

Northpower Technical Requirements for Small Scale Distributed Generation

Date of Issue: 1 March 2010

Introduction

This document is to give guidance on the technical connection issues relating to distributed generation and is primarily written with "small scale" generation in mind. "small scale" is relative to the size or capacity of the network at the point of connection. Generally it relates to generation connected into the Low Voltage network (400/230 Volt) and would have a maximum net output less than a typical domestic installation (10 kW). However, the principles outlined in this document can be applied to distributed generation greater than 10 kW. Very large distributed generation schemes, e.g. greater than 1 MW, are usually specifically engineered for each scheme.

This document only applies to generation connected to (or operates in parallel to) Northpower's network. It does not cover standby or emergency generation that is not capable of generating into Northpower's network.

This document does not look at the economics of such systems, nor can it be used to design these systems. The cost and return can vary significantly, due to generation sources available, the installation load pattern and reliability requirements.

Key Issues – Relating to Network Connection

The main issues that concern Northpower relate to the Network connection of generation systems, the key issues being:

1. Electrical safety of the system.
2. The impact on the quality of supply.
3. The capability of the network to handle the generation.
4. Appropriate commercial arrangements for the sale of electrical output generation have been made.

1. Electrical Safety

There are two main aspects of safety:

- i. The safety of the generation installation and associated lines and cables.
 - a. Faults within the generation system of installation.
 - b. Faults in the network.
 - c. Running part of the network in an "islanded" situation. The generator may run the installation associated with it "islanded".

Regulation 41 of the Electricity Regulations requires "mains paralleled generation systems" to be inspected by a registered electrical inspector.

ii. **Safety of staff working on the network.**

There is often a need to de-energise a section of network to allow work to be undertaken safely. This requires isolating the section of network from all sources of electricity.

Therefore, it is essential that all generation systems capable of being connected to the network are known, and that there are readily identifiable physical isolation point(s) for each generation system. Northpower will require access to the generation isolation point. This isolation may be the “service main” fuse.

2. Quality of Supply

The term “quality of supply” generally means the electrical voltage and frequency are maintained between limits defined in the Electricity Regulations, and harmonic levels comply with ECP 36 measured at the installation “point of supply”.

3. Network Capability

There needs to be a check to ensure that the proposed generation does not exceed the capability of the network. If there is a network capability issue, any costs placed on the generation owner of rectifying the issue, will be in accordance with the “Distributed Generation” Regulations. For most “small scale” systems, network capability is not expected to be a significant issue.

As Northpower is not concerned with the capability of the electrical system within the installation, it would be advisable that the owner has this aspect checked by a qualified electrical person.

The generation system needs to be capable of connecting to a grid operating at a frequency of 50 Hz. The connection voltage will be “standard low voltage” as defined by the electricity regulations for “small” scale (less than 10 kW) schemes. Larger schemes may be “standard low voltage” or at one of the “high” voltages used by Northpower. A generator may provide a suitable transformer to achieve a connection to Northpower’s network if the generation voltage is different to that of Northpower’s.

4. Number of Phases

This will depend on the scale, type of generation system, and the number of phases available at the grid connection point. It is most likely that the very small scale schemes (less than 1 kW) will be single phase while the small scale schemes (between 1 kW to 10 kW) will be 3 phase.

5. Commercial Arrangement for the Generation

Northpower is obliged to ensure that any installation (load or generator) has made an appropriate arrangement with an energy company that has a “use of system” agreement with Northpower. An existing installation that installs a generation system that is capable of connecting to the network will most likely need their energy company’s agreement relating to the commercial arrangement for any energy injected into the distribution network.

In regards to the commercial viability of the generation system, it is up to the person considering or proposing the system to consider all the costs and benefits.

Non Electrical Compliance issues

In addition to the above electrical issues there are a number of other compliance issues that may need to be dealt with. These can include but are not limited to the following:

1. Compliance with District Council rules. Generation of electricity for commercial gain or sale may not be a permitted activity, the property may need a “designation” or “resource consent” may be required for generation activity.
2. Wind generation systems have a number of issues which generally include:

- a. District Council plans generally place height restrictions on structures and these vary depending on the zoning.
 - b. District Council plans usually have noise level requirements; these vary depending on the zoning and time of day.
 - c. District Councils may require wind turbine structures to have building consents.
3. Micro hydro systems may require a resource consent from the Regional Council basically to divert water and alter the water way. Even though the scale is small, the Resource Management Act does not make a distinction between utilising a small stream or a major river.

