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**DISTRIBUTED GENERATION CONNECTION POLICY
AND TECHNICAL STANDARDS
<10KW**

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1 Introduction

The term *Distributed Generation* (DG) (sometimes referred to as embedded generation) relates to any electricity generation facility that either produces electricity for use at the point of location or supplies electricity to other consumers through a local lines distribution network at distribution rather than transmission voltages.

The surplus energy not used by the consumer that operates a DG needs to be sold to an electricity *Retailer*. Top Energy is an Electricity Lines Business (as defined by the Electricity Act) and as such cannot purchase the surplus electricity

2 Scope

This document does not apply to DG systems that are operating stand-alone and do not connect to the Top Energy network.

The information in this document applies to DG that is less than 10 kW, and would usually consist of a single phase system. The DG would typically be installed in domestic or commercial premises.

On an individual basis DG plant below 10kW normally has relatively little impact when connected to Top Energy's network. However, Top Energy will need to be involved in the connection process. The reasons for Top Energy's involvement are numerous and range from health & safety issues through to the potential for consumer equipment damage. This document is used by both Top Energy and the DG owner to enable efficient and safe connection of DG schemes to Top Energy's distribution network.

The information in this document is of a general nature, and the exact technical standards and information requirements finally implemented may vary depending on the type DG that is being installed.

3 Document Revisions

Top Energy may amend and expand this document from time to time where it may be necessary to meet the requirements of the applicable regulations and to suit the needs of the distribution network.

4 Definitions

The following terms have been included in this document and are, for clarity, defined as outlined below.

Distributed Generation (DG)	Electrical equipment capable of producing electricity and which is distributed across Top Energy's electrical network.
Distributed Generator	The operator of a Distribution Generation facility.
Retailer	Electrical company that buys and sells electricity.
Electrical Lines Business (ELB)	Electrical network company that transports electricity from generators to consumers (on behalf of Retailers).
Certificate of Compliance (CoC)	Document signed by the installing electrical worker and a registered/licensed inspector that certifies that the Distributed Generation is electrically safe.
Transpower	Electricity transmission grid owner and operator.
Electricity Commission	The Electricity Commission is a Crown owned entity set up under the Electricity Act to oversee New Zealand's electricity industry and markets.
Electricity Governance Rules (EGR)	These define the rules associated with the general operation of the New Zealand Electricity Industry. The rules are made by the Minister of Energy in accordance with the Electricity Act 1992.
Formal Application	Completed application form submitted to Top Energy formally requesting permission to connect.
Islanded Network	Network condition whereby a DG operates and supplies a local load whilst not connected to the national grid.

5 Top Energy's Approach to Distributed Generation

Top Energy's approach to DG is based on the following key principles:

- DG are able to connect to Top Energy's electricity distribution network on fair and equitable terms that do not discriminate between different DG schemes,
- The terms under which DG can connect and operate are as clear and straightforward as possible (within the limitations of maintaining a secure and safe electrical distribution network),
- All DG applications will be processed as fast as possible,
- All technical and safety standards relating to DG are based on industry practice,
- All relevant legislation and regulatory requirements are adhered to, and.
- The company's right to limit the total DG capacity connected to its network (in particular to each 11kV/22kV feeder).

