



THE LINES COMPANY

DISTRIBUTED GENERATION POLICY

CONTROLLED DOCUMENT REVIEW TABLE

VERSION	ISSUE DATE	COMMENTS
1	January 2008	Original authorized issue
2	February 2015	Updated issue in line with EA Code Part 6
3	April 2015	Fees for Part 1A application added
4	May 2015	Congestion Policy updated, TLC Pricing methodology referenced, List of Inverters included
5	June 2015	Contact for Enquiries changed
6	Sept 2016	Title changed, gst clarified, Safety requirements emphasised
7	June 2018	Minor clerical alterations

Table of Contents

1. DISTRIBUTED GENERATION	3
2. FOREWORD	3
3. INTRODUCTION	3
3.1 PROCESS FOR OBTAINING APPROVAL	3
3.1.1 <i>Generation of 10 kW or Less (Specified Circumstances)</i>	4
3.1.2 <i>Generation of 10 kW or Less</i>	4
3.1.3 <i>Generation above 10 kW</i>	4
4. TLC'S STANDARDS	4
4.1 CONNECTION AND OPERATION STANDARDS FOR PHOTOVOLTAIC INSTALLATIONS BELOW 10 kW	4
4.2 CONNECTION AND OPERATION STANDARDS FOR OTHER INSTALLATIONS BELOW 10 kW	4
4.3 CONNECTION AND OPERATION STANDARDS FOR ABOVE 10 kW INSTALLATIONS	4
4.3.1 <i>Planning</i>	4
4.3.2 <i>Design</i>	4
4.3.3 <i>Construction</i>	5
4.3.4 <i>Testing</i>	5
4.3.5 <i>Inspection</i>	6
4.3.6 <i>Operation</i>	6
4.4 CONGESTION MANAGEMENT POLICY	8
4.4.1 <i>Up to 10 kW</i>	8
4.4.2 <i>Over 10 kW</i>	8
4.5 EMERGENCY RESPONSE POLICIES	9
4.5.1 <i>Interruptions and Disconnections</i>	9
4.5.2 <i>Contact Details</i>	9
4.5.3 <i>Grid Emergencies</i>	9
4.6 DISTRIBUTED GENERATION SAFETY STANDARDS	9
4.6.1 <i>Compliance with Regulations</i>	9
4.6.2 <i>High Voltage Connections</i>	9
4.6.3 <i>Control Room Safety Standards</i>	9
4.6.4 <i>Assurances</i>	9
4.6.5 <i>Owners Obligations</i>	10
4.6.6 <i>Unsafe Equipment and Practices</i>	10
5. TERMS	11
5.1 REGULATED TERMS	11
5.1.1 <i>Pricing</i>	11
5.2 FAULTS	12
5.2.1 <i>Loss of Supply due to Unplanned Events</i>	12
5.2.2 <i>Disconnection in Emergency Situation</i>	12
6. FEES	13
6.1 FEES FOR DISTRIBUTED GENERATION APPLICATION	13
6.1.1 <i>Up to 10 kW</i>	13
6.1.2 <i>Over 10 kW</i>	13
6.1.3 <i>What the fees will cover</i>	13
6.2 FEES FOR INSPECTION & OBSERVATION OF TESTING	13
7. INFORMATION THAT IS MADE PUBLICLY AVAILABLE	14
7.1 APPLICATION FORMS	14
7.2 CONNECTION & OPERATION STANDARDS	14
7.3 REGULATED TERMS	14
7.4 CURTAILMENT OR INTERRUPTION OF DISTRIBUTED GENERATION	14
7.5 EXPORT CONGESTION	14
7.6 LIST OF INVERTERS	14
7.7 FEES	14
7.8 CONTACT FOR ENQUIRIES	14

1. Distributed Generation -

- is generation that is connected directly to local networks rather than the national grid.

Distributed generation encompasses a range of technologies and scales, including small-scale systems such as photovoltaic modules, small wind turbines and micro-hydro schemes. This generation may be used, for example, as electricity sources for businesses, homes or farms.

