DISTRIBUTED GENERATION OVER 10KW CONNECTION STANDARD GENERATE - AEN

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1 GENERAL

1.1 Scope

The purpose of this document is to define the process for the connection of generation to Powerco's network under Part 2 of Schedule 6.1 of the Electricity Industry Participation Code. The generating unit shall comply with the standards specified in this document.

This standard applies to generating units having an output capacity of over 10kW, which are connected, or intended to be connected, to Powerco's network.

Applications for connection of generators of greater capacity than 1,000kW, while also subject to this standard, will require further specific investigations into network security and integrity due to scale. These investigations shall be supported by a detailed concept design submitted by the applicant in accordance with Powerco's *310S103 Guide to Customer Initiated Works Process – Electricity Networks*.

Connection requirements for generators of a capacity up to 10kW are defined in *393S089 Distributed Generation Up To 10kW Connection Standard*.

1.2 Application

This document applies to all operators of distributed generation within the above mentioned scope which is, or is to be connected to Powerco's electricity network. It should be applied in conjunction with the methodologies outlined in *173S003 Powerco Distributed Generation (DG) Policy*.

1.3 Objective of this Standard

The objective of this document is to provide a clear perspective of Powerco's technical requirements for the enquiry, approval, installation and connection of distributed generation.
This document may also serve as an informative document for Powerco customers wishing to connect distributed generation to Powerco's network.

1.4 Referenced Documents

1.4.1 Industry Rules and Standards

Electricity (Safety) Regulations

Electricity Industry Participation Code 2010

SM-EI	Safety Manual - Electricity Industry (SM-EI) – Parts 1, 2 and 3 inclusive
NZECP 35	Power Systems Earthing
AS/NZS3000:2018	Electrical Installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 4777.1:2016	Grid Connection of Energy Systems via Inverters Part 1: Installation requirements
AS/NZS 4777.2:2015	Grid Connection of Energy Systems via Inverters Part 2: Inverter requirements
AS/NZS 4676	Structural Design Requirements for Utility Services Poles

1.4.2 Powerco Documents

100R001	Risk Management Framework
170S001	Permanent Disconnection Standard – Electricity Network
173S003	Powerco Distributed Generation (DG) Policy

220S002	Powerco Standard Definitions
393S007	Powerco Electricity Network Connection Standard
393S089	Distributed Generation Up To 10kW Connection Standard
310S103	Guide to Customer Initiated Works Process – Electricity Networks

1.5 Definitions

Unless stated below, words and phrases in this specification have the meaning defined in: -

- AS/NZS 4676
- *220S002 Powerco Standard Definitions*
- Common English language definitions.

Term	Description
DG	Distributed Generation.
ICP	Installation Control Point.
Grid	For the purposes of this document, Powerco's network.
Grid-Tied	A generator operating in parallel with the network.
Inverter	An electronic device designed to convert DC to AC.
Network	Means Powerco's distribution system of electrical power. For the purposes of this document, the term 'network' refers to the low voltage (400V) and high voltage (6.6kV, 11kV, etc.) networks for the connection of distributed generation and all equipment that may be affected upstream

1.6 Hazard Identification and Management

A systematic method of identifying all risks shall be applied to all design, construction, maintenance and operation activities undertaken on Powerco's networks, generally as required by Powerco's *100R001 Risk Management Charter*. Appropriate risk elimination, mitigation or reduction methods shall be implemented before work commences on any network asset.

1.7 Copyright

1.8 Document Owner

Contact Person: Chief Engineer

2 BACKGROUND

This standard is intended for generation operators wishing to connect generation to the Powerco network. Smaller plant (<100kW) may use induction or synchronous generators where the energy source is kinetic or may use several solid state inverters in parallel for direct current (DC) sources such as photo-voltaic panels. Larger plant designs may utilize synchronous generators or turbo-alternators.

Protection systems for significant generation plants require careful co-ordination with Powerco's network protection systems in order to minimize fault events and power quality issues on the network and to eliminate unnecessary tripping of the generation protection system.