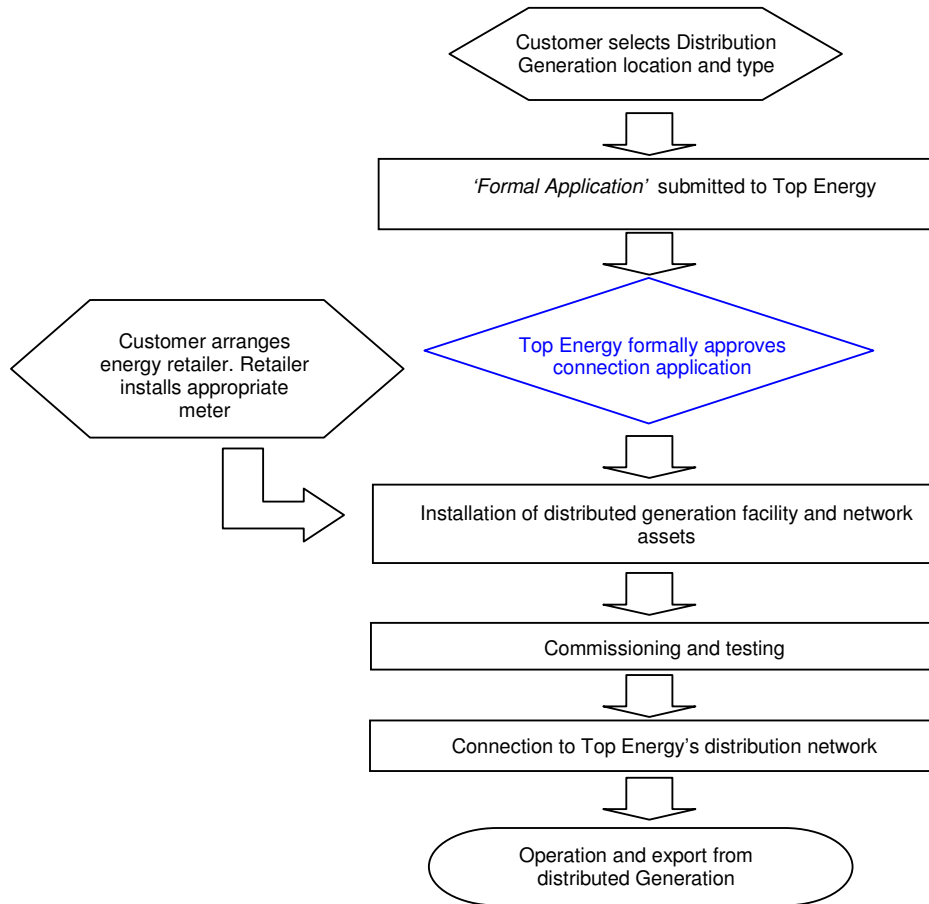
6 Other Related Documents

DG-001 DG Connection Policy and Technical Standards: **≥500kW**

DG-002 DG Connection Policy and Technical Standards: **<500kW & ≥10kW**

7 General Procedure for Connection

The following flow chart outlines a simplistic approach to the connection process required to connect a small DG to Top Energy's network (from 'Formal Application' to final connection).



7.1 Selecting a DG System

The most common small DG systems (<10kW) are solar powered (photo-voltaic panels), wind turbines and micro-hydro generators. Any DG system must conform to the appropriate standards, including those outlined in Section A.2. In particular AS 4777 which have been written with solar power systems in mind, but which could potentially be applied to other grid connected inverter systems.

7.2 Making a Formal Application

Prior to committing to install DG plant a *Formal Application* should be made to Top Energy by completing a *Distributed Generator Installation Application Form*. Top Energy needs to know the location, type and size of the DG system, plus the name of the electrician/contractor who is installing the system. Top Energy also needs to know the name of the electricity retailer who has agreed to buy excess electricity, so that Top Energy can arrange to credit them for a portion of the delivery charges relating to the exported generation. Applications forms are provided at the back of Appendix A of

this policy document and are also available from Top Energy offices, via written request or can be down loaded from the web-site (<http://www.topenergy.co.nz/>).

Top Energy will process a 'Formal Application' for a DG that has an output of <10kW within 20 working days, and will provide written permission to connect your generator if all conditions are met.

Connection to Top Energy's distribution network should only be made after written approval for the connection has been obtained from Top Energy via a Formal Application.

Top Energy may also wish to discuss the initial concept design and connection to ensure that the installation is acceptable to both parties.

In the case of an inverter type DG system, on receipt of a proponent's connection application Top Energy will confirm that it is certified as complying with AS 4777 and then the consumer's data will be registered in the Top Energy's DG Register. The consumer will then be advised in writing of Top Energy's permission to connect.