The distributed generation policy is on the TLC Web site which can be found www.thelinescompany.co.nz/about-us/policies

2. Foreword

This document provides information that will enable the effective connection of generation to the TLC network. This document complies with the Electricity Industry Participation Code 2010, Part 6 - Connection of Distributed Generation, (referred hereafter in this document as the "DG Code"). It is recommended that generators read this Code, a copy of which is available on the Electricity Authority website www.ea.govt.nz/code-and-compliance/the-code/part-6-connection-of-distributed-generation/

The TLC Terms of Service state that TLC may de-energise, or refuse to connect, any Installation that has a generation installed that does not comply with either this Policy or TLC's Network Code. See Clauses 11.4 & 13.6 of the Terms of Service a copy of which is available on TLC's website.

The Lines Company reserves the right to amend any part of this policy at any time

3. Introduction

The Lines Company's electricity distribution business covers a large geographical area that has many locations suitable for various sizes and types of distributed generation.

The Lines Company has many generation sites already connected to the Network and has had experiences with the technical issues that can result. The connection of distributed generation, of greater than 10 kW, can be technically complex and result in many initial and ongoing issues that need resolving.

Safety to staff, customers, the public and other stakeholders is The Lines Company's highest priority. Hence you must advise TLC of any generator you have connected in your installation by completing one of the applications below. TLC must also ensure the network is secure at all times and that the risk of damage is minimised.

Generation owners will be responsible for claims from other customers for damaged equipment when generators fail to operate within compliance with the electricity regulations and other legislation.

The Lines Company must know where all generators are located and have the ability to isolate plant from the network for safety. Generators can back feed on to the TLC's Network and pose a danger to staff working on the Network.

3.1 Process for Obtaining Approval

There are three types of application as detailed below. The application to use is as detailed in Clauses 1A, 1B, 1C & 1D of Schedule 6.1 of the DG Code.

TLC requires a written application be submitted for any distributed generation.

Copies of application forms are on the TLC Web site [www.thelinescompany.co.nz/customers/generating your own power](http://www.thelinescompany.co.nz/customers/generating_your_own_power).

3.1.1 Generation of 10 kW or Less (Specified Circumstances)

If the proposal meets the specified circumstances as laid out in Schedule 6.1 Clause 1D of the DG Code application can be made under Part 1A. Part 6 of the DG Code, including the time periods, as specified in Part 1A shall apply.

For an application under this section the Distributed Generator must include documentation to prove that the requirements of Schedule 6.1 Clause 1D of the DG Code have been met. This must include details of the inverter proposed and its compliance with AS 4777 as detailed elsewhere in this document.

3.1.2 Generation of 10 kW or Less

The application shall be as detailed in Schedule 6.1 Part 1 of the DG Code. Part 6 of the DG Code, including the time periods, as specified in Part 1 shall apply.

For an application under this section the Distributed Generator must include documentation to prove that the requirements of Schedule 6.1 Clause 1B of the DG Code have been met. This must include details of the inverter, if one is proposed, and its compliance with AS 4777 as detailed elsewhere in this document.

3.1.3 Generation above 10 kW

The application shall be as detailed in Schedule 6.1 Part 2 of the DG Code. Part 6 of the DG Code, including the time periods, as specified in Part 2 shall apply.

4. TLC's Standards

4.1 Connection and Operation Standards for Photovoltaic installations below 10 kW

Specifically for residential installations which do not wish to sell kWh's in to the network. These are as detailed in TLC's Network Code which is available on the Web site.

4.2 Connection and Operation Standards for other installations below 10 kW

These are as detailed in TLC's Network Code which is available on the Web site.

4.3 Connection and Operation Standards for above 10 kW installations

4.3.1 Planning

There will be a number of cases where it is not possible for TLC to determine if a generator can connect without seeking additional external advice.

The planning process will probably leave the generator with a number of decision path options.

4.3.2 Design

Once the generator has confirmed the preferred option, and given notice it wishes to proceed, TLC will prepare a design specification for connection.

A cost estimate will be given to the generator and work will commence once payment is made to TLC or other arrangements, satisfactory to TLC, are made for payment.

If the generator chooses an external party for design TLC shall review the design for

compliance with Acts, Regulations, Codes and Standards.

