ES 11

Requirements for Connection of Embedded Generators

JULY 2011

SCOPE

This publication contains essential information and requirements relevant to applicants (Generators) proposing to connect or alter a connection of an embedded generating system to Ausgrid's network for parallel operation.

WARNING

It is illegal for persons other than licensed electricians, or persons authorised by legislation, to work on the fixed wiring of any electrical installation.

Penalties for conviction are severe. It is the responsibility of the user of this document to ensure that only the current version is being used.

Ausgrid may amend this document at any time.

Document and Amendment History

Issue No.	Date	Approved By	Summary of Changes
1	July 2011	Manager – Connection Policy	This is the first edition

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1 Introduction

Embedded or distributed generation is any form of generation which is intended to operate whilst electrically connected to the distribution network for extended periods. Operation of generation of this type is sometimes referred to as 'parallel operation', reflecting that the generator operates in parallel with the distribution network.

Embedded generation can be connected directly to a Distribution Network Service Provider (DNSP) network or indirectly via customer's own electrical installation. In the latter case, a principal use of the generation may be to supply, or offset, a customer's own (on-site) demand. Conversely, it may be that the sole purpose of the embedded generator is to produce and export electricity onto the local distribution network. This may be exclusively an energy sales (retail) function or could also be associated with providing local support to the distribution network ranging from demand reduction on a specific area of the distribution network to more specific voltage regulation through the provision of reactive power.

The National Electricity Rules (the "Rules") define:

Embedded generating unit A generating unit connected within a distribution network and not having direct access to the transmission network;

Embedded Generator A Generator who owns, operates or controls an embedded generating unit.

In this document the term 'embedded generator' is used to mean the physical generation unit. The owner or operator of embedded generation is usually referred to as an embedded generation proponent, developer or operator. Throughout this document the abbreviation "EG" stands for embedded generation.

This document sets out Ausgrid's requirements in general for the electrical connection of EGs to the network but does not cover:

- the relationship of the applicant for connection with any retailer with regard to any energy purchase agreements; or
- the installation of private generators for emergency standby supply where the generator may only be called to run in parallel with the network for very brief periods during transition from network supply to private supply; or
- private generation completely isolated from the network.

The connection of EGs will primarily be based on the relevant terms of the following documents:

EG Rating	**Source Documents**
Up to 10kVA for single phase & 30kVA for three phase	• Ausgrid's Standard Form Customer Connection Contract (SFCCC) • ES 1 – Customer Connection Information • Service & Installation Rules of NSW (SIR) and • AS 4777 – Grid connection of energy systems via inverters (if applicable)
Greater than 30kVA but less than 5MW	To be determined on a case by case basis, it will either be a combination of SFCCC, ES 1, NS 194 and The Service & Installation Rules of NSW or Ausgrid's standard Generator Connection Agreement (GCA) with detailed or concise Schedule 2
5MW and above	The Rules and the GCA

1.1 Basic EG Connection Process

The connection of a generator may be made:

- directly to the network at an available network voltage; or
- within a customer's electrical installation at a voltage within that installation.

The basic process leading up to the final connection and its ongoing management is the same in all cases.

Requirements of a generator connection for exporting energy to the network vary in some important respects to the normal customer connection for importing energy from the network (load connections). For generators of nameplate rating of 5MW and above compliance with the National Electricity Rules (NER) is mandatory unless exempted. NSW jurisdictional regulations impose specific requirements on load connections with regard to capital contributions and contestability of the design & construction of connection assets.

Technical investigations are required to determine:

- capacity of the network to convey the generation output;
- voltage regulation;
- anti-islanding measures;
- contribution to fault levels and fault detection under reverse power flow;
- synchronising, isolation, system stability and safety;
- stand-by supply;
- quality of supply etc.

These technical studies need to be carried out to determine whether or not network extension and/or augmentation is required. A site specific Generator Connection Agreement may also be required.

The process to deal with every application needs to comply with the NER (including Ausgrid's requirements under the NER) which mandates the main features to be followed.

NOTE: Regardless of the first point of contact within Ausgrid, the Application or Enquiry must be directed to the relevant Installation Data Operations and relevant staff of:

Operations Region where generator is to be connected for 200A & less at LV connections or where no contestable work is required;

The Manager – Contestability for greater than 200A at LV connections or where contestable work is required;

The Manager – Major Connections for 5MW and above connections or higher than 11kV connections.

1.2 Retailer

The generator output or a portion of it may be imported into the network to supply other load. This is a commercial decision made by the applicant in conjunction with its chosen retailer for the sale and/or purchase of energy. The purpose of this document is to enable the physical connection to Ausgrid's network (including provision of appropriate metering installation) and negotiation of the associated technical and commercial network requirements. It does not directly apply itself to the applicant's relationship with a retailer.

1.3 Difference with Customer Connections

Ausgrid's capital contribution policy in ES 8 *Capital Contribution and Asset Relocation Works Guidelines* will not usually be applicable to generator connections although there are points of relevance. ES 8 is based on customer connections constructed for the sole purpose of conveying energy to customers on behalf of retailers and for which the network service provider (Ausgrid) is paid network use of system charges. A generator exports energy and there will usually not be any network use of system charges paid to Ausgrid which contribute to the related connection costs of that generator. Consequently the applicant for generator connection will be required to fund the total costs of connection necessary for the satisfactory operation of the generator in parallel with the network. This may include the costs of augmentation of shared assets and will include material which would otherwise be supplied as free-issue material (to a load customer). Ausgrid may contribute to some or all of the augmentation costs if there is a benefit to Ausgrid.