If an application to connect a DG system is declined, Top Energy will provide the applicant with an explanation of the decision. Any steps or measures which could be taken to enable a connection will be provided with the explanation, if appropriate.

7.3 Contacting a Retailer

A DG owner needs to approach an electricity *Retailer* who will provide a mechanism to trade any surplus/exported DG electricity within the New Zealand Electricity Market (NZEM). That is, the *Retailer* will take receipt of, or purchase, any surplus electricity. The requirements for *Retailers* in relation to trading electricity on the electricity market are covered in the EGRs.

The electricity *Retailers* currently operating on Top Energy's network are:

- Contact Energy (<http://www.contact-energy.co.nz/>)
- Genesis (<http://www.genesisenergy.co.nz/>)
- Mercury Energy (<http://www.mercury.co.nz/Home/Default.aspx>)
- Trustpower (<http://www.trustpower.co.nz/>)

A DG owner that does not have contractual arrangements with an electricity retailer to purchase excess electricity will not be permitted to connect to Top Energy's network.

The selected *Retailer* will also arrange the metering arrangements required for the DG scheme and may install a new, or second, meter to record the amount of electricity generated and exported into the network. They will also outline the tariff and/or meter charge depending on the DG connection location and the type of metering system installed. The tariff should outline the pricing options associated with energy purchase (imported) and energy sale (exported).

7.4 Metering

The minimum metering requirements that Top Energy would accept would be two normal “reverse run stop” disc-type meters (Ferraris Meters), one meter measuring the imported energy and the other measuring the exported energy, or a two register meter.

7.5 Installation

All DG plant should be installed by a qualified tradesperson and should comply with all relevant building and electrical codes/standards. All electrical wiring should be undertaken by a registered electrician.

It is the responsibility of the DG to contact the local council and satisfy any building or other consents which may be required.

7.6 Prior to final connection

Prior to the final physical DG connection being made the DG owner must supply Top Energy with a copy of the energy sale/purchase agreement with an electricity *Retailer*.

7.7 Connection to Top Energy’s network

Once Top Energy is satisfied that the DG owner has provided all relevant information and is compliant with the required Top Energy and industry standards (including building and electrical codes) final connection to the network may be made.

8 Commercial Arrangements (Payment/Charges)

Owners of DG plant could receive payment for the electricity that their plant exports into the Top Energy network from their chosen energy *Retailer*. A common payment practise is that their Retailer will simply adjust the DG owner’s energy account to reflect the amount of energy that has been purchased and/or exported; this process is referred to as “net billing”.

9 Technical Standards

In order to connect to Top Energy’s network a DG must meet with Top Energy’s Technical Standards. These standards include the normal industry standards as outlined in Appendix A.

10 Health and Safety

Top Energy places significant emphasis on health & safety. That is the health & safety of DG owners, the public, other connected consumers and those working on the Top Energy network.

Historically distribution networks were designed to facilitate the distribution of electricity from point to point and no consideration was included to allow for injection of electricity mid-network. Subsequently a number of health and safety, technical, and commercial implications arise.

If there is a power cut (loss of supply from Top Energy's network) and the DG plant continues to operate some electricity wires could still be *live* (even in Top Energy's network) at a time when they are assumed to be *dead*. This situation could pose the risk of serious injury to anyone working on the network or damage to connected equipment. Hence the need to ensure that DG equipment disconnects and provides isolation during a power-cut. For example a photo-voltaic system manufactured and installed according to AS4777 should prevent this happening.

Top Energy reserves the right to disconnect any DG scheme found to be unsafe, and shall not reconnect the DG until Top Energy approved it as safe.

For health & safety reasons, always check with Top Energy before installing or connecting DG plant.

11 Signage

Signage shall as a minimum be placed:

- On the switchboard that has the DG system directly connected to it.
- On all switchboards including main switchboard and distribution board(s) between the main switchboard and the board that has the DG system directly connected to it.
- In all meter boxes containing the distributor's metering equipment.

Signage should describe the actual type of generation source installed.