If TLC is in doubt about any matters it may choose to ask the generator to further review by engaging external advice. This would be at the generators expense.

4.3.3 Construction

Construction techniques and arrangements should minimise the impact on other customers of making the connection. High Voltage construction work shall comply with all Acts, Regulations, Codes and Standards.

TLC shall carry out an inspection of all High Voltage installations to ensure they are safe, will not interfere with other network customers if they fault, and meet industry accepted practice.

Any assets which TLC is to own can be constructed by contractors of the generators' choice, but these will be subcontracted to TLC. TLC's construction arm can provide competitive quotations for work to the design standard, but do not have a monopoly on the work. No network related construction will commence until payment to TLC is received in full unless other arrangements for payment are made to TLC's satisfaction.

When construction is being carried out by an external contractor, no work will be allowed to commence on TLC owned network if any monies are outstanding from the application and evaluation process.

4.3.4 Testing

The objective is to ensure protection equipment operates and that life and property is exposed to the lowest possible safety risks in the current environment using the best available technologies.

Testing should include:-

- Earth mats, earth electrodes, star point earthing including earthing resistors.
- HV cables.
- Transformers.
- Regulators: Operation.
- Circuit breakers: Over Current: Earth Fault.
- Any RCD devices.
- 400V tests as per NZ AS 3000.
- Over Voltage.
- Under Voltage – including the loss of a phase.
- Under frequency.
- Input energy fluctuations and the effects on output Voltage and power factor.
- Auto-reclosing.

Test results shall be reconciled to models used to study the proposal before construction. Variations of consequence will need to be explored before final permanent connections can take place.

Variations of consequence will likely be associated with safety, network interference and non-compliance with any relevant Electricity Regulations, Standards or Codes, especially the DG Code. Each particular plant will have specific testing needs. These will be detailed in the documentation issued to the generator when TLC confirms the final application to connect. Any testing TLC specifies will be in addition to the requirements covered under the electrical wiring codes for practice for the issue of a

compliance certificate. TLC will be focussing on electrical ‘works’ issues.

TLC will witness tests and charge the amounts detailed in Section 6 “Fees” below when it deems these tests necessary.

4.3.5 Inspection

TLC will inspect all HV connections including any greater than 230/400 Volt and also more complex connections before connection to the network to ensure they are safe and meet acceptable industry guidelines.

The focus of inspections will include:-

- Safety.
- Protection.
- Over frequency.
- Synchronisation.
- Islanding.
- Single phasing.
- Self-excitation on loss of supply.
- Shutdown to allow auto reclosing.
- Variations in input power and reactive power adjustments.
- Operating Voltages.
- Speed of shutdown on loss of supply.
- Provision of SCADA data to TLC where required.

The intent of the inspections is to make sure the installation is safe to connect.

TLC will not be liable for issues that these inspections fail to reveal.

Where inspections reveal variations of consequence when compared to the Connection Approval, Acts, Regulations, Codes and Standards, then these will need to be rectified before final connection is made and a sustained operation is commenced.

4.3.6 Operation

4.3.6.1 Operating Parameters

The modelling carried out by TLC as part of the initial and final application will give a good indication of the likely operating range that the distributed generation can operate in.

Each particular plant will be different and carry its own specific set of criteria that will be reported to the generator on approval of the initial and final application. The plant, once it is connected, must continue to operate within these parameters.

When operating the generator has an obligation to ensure the generation plant is able to:-

- Have the power switched off and turned back on (auto reclosed) without sustaining damage or causing damage to embedded appliances or other customers’ equipment.
- Isolate itself and shut down when the supply is removed.
- Not produce Voltages outside the regulation limits particularly during light load times at the point of connection.
- Not produce harmonics that exceed harmonic codes.
- Not self excite if isolated or started without supply.

- Not have magnetising in-rush currents that affect other customers or equipment. (Asynchronous generators can have in-rush currents in the order of 7 times full load current)
- Inhibit parallel operation unless all phases are available and within normal limits.
- Disconnect from the supply in the event of unacceptable deviations of Voltage or frequency.
- Not cause interference with network protection or cause circulating currents by the way star points are connected.
- Not cause variations in Voltage that cannot be tracked by regulators.
- Not cause network tap changers to operate at an excessive rate (30 tap changes per day would be considered normal).
- Not cause momentary fluctuations that cause interference with other customers' equipment and the power system.
- Not cause fault current levels which exceed network equipment ratings.
- Not cause any adverse network effects during through fault events.