Dedicated extensions to the network or alterations to an existing connection are designed and constructed at the generator's cost and in general, where a connection asset is funded by the proponent, Ausgrid may permit the generator its choice of accredited service provider following the contestability process outlined in ES10.

Augmentation of the existing shared network may also be required to enable the output of the generator to be conveyed to the end users where the existing infrastructure is inadequate or where capacity is already allocated (e.g. to other generators). Contestability is not usually an option for any augmentation of the shared network regardless of who funds the augmentation.

1.4 Registered, Scheduled or Market Generators

Depending on size, the applicant's energy marketing plans and NER, generators may need to register with AEMO as scheduled or become market generators as follows:

Exempt from registration	**Typical Capability**	**Examples**
	Less than 5 MW	1 MW diesel generator in a high-rise building
	Less than 30 MW, and annual export less than 20 GWh	20 MW biomass-fuelled generator with limited fuel supplies

Registration required.

Non-Scheduled	**Non-Market**	Less than 30 MW, all purchased locally	10 MW, all purchased by a customer at the same connection point
	Market	Between 5 MW and 30 MW, not purchased locally	10 MW generator supplying pool
Semi-Scheduled	**Non-Market**	Intermittent output, greater than 30MW, all purchased locally	150 MW wind farm, all purchased under contract to a local retailer
	Market	Intermittent output, greater than 30MW, not purchased locally	150 MW wind farm supplying pool
Scheduled	**Non-Market**	Greater than 30 MW, all purchased locally	40 MW hydro station, all purchased under contract to a local retailer
	Market	Greater than 30 MW, not purchased locally	2000 MW power station supplying pool

1.5 Connection information of Distribution District - Area of Electricity Network

Ausgrid has electricity network in the following Local Government areas:

Ashfield	Drummoyne	Lane Cove	North Sydney	South Sydney
Auburn	Gosford	Leichhardt	Pittwater	Strathfield
Bankstown	Hornsby	Maitland	Port Stephens	Sutherland
Botany	Hunters Hill	Manly	Randwick	Sydney
Burwood	Hurstville	Marrickville	Rockdale	Warringah
Canterbury	Kogarah	Mosman	Ryde	Waverley
Cessnock	Ku-ring-gai	Muswellbrook	Scone	Willoughby
Concord	Lake Macquarie	Newcastle	Singleton	Woollahra
				Wyong

2 Reference Documents

The following publications should be read in conjunction with this guideline:

- National Electricity Rules (NER) http://www.aemc.gov.au/Electricity/National-Electricity-Rules/Current-Rules.html
- Service and Installation Rules of NSW (SIR) http://www.industry.nsw.gov.au/energy/electricity/network-connections/rules
- Ausgrid's Standard Form Customer Connection Contract (SFCCC)
- Electrical Supply (ES) Standards
- NS 194 Connection of Embedded Generators
- NS 195 High Voltage Customer Connections (HVCs)
- NS 104 Specification for Network Project Design Plans
- Ausgrid's Generator Connection Agreement - comprising of the General Conditions (GC) & the Instrument of Agreement (IOA)
- Connecting New Generation - A Process Overview (AEMO)
- AS 4777 – Grid connection of energy systems via inverters
- AS/NZS 3000 - Wiring Rules
- Ausgrid's Electrical Safety Rules

3 Explanation of Terms

Accredited Service Provider means a person accredited under Part 10 of the *Electricity Supply (General) Regulation 2001* (NSW).

AEMC means Australian Energy Market Commission, is responsible for rule making and national energy market reform & development. http://www.aemc.gov.au/

AEMO means:

- for the period prior to 1 July 2009, NEMMCO;
- for the period from 1 July 2009 the Australian Energy Market Operator Limited, as defined in the NEL, ABN: 94 072 010 327 being the company which operates and administers the "National Electricity Market" in accordance with the Rules, or any successor or replacement body which exercises that function. http://aemo.com.au/index.html

AER means the Australian Energy Regulator, established by section 44AE of the *Trade Practices Act 1974* (Cth).

Approval means any approval, authorisation, certificate, consent, exemption, filing, licence, notarisation, permit, registration, ruling, statutory required policy of insurance or waiver (and any renewal or variation of any of them) by or with an Authority.

Authority means any government or regulatory department, body, instrumentality, minister, agency or other authority.

Avoided TUOS means *avoided Customer TUOS usage charges*, calculated in accordance with clause 5.5(i) of the Rules.

Compliance Officer means an Ausgrid officer, who carries out the following specific functions, to monitor compliance by ASPs with Ausgrid's Contestable Works specifications, standards and safety requirements:

- Inspection and facilitation of ASP/1 work and work practices and investigating and recommending ASP corrective/disciplinary actions
- Authorisation and worksite safety compliance auditing of ASP/2s

Connection means physical connection of the Generating Facilities (via the Contestable Works) to Ausgrid's Distribution System and electrification of the Contestable Works, and **Connect** and **Connected** have corresponding meanings. Alternatively connection may also mean connection to the customer's own existing installation using new facilities permitting the generating unit to operate in parallel with the network via the customer's installation.