3 SYSTEM REQUIREMENTS

3.1 Momentarily Paralleled Standby Generators

Where a consumer has generating equipment for standby or emergency supply purposes, changeover switches and changeover devices are required such that parallel connection to the Powerco network is not possible for longer than two (2) seconds.

This standard does not apply to these momentarily paralleled standby generators.

3.2 Parallel Connected Generating Units

- Inverter based units shall comply with AS/NZS 4777 Part 1 and Part 2 and AS/NZS 3000: *2018 Australia /New Zealand Wiring Rules*. The generation at any installation is to be balanced and the maximum allowed unbalance is 5kVA between phases.

Non-inverter (AC) units shall comply with Powerco's protection requirements as prescribed within this document.

Upon request, information on the generation facility and test results shall be provided to Powerco on the information and test details report as scheduled in *Appendix A Distributed Generation Plant Specification and Commissioning Report* of this document.

3.2.1 Portable Generating Sets

Portable mains parallel generating sets shall not be permitted to be connected to the Powerco network by any person or persons except by approved Powerco staff or contractors under emergency conditions.

3.2.2 Isolation from Network

Refer to Safety Manual – Electricity Industry (SM-EI) Section 6 "*Precautions With Electrical Equipment".*

3.2.3 Protection Co-ordination

The protection associated with distributed generating plant shall co-ordinate with the protection associated with the Powerco distribution system as follows:

(a) For generating plant directly connected to the Powerco distribution system, the generator must meet the target clearance times for fault current interchange with the Powerco distribution system in order to reduce to a minimum the impact on the Powerco distribution system of faults on circuits owned by generators. Powerco will ensure that the Powerco protection settings meet its own target clearance times. The target clearance times are measured from fault current inception to arc-extinction, and will be specified by Powerco to meet the requirements of the relevant part of the distribution system.

(b) The setting or operating limits of any protection controlling a circuit breaker, or operating values of any automatic switching device at any point of connection with the Powerco distribution system, shall be agreed between Powerco and the consumer, in writing, during the connection approval process. The protection settings or operating values shall not be changed without the express agreement of Powerco.

(c) The Generator shall provide automatic isolation and non-reconnection for "no network voltage" within a maximum time of two (2) seconds. Powerco may specify a faster disconnection time to not less than one second as determined by Powerco Asset Management, on a case-by-case basis.

(d) Auto-reclosing or auto-resynchronising by the generator plants protection and control system is not permitted until after at least after two (2) minutes of continuous Powerco network re-energisation.

(e) Inverter based generators must meet AS/NZS 4777 protection requirements. Where these standards require more conservative parameters then the provisions of Powerco's standard shall apply.

3.2.4 Supply to Islanded part of Powerco's Network

It is conceivable that a part of the Powerco distribution system to which distributed generators are connected can, under certain conditions, become islanded from the rest of the system.

Following this situation occurring, the generating units must automatically disconnect from the Powerco Network within two (2) seconds.

3.2.5 Metering and ICP Status

An export meter shall be fitted as required by the *Electricity Industry Participation Code Part 10 – Metering*. The Powerco DG administrator shall advise the CIW team of approvals of any application to enable ICP status to be updated.

The generator plant operator shall provide Powerco, at Powerco's request, interval data and cumulative data recorded by their meters. Metering details shall be provided on the test and information sheet as detailed in *Appendix A Distributed Generation Plant Specification and Commissioning Report*.

3.2.6 Generators with Governors in Service

Powerco must approve protection systems of generators with governors in service. Information on governors and the types in service are required to be supplied from the test and information sheets in section *5 Appendix A* Application And Connection Process. If

such information is submitted to Powerco, a further test may be required by Powerco before the generator is permitted to be connected.

