

**Distributed Generation (greater than 10kW)
Connecting to Vector's electricity network**

**Important information
about installing distributed generation
with capacity greater than 10 kilowatts**

Purpose of this document:

This document provides a brief outline of the process for installing distributed generation with capacity of greater than 10 kilowatts on Vector's electricity network. Its purpose is to provide the prospective generator with the key aspects involved when connecting distributed generation to Vector's electricity networks, and is not intended to be a comprehensive handbook.

This document is to be read in conjunction with the following Vector documents:

- Technical Requirements for Connection of Distributed Generation
- Distribution Code
- Initial Application Form for Connection of Distributed Generation (>10kW)
- Distributed Generation Connection Agreement Template

These documents are available at Vector's website:

www.vectorelectricity.co.nz/about/distributedgeneration.php

Each distributed generation situation is different and needs to be discussed with a Vector representative. For further information about distributed generation, please call (09) 303 0626 or email dginfo@vector.co.nz

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Distributed generation – setting the scene

- Installation of distributed generation can be a complex matter and for connections greater than 10kW you need to involve Vector from the early stages in your investigation process. The sooner you involve Vector, the more informed you can be and the smoother the process can run.
- Connection of distributed generation to an electricity network has a wide range of implications. This includes personnel and public safety, network performance, service quality, investment in the network, and commercial agreements.
- If your generation is to be connected to Vector's network then it must comply with Vector's requirements for connection of distributed generation to our network.
- The electricity you may sell from your distributed generation system is distributed on the network of your lines company. Vector is the lines company for three regions:
 - **Auckland** (Auckland City, Manukau City and parts of Papakura District)
 - **Northern** (North Shore City, Waitakere City and Rodney District)

NOTE: Vector operates its Northern region under the UnitedNetworks brand, but your query will be handled by a Vector representative.
- If your generation will be for isolated localised operation only ("islanded" within your own private network and never synchronises with our network) and you have no requirements to export any excess energy, this document is not applicable to you. **This requires your generation system to be physically isolated from Vector's electricity network.**

For further information

When you decide to install distributed generation, you want to do it right. We want you to do it right too. If you have any queries or need more information after reading this document, please contact us:

Phone Number: **(09) 303 0626**
Address: **Customer Connection Coordinator**
Vector Limited
PO Box 99882
Newmarket
Auckland
Email: **dginfo@vector.co.nz**
Website: **www.vectorelectricity.co.nz**

Implications of connecting distributed generation

Historically, distribution networks have been designed for the distribution of electricity from the national grid to consumers, and have not been designed to allow injection of electricity mid-network. As a result the health and safety, technical, and commercial implications outlined below can occur.

Health and safety implications

The connection of distributed generation requires safety equipment and procedures to be put in place to ensure safe interaction between your private network and Vector's electricity network. If not managed correctly, it is possible for your generation system to backfeed electricity onto our network which could endanger the lives of Vector personnel and the public.

For everyone's safety your generating system must also meet statutory requirements, comply with international manufacturing standards and safety standards specified by Vector. **Vector maintains the right to disconnect any site found to be unsafe, and shall not reconnect the site until it is approved safe.**

Please respect these standards and remember this first rule for safety:

Check with Vector first!

For everyone's safety, you must check with Vector before installing or connecting your distributed generation system.

Technical implications

The effect of connecting a distributed generator to our network requires detailed investigation and discussion with Vector. Depending on the particular situation, the connection of your generation may require the reinforcement of the existing network.

Technical aspects to be discussed include:

- Safety requirements
- Connection capacity requirements
- Protection and control requirements
- Synchronisation between networks
- Fault current
- Islanding
- Black start capability (mainly for larger generation stations)
- Power quality
- Reactive power compensation
- Other aspects relevant to individual situations

Commercial implications

Connection costs

Connecting your distributed generation system to Vector's network will require us to install additional connection assets. Dependent on your specific connection, there may also be other network reinforcement and/or investment costs. Vector will pass these associated costs on to you.