Distribution District means Ausgrid's distribution district as defined in Schedule 3 of the Electricity Supply Act 1995 (NSW) - (ES Act).

Distribution Network Service Provider's Licence means a "Distribution Network Service Provider's Licence" granted under section 14 of the ES Act.

Easement includes an easement for infrastructure (including power lines) or a right of way.

Emergency means the actual or imminent occurrence of an event which in any way poses or has the potential to pose a threat to the safety of persons, hazard to any equipment or property or a threat to *power system security.*

General Conditions mean the General Conditions (GC) of Ausgrid's standard Generator Connection Agreement (GCA).

Generating Facilities means the generating units described and includes all associated Equipment (including cabling).

Generator Connection Officer (GCO) relevant staff member of the Operations Regions or the Manager – Contestability or the Manager – Major Connections.

Instrument of Agreement is the Instrument of Agreement (IoA) of Ausgrid's standard Generator Connection Agreement (GCA).

IPART means the Independent Pricing and Regulatory Tribunal of New South Wales, established under the *Independent Pricing and Regulatory Tribunal Act 1992* (NSW). http://www.ipart.nsw.gov.au/welcome.asp

Licence means a right to occupy land that is not an interest in land.

Major Defect means a defect which, in the opinion of Ausgrid, has the consequences that the relevant works are unsafe or not suitable to energise or leave energised.

Metering Data Agent means a party accredited by AEMO, who collects and processes *metering data* and delivers it to AEMO (if applicable), Ausgrid and the relevant *financially responsible market participant* as per the NER.

Minor Defect means a defect which, in the opinion of Ausgrid, is not a Major Defect.

NEL means the *National Electricity (NSW) Law*.

NEMMCO means National Electricity Market Management Company Limited ABN: 94 072 010 327.

Operating means the switching or electrical isolation of equipment, and where applicable, earthing of high or low voltage equipment.

Period of Connection means the Fixed Period of Connection or the Minimum Period of Connection, as applicable.

Power Transfer Capability means the ability of Ausgrid's Distribution System to deliver electrical power to, or receive electrical power from, the Generating Facilities.

Practical Completion of the Contestable Works means the date on which Ausgrid determines that:

(a) the Contestable Works have been completed in accordance with the Agreement;

(b) the Contestable Works are free from Major Defects;

(c) satisfactory test certificates have been produced in relation to the Contestable Works; and

(d) the Generator has provided Ausgrid with as built drawings with respect to the Contestable Works (including field recordings prepared after trenching and before backfilling of the exact locations of any underground cable ducts, cables and joints) and

(e) Deeds of Agreement have been completed.

Property Right means any estate, interest or right in relation to land.

Registered Surveyor means a person registered as a surveyor under the *Surveying Act 2002* (NSW).

Rules means the National Electricity Rules approved under Part 7 of the NEL. http://www.aemc.gov.au/Electricity/National-Electricity-Rules/Current-Rules.html

Service and Installation Rules of NSW (SIR) means the document of that name published by the Department of Industry & Investment, as amended from time to time.

Services mean any or all of the Network Services, the Metering Services and any other services provided by Ausgrid.

Survey Plan means a plan satisfactory to Ausgrid prepared by a Registered Surveyor to permit registration of Easements or leases.

System Operations Function or Power has the meaning given to that expression in section 119 of the NEL.

Warranty Bond means an unconditional undertaking issued by a bank or insurance company in favour of Ausgrid for the amount specified in each case.

Warranty Period **means a period of 3 years commencing upon Connection.**

4 Types of Embedded Generation

There are a number of different generator types employing different technologies which can be connected to the distribution networks and which can, therefore, be designated as EG. The characteristics of some forms of EG can have an impact on the way in which the generation unit is connected to the network and the way in which it operates. The technical impact of connecting different generator types may also affect the commercial arrangements for network access, such as connection charges and contractual provisions. EG covers a wide range of sizes and technologies. Generators can range in size from a few kilowatts (kW) up to a hundred megawatts (MW) or more. EG technologies are broad and diverse and can include the following:

- open and closed cycle gas turbines (traditional);
- reciprocating engines (diesel, oil);
- hydro;
- wind turbines;
- photovoltaic generation (solar);
- fuel cells; and
- tri/co-generation.

Generation sources such as fuel cells and photovoltaic installations generate DC (direct current) electricity and are therefore required to be connected to the distribution network via an inverter. The inverter converts the DC generated output to alternating current (AC) so that the generated energy can be exported into the network.

More traditional rotating generation machines can be either synchronous generators or asynchronous generators. Synchronous machines can operate either in isolation from the grid or connected to the grid. When connected to the distribution networks, a synchronous machine is ‘locked into’ the grid, i.e. operating at the same frequency.

Asynchronous generators draw their magnetising current from the grid during operation and are generally not capable of isolated operation. The provision of magnetising current for the operation of asynchronous machines can place additional demands on the local distribution network.