3.2.7 Summary of Protection Requirements

REQUIREMENTS	10kW to 100kW	100kW to 500kW	Above 500kW
Generator Circuit Breaker	X	X	X
Dedicated Transformer	X**	X	X
Disconnect Switch	X	X	X
Over-voltage Protection	X	X	X
Under-voltage Protection	X	X	X
Over-frequency Protection	X	X	X
Under-frequency Protection	X	X	X
Earth-fault Protection	X	X	X
Over-current Voltage Restraint Protection	n/a	n/a	X
Neutral Voltage Displacement Protection	X**	X	X
Synchronisation	X	X	X
Loss Of Mains Protection	X	X	X
Power Factor or Voltage Regulation Equipment	X	X	X
Fault Interrupting Devices	n/a	X	X
Powerco SCADA Visibility Status and Metering	n/a	n/a	X

X** indicates installation specific – at Powerco discretion.

n/a indicates not required.

3.2.8 Generator Connection Diagram

A relay and single line diagram or similar connection schematic showing the proposed installation, protection system and connection point to the network shall be provided with the initial application. A confirmed design schematic shall be provided prior to the generator being commissioned.

3.3 Network Connection Contract

Any distributed generation installation which is not connected under a specific network connection contract (with Powerco) will be deemed to be connected under Regulated Terms, as specified by the *Electricity Industry Participation Code 2010 – Part 6 Connection of Distributed Generation.*

3.4 Access

The customer shall provide Powerco or a Powerco authorised service provider with safe and unobstructed access to the generation site and all upstream equipment at all reasonable times, providing:

- Access is required for matters concerning the generation circuit and its connection to the Powerco network.
- Powerco shall make a written request to the customer to access the site for scheduled works.
- Powerco or a Powerco authorised service provider may not interfere with the customer's equipment without expressed consent. This does not include methods of isolation.
- Powerco may require immediate access to the customer's equipment in the event of an emergency (i.e., to prevent a breach of safety or damage to property). Powerco shall inform the customer of the circumstances and events as soon as practicable.

3.5 Interruptions / Temporary Disconnection from the Network

Powerco may, from time to time, isolate any distributed generation in order to perform certain maintenance tasks or manage the network capacity. Refer to *173S003 Powerco Distributed Generation (DG) Policy*.

3.6 Permanent Disconnection

Permanent disconnection of the ICP should comply with Powerco's *170S001 Permanent Disconnection Standard*. Permanent disconnection of the distributed generator circuit only shall include: -

- The customer informing their retailer of the disconnection.
- At least one device (circuit breaker, etc.) must be removed from the distributed generator circuit.
- The remaining circuit, if any, must be "made safe" and comply with *AS/NZS 3000: 2018 Australia /New Zealand Wiring Rules*.
- Any signs indicating the presence of distributed generation shall be removed from the customer service by Powerco or an authorised Powerco service provider.

4 CONNECTION AND APPROVAL PROCEDURES

4.1 Enquiry from the Customer

The customer must make an application in writing to Powerco for the connection of distributed generation. The customer must include the following information:

- Location – the address of where the generation is to be installed.
- Contact details of the owner and the installer of the equipment.
- The invoicing address for the appropriate application fee.
- Power – the maximum output from the AC connection of the generator.
- Type – the type of AC commutation device e.g.: electronic inverter, AC induction, synchronous, etc.
- Technical Specifications – Voltage, frequency, etc. Inverters must comply with AS/NZS 4777. Other types may have special requirements.
- Schematic diagram distinctly showing the relevant existing circuits and the intended generation.
- The intended time frame for connection.
- A detailed concept design upon request.

4.2 Approval of Design

The approval process shall begin once the customer has supplied satisfactory information about the intended connection, and has paid the appropriate application fee. Depending on the type and size of the generator and connection details, further information may be required by Powerco. This information will need to be provided by the generator at the reasonable request of Powerco. When planning, protection and SCADA requirements are met, the design approval may be given by a member of Powerco's electricity planning team. See *Appendix A Application and Connection process.*

The generator shall complete the plant and commissioning report in *6 Appendix B Distributed Generation Plant Specification and Commissioning Report*, before connection can be approved and completed. Further tests may be required for load governed generators. The completed report shall be forwarded to Powerco.

4.3 Retailer Contractual Agreement

The customer should pursue an agreement with their energy retailer for the export of energy. There will be no additional charges from Powerco for the export of energy.

