date		
3. Project Size:	Number of Units		
	Rating of Each Unit		
	Proposed Total Capacity		
	Proposed Total Capacity, Future		
4. Project Location (Address / City / Town)			
5. Project Developer or Contractor			
	Company		
	Contact		
	Mailing		
	Telephone		
	Fax		
	E-mail		
6. Project Owner			
	Company		
	Contact Person		
	Mailing Address		
	Telephone		
	Fax		
	E-mail		
7. Existing Electric Service (If applicable)			
Capacity (Amps)	Voltage (Volts)	Load (kW)	
8. Engineering Consultant	Company		
	Contact Person		
	Mailing Address		
	Telephone		
	Fax		
	E-mail		

9. Project Type			
Wind Turbine	Hydraulic Turbine	Steam Turbine	Gas Turbine
Diesel Engine	Solar	Fuel Cell	Biomass
Co-generation / CHP (Combined Heat and Power)			
Other, Please specify			

10. Generator Voltage and Type:			
a) Generation Voltage	AC	DC	Volts
Generation VA			
Generation Output (W)			
Generator power factor (p.u.)			
Resistance/Reactance(R/X) – (p.u.) both zero sequence and positive/negative sequence.			
Saturated Subtransient Reactance			
Internal Reactance			
Maximum Generator Voltage			
Sustained Short Circuit Current			
b) Type: Rotating Generators	Synchronous	Induction(asynchronous)	
Other Please specify			
c) Non rotating DC Generation			
DC Source-Photovoltaic Arrays	DC Source-Fuel Cells		
DC Source-Batteries			
Other Please specify			
d) Generator Operational Capability	grid dependant	islanding/standby power	
e) Generation Connection	Delta	Wye	Wye grounded

11. Proposed Step-up Interface Transformer Connection	
(Delta, wye – solid grounded, wye – impedance grounded etc.) Vector Group	
High Voltage*	
Low Voltage **	
Rated Apparent Power	
Reference Short Circuit Voltage	
Iron losses(kW)	
No load current	
The Connection of the windings should also be indicated in the Single Line Diagram (SLD).	
Note: * “High Voltage” refers to the connection voltage to Ausgrid’s distribution system. ** “Low Voltage” refers to the generation or any other intermediate voltage.	

12. Location Map and Connection Voltage to Ausgrid’s Distribution System	
Provide Site Location with suitable details of generation facility, line routing and proposed connections to the Ausgrid’s network.	
Drawing / Sketch No.	Rev.
Proposed connection voltage to Ausgrid’s distribution system	kV

OH/UG Connection details – lay , length and voltage	
Resistance ,reactance and capacitance of circuit elements	

13. Single Line Diagram (SLD)

Provide SLD of EG facility showing the interface point to Ausgrid's distribution system.

The SLD should include the required disconnecting device and show various equipment: generators, high and low voltage switchgear, transformers, motors, all protective relays / devices, instrument transformers (CTs and VTs), metering, synchronizing etc.

Provide as much information as possible on the SLD.

Note: If the project includes extension or upgrades to existing EG facilities, show clearly the existing and new electrical equipment and include information on the existing generating unit(s).

SLD Drawing Number:

Rev.

14. Operation, Generation and Load Information:

Mode of Operation:	24	hour	or	Base	Load:
	Yes, No, _____ kW				
Load Displacement: Yes, No	Power Export? Yes, No, _____ kW				
If Yes, existing load: _____ kW	Peak Period Only? Yes, No, _____ kW				
New load: _____ kW					

Intent Of Generation:

Annual Capacity Factor	%	
Prospective number of annual scheduled starts / stops, and timing there of		
Estimated maximum load of the EG facility	kVA	kW
Prospective maximum power export from the EG facility (to Ausgrid system)	kVA	kW

15. Customer Signature:

Date



© Ausgrid.

This document must not be reproduced in whole or in part or converted to machine readable form or stored in a computer or imaging system without the written permission of Ausgrid.

Revision History

Initial issue:	October 2014
Current issue:	October 2014

Document Control

Authorised By:	Date: 29 Sep 2014
Darko Grcev	
Manager – Primary Systems (act.)	
Document Number:	NS 194B