5 The Generator Connection Agreement (GCA)

This is required where there is:

- an expectation of export to the Network whether or not connection works are required; or
- a need to alter existing or install additional network connection assets for technical reasons (capacity constraints, protection, quality, reliability, or Rule compliance); or
- where total generating capacity is 5MW and above; or
- may also be required where a substantial contribution is made by the generator to its own requirements and an Ausgrid network standby supply may need to be established on loss of generation.

The GCA consists of two documents which are:

- The General Conditions (GC) which is the basis of the GCA. It is not job specific and does not vary; and
- The Instrument of Agreement (IoA) which is job specific and requires project details to be entered and to be signed by the parties to the agreement. The IoA incorporates schedules including an Operation and Maintenance Protocol which are designed to facilitate the inclusion of these details. The GCA usually follows the process step called “Offer to Connect” and, where necessary under the NER, it must be submitted or notified to AEMO.

The IoA will be filled in by the Generator Connection Officer (GCO) as appropriate in conjunction with the applicant and may then arrange for the document to be signed by both parties. The original of the GCA will be held by Ausgrid who will arrange for submission of a copy to AEMO if required.

6 Responsibilities

6.1 Applicant (Generator) for Generator Connection

Make Connection Enquiry and Application for Connection and provide information as required by the GCO or the NER. Design and construct its own generator facilities as well as providing at its cost the necessary network connection arrangements in accordance with the NER and Ausgrid's requirements. Submit technical details to Ausgrid and if required to AEMO. For further details visit AEMO website http://aemo.com.au/index.html

6.2 Ausgrid

Prepare and keep under review the standard Generator Connection Agreement. Monitor compliance with the NER and connection policy. Manage regulatory issues and facilitate advice on avoided use of system costs.

Provide guidance and assistance to other relevant stakeholders in formulation of job specific Generator Connection Agreements and on interaction with AEMO, TransGrid and other DNSPs. Also:

- Plan and coordinate the generator connection project with the developer and the relevant staff to ensure a satisfactory connection, including protection design, addressing of capacity constraints in Ausgrid network, and facilitating an Operating and Maintenance Protocol prior to commissioning.
- Manage the cost recovery from the applicant and facilitate testing, inspections and commissioning.
- Monitor the ongoing operation of the embedded generator for compliance with the NER and any GCA. This includes the effects of any subsequent network developments or augmentation which may affect rights or obligations imposed by a GCA such as network capacity funded by the applicant.
- Arrange for a sign-off within Ausgrid of any technical studies by the party carrying them out and also formally advise in writing to the generator applicant of approved settings in accordance with S5.2.2 of the NER.
- Carry out technical studies and provide and/or approve protection and control settings to enable generator connection and commissioning in accordance with the NER.
- Carry out inspection and testing (if required) of the contestable work for compliance with Network Standards and the generator protection scheme for its adequacy and coordination. This latter work will be charged to the applicant by Ausgrid either for a Monopoly Fee or at a reasonable commercial rate as relevant. Ausgrid may also undertake contestable connection work if selected in its capacity as an Accredited Service Provider (ASP).
- Prepare and maintain an agreed Operating and Maintenance Protocol.
- Advise on avoided Transmission Use of System (TUOS) charges related matters.