If, after construction, a generator finds that it wishes to operate plant outside the criteria agreed to in the application process and additional capital equipment or network tuning is needed, then these, and any associated studies, must be funded by the generator.

In cases where safety problems, network interference, non-compliance with any relevant Electricity Regulations, Standards or Codes, especially the DG Code exist, TLC may instruct that the site has to be operated at reduced output or disconnected until outstanding problems are addressed.

4.3.6.2 Protection

To protect against the issues outlined above, the minimum protection to be provided shall include:-

- Loss of external supply.
- External system over Voltage.
- External system under Voltage and phase balance/loss of phase.
- External system over and under frequency.
- Overcurrent.

The recommend settings for this equipment are detailed in the Table below.

Protection	Phases	Trip Settings	Tripping Time
Over Voltage	All to neutral	+ 10%	1.0 second
Under Voltage	All to neutral	- 10%	1.0 second
Under frequency	One	- 2%	1.0 second
Over frequency	One	+ 2%	1.0 second
Vector shift	One	6 to 12 degrees	1.0 second
Overcurrent	All Phases	100% of rated pickup	Inverse time

4.3.6.3 Inverter Systems

The same concepts shall apply to inverter systems. Protection settings shall be as per AS/NZS 4777.

4.3.6.4 Modifications to Plant

The generator must notify TLC of modifications to plant that could affect the network.

4.4 Congestion Management Policy

4.4.1 Up to 10 kW

For installations up to 10 kW it is unlikely that they will cause congestion.

This assumes that all generators have been applied for and are operating in compliance with their Applications, Regulations and operating standards.

Where it is found that generators have been connected without Application or are operating outside specified criteria then the installation may be disconnected.

4.4.2 Over 10 kW

4.4.2.1 Congestion Management Policy

Where it is found that generators have been connected without Application or are operating outside specified criteria then the installation may be disconnected. Any such disconnections shall be carried out in accordance with the DG Code Schedule 6.2 Clauses 10 to 15

Costs associated with the technical resource needed to sort out individual or a number of generators congestion problems shall be allocated and recovered from the affected generators.

4.4.2.2 Power Factor

All connected generation has a cumulative effect of reducing network power factor (unless it is operating at a line leading power factor that may cause Voltage rise problems). Operating the network at a reduced power factor can create problems and result in penalty charges from Transpower and non-compliance with electricity governance rules.

A declining power factor overall or localised network low power factor has the potential to cause network congestion problems.

To overcome congestion issues caused by low power factor TLC reserves the right to:-

- Restrict connections in certain areas.
- Add correction at the sub-transmission or distribution level. The cost of this will be allocated across all generators in proportion to the level of the problem their particular installation is causing.
- Pass on, in proportion to the amounts particular generators are contributing, any penalty charges from Transpower. These would be determined by using a load flow analysis with the generator turned on and off.

The above costs may also include amounts paid to any generator in recognition of the savings or benefits that its plant contributes to reducing incurred penalty charges from Transpower.

4.4.2.3 Network Active & Reactive Power Flows and Voltages

TLC shall monitor network Voltages, power factors and current in areas around installations and reconcile these with studies completed based on application data. Where there are flows being caused by a plant operating in variance to the details submitted in the connection application and this is causing network congestion greater than the parameters of the application, then TLC will ask the generator to operate within the ranges of the application or to fund network investment to remove

congestion caused by out of tolerance active, reactive power flows, Voltages, fluctuations or harmonics.

If the generator chooses not to comply, then TLC may either disconnect the plant or request the generator to pay additional capital or operating costs. If payment is not made following such a request, TLC will disconnect the plant.

4.4.2.4 Professional Services

Professional services to resolve generator technical issues shall be charged directly to the particular generator or group of generators to which the issues can be attributed.

Professional service costs associated with general generation issues shall be funded by all connected parties in proportion to their peak injection.