4.4 Connection

The customer must provide a certificate of compliance signed by the registered electrician installing the distributed generation or a licensed inspector to Powerco, verifying that the installation complies with Powerco's network requirements and is electrically safe. Powerco may then approve the plant for commissioning. At the point of isolation between the generator and Powerco's network a warning tag as shown below shall be fixed to the structure.

WARNING

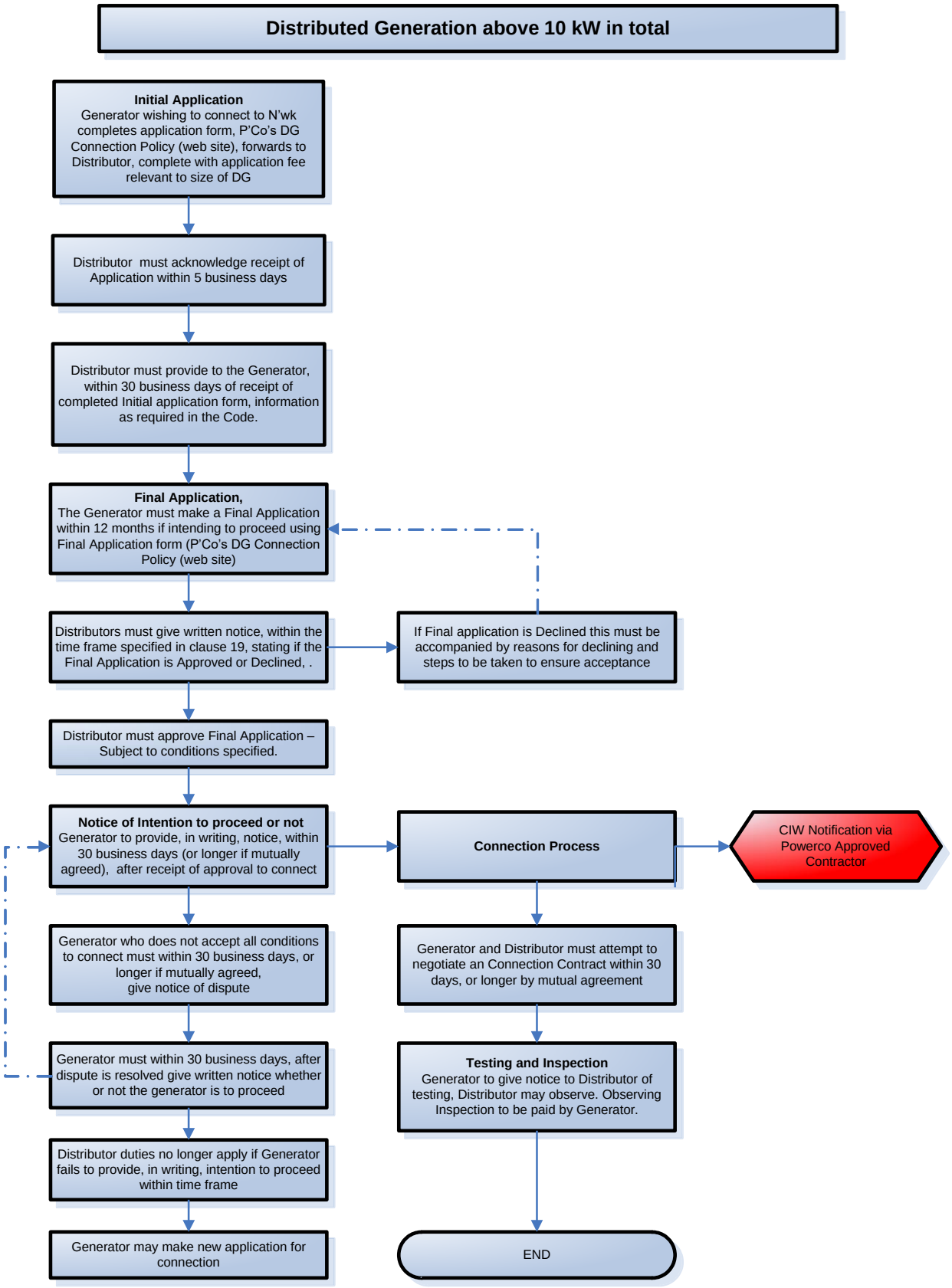
THIS ICP CONTAINS DISTRIBUTED GENERATION.