7 Connection Sequence

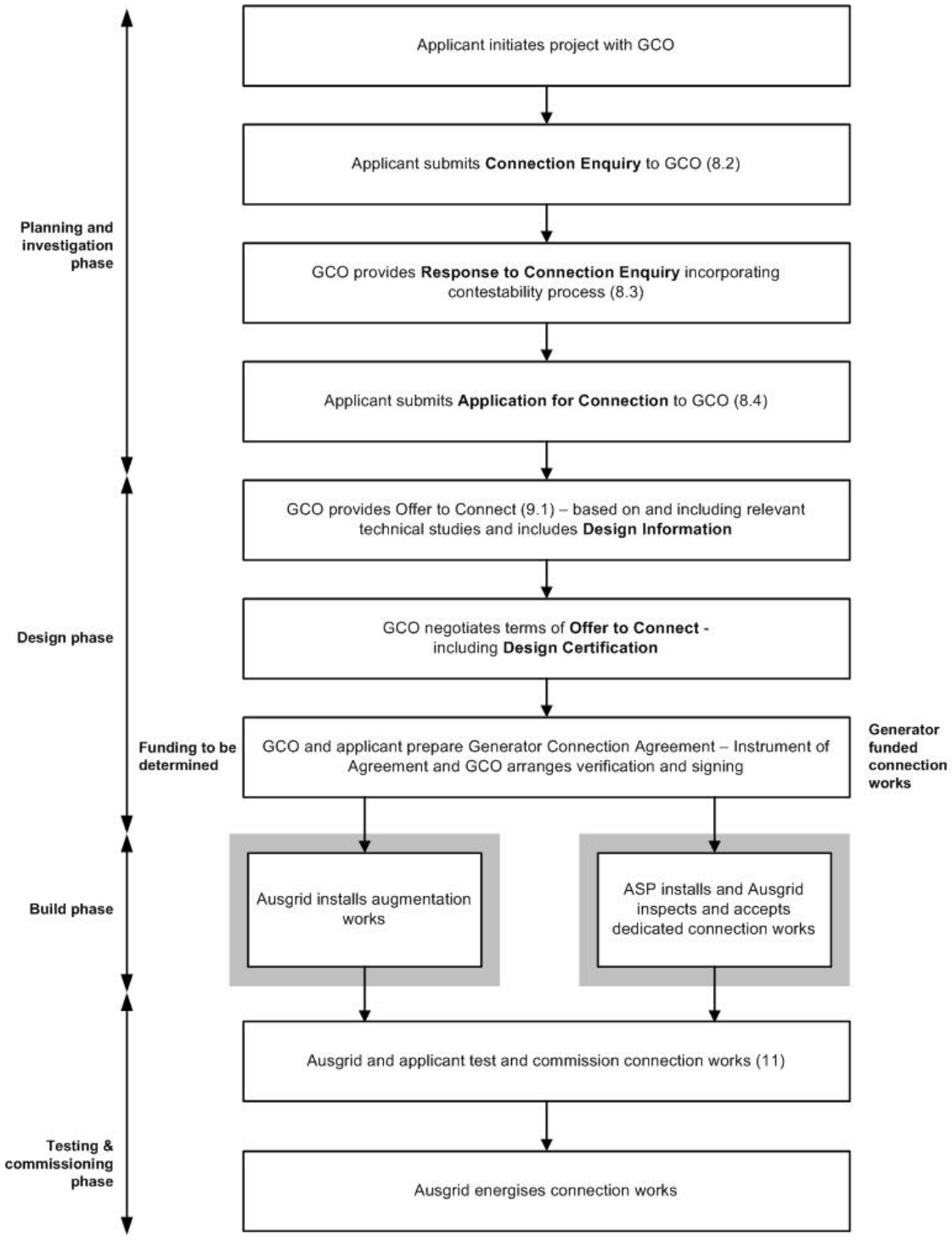

Figure 1

NOTE: For smaller generators it would be possible to combine a few steps of the above Connection Sequence as appropriate. It is possible for instance that the obligations under the Connection Enquiry and the Application for Connection may be satisfied by one submission and responded to accordingly.

8 The Planning and Investigation Phase

This phase will examine and assess available options for connecting the generating unit(s) to Ausgrid's network or to the customer's installation. Early discussions between the applicant (Generator) and Ausgrid are desirable to identify network constraints, the need for new connection works and to commence the technical studies to assist the applicant to determine the feasibility of the generation proposal. Where the applicant will be required to fund connection costs and contestability is permitted, the choice of service provider will rest with the applicant. Information on the applicant's various funding obligations are set out in clause 12 of this guideline. The following sequence needs to be followed by the applicant for connection and the GCO.

8.1 Small Generators

Where it is apparent that the generator output will be fully utilised within the installation even if the rating exceeds 10kVA for single phase and 30kVA for three phase, the process in the Service and Installation Rules of NSW should be adhered to and there may not be a requirement for a separate generator connection agreement. Where the rating exceeds 10 kVA/30 kVA the applicant should always check with the GCO prior to any work being planned or commenced as technical studies may be necessary and the location may necessitate connection works and/or a separate connection agreement and consideration of costing and compliance issues.

8.2 Connection Enquiry

The applicant must submit a Connection Enquiry. This stage is usually necessary to establish the feasibility of the project especially for larger generators. **Smaller generators may possibly be dealt with by proceeding directly to the Application for Connection stage**.

Obtain Information

For the purposes of evaluation and planning, the Generator is required to submit to the GCO the following information as appropriate. Some of this information will also be relevant when completing the Instrument of Agreement.

(a) Type of plant (eg, land-fill gas, mini hydro, coal, wind, micro gas turbines, solar, etc).

(b) Site location (listing any point of connection alternatives in order of preference).

(c) Maximum power generation of whole plant in MW and MVA.

(d) Profile of production and consumption. Expected energy production (MWh per month - ie for export into the network) and energy consumption (ie energy required from the network to start the plant and/or supply auxiliary loads and/or other permanent load).

(e) Plant configuration – e.g. number of generating units and their arrangement.

(f) Plant characteristics and nature of any disturbing load (nature of power electronic plant that may produce harmonic distortion, size of disturbing component MW/MVAR, duty cycle, etc).

(g) Mode of generation such as synchronous generator, induction generator, photovoltaic array, etc.

(h) Estimated date for each generating unit to be in service.

(i) Name and address of enquirer, and, if relevant, of the party for whom the enquirer is acting.

(j) List of technical data Ausgrid considers appropriate depending on the size and complexity of the proposed facility to be connected.

(k) In general the AEMO website will provide appropriate templates for the provision of the necessary technical and performance data. Refer to: http://aemo.com.au/registration/registration.html

Some of this information may not be available until the Application for Connection stage.

Commence Technical and Planning Studies

On receipt of the Connection Enquiry, GCO will facilitate and coordinate technical and planning investigations to:

- ensure adequate network capacity;
- ensure attention is given to fault clearance, anti-islanding, synchronisation, system stability (involving TransGrid if necessary for large generators) and other quality of supply and safety matters;
- prepare conceptual design of the connection and nominate Point of Connection options to the existing network and the preferred option.