4.5 Emergency Response Policies

4.5.1 Interruptions and Disconnections

Interruptions and disconnections shall be in compliance with Paragraphs 10 to 15 of DG Code Schedule 6.2.

4.5.2 Contact Details

Generators should ensure TLC has up to date records of how to contact them.

It however will not be practical for TLC to contact generators individually during emergency situations.

4.5.3 Grid Emergencies

TLC will endeavour to arrange protection to keep generation on line as long as possible during grid emergencies. There will however be events that result in the generation being disconnected during grid emergencies. This may be initiated under grid security rules by the grid operator.

4.6 Distributed Generation Safety Standards

4.6.1 Compliance with Regulations

Installations must be constructed and comply with the Electricity Act and associated regulations.

4.6.2 High Voltage Connections

High Voltage installations involving 'works' must be designed, installed, maintained and renewed in a manner that allows compliance with legislation, codes and standards.

4.6.3 Control Room Safety Standards

The operation of the plant including connection, reconnections and isolations for working and earthing that could have any effect on the TLC network, shall be completed in accordance with TLC's control room safety standards and the Safety Manual – Electricity Industry (SM-EI).

4.6.4 Assurances

All assurances of the state of the generator's plants and the TLC network (See SM-EI for definition of assurances) shall be in writing and done in such a way that they comply with TLC's control room safety standards and the SM-EI.

4.6.5 Owners Obligations

The operation of equipment on the generator's premises is the generator's responsibility. TLC has no authority over the operation of this equipment. However if the generator contracts TLC to operate the equipment TLC's procedures will be used.

4.6.6 Unsafe Equipment and Practices

If TLC becomes aware of unsafe equipment or unsafe practices being employed by a generator, it will notify WorkSafe NZ. TLC will co-operate fully in the enforcement of safety sections of acts, regulations and codes. This includes risks to the public, other customers, staff, contractors and other groups.

5. Terms

5.1 Regulated Terms

The TLC's regulated terms shall apply to all applications granted under Schedule 6.1 of the DG Code unless contracted out of by TLC and the generator. They will also apply if TLC & a distributed generator do not enter in to a connection contract. Refer to Clause 7.3 for details.

These terms can be found on the TLC Web site www.thelinescompany.co.nz/customers/generating your own power and do not give any right to capacity to any generator.

5.1.1 Pricing

Details of the pricing are in laid out in "TLC's Pricing Methodology" which is available at www.thelinescompany.co.nz/media/tlc-pricing-methodology_2015.pdf.

5.1.1.1 Installations up to 10 kW

Please refer to "Pricing & Billing" on the TLC website, www.thelinescompany.co.nz for the detailed calculation of this charge and also the "Pricing Methodology" above.

5.1.1.2 Installations over 10 kW

Option 1: Default Pricing

The default pricing principles are as in Schedule 6.4 of the DG Code and also the "Pricing Methodology" above.

This will result in the following issues having to be worked through by both TLC and generators.

- The generators will have no guaranteed capacity rights.
- Prices will be site specific.
- There will be a high setup and review cost in terms of professional input that the generator will fund.
- It is likely that prices will be variable and uncertain in nature.

In accordance with the principles, a price will be recalculated each year based on the costs incurred by TLC in providing the generators with capacity in the year ahead.

Option 2 : Long Term Contract

A long term contract which gives the generator more certainty may be offered where the generator contributes a sum towards the cost of the provision of network capacity and specific assets.

Transmission Avoidance Credits

Irrespective of the option taken, credits will be given for any proven assistance the generation gives the network in reducing planned and unplanned outage minutes and proven transmission savings.

Where the total generation exceeds the total load at any GXP on any half hour when transmission savings are calculated, the savings for the half hour shall be shared between the generators in proportion to their output during the half hour.

Additional Charges

Additional charges may result if the generation causes adverse effects such as:-

- Power factor reduction in the network.
- Increased losses.

- Reliability constraints.
- Professional services costs.

Transmission charges for injection will be proportioned to generators based on outputs when charges are incurred.

These benefits and costs will be calculated and added or subtracted from the capacity charge based on the network configuration and plant location.