Ongoing costs

Vector may charge for ongoing expenses incurred because of your distributed generation connection to our network. Where we incur ongoing or periodic expenses, such as expenses for routine maintenance, we may apply a connection charge to help cover these costs.

The charges and associated commercial terms need to be individualised for each generator and will be formalised in a 'Distributed Generation Connection Agreement'. A draft version of this agreement is available to download from Vector's website.

Other implications and considerations

Timing of installation

The connection of distributed generation to our network can be complex and may require detailed design and planning. Approval for this must be obtained Vector prior to connection so you will need to factor this into your timeframe.

Metering

Your electricity retailer may need to install a new meter. This new meter will be able to measure the amount of surplus electricity that you generate and sell back.

An import/export meter is the minimum requirement for use with distributed generation systems. An import/export meter has the capability to measure both imported and exported volumes of energy. This ensures you receive the correct payment for the electricity you contribute to the electricity retailer and that you are charged correctly when you use electricity supplied by the retailer.

There may be extra rental costs for this type of meter and your electricity retailer will advise you about these. You may also have to pay your electricity retailer a tariff or meter change fee, depending on your location and your current metering configuration.

Vector's network information systems

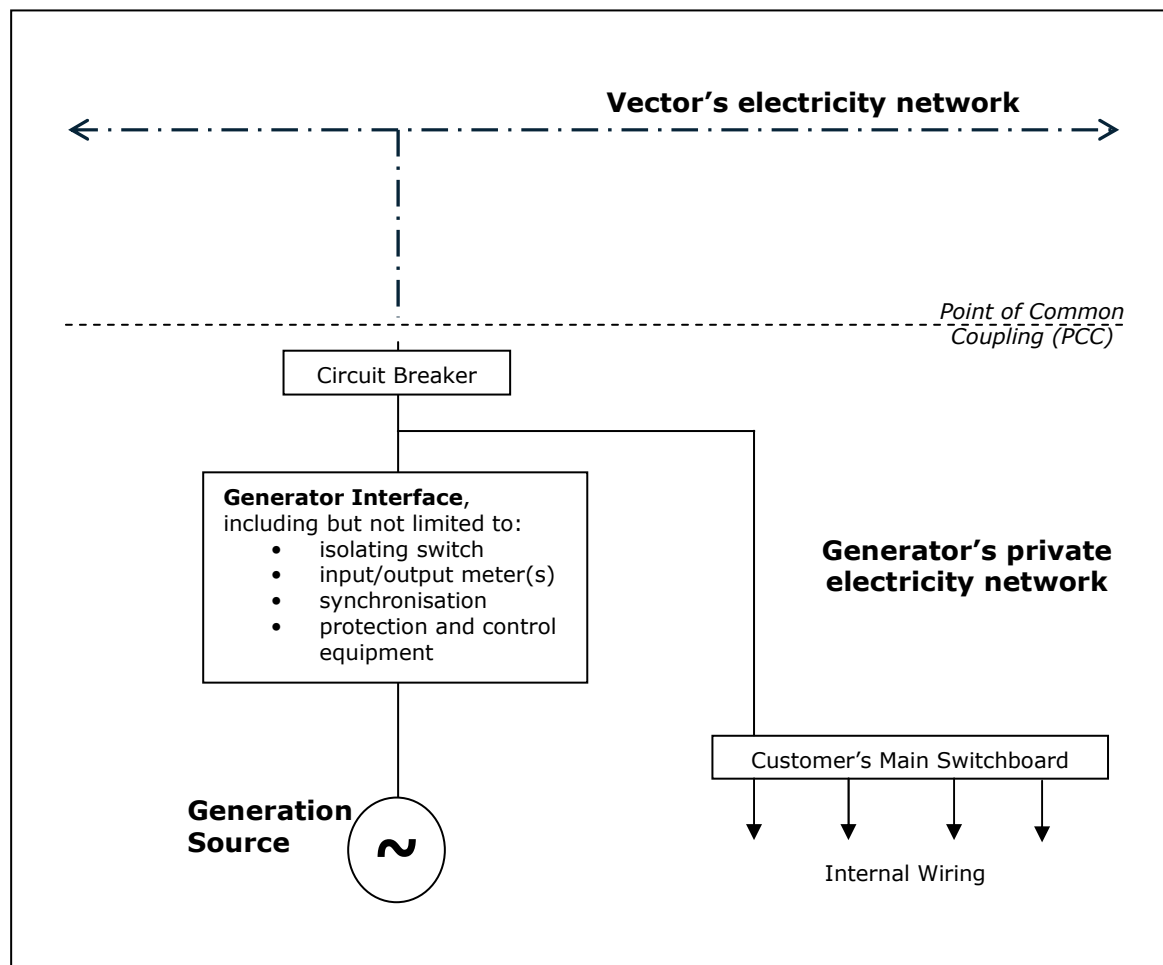
Vector keeps comprehensive information systems for its networks. These will need to be updated to include your generator system details.