Process for Connecting a Distributed Generation System

1. Develop a design to determine the electrical capacity, energy production and electrical system specification.
2. Complete commercial arrangements with an Energy Company (must be completed before Step 7).
3. Submit proposal to Northpower who will check that the Network is capable of handling the proposed generation and for any potential “quality of supply” issues. Northpower will advise if any enhancements (including additional network) to the network are required. The application should be made on the official Distributed Generation Application form.
4. Approve application once any technical issues are resolved and arrangements made for metering. Note the approval notice will contain any relevant technical conditions, e.g. maximum net power, power factor etc.
5. Notify Northpower of intention to proceed.
6. Install the generation system (made ready to connect), and have it inspected by a registered electrical inspector. Note the inspector may need to run the generation system for testing purposes.
7. Permission to connect generation will be given on receiving a copy of the Inspection Report, notification from the Energy Company, and confirmation with Electricity Governance (Connection of Distributed Generation) Regulation 2007, unless a connection contract has been entered into (generally small scale distributed generation will be on “regulated terms”).

Application for a New Distributed Generation System or to Alter an Existing System

An application is required for all new distribution generation schemes. In regards to altering an existing system an application should only be made if the proposed alteration would result in a breach of the original conditions set out for the system. This would typically include increasing the net generation into Northpower’s network beyond what has been approved, or increasing the number of phases the generation is connected into.

Maintaining and renewing equipment associated with the generation system would not normally be required for a new application. However, Northpower must be notified if the generation system will be permanently decommissioned.

Responsibility of Owner/Operator of Distributed Generation System

- Maintenance and safe operation of the generation system (including inverters, protection devices, cabling etc).
- Ensure the generation system complies with all relevant Acts, Regulations and Rules.
- Operating the system within the net output level specified in the Network approval.

Disconnection/Interruption of Generation

Northpower reserves the right to disconnect or interrupt the generation. The conditions for disconnection or interruption of generation will be as per the “regulated terms”, unless there is a

connection contract which has a specific clause(s) regarding disconnection and interruption. In principle disconnection/interruption clauses would cover the following issues:

- At the request of the generator.
- Non payment of line services.
- For safety, or to prevent damage to property.
- To allow planned maintenance to be carried out on the network (notification will be by the normal shutdown notification process).
- To affect fault repairs in the network may also cause an interruption to the generation).
- Should the generation system cause a problem to the Network or interfere with our consumers' generators connected to the network. These could include but are not limited to; injection of excessive harmonics, generation of surges and sags, and interference with the ripple control signals.

Application Fee

There is no fee to make an application for distributed generation. Fees are only charged when work is to be undertaken, or a new ICP (individual connection point) needs to be set up in the registry.

General Notes

1. The process is basically the same whether it is an existing installation having a generation system added, or a new installation and generation system.
2. The registered electrical inspector does not have to be a Northpower inspector.
3. It is expected that most “small scale” distributed generation systems will be connected into the installation main switchboard rather than utilise a separate supply from the network.
4. It is up to the owner to ensure the Council requirements have been met. Connection to the network is based solely on the electrical issues.
5. Applicants should apply sufficient generation capacity to allow for expansion of the generation. Alternatively, Northpower may give approval for greater generation of output than applied for, to enable generation to be increased in the future without re-applying for increased generation capacity.
6. The reason for suggesting an arrangement is made with a retailer earlier is that the commercial arrangement may affect the financial viability of the proposed scheme or scale of the proposed scheme.
7. Standard low voltage and frequency is defined by Regulations 53 and 54 or the Electricity Regulations.
8. The connection process for distributed generation greater than 10 kW is basically the same except the application may be in 2 stages – initial application and final application. Also, the technical data required may be more extensive than a scheme with less than 10 kW.

Relevant Regulations, Rules, Guides and Codes of Practice:

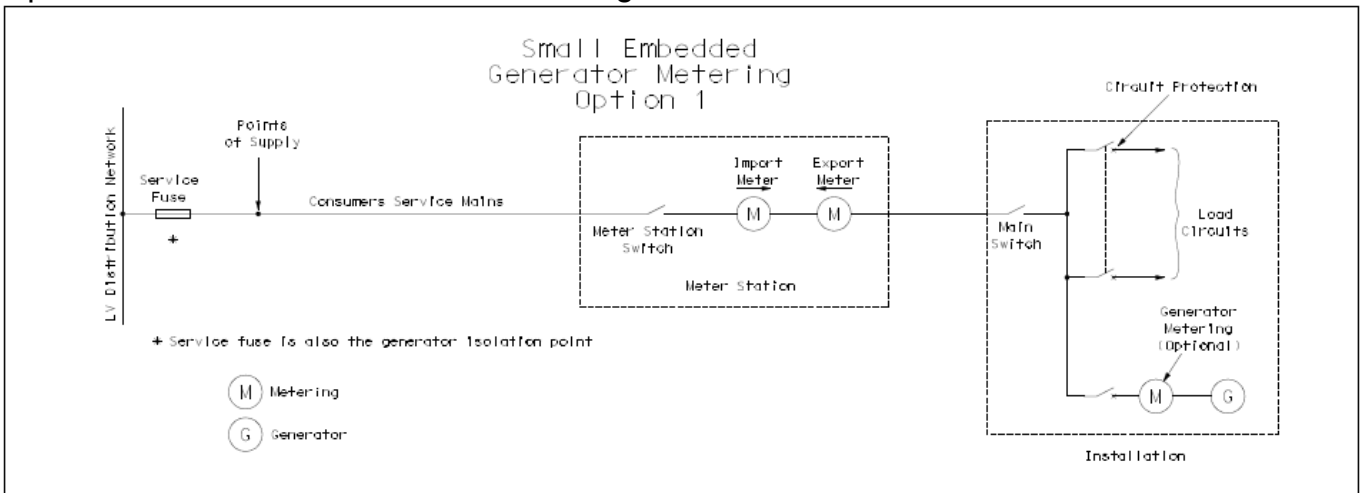
- Electricity Governance (connection of Distributed Generation Regulations) 2007.
- Electricity Regulations 1997 (and Amendments).
- Electricity Engineers Association. Draft Guide for the Connection of Generating Plant.
- Part ‘C’ of the Electricity Commission Governance Rules for Generators Greater than 1 MW.
- AS/NZS 3000 Wiring Rules.
- AS 4777-2002 Grid Connection of Energy Systems via Inverters.
- BS EN 50160:2000 Voltage characteristics of electricity supplied by public distribution system.

Connection Configuration:

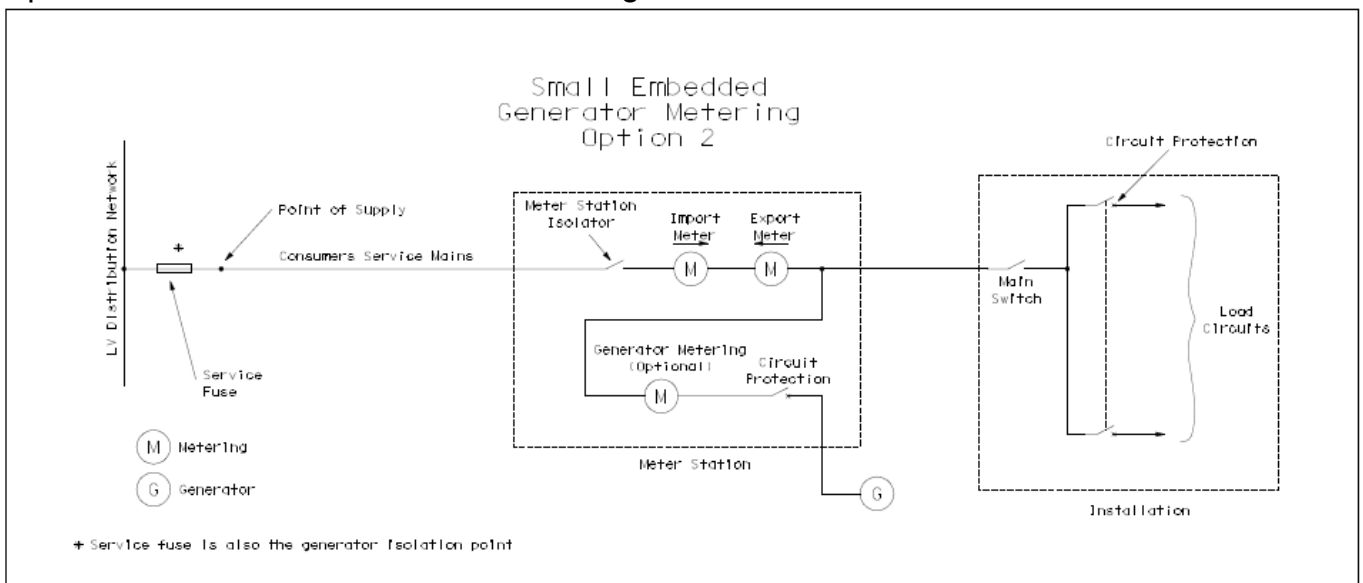
There are several options for connecting small scale distribution generation. These include (see concept diagrams):

- Connecting to the switchboard of an existing installation. In this configuration the generation is effectively supplied via a sub circuit from the switchboard (Option 1).
- Connecting into an existing service main. In this configuration the generation is effectively a separate installation supplied from a common service main. (Option 2).
- Connection into the network. In this configuration the generation has a unique connection, including ICP (Option 3).

Option 1 - Small Embedded Generator Metering



Option 2 – Small Embedded Generator Metering



Option 3 – Small Embedded Generator Metering