5.2 Faults

5.2.1 Loss of Supply due to Unplanned Events

TLC shall endeavour to restore supply to generators after an unplanned event such as a storm occurs. During such events priority to restore supply is:-

- Sustenance of life.
- Essential services.
- Minimising significant environmental and property damage.

It must be recognised that TLC owns and operates a large rural network made up of radial spurs with limited back up or alternatives. Restoration after a significant event can take time and depends on many factors including the location of available resources and the seriousness of a fault.

Distributed generation restoration would typically be included in the final group. It is recognised that there will be cases where early restoration may help overall network stability and as a consequence these installations may be restored to assist with maintaining life and essential services where practical.

Generation on the standard connection terms does not contribute to the general faults service. They will receive a lower priority during adverse conditions compared to customers who are contributing. Specific services shall be charged to the affected generator.

5.2.2 Disconnection in Emergency Situation

TLC shall disconnect installations in emergency situation to maintain safety or network stability. Typically, events will include:-

- Force majeure events, including extensive storms.
- Emergency events caused by failure of network or customer equipment.
- Situations where safety to life risks need to be minimised.
- Situations where damage to equipment risks need to be minimised.

6. Fees

6.1 Fees for Distributed Generation Application

All fees are quoted exclusive of gst which must be added to any payment.

6.1.1 Up to 10 kW

When application is made under Schedule 6.1 Part 1 of the DG Code it must be accompanied by a \$200 payment.

When application is made under Schedule 6.1 Part 1A of the DG Code it must be accompanied by a \$100 payment. In addition if TLC advises of a deficiency that has to be rectified by the Distributed Generator a further fee of \$80 is payable.

6.1.2 Over 10 kW

10 kW to 100 kW	\$500
100 kW to 1 MW	\$1,000
1 MW and greater	\$5,000

These fees must be forwarded with the initial application.

6.1.3 What the fees will cover

Fees will cover professional in-house services to provide a study of the likely implications of the connections and a short report outlining the options for making a connection.

The fees will not cover:

- Advice following variations by the generator of the information enclosed in the application, initial application or final application.
- Detailed studies.
- External peer review.
- Electricity market and retailer issues.
- Transpower grid connection studies and evaluation costs.
- Other costs detailed as generator costs in this document.
- Resolving issues associated with pricing and connection terms
- Resolving any landowner issues.
- Providing information outside of that specified in the DG Regulations.
- Customer consultation on any connection issues as required by the Commerce Commission.

6.2 Fees for Inspection & Observation of Testing

Distributed generation of up to 10 kW	\$105
Distributed generation of above 10 kW but less than 100 kW	\$120
Distributed generation of 100 kW and above	\$1,200

7. Information that is made Publicly Available.

TLC's website is www.thelinescompany.co.nz.

7.1 Application Forms

Available on TLC's website www.thelinescompany.co.nz/customers/generating your own power or can be provided on request. the

7.2 Connection & Operation Standards.

Refer to Clause 3.1 "Connection & Operation Standards" of this document "TLC Distributed Generation Policy". This document is available on TLC's website and can be provided on request.

7.3 Regulated Terms

Refer to Clause 4 "Terms" of this document. The TLC's Regulated Terms are also on TLC's website as a separate document and can be provided on request.

7.4 Curtailment or Interruption of Distributed Generation

Refer to Clause 5 "Disconnection Policy" of this document "TLC Distributed Generation". This document is available on TLC's website and can be provided on request.

7.5 Export Congestion

No locations are deemed to be congested at present.
However note Clause 3.2 "Congestion Management Policy" of this document "TLC Distributed Generation".

7.6 List of Inverters

To date no makes or models of inverters have been approved for connection to TLC's network. It is expected that inverters issued with a Declaration of Conformity to AS 4777.1 by an accredited laboratory will be added to the list as and when necessary.

7.7 Fees

Detailed in Clause 6 "Fees" of this document "TLC Distributed Generation Policy". This document is available on TLC's website and can be provided on request.

7.8 Contact for Enquiries

The Lines Company
P O Box 281
Te Kuiti 3910

07 878 0600 (Ph) - 07 878 7024 (Fax)
Email – connections@thelines.co.nz