Energy retailing/trading

As a generator you are required to have a sale/purchase agreement with an electricity retailer. Information can be found on the M-Co (Marketplace Company) website, www.m-co.co.nz, or from your electricity retailer. The requirements for generators to trade electricity on the electricity market are covered in the Electricity Governance Rules.

'Typical' generator connection diagram

The following is a generic representation of a typical distributed generation connection. Each installation is different and needs to be discussed with Vector.



Technical standards to be met

The following is a summary of Vector's standards that must be met, and are available to download as documents from Vector's website:

- Distribution Code
- Technical Requirements for the Connection of Distributed Generation (DG)

The following is a summary of the key industry standards that must be met:

- IEC Standards
 - IEC 60255 Electrical Relays
 - IEC 60068-2 Environmental Testing
 - IEC 61000-4 Electromagnetic Compatibility
- IEEE Standards
 - IEE 519-1992 Recommended practices and requirements for harmonic control in electrical power systems
 - IEEE 929-2000 Recommended practices for utility interface of Photovoltaic (PV) systems
- Electrical Codes of Practice
 - Available at the Energy Safety Service (ESS) website www.ess.govt.nz/rules/rules_codes.asp
- AS/NZS Standards, in particular:
 - AS/NZS 3000 – Electrical Installations (known as the Australian/New Zealand Wiring Rules)
 - AS 4777 provides standards for connecting inverter-based systems, but is only a useful guideline to installing other forms of generation.
 - These standards are available at www.standards.com.au.

Other standards may be applicable depending on your generation system, and these need to be discussed with Vector.

Important steps to connecting distributed generation

Read Vector's distributed generation documents

Please familiarise yourself with the documents available on Vector's website. If you do not have access to the website, contact Vector to request a copy of these documents:

- Technical Requirements for Connection of Distributed Generation
- Distribution Code
- Initial Application Form for Connection of Distributed Generation (>10kW)
- Distributed Generation Connection Agreement Template

Initial Application to Vector

Our process for connecting distributed generation is governed by regulation. As part of this process, we will need you to complete our application form. This is available on our website. Please ensure you complete this application form correctly, and include your application fee, otherwise we will return your application form to you.

If you have any other information that may help us with your application, please also include this with your application form. Further details about our contact details and application fees are available on page 11.

Vector to discuss with you

A Vector representative will contact you to discuss your initial application. We will then highlight any potential issues and provide information about our particular connection requirements.

Key aspects Vector will want to discuss:

- Proposed location of your generator
- Specifications of your generator
- Proposed schedule for connection to the network
- Proposed design and installation contractors for your generator
- Technical implications of connecting your generator
- Commercial implications of connecting your generator
- Planning and scheduling
- Companies that will be involved in the design and installation process

Design in conjunction

Once we have discussed the effects of your proposed generation installation, further investigation and design work needs to be undertaken by both Vector and your

representatives. Ongoing discussion needs to occur to ensure the design process goes smoothly and an acceptable outcome is reached.