The installer of a DG system shall supply and install appropriate signage on the installation in accordance with requirements as required by AS 4777.2.

12 Obligations of DG Owners

A DG owner (<10kW) must maintain and operate all DG plant and equipment in accordance with:

- Applicable Regulations and relevant laws
- the Electricity Governance Rules (Metering, Retail, etc)
- the relevant Electricity Act and Technical Regulations
- Top Energy's requirements as outlined in this document
- Good electricity industry practice and applicable Standards

13 Change of Occupancy/Ownership

Should a consumer sell their property or company (including the DG) it is important that the new owner/operator of the DG equipment understands the requirements for ensuring a safe and well maintained electrical connection. The new owner/operator is required to complete and resubmit to Top Energy an updated '*DG Installation Application Form*' (including the updated contact details).

Registration of DG ownership is not intended to restrict connection, but rather a safety provision and to provide information for energy billing and network planning requirements.

14 Contact Details

More information in relation to connecting DG to Top Energy's network can be obtained by contacting:

Top Energy Limited

Station Road
PO Box 243
Kaikohe 0400
New Zealand

General Enquiries

Phone : +64-9-401 5440
Fax : +64-9-401 5611

Email : info@topenergy.co.nz

Web : <http://www.topenergy.co.nz/>

Appendix A Technical Standards : <10kW

A.1 Introduction

This appendix details the requirements for the connection and operation of Distributed Generation (DG) rated **below 10 kW**.

These requirements apply to all existing or prospective DG that may operate in parallel with Top Energy’s distribution network regardless of whether energy is exported or not.

A.2 Regulations and Standards

All electrical apparatus, materials and wiring supplied shall comply with the latest editions of the relevant New Zealand standards, and the relevant IEC/IEEE standards. In particular this would include the following:

Standard Number (if applicable)	Title/Organisation/Documentation
-	The New Zealand Electricity Act
-	The Electricity Regulations
-	New Zealand Electricity Codes of Practice (NZECP)
-	EEA Guide for the Connection of Generating Plant
-	Electricity Governance Rules (EGR)
AS/NZS 3000:2000	Australia/New Zealand Standard - Wiring Rules
AS/NZS 61000.3.7	Electromagnetic compatibility (EMC) Limits – Assessment of emission limits for fluctuating loads in MV and HV power systems
IEEE Standard 519-1992	Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
IEC 60255	Electrical relays (all relevant standards)
IEC 60068-2	Environmental testing
IEC 61000-4	Electromagnetic compatibility

IEEE 929-2000	IEEE Recommended Practices for Utility Interface of Photovoltaic (PV) systems
AS 4777 : Australian Standard for Grid Connection of Energy Systems via Inverters.	AS 4777.1-2002 : Grid connection of energy systems via inverters - Installation requirements AS 4777.2-2002 : Grid connection of energy systems via inverters - Inverter requirements AS 4777.3-2002 : Grid connection of energy systems via inverters - Protection requirements
IEC 61173:1992	Overvoltage protection for photovoltaic (PV) power generating systems – Guide for both stand-alone and grid-connected

A.3 Short Circuit Capacity

The DG plant must comply with AS/NZS 3000.

A.4 Network fault levels

It is expected that DG systems with inverters will not normally contribute significantly to network fault levels.

A.5 Residual current devices (RCDs)

DG systems shall be connected to the electrical installation on the grid side of any residual current devices.

A.6 Acceptable Inverter Systems

Top Energy will only accept (for connection) inverters that have been tested by an authorised testing laboratory and certified as being in compliance with AS 4777 and issued with an accreditation number.

A.7 Inverters and Grid protection devices

Inverters shall comply with the requirements of AS 4777.2. The inverter energy system shall incorporate a grid protection device, which shall comply with the requirements of AS 4777.3. The grid protection device may be integral with the inverter. The protection settings of the grid protection device shall not exceed the capabilities of the inverter.

All inverters and grid protection devices must be tested by an authorised testing laboratory and certified as being in compliance with AS 4777 and issued with an accreditation number.