8.3 Response to the Connection Enquiry

Ausgrid will generally respond to the Connection Enquiry within 10 business days or by a time agreed with the applicant. The Response to Connection Enquiry will include some or all of the following information and be based on the technical investigations already undertaken:

(a) Available options for connecting the generating unit(s) to Ausgrid network.

(b) The identity of other parties that would need to be involved in planning the connection and if they need to be paid for technical studies and transmission and distribution services or both. This is relevant for large applications where TransGrid and/or other transmission or distribution networks need to be involved.

(c) Whether a generator connection agreement will be required.

(d) An indication of the likely connection works required, which of these will be contestable, which of these can only be provided by Ausgrid and the funding implications.

(e) Preliminary program of milestones for connection and commissioning activities.

(f) Various charges for administrative and monopoly services, technical & investigation studies etc. and are payable progressively.

(g) Further information required from the applicant in its “Application for Connection” such as:

- standards of automatic access, minimum access and plant (these will be largely determined by the technical studies);
- if and to what extent AEMO is involved;
- preferred connection option and specifications of the facility to be connected;
- expectations of the level and standard of service of power transfer capability desired;
- technical data to be included with the application for connection (IoA schedules).

8.4 Application for Connection

The applicant will be advised in the Response to Connection Enquiry, of the need for the applicant to then submit a formal “Application for Connection” to Ausgrid. Usually, the Application for Connection would be made once the project has obtained financial backing and local planning permission. However, in some cases, it may be necessary for the Generator to make an early Application for Connection nominating the preferred connection option as the agreed connection works may need to be included within the planning and environmental approval process.

The application for connection may include the generator technical data and proposed settings and GCO will have this information checked by the appropriate technical experts in Ausgrid. When Ausgrid is satisfied with the settings, the settings will be approved in writing by Ausgrid. This may be done separately or as part of the Offer to Connect.

8.5 New Connection Works

Ausgrid will usually require that new design and construction works which the applicant is required to fund will be made contestable (with some exceptions which will be specified). This means that the applicant will be required to engage service providers appropriately accredited for design and or construction to carry out these works in accordance with the process for contestability. This process is set out in ES10 and ES4 and will be further explained in the Offer to Connect for each application and the job specific documentation provided by Ausgrid. Ausgrid will carry out work that is not made contestable whether funded by the applicant or by Ausgrid.

Where there are to be contestable works, details of the contestable and non-contestable components of the Connection Works to be constructed, who will ultimately own them, who will construct them or procure their construction, and who will fund them, will be set out in the Offer to Connect. These details as well as details of the Generating Facilities will also be shown in the diagram in Part E of Schedule 1 of the Instrument of Agreement.

8.6 Non-Contestable Works

Ausgrid will construct and install, or procure the construction and installation of, the Non-Contestable Works.

Note to Generators: The Generator is liable to pay the Non-Contestable Works Charge (if specified in the Instrument of Agreement, at the time specified in the Instrument of Agreement).

8.7 Contestable Works

The scope of the Contestable Works will be determined by Ausgrid. The Contestable Works must be designed and constructed to specifications and standards determined and advised by Ausgrid. Ausgrid may inspect and give reasonable directions in relation to the construction of the Contestable Works.

The Generator must (by a separate contract as per ES 9) engage the services of appropriate Accredited Service Providers to design, construct and install the Contestable Works. That contract will be separate to the GCA, even if the Generator chooses to engage Ausgrid as an ASP.

The Generator warrants that the Contestable Works will, once completed, be of a high standard of workmanship, be fit for their intended use, and comply with all relevant Ausgrid Standards, *Australian Standards* and *good electricity industry practice*. The Generator will indemnify Ausgrid for any loss, damage, liability, claim or expense arising from a breach of any such warranty. The Transferred Works (being those of the Contestable Works that are to be transferred to Ausgrid) will be owned by Ausgrid, free of all Encumbrances, upon Connection, and the Generator will do all things necessary to ensure that ownership of those works is transferred to Ausgrid at that time.

If required the Generator will, prior to Connection, arrange for the deposit of a Warranty Bond (as per ES 10) as surety for rectification of any defects in the Transferred Works during the Warranty Period. The Generator will ensure that Ausgrid has the benefit of all warranties given and obligations to be performed by the Accredited Service Provider under the relevant construction contract, and may make a claim directly on the Accredited Service Provider for any breach of these.

The generator must also where necessary provide or arrange to provide Ausgrid with suitable access and lease and easement rights as set out in ES10 and in ES9.

9 The Design Phase

9.1 Offer to Connect

On receipt of the Application for Connection, Ausgrid will respond in writing with a formal "Offer to Connect" within the time period specified in the preliminary program or by a time agreed with the applicant. Ausgrid's response will normally be appropriate to the degree of complexity of the application and be as comprehensive as is necessary. It will include general advice to the effect that 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.

The Offer will be based on:

- Ausgrid's requirements identified in the preceding technical studies and investigations;
- the applicant's final requirements also based on the preceding investigations and identified in its application.

It may not always be practical to include all the conditions in the Offer to Connect by the required date. In some circumstances further information exchange may be required between the parties. The applicant will be advised of these matters and the likely completion date.