Installation of generation

Once you have finalised your installation design, Vector will require a design review before approving connection of your system to our network. You must use a suitably qualified installer (a Registered Electrician or Certified Contractor) to install your generator and electrical wiring. You must send Vector a copy of the Certification of Compliance (CoC) that your installer must provide to you on completion.

Final application and approval to proceed

When you are ready to connect to Vector's network you need to notify Vector that you wish to proceed. We can then organise your final connection to our network.

You must have obtained and provided to Vector:

- Certificate of Compliance (CoC)
- Sale/Purchase Agreement with an Electricity Retailer
- Distributed Generation Connection Agreement
- Payment for connection related costs
- Operating procedures
- Contact details and procedures
- All other information requirements
- All relevant information to allow us to update our network records
- Proposed connection schedule

Prior to connection any network reinforcement projects must be completed (if required to allow connection to the network).

A connection agreement will be negotiated between Vector and yourself within 30 business days of receipt of your notice to proceed. This period can be extended by mutual agreement. If we cannot conclude a connection agreement within the agreed time, you will be connected as soon as is practical on the terms prescribed in the Electricity Governance (Connection of Distributed Generation) Regulations 2007.

Connection to Vector's electricity network

Once Vector is satisfied that your generation system is compliant with all Vector and industry standards and requirements, connection to Vector's network can be organised.

Final connection to Vector's network will require:

- Final system/site inspection and approval by a Vector representative. Applicable fees for this are outlined overleaf.

- Connection to the network by a Vector approved contractor.
- Update of Vector’s Information Systems.

Fees

Upfront application fee

It takes time for Vector to analyse and review the information that you provide. Vector will charge an initial application fee to help cover our costs. The application fee varies depending on the size of your connection and will be charged as follows:

Connection size	Application Fee
>10kW and <100kW	\$500*
≥100kW and <1MW	\$1,000*
≥1MW	\$5,000*

* In accordance with the Electricity Governance (Connection of Distributed Generation) Regulations 2007

Please ensure that you send your application fee payment in with your initial application. If you do not send this in, your application may not be accepted.

On-site observation and testing fee

Depending on the installation, Vector may require a site visit and inspection to ensure that we are satisfied with the installation. If Vector requires a site visit, we will charge a nominal fee to help cover the expenses we incur. These charges are as follows:

Connection size	Inspection Fee
>10kW and <100kW	\$120*
≥100kW	\$1,200*

* In accordance with the Electricity Governance (Connection of Distributed Generation) Regulations 2007

All cheques should be made payable to “Vector Limited”.

Useful links

Vector Electricity

www.vectorelectricity.co.nz

Distributed Generation Information

http://www.vectorelectricity.co.nz/business/connection_policies.php

Electricity demand-side exchange:

www.demandexchange.co.nz

(An electricity demand-side exchange service provided by Vector Limited)

Metering:

Stream Information Limited

www.streaminfo.co.nz

(Stream Information Limited is a joint venture between Vector Limited and Total Metering Limited)

NGC Metering Limited

<http://www.ngc.co.nz/iem/>

Electricity industry:

The Electricity Commission

www.electricitycommission.govt.nz

The Ministry of Economic Development (MED)

www.med.govt.nz

M-Co (the Marketplace Company)

www.m-co.co.nz

www.nzelectricity.co.nz

Electricity Networks Association (ENA)

www.electricity.org.nz

Further links:

Please refer to the Vector website for further industry related links

<http://www.vectorelectricity.co.nz/utilities/links.php>

Government Regulations:

Electricity Governance (Connection of Distributed Generation) Regulations 2007

<http://www.legislation.govt.nz>

Information requirements for distributed generation

The following are the information requirements for distributed generation, and is extracted from Vector's "Distribution Code". The Distribution Code is available on Vector's website, and must be read by anyone planning to install distributed generation on Vector's electricity network.