TEST AND PROVE DE-ENERGISED AFTER ISOLATION

4.5 After Connection

The customer shall provide as-built information including drawings and schematics to Powerco following connection of the distributed generation to the network.

5 APPENDIX A - APPLICATION AND CONNECTION PROCESS



6 APPENDIX B – DISTRIBUTED GENERATION PLANT SPECIFICATION AND COMMISSIONING REPORT

INITIAL APPLICATION FORM

The name, address and telephone number of the Customer, being the owner/operator of the DG:	
The contact details of the installer including address, telephone number and email address:	
Application fee invoice to:	
Is this a new installation or capacity increase to existing?	
Generator capacity in kW:	
Type of DG – (photovoltaic, wind, gas etc)	
Proposed location of the DG NZMG coordinates or address:	
Proposed connection date:	
Technical specifications of the DG and associated equipment, including: ▪ Technical specifications of equipment that allows the DG to be disconnected from the Network on loss of mains voltage: ▪ The number of phases: ▪ The proposed point of connection to the Network - ICP or transformer number: ▪ Any battery storage? ▪ Details of any load at the proposed point of connection: ▪ Connection voltage:	
The maximum active power injected in MW:	

The reactive power requirements MVArs if any:	
Resistance and reactance details of the generating unit:	
Fault level contribution kA:	
Method of voltage control:	
Single line diagram of proposed connection attached:	
Means of synchronisation and connection and disconnection to the Network, including the type and ratings of circuit breaker proposed:	
Details of compliance with frequency and voltage support requirements as specified in the Electricity Industry Participation Code 2010 if applicable:	
Proposed periods and amounts of electricity injections into, and off takes from, the Network if known:	
Any other information that is required by Transpower New Zealand Limited as the system operator:	
Energy Retailer for load and generation:	

Declaration

[ ], being the applicant for the connection of the DG referred to in this **Initial Application Form** to Powerco's Distribution Network, certify that the above information is true and correct.
Signed for/by the applicant:

_____

_____
[insert name and position]

_____
[insert date]

For Powerco Use: Network Approval Confirmation
Application requirements complete: Yes/No Application approved to progress to installation and testing: Yes/No Signed: Date:

Network Connection Details		
Zone Substation	**Feeder**	**Distribution Transformer**

FINAL APPLICATION FORM

The name, address and telephone number of the Customer:	
The contact details of the installer including address, telephone number and email address:	
Whether the proposed connection is a new connection or an increase in capacity for an existing connection:	
Generation capacity in kW:	
Type of DG (photovoltaic, wind, gas etc)	
Proposed location of the DG NZMG co-ordinates or address:	
Proposed connection date:	
Energy Retailer for load and generation	
The information specified in or provided in connection with the Initial Application dated [ ] relating to the DG is confirmed and is true and correct at the date of this Final Application.	

Declaration

[ ], being the applicant for the connection of the DG referred to in this **Final Application Form** to Powerco's Distribution Network, certify that the above information is true and correct.

Signed for/by the applicant:

_____

_____

[insert name and position]

_____

[insert date]

For Powerco Use: Network Approval Confirmation
Application requirements complete: Yes/No Application approved for connection: Yes/No Signed: Date:

Network Connection Details		
Zone Substation	**Feeder**	**Distribution Transformer**

EMBEDDED GENERATION - COMMISSIONING REPORT

Installation tested by:	
Date test completed:	
Loss of network supply auto-isolation test proven (Y/N):	
Auto-isolation disconnection speed (Sec):	
Auto-restoration (if existing) after specified delay proven (Y/N):	
Overspeed disconnection process proven (>15kW) (Y/N:	
MEN Earth test results (Ohms):	
Protection setting details (Attach additional details where necessary):	
Electrical inspection and issue of Certificate Of Compliance completed (Y/N:	
Name of Electrical Inspector:	

**** Powerco Engineer contact:***	

Other tests requested by Powerco (To be specified):