A - Generators connected within a private installation - no new supply mains

Where there is no requirement for any contestable works or any augmentation of existing shared mains, the Offer to Connect may consist of correspondence setting out the work required and confirming the technical aspects of the generator and its operating arrangements. The work may be modifications within an existing customer substation designed and carried out by Ausgrid and funded by the applicant. Any standby tariff will need to be arranged at this stage.

For larger installations it may be necessary to initiate a GCA and Ausgrid will advise the applicant accordingly.

B - Generators requiring new connection works

The Offer to Connect will be based on the preceding investigations and:

- consists of a Design Information Package (DIP) where there is contestable work and supporting correspondence to facilitate the contestable process including a contestable design (Ausgrid may exclude aspects of the design such as the protection design of the Connection Point and network from contestability and instead carry out this work at the applicants cost);
- initiate and coordinate with the applicant any network augmentation designed by Ausgrid;
- advise the applicant of the need to coordinate testing, inspection and commissioning arrangements of the Generating Units and the Connection Point including the protection and isolation arrangement within the generating facilities;
- commence the preparation and signing of the GCA where this is required.

Some or all of the following items may need to be checked and resolved in this process:

(a) Metering design and access arrangements and NMI allocation (metering design and provision rests with the retailer).

(b) Pricing implications (avoided TUOS).

(c) Technical requirements identified by Ausgrid as the automatic or the negotiated access standards applying to both the contestable works and the Generator Facilities.

(d) Authorised export (i.e. to Network)/import demand.

(e) Performance standards submitted and agreed including the understanding reached on the ratings and reliability of the agreed connection.

(f) Connection service (monopoly) charges and other Ausgrid charges.

(g) Generator to provide test reports and detailed field recordings showing the actual position of the final “as built” connection assets for inclusion in Ausgrid’s GIS system and a final red lined survey plan showing the actual position of cables within easements prior to commissioning.

(h) Technical, commercial and legal conditions required for the connection or extension to the network that the parties have negotiated and agreed to and in particular the granting of property rights as detailed in the GCA.

(i) Automatic load shedding facilities for 60 percent of the load at anytime where peak load requirement is expected to exceed 10MW.

(j) An ongoing compliance and maintenance program and testing intervals for protection. This may be incorporated in the Operating and Maintenance Protocol which will include a requirement for the generator to maintain records and for these to be audited.

(k) Duration and termination conditions of the connection agreement.

9.2 Generator Connection Agreement (GCA)

When it is necessary to have a GCA, some of the agreed information and conditions detailed in the Offer to Connect will be incorporated into the “Instrument of Agreement” (IoA).

A generating facility with an installed capacity of 5MW and above needs to be registered with AEMO. The Offer to Connect and the GCA must be consistent with any requirements set by AEMO.

The IoA including the schedules will be completed by Ausgrid in conjunction with the applicant, using the standard form of the agreement.

9.3 Design Approval

The applicant will submit for approval and certification by Ausgrid a design prepared by an accredited designer in accordance with the Design Information and NS 104 for the contestable works incorporating an environmental impact assessment as well as plans detailing the lease, easement and access requirements. The design will need to incorporate the results of the technical studies carried out by Ausgrid. The need for a separate ES 9 contract will be assessed when preparing the GCA.

10 The Construction Phase

The Generator should provide an action plan coordinating the activities of its own contractors, those of the ASP and Ausgrid for the construction, testing and commissioning of the Generator's own facilities and the connection works.

The Generator may choose an ASP to carry out the contestable construction works. These works will consist of the construction of the dedicated connection works identified as such in the Design Information and the certified design. The process to be followed is similar to that which applies to contestability for non-generator customer connection works. The technical studies (including subsequent amendments) carried out by Ausgrid as a precursor to or in conjunction with the "Offer to Connect" are not contestable.

The GCO will coordinate the construction of the augmentation works carried out by Ausgrid at its cost and the Compliance Officers will carry out their normal roles with respect to the contestable works.

11 The Testing and Commissioning Phase

The NER requires the generator to provide a Commissioning Program with 3 months notice for connection to a transmission system or 1 months notice otherwise, to Ausgrid. Ausgrid will respond to this program within 15 days either to agree with or request changes to the program in the interest of maintaining power system security, safety or quality of supply. Before the connection and/or the generator installation are commissioned, tests must be carried out to ensure that the works are correctly installed and that the protection and metering systems operate as required. Ausgrid will consider whether it will witness some of these tests in accordance with any applicable standards. At least two weeks notice should be provided by the Generator for inspection testing. Copies of the test results may be requested by Ausgrid and must be kept on record by the Generator.

The GCO will ensure that as-built project details are submitted by the Generator prior to commissioning and are subsequently entered into Ausgrid's databases (GIS and iAMS). A connection point diagram is necessary.

12 Assessment of Costs

Ausgrid must specify in the Offer to Connect and/or in the Design Information the contestable as well as the non-contestable works. These are described below and in Figure 2.

NOTE: The NER provides that the applicant for connection may be charged for all reasonable costs incurred in facilitating, planning, designing, making and maintaining the connection to the network. This will be a mix of Monopoly Fees, recoverable rates and commercial rates.