Distribution Code - Appendix 4

INFORMATION REQUIREMENTS FOR DISTRIBUTED GENERATION

1. REQUIRED FOR ALL GENERATORS CONNECTED TO THE NETWORK

1.1 Generating Plant Data

- (i) Terminal volts (kV);
- (ii) Rated kVA;
- (iii) Rated kW;
- (iv) Maximum active power sent out (kW max) reactive power requirements (kVAR), if any;
- (v) Type of generating plant - synchronous, asynchronous, etc;
- (vi) Type of prime mover;
- (vii) Anticipated operating regime of generation eg, continuous, intermittent, peak lopping;
- (viii) Fault level contribution (for large machines, this may be covered by the details listed in section 2);
- (ix) Method of voltage control;
- (x) Generator transformer details, as applicable; and
- (xi) Requirements for top-up supplies and/or standby supplies.

1.2 Interface Arrangements

- (i) The means of synchronisation between the Distribution Network and the Generator;
- (ii) Details of arrangements for connecting with earth that part of the Generator's system directly connected to the distribution system;
- (iii) The means of connection and disconnection which are to be employed;
- (iv) Ability of plant to backfeed the external system;
- (v) Protection equipment and protection setting; and
- (vi) Precautions to be taken to ensure the continuance of safe conditions should any earthed neutral point of the Generator's system operated at HV become disconnected from earth.

2. INFORMATION REQUIRED FOR LARGE GENERATORS

This section applies to distributed generators connected at voltages equal to or greater than 6.6kV or of capacity greater than 1 MW and details the technical and design information requirements not specifically covered above. The following information is required by Vector to determine the effect of the proposed generation on the network.

2.1 Technical Data

Generating plant information (impedances p.u. on rating):

Type of prime mover
Rated MVA

Rated MW
 Generator MW/MVAr capability chart (at terminals)
 Type of excitation system
 Inertia constant MW secs/MVA (whole machine)
 Stator resistance

Direct axis reactances	Sub-Transient Transient Synchronous
Quadrature axis reactances	Sub-Transient Synchronous
Time constants	Direct axis Sub-Transient & Transient Quadrature Axis
Open or short	Sub-Transient (stating either circuit time constant)
Zero sequence	Resistance Reactance
Negative sequence	Resistance Reactance
Generator transformer	Resistance Reactance MVA Rating Tap arrangement Vector group Earthing

- (i) Automatic voltage regulator;
- (ii) A block diagram for the model of the AVR system including the data on the forward and feedback gains, time constants and voltage control limits;
- (iii) Speed governor and prime mover data; and
- (iv) A block diagram for the model of the generating plant governor detailing the governor flyball, if applicable, and system control and turbine time constants, together with the turbine rating and maximum power.

2.2 Interface Arrangements

- (i) The means of synchronisation between the Distribution Network and the Generator.
- (ii) Details of arrangements for connecting with earth that part of the Generator's system directly connected to the distribution system;
- (iii) The means of connection and disconnection which are to be employed;
- (iv) Ability of plant to backfeed external system;
- (v) Protection equipment and protection setting; and
- (vi) Precautions to be taken to ensure the continuance of safe conditions should any earthed neutral point of the Generator's system operated at HV become disconnected from earth.

2.3 Capacity and Standby Requirements

- (i) Registered capacity and minimum generation of each generating unit and power station in MW;
- (ii) Generating unit and power station auxiliary demand (active power and reactive power) in MW and MVAr, at registered capacity conditions. For Users with own generation, this should include top-up requirements;

(iii) Generating unit and power station auxiliary demand (active power and reactive power) in MW and MVAR, under minimum generation conditions. For Users with own generation, this should include top-up and standby requirements.

3. FURTHER INFORMATION REQUIRED BY TRANSPOWER

Generators with large machines may be subject to the Transpower Connection Code and central dispatch. Where this applies any information supplied to Vector, and also any further information requested by Transpower will be forwarded to Transpower. It will be the responsibility of the Generator to provide the information required to Vector. Vector will pass on the information to Transpower.

There may also be information required under the terms of any Transpower contract in respect of the transfer of energy from the Generator to the Generator's Customer.