A.8 Connection Point

The DG system shall be connected by fixed wiring to a dedicated circuit on a switchboard. It is preferable that a DG system be connected directly to the main switchboard. In installations where this is not possible or desirable the nearest distribution board shall be used and all distribution boards between the inverter energy system and the main switchboard including the main switchboard shall be labelled. See section on labelling/signage.

The rating of the inverter circuit cables and all the cables between any distribution boards and the main switchboard which carry the DG output must be rated for at least the full output of the DG system in accordance with AS/NZS 3000.

A.9 Isolation Switches

There shall be a visible and accessible method of ensuring that the DG system is disconnected from the network and disconnected from the consumer's installation. The main switch for the switchboard, to which the DG system is directly connected, shall be a lockable switch in the OFF position, which operates in all live conductors. The operation of this switch shall isolate the DG system from that switchboard.

This switch is to provide isolation of the DG system for persons working on other parts of the electrical installation.

The isolation switch shall be installed to the requirements governing main switches in AS/NZS 3000, irrespective of where the DG system circuit emanates from.

A.10 Reconnection Procedure for Inverters

If voltage and / or frequency fall below set limits as defined in AS4777, the inverter energy system must be automatically disconnected from the network. Tests shall be carried out to confirm that there is a minimum 1 minute time delay before the inverter energy system is automatically reconnected onto the network after the network has returned to nominal voltage and frequency.

A.11 Electrical Safety

Inverter and grid protection devices shall comply with appropriate electrical safety requirements of AS/NZS 3100

The DG installation shall comply with the appropriate requirements of AS/NZS 3000 (Wiring Rules) and AS 4777.1 (Grid connection of energy systems via inverters).

A.12 Issues for Investigation by Top Energy

The following technical items are seen as potential issues for the connection of DG less than 10kW and may require further investigation by Top Energy.

- Network Load Balance for local distribution feeders
-

- Network Thermal Overload conditions
- Harmonic Saturation
- Voltage

Top Energy sees that the control and recording of small-embedded generation installations as imperative in managing quality of supply. It is envisaged that limits will need to be enforced on the total kVA of small inverter type DG installations connected per transformer, with lower limits applying on LV networks to minimise the impact of harmonic saturation.

Top Energy also envisages that the total kVA of DG connected to an 11kV/22kV distribution feeder will need to be limited.



TOP ENERGY

DISTRIBUTED GENERATION INSTALLATION APPLICATION FORM

RATED GENERATION OUTPUT <10 KW

(Please print this form, complete it and return to Top Energy)

A. Consumer Facility Information – Where will the generating facility be	
Name shown on Retailer Account	
ICP Number (from power bill)	
Electricity Retailer	
Electricity Retailer Account No.	
Meter Number	
Street Address	
Suburb	
City	
Phone No.	

Note: If available please also submit a copy of electricity retailer bill

B. Contact Information – Who should be contacted for additional information?	
Contact Person / Installation Contractor	
Company Name	
Phone	
Fax	
E-mail	
Mailing Address	
City/Town	

C. Technical Information	
DG Plant Manufacturer	
DG Plant Model	
DG Supplier	
Primary Energy Source	
Rating and type of prime mover	
Type of DG plant (i.e. photovoltaic)	
Rating Details:	

Apparent Power	kVA
Power Factor	
Current	Amps
Voltage	Volts
Phases	<input type="checkbox"/> 1 - phase <input type="checkbox"/> 3-
Rated Maximum Output (kW)	

D. Single/One-line diagram attached Yes No

E. Operating Date – From what date is the generator expected to operate

I acknowledge that I am responsible for the connection of the generating facility and that it will be installed to the appropriate standards as required and outlined by Top Energy.

I acknowledge that I am also responsible for the maintenance and operation of the facility and recognise the responsibilities and obligations associated with connecting distributed generation to the Top Energy distribution network.

Signed

Print Name: _____

Position: _____

On Behalf of: _____

Date: _____

END OF DOCUMENT