The completed report including a COC shall be forwarded to Distributed Generation, Powerco Ltd, Private Bag 2061, New Plymouth, 4340 or emailed to distributedgeneration@powerco.co.nz

Report completed by:

Name:

Address:

7 DOCUMENT REVIEW HISTORY

Version Number	Reviewed By.	Review Date	Reason
1	Unknown	Unknown	Unknown
2	Unknown	Unknown	Unknown
3	Unknown	14/04/05	Unknown
4	S. Hadley-Jones K. Thomas R. Coleman M. Smith	18/08/08	Changed standard name to align more closely with Micro Generation standard name (NB: previous name was *Standard For Connection Of Small Generation To Powerco's Network*). Added in Section 1 new H&S, Hazard Identification and Environmental clauses. Added new clause 2 and 3.1. Reworded many of the requirements in 3.2 (including requirement for AS4777 approval). Added new clauses 3.5 to 3.7. Modified extensively clause 4. Deleted references to ECP 4 throughout document. Included Appendix B, Process flow chart and Design approval notice. Included reference to COC in commissioning test report template Part 2. Updated reference from "Network Management Centre" to "Network Operations Centre" in commissioning test report template Part 3. Added Flow Chart in Appendix B and Approval Form in Appendix C. Added Document Review History table plus Change Request form.
5	M. Smith	3/11/09	Redefined scope and included requirement for detailed concept design, referenced to CIW process. Document now references Powerco's DG Policy. Deleted HSE clauses (this standard is about setting technical parameters, not work practices outside Powerco network which are covered by other documents). Included references to international standards for inverters. Reduced auto-isolation time from 3 seconds to 2 seconds. Included requirement to advise CIW team for ICP update. Included protection requirement summary table. Changed reference to "MARIA" to "Electricity Registry". Included CIW process in flow chart. Included Fee check in approval document. Deleted EGR Frequency keeping requirements – apply to generators >30MW only Changed Risk clause to refer to AS/NZS ISO 31000
6	M. Smith	17/06/10	Added labelling requirement in 4.4 Connection. Added new Appendix A - Application & Connection Process. Renumbered old Appendix A to become B - Commissioning Report (Parts 1 to 3). Updated flow chart to align with Retailer Guide. Removed Old Appendix B – Process Flow Chart & Proposal Approval Notice and Appendix C Embedded Generation Proposal Approval sheet.
7	M. Smith	19/04/11	Updated to reflect legislative changes (Electricity Industry Participation Code 2010 and Electricity (Safety) Regulations 2010)
8	M. Smith	11/05/12	Title changed (previously was " Small Embedded Generation 10kW – 1000kW Standard"). Updated to align with updated DG Policy.
9	M. Smith	14/ 3/2014	Updated to align with reviewed AS/NZS 4777 draft. Rationalised application form. Concurrent with review of DG Policy and DG up to10kW Standard.

10	T. Naidoo R. Pittwood	29/07/2020	Updated references to Standards to reflect the latest names throughout the document Amended scope as follows: Included “under either Part 2 of Schedule 6.1 of the Electricity Industry Participation Code.” To first sentence Removed references to the withdrawn standard AS/ZNS 4777.3 Changed document owner to Chief Engineer 3.2 Added “The generation at any installation is to be balanced and the maximum allowed unbalance is 5kVA between phases” Amended postal address for commissioning report and added email address

8 POWERCO STANDARD - DOCUMENT CHANGE REQUEST

Memo To: **Chief Engineer,**
Junction Street,
New Plymouth.

Change Details:
(Attach separate sheets as necessary).

Paragraphs Affected:

Priority: **Urgent** (Within 1 week) ☐ **Routine** (Within 12 months) ☐ **Low** (Next Review) ☐

Submitted By (Print Name)	**Date**

Document Change Request - Acknowledgement

Dear ……

Thank you for your suggestion regarding changes to the above mentioned document.

Your request has been noted and added to our works program. Should we require any additional information regarding your notification then we will be in contact with you.

Thank you for your contribution to improving the quality of Powerco's documentation.

Regards,

…… ……..

Chief Engineer **Date**

393S012 Ends