12.1 Preparation of Response to Connection Enquiry, Offer to Connect and the Instrument of Agreement

The time spent by Ausgrid in preparing these responses and documents shall be charged for on the basis of appropriate regulated hourly rates as set out in ES 5 for comparable services.

12.2 Technical Studies by Ausgrid

This is the work carried out by Ausgrid to examine technical aspects of the application, particularly in regard to the protection of Ausgrid's system and that of the applicant's installation to determine the impacts on Ausgrid's network infrastructure and on other networks and network users and assist the formulation of the responses by Ausgrid. NER and Ausgrid's Network Standard NS194 be referred in this respect. Ausgrid's reasonable commercial consulting rates nominated in advance will apply and the work will not be available to external consultants. Other work in this category may involve monitoring and witnessing testing of the generator's installation and of the contestable works.

12.3 Technical Studies by TransGrid

Some large generator connections may require stability studies by Ausgrid and in some circumstances by TransGrid. The involvement of TransGrid will be arranged by Ausgrid and the costs passed onto the applicant.

12.4 Technical Studies by AEMO

In some circumstances AEMO will require details of the generator technical and performance data so as to carry out studies of its own. AEMO will make a charge for this work which will be paid by the applicant. The scale of charges has been provided by AEMO. This information will generally be provided directly to AEMO by the applicant and the GCO will ensure that this happens.

12.5 Monopoly Services and Contestable Works

Where it is necessary for Ausgrid to provide typical monopoly services defined by AER for facilitating contestable works, then the relevant fee structure determined by AER and detailed in ES5 will be applied.

Where there are contestable works including the associated design, this will be scoped in the Design Information package and will be the subject of a contestable quote from the applicant's chosen ASP. Ausgrid shall prepare the Connection Point protection design for its nominated commercial consulting rate.

12.6 Network Augmentation

Where augmentation or reconstruction of existing shared network assets is required, this will be determined as part of the Offer to Connect. The design and construction of this work will be carried out by Ausgrid and the applicant charged for the cost of this work in accordance with the pricing principles provided by AER. In some circumstances, Ausgrid may decide to contribute to this augmentation to the extent of its value to Ausgrid in supplying other customers

12.7 Avoided Use of System Costs

There may be charges payable by Ausgrid to the Generator in some circumstances. These are avoided Transmission Use of System (TUOS) charges and will be assessed by Ausgrid.

12.8 Stand-by Charges

A Generator may request capacity to be reserved in the network to supplement or replace the supply normally provided by the Generator during periods of its maintenance or outages. Such requests will need to be investigated and charged for in the normal way. This is to say that all costs incurred in providing dedicated assets to enable such network stand-by capacity will be charged to the applicant as set out in this guideline. In addition a Stand-by tariff will need to be established. It should be noted that an auxiliary supply from the network is often required by generating units during start-up.

12.9 Metering and Data Management Charges

Embedded Generators governed by the NER are bound by the metering and data management requirements of Chapter 7 and the applicant must make its own arrangements with a retailer. These requirements and the associated charges relate to the issuing of a NMI, activities of meter installation, meter operation, meter reading, data collection and data aggregation. Where appropriate, the Generator must comply with Ausgrid's Electrical Supply Standard ES3 – *Metering Installations* and the *Service and Installation Rules of NSW*.

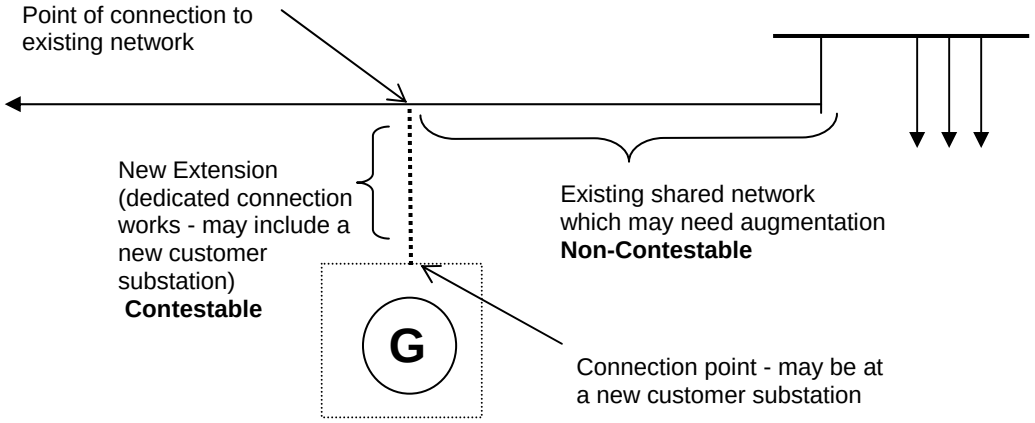

Figure 2: Example of direct connection to Network

13 Other Considerations

Considerations such as:

- Leases and Easements with respective Deeds
- Agreements with ASPs for Contestable Works
- Bank Guarantees
- Environmental Assessments
- Overhead & Underground Mains Policy
- Dispute Resolution

are set out in ES 9, ES 10 and the standard GCA.

14 AEMO Templates

Generator Technical Requirements, Generator Performance Standards templates and other related information is accessible through the following link: http://aemo.com.au/registration